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There's More to Marriage than Love: The Effect of Legal Status and Cultural Distance on Intermarriages and Separations*

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Abstract

This paper analyses the marriage decisions of natives and migrants focusing on the role of legal status and cultural distance. We exploit the successive enlargements of the European Union as a natural experiment that granted legal status only to some groups of foreign immigrants. Using Italian administrative data on the universe of marriages and separations, we show that access to legal status reduces by 60 percent the probability of immigrants intermarrying with natives, and it increases by 20 percent the hazard rate of separation for mixed couples formed before legal status acquisition. Building on this evidence, we develop and structurally estimate a multidimensional equilibrium model of marriage and separation, where individuals match on observed and unobserved characteristics. Allowing for trade-offs between cultural distance, legal status, and other socio-economic spousal characteristics, we quantify the role of legal status and the strength of cultural affinity. Through the evaluation of counterfactual policies, we show that granting legal status to migrants to foster their inclusion in the legal labor market paradoxically slows down the integration of minorities along cultural lines. We also show how recent migration waves will foster a gender marital imbalance within those communities.

JEL Codes: J11, J12, J15.
Keywords: Intermarriages, marital matching, separations, legal status, cultural distance.

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1 Introduction

Immigration is deeply transforming the structure of families in destination countries. In the wake of increasing migration flows, intermarriages between natives and foreigners account for a large and growing share of total marriages. In 2015, the share of intermarriages over total marriages reached 14 percent in France, 12 percent in the United States and Germany, and 9 percent in Italy (OECD, 2017), see Figure 1. This phenomenon has important implications for the cultural integration of foreign spouses as well as of the second generations – because of parental cultural transmission (Bisin and Tura, 2019). Indeed, intermarriages are often interpreted as a sign of integration of minorities (see, e.g., Gordon, 1964; Meng and Gregory, 2005; Constant and Zimmermann, 2008; Algan et al., 2012; Furtado and Trejo, 2013). This interpretation is consistent with the implications of standard equilibrium models of marital matching (Becker, 1973, 1974), which predict positive assortative mating along cultural lines, provided that similarity in the ethnic origin of spouses enhances the household production function. Within this framework, the lower the cultural distance between the spouses, ceteris paribus, the higher the incidence of intermarriages relative to homogamous marriages.

However, the intermarriage rate depends on another critical factor: legal status acquisition incentives. In most destination countries, foreign spouses of native citizens enjoy immediate access to residence and work as well as a privileged path to citizenship. In a standard model, these legal status benefits increase the marital surplus in intermarriages relative to that in homogamous marriages. Hence, marital equilibrium results from a tension between positive mating along cultural lines, to enhance complementarities within the household production function, and preferences to intermarry with natives, driven by legal status incentives.

Our analysis quantifies the importance of the legal status motive and of cultural distance to intermarriage and marital stability. We contribute to the literature on marriage, migration and the economics of culture in several important and novel ways. First, we exploit a large natural experiment that granted differentially legal status to a particular group of migrants. From an empirical perspective, it is generally difficult to disentangle the effect of legal status incentives and cultural distance, as they often are collinear. In addition, legal status may be correlated with several personality traits that are relevant for marital matching decisions, so marriage rates according to the legal status of the foreign spouse do not tell us about the effect of legal status incentives per se. To overcome this identification challenge, we leverage the successive enlargements of the European Union (EU). Between 2004 and 2007, 12 countries, accounting in total for about 80 million inhabitants,

joined the EU.[1] As a consequence, their citizens acquired permanent legal status, including the right to free movement and work, within all member countries (apart from transitory restrictions to employment that were imposed in some EU countries). Therefore, the EU enlargement eliminated legal status benefits from the marriage market for new EU citizens living in other EU countries– but not for other immigrants. This episode constitutes an ideal research design for separately identifying the effect of legal status incentives and of cultural affinity from other socio-economic characteristics. We exploit registry data on the universe of marriages and separations in Italy over the period 1998-2012. This allows us to look at individual decisions involving 3.6 million marriages and over 200 thousand separations before and after the enlargements and we analyse flows into and out of marriage. We show using difference-in-differences and event study techniques that the enlargements of the EU had a profound effect on mixed marriages and separations as soon as the relevant information became known. The probability of intermarrying with native males decreases by 60 percent, ceteris paribus, for migrants from new EU countries relative to migrants from other countries after (the announcement of) the EU enlargement. Such effect is partly offset by an increase in cohabitations outside legal marriage between native males and foreign females. However, cohabitations are very limited in number compared to marriages, so the effect on the total number of mixed couples remains negative and qualitatively similar to the effect on legal marriages.[2] During the same period, the hazard rate of separation for mixed couples formed before the enlargement between natives and citizens from new EU countries increased by 20 percent. We also document substitution patterns across national groups in the choice of spouses. The sharp decline in marriages between natives and Polish citizens following the entry of Poland into the EU favored mixed marriages involving Romanian spouses. However, this marriage market unraveled after a few years when Romania entered the EU. This in turned favored mixed marriages involving spouses from other Eastern European countries.

A second contribution is to develop and structurally estimate an equilibrium model of the marriage market, where marital and separation choices are considered jointly. We consider a multidimensional transferable utility matching model, where individuals match on both observables and unobservables. We depart from the standard workhorse model in this literature derived in Choo and Siow (2006b) in several ways. Our model is multidimensional, a feature shared with the recent literature (Dupuy and Galichon, 2014; Galichon and Salanié,

[1] These countries were Eastern European countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia) plus two Mediterranean countries (Malta and Cyprus).

[2] These effects are virtually identical by gender of the foreign spouse and robust to controlling for a rich set of fixed effects; to including or excluding the (estimated) number of undocumented immigrants; and to controlling flexibly for the number of potential matches by nationality.

2015, 2017; Ciscato et al., 2019).[3] We extend the model to a multi-market framework and we exploit variation over time (before and after the EU enlargement) and across geographical areas with different population characteristics to achieve model identification.[4] Importantly, we propose a model where the marital surplus is specific to a given couple and evolves over time, by introducing a match-specific random component. Our specification allows for sorting on unobserved characteristics on both sides of the market, but also for complementarity between observables and unobservable characteristics, by relaxing the separable linearity regarding the idiosyncratic shock. In comparison, the Choo and Siow (2006b) model and the existing literature rests on individual additively separable random shocks over observable characteristics of the potential spouses, which rules out any complementarity between unobserved characteristics (Chiappori and Salanié, 2016).[5] While the assumptions made in the seminal literature allow for closed-form tractability, they impose strong restrictions on the substitution patterns across different types of spouses (Decker et al., 2013). We test these implications in our data and we show that they are at odds with the patterns of marriages we seek to investigate, while our model aligns better with these substitution patterns.

Thanks to our model, we separately identify the contribution of different factors which simultaneously affect the marital equilibrium and later separation choices, by exploiting both observed matching patterns and separation rates over time and across markets. Intuitively, by looking at marriages involving new EU citizens, the decline in marriages with natives and the increase in separations reveal how much those citizens valued legal status. If new EU citizens are less keen to marry natives, they, in turn, have to opt for other types of spouses, perhaps more culturally distant or with different characteristics. This trade-off then reveals the value of cultural affinity and of differences in terms of, for example, age and education.

The observation of both marriages and separations provides us the necessary power to disentangle the variation over time in marital gains parameters from potential variation in unobserved composition effects due to the EU enlargements. The intuition is that, while the marriage equilibrium is affected both by the institutional environment and market compe-

[3]While in principle the fully nonparametric estimation derived in Choo and Siow (2006b) might be applied to a multidimensional setting, in practice the multidimensional nature of the marriage market is reduced because it generates too many cells with no observation.

[4]In a similar fashion, Chiappori et al. (2017) investigate changes in the returns to education on the US marriage market in the aftermath of World War II by exploiting variation across cohorts.

[5]A direct consequence of the separability assumption is that if two men belong to the same group, and their respective partners belong to the same group, the two potential matching allocations in the market lead to the same total surplus. This allows to translate the individual matching problem into a matching along observables only. With a different approach, Galichon and Salanié (2015) and Galichon and Salanié (2017) maintain the additive separability but relax the multinomial logit structure in Choo and Siow (2006b) by allowing for correlations between shocks. Chiappori et al. (2017) allow for heteroskedasticity in the error term.

tition in each period, separations are affected by changes in the institutional environment, keeping constant the observable traits of the spouse that led to marriage. Finally, our model also allows us to estimate the importance of general equilibrium effects (the "spillover effects" emphasized by Choo and Siow, 2006a,b) in response to the EU enlargements, and to investigative the implications of highly debated and controversial immigration policies via counterfactual simulations.

Our analysis provides evidence on the value of legal status, the absence of which leads to a penalty in the marriage surplus ranging from about 15 percent in the North of Italy to 7 percent in the South of Italy – where informal work makes legal status less valuable. This effect is of similar magnitude to that of education on marriage surplus. Previous work has examined the effect of legal status on labor market opportunities (Amuedo-Dorantes et al., 2007; Lozano and Sorensen, 2011), criminal activity (Mastrobuoni and Pinotti, 2015; Pinotti, 2017; Fasani, 2018), and consumption (Dustmann et al., 2017). However, the implications of legal status for marriage formation have been largely neglected.[6]

We also evaluate the role of cultural affinity across different nationality groups. This measure of affinity is obtained from revealed preferences through marriage choices. We show that mixed marriages carry a marital surplus penalty that can be substantial across some nationality groups. Perhaps surprisingly, the cultural dimension in marriage has been overlooked, despite its relevance for various social and economic behaviours and the strong persistence of cultural traits across generations (Bisin and Verdier, 2000; Bisin et al., 2004; Fernández et al., 2004; Doepke and Zilibotti, 2008; Fernandez, 2011; Alesina et al., 2013).[7]

We use our model to evaluate several counterfactual policies. The first one would grant legal status to all migrants in the country. Such policies have been enacted in the past in countries such as France, Spain and partially in the United States. Although these policies aim to foster integration through access to the legal labor market, we show that they reduce mixed marriages in favor of homogamous ones, by eliminating the benefits of legal status from the marriage market. Paradoxically, such measures may slow down the cultural integration

[6]One notable exception is Azzolini and Guetto (2017), who document the negative effect of the EU enlargement on the number of intermarriages using synthetic control methods. Relative to this previous work, we provide a theoretical and empirical (structural) framework that allows us to study not only the effect of the EU enlargement on the number of marriages, but also on their characteristics and stability, and on cross-nationality substitution in marriage markets. In addition, we also estimate the impact of legal status acquisition on separations.

[7]The previous literature on marriage has focused on the sorting mechanisms along age (Choo and Siow, 2006b; Choo, 2015; Shephard, 2019); income and body mass index (Chiappori et al., 2012); educational attainment (Chiappori et al., 2009, 2017; Gayle and Shephard, 2019); human capital and fertility (Low, 2019); and personality traits (Dupuy and Galichon, 2014). One exception is Ahn (2018) who studies cross-border marriages in East Asia and investigates how immigration policies affects the matching equilibrium of the marriage market in the country of origin and contributes to strengthen the bargaining power of women.

of immigrant minorities, with potentially detrimental and persistent effects on successive generations. In addition, we show that such policies transfer marital surplus from natives to migrants, and in particular migrant men, as they have a higher likelihood of marrying women from their own community.

Second, we evaluate the effects of an unconstrained open-border immigration policy, by simulating a surge in migration inflows from Africa. Because of a marked asymmetry in cultural affinity preferences along gender lines – intermarriages are more prevalent between native man and foreign women than between native women and foreign men – new migrant women would get married while few of the migrant men do. Therefore, a large group of foreign single men will face difficulties in the labor market, due to lack of legal status, and more generally in integrating into the host communities.

The paper is organized as follows. Section 2 describes the institutional background and the characteristics of the EU enlargements to East European countries. Section 3 describes the data and empirical strategy and presents the empirical results concerning the effect of legal status on gains from marriage and on separations. Section 4 develops and structurally estimates the multidimensional equilibrium model of the marriage market and subsequent separations. Finally, Section 5 concludes.

2 Institutional background

2.1 Italian migration policy

Immigration to Italy is a relatively recent phenomenon. The number of official foreign residents increased tenfold between 1990 and 2017 – from 500 thousand to 5 million. Figure 2 shows the composition of immigrant population by area of origin. Just less than a third of all foreign residents – 1.5 million – come from another country within the EU. By virtue of the Schengen agreement, all EU citizens may freely circulate and work in Italy.

The access of immigrants from all other countries is instead regulated by a rigid quota system. The main pathway to an official stay is through work permits, issued each year by the national government. The so-called *Decreto Flussi* ("Flows Decree") sets stringent limits on the number of permits available by type of contract and province, and applications must be backed by job offers from prospective employers in Italy. Applicants who eventually obtain a work permit are allowed to reside in Italy for the duration of the job; their spouses and children are entitled to a residence permit for "family re-unification". If the job contract is terminated, however, the foreign worker has 6 months in which to find a new job, otherwise (s)he must leave the country. The application for Italian citizenship requires 10

years of continuous (legal) residence. Overall, Italian migration policy is quite restrictive. For instance, Italy ranks third out of the 12 EU countries in the Strictness of Immigration Policy index produced by the Fondazione Rodolfo Debenedetti.[8]

However, such restrictions do *not* apply to foreign spouses of Italian citizens. They enjoy immediate access to residence and work in Italy, and can apply for citizenship after 2 years of marriage (as opposed to 10 years of continuous residence in Italy).[9] Intermarriage with natives thus constitutes an attractive gateway to residency, work, and citizenship in Italy. The same rights to residence and work in Italy – but not the preferential path to citizenship – also apply to foreigners from non-EU countries married to non-Italian EU citizens.

Figure 3 shows the share of foreigners over total residents and the intermarriage rate, separately for foreign females and males, over the period 1996-2013. The intermarriage rate is defined as the share of marriages contracted between a foreign and a native spouse over the total number of marriages contracted in a given year. This graph conveys two main facts. First, native males and foreign females tend to intermarry more than native females and foreign males; our theoretical model in Section 4 will account for this fact. Second, intermarriage rates increase in parallel with the share of foreign residents until the second half of the 2000s, but diverge thereafter. Indeed, the growth in the share of foreigners over total residents accelerates starting in 2007, whereas intermarriage rates flatten out, especially for immigrant females, during the same period. Both these changes in trends coincide with the admission of millions of Eastern Europeans to free circulation in all EU countries, including Italy.

2.2 EU enlargement

The EU is an economic and political partnership of 28 countries. This configuration is the result of subsequent enlargements that are still ongoing, as several countries are negotiating admission conditions. It was instituted by the Maastricht Treaty on November 1, 1993, and consisted of 12 countries. It was not until a decade later that Eastern European countries were also admitted to the EU. The first round of the enlargement became effective on May 1, 2004, and involved ten countries ($EU2004$ henceforth): Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia and Slovenia. Three years later, on January 1, 2007, Romania and Bulgaria also joined the EU ($EU2007$ henceforth).

[8]The index is described at http://www.frdb.org/page/data/categoria/international-data/scheda/inventory-of-migration-policies-1990-2005/doc_pk/11028.

[9]The period required to apply for citizenship increases to 3 years if the spouses reside outside Italy after marriage, whereas it is shortened by half if the couple has children.

Both rounds of enlargement were preceded by complex and lengthy negotiations. Figure 4 shows the timing of the final decision stages. The EU Council – the executive branch of the Union – agreed upon the 2004 enlargement in December 2002; the timing for the 2007 enlargement is similar, the EU Council taking the final decision in December 2005. Therefore, uncertainty regarding the outcome of both enlargements unraveled at the beginning of the previous calendar year. Our empirical analysis will allow for anticipation effects during this period.

In principle, citizens from new member countries acquired the right to reside and work in all other countries of the EU; in practice, many countries in the latter group adopted transitory regimes imposing barriers against new EU citizens from Eastern Europe. For instance, Germany eliminated entry quotas for Polish workers only in 2011. Similarly, until 2014 Bulgarians and Romanians needed to acquire a special permit to work in several EU member states – Austria, Belgium, France, Germany, and the United Kingdom.

By contrast, Italy largely adhered to the principle of free circulation, maintaining only mild restrictions to the employment of new EU citizens in some sectors of the economy. In 2004 and 2005 the Italian government set a cap of 20 and 79.5 thousand, respectively, to the number of employees from new EU countries. On the other hand, there were neither restrictions to residency nor to non-dependent working activity (i.e., self-employment or entrepreneurship). As for the 2007 enlargement, the government also lifted restrictions on dependent employment in most economic sectors.

3 The effect of EU enlargement on marriages and separations

Figure 5 shows the evolution of marriages and separations between natives and immigrant spouses, by area of origin, during the period 1998-2012 (all series are indexed to 1 in 1998). Figure 5a shows that intermarriages between natives and new EU citizens were on an upward trend until the announcement of EU council decisions (i.e., in 2002 and 2005, respectively) and declined sharply immediately after. In contrast, marriage rates between natives exhibit a steady and slow decline over that period. Figure 5b shows the dynamics of separation, the formal act that starts the divorce proceedings (as explained in Section 3.3, at least three years of legal separation are required for obtaining divorce). Separations between new EU immigrants and natives exhibit abnormal spikes after the EU enlargements, and decline immediately after.

This preliminary evidence is consistent with legal status acquisition reducing gains from

marriage between migrants and natives. We next illustrate our strategies for identifying this effect, keeping constant the number of available matches in the marriage market.

3.1 Marriages: data and methodology

The marriage rates depicted in Figure 5a do not take into account changes in the number of available matching opportunities in the market – notably, the large increase in the number of foreigners from new EU countries. An increase in mixed marriage rates could occur either because those marriages become more desirable or, mechanically, because there are more available individuals of a given nationality. To take into account the change in the pool of available men and women, we follow the methodology introduced by Choo and Siow (2006b). We rescale the number of total marriages between males from country x and females from country y by the geometric average of single males and females to calculate the gains to marriage:

$$\Phi(x,y) = \ln \frac{marriages(x,y)^2}{singles(x) \cdot singles(y)}. \tag{1}$$

Intuitively, a higher number of observed marriages between type-x males and type-y females, relative to the number of potential matches between the same types, signals higher gains to marriage.[10] The gains to marriage $\Phi(x,y)$ in equation (1) will be the main dependent variable in our empirical analysis. We focus on heterosexual marriages in which at least one of the spouses is Italian, and compute $\Phi(x,y)$ across cells defined by the country of origin of the foreign spouse, year of marriage, and Italian province of residence of spouses.[11]

We compute $\Phi(x,y)$ in equation (1) across country of origin-province-year cells exploiting rich registry data on the universe of marriages formed in Italy and on the number of foreign residents. These data were made available by ISTAT through its Laboratory for Elementary Data Analysis (ADELE). Vital statistics registries provide detailed information on the universe of marriages celebrated each year in Italy between 1998 and 2012 – more than 3.6 million marriages (see Panel A of Table 1). Using information on spouses' country of origin, reported in the marriage records, we compute the numerator of the marital matching surplus $\Phi(x,y)$ in equation (1).[12] Following Choo and Siow (2006a), we will alternatively measure

[10] Choo and Siow (2006b) show that $\Phi(x,y)$ equals the systematic component of gains from marriage in the unique equilibrium of a random utility model with transferable utility between spouses. We discuss and extend such model in Section 4.

[11] Italian provinces correspond to level 3 of the EU Nomenclature of Territorial Units for Statistics (NUTS). In Census year 2001, there were 99 provinces, with average and median population of 551 and 377 thousand inhabitants, respectively.

[12] In addition to country of origin, marriage records report spouses' date of birth, educational attainment,

the numerator of $\Phi(x, y)$ by the number of cohabiting couples not in a legal relationship, and by the sum of marriages and cohabitations, which are available from the decennial population Census.

Measuring the number of singles (i.e., the denominator of the marital matching surplus $\Phi(x, y)$ in equation 1) has two main challenges. First, the exact number of residents by country of origin and marital status is available only from the decennial Census. We thus count the singles in 1991, 2001, and 2011 by the number of unmarried individuals aged between 18 and 60; Panels C and D of Table 1 show the number of observations and summary statistics for years 2001 and 2011, respectively. We then interpolate these data outside Census years exploiting variability over time of official migration inflows. This allows us to account for non-linear increase in the presence of singles across years. The exact procedure is described in Appendix A.

Second, neither the Census nor other official migration statistics include data on unofficial immigrants. However, neglecting unofficial migrants from the denominator of (1) would bias the estimated gains to marriage upward for all immigrants except new EU citizens in the post-enlargement period. This would lead us, in turn, to over-estimate the reduction in the gains to marriage for such groups after the EU enlargement, as we discuss in detail in Section 3.2 and in Appendix A. To avoid this problem, we account for the presence of undocumented immigrants drawing on (i) administrative data on applications for amnesty by irregular immigrants in year 2002, and (ii) yearly estimates of the total number of irregular immigrants present in Italy during the period 1991-2013.

The general amnesty of 2002 is the largest one ever enacted in Italy, granting a temporary residence and working permit to about 700 thousand irregular immigrants – a third of the total immigrant population at that time.[13] Based on administrative data on the universe of applications for amnesty, we compute the number of singles (i.e., unmarried individuals aged between 18 and 60) among unofficial immigrants in year 2002, by country of origin and Italian province of residence. We then impute the total (estimated) number of unofficial immigrant singles in all other years to country of origin-province cells based on the distribution of amnesty applications across the same cells. Appendix A provides the details of this procedure and the data used to implement it. The total number of singles in each cell equals the sum

previous marital status, employment status and professional level, municipality of residence at the time of marriage, and province of residence after marriage. In Section 4 we use this information to investigate trade-offs in spouses' characteristics.

[13] All immigrants that had been residing for at least three months in Italy and were (unofficially) employed at the time of the amnesty were eligible for a 2-year residence permit. The working condition was certified by the employer. Importantly, regularized immigrant workers did not obtain permanent legal status – as it was the case, instead, for new EU citizens. Devillanova et al. (2017) provide additional details.

of singles among official and unofficial migrants in such cell. We investigate the robustness of results to excluding (imputed) unofficial immigrants from the computation of singles.

We estimate the following equation for the gains to marriage $\Phi_{IT,y,t,p}$ between native males ($x = IT$) and females from country of origin y, in province p, and year t:

$$\Phi_{IT,y,t,p} = \beta(newEU_y \times postEU_{y,t}) + FEs + \varepsilon_{IT,y,p,t}, \tag{2}$$

where $newEU_y$ is a dummy for females from $EU2004$ or $EU2007$ countries; $postEU_{y,t}$ is a dummy variable for the years after each enlargement, i.e. $postEU_{y,t} = 1$ from 2004 (2007) onwards for females from $EU2004$ ($EU2007$) countries; FEs are different sets of fixed effects for year, province, and foreign spouse's country of origin, possibly interacted with time trends; finally, $\varepsilon_{IT,y,p,t}$ is an error term summarizing the effect of other determinants of gains from marriage. We estimate an analogous equation for the gains from marriage between native females and males from country of origin x, $\Phi_{x,IT,p,t}$.

The coefficient β in equation (2) captures the relative change in gains from intermarrying with natives after the EU enlargement between immigrants from new EU countries and other countries, respectively. Given that immigrants may acquire legal status for other reasons than admission to the EU, β provides a lower bound, in terms of magnitude, to the effect of legal status acquisition (put differently, it represents the "intention-to-treat" effect of legal status).

3.2 The effect of the EU enlargement on marriage formation

3.2.1 Main results

Figure 6 plots the gains from marriage with natives, as measured by $\Phi(x, y)$ in equation (1), for different groups of immigrants during the period 1998-2012.[14] The announcements of both the 2004 and 2007 enlargements bring a decline in gains to marriage between new EU citizens and natives, with the exception of marriages between $EU2004$ males and native females. However, the latter amount to less than 100 intermarriages per year, so gains from such marriages may be imprecisely estimated.

We quantify the changes in Figures 6 by estimating the difference-in-differences specification in equation (2); results weighted by province population are presented in Table 2.[15]

[14] Figure C.3 in the Appendix shows the evolution of the different components of $\Phi(x, y)$, namely the number of intermarriages and the number of immigrant singles. Table C.1 reports the complete list of countries in each group.

[15] The non-weighted results are virtually identical and are presented in Appendix Table C.2.

Columns (1)-(3) show the results for marriages in which the husband is native, while columns (4)-(6) show the results for marriages in which the wife is native. According to the baseline specification (columns 1 and 4), which includes year, province, and country of origin fixed effects, admission to the EU brings a 0.7 log point decrease in gains from marriage between females from new EU countries and native males, and an even larger decrease – twice as much – in gains from marriage between males from new EU countries and native females. However, the two estimates become very similar, and close to unity, when we control for underlying trends by province and country of origin as well as for province × country of origin fixed effects (columns 2 and 4). According to these estimates, admission to the EU decreased gains from marriages with native males and females by 58 and 64 percent, respectively. The estimated effect is slightly larger when including only official immigrants in the computation of the number of singles (columns 3 and 6), consistent with the discussion in Section 3 and Appendix A. However, this larger effect comes from underestimating the number of singles for all immigrant groups except new EU citizens in the post-enlargement period. For this reason, we prefer to include unofficial immigrants throughout the analysis.

Figure 7 plots the estimated coefficients and confidence intervals obtained when interacting a full set of year fixed effects with separate dummies for marriages between natives and, respectively, immigrants from $EU2004$ and $EU2007$ countries (see also the Appendix Table C.3). The first two graphs confirm that marriages between native males and females from new EU countries drop markedly after the latter obtain legal status. Interestingly, the 2004 enlargement also induced a strong increase in marriages between native males and $EU2007$ females. This is consistent with native males substituting $EU2007$ for $EU2004$ females when the announcement of the 2004 enlargements lowers (expected) gains to marriage for the latter group. Marriages between native females and males from $EU2007$ countries also decrease strongly after the announcement of the 2007 enlargement, while the evidence is less clear for males from $EU2004$ countries. As we already mentioned, however, there are very few marriages between native females and males from $EU2004$ countries. Finally, Figure 7 documents the absence of differential trends before the announcement of either enlargement.

3.2.2 Robustness

In Table 3 we investigate the sensitivity of our baseline estimate to relaxing two restrictions imposed by the model of Choo and Siow (2006b). First, their empirical framework implies that, for constant gains from marriage, percent changes Δ_x and Δ_y in the number of male and female singles, respectively, would induce a percent change $(\Delta_x+\Delta_y)/2$ in the number of marriages. In columns (1) and (5), we relax this restriction by controlling on the right-hand

side of equation (2) for the (log) number of single males and females at the denominator of equation (1). Second, the propensity of foreigners to intermarry with natives likely reflects the availability of other singles from the same country of origin. Indeed, the period after the EU enlargement witnessed large inflows from new EU countries, so the estimated decrease in the number of intermarriages could reflect greater availability of singles from the same country of origin. In columns (2) and (6) of Table 3, we thus control for the log number of singles from the same country of origin of the foreign spouse, in each province and year. In columns (3) and (7) we include all these additional control variables at the same time, and in columns (4) and (8) we further interact them with country of origin fixed effects. In all these specifications, the effect of interest remains virtually identical to the baseline estimate in Table 2. In the most stringent specification (columns 4 and 8), keeping constant the number of singles as well as trends by province and country of origin, admission to the EU decreased the propensity to marry with natives by more than 60 percent for both males and females from new EU countries.

Results are also robust to re-estimating the effect assuming that the whole of Italy is a single marriage market; to leaving out one country of origin at a time; to accounting for sample selection potentially induced by the fact that there are no marriages in some cells (so the logarithm in equation (1) is not defined); and to alternative one-way and two-way clustering of standard errors. These results are available upon request. Finally, in Table C.5 of the Appendix we provide indirect evidence that online marital matching was not a relevant phenomenon in Italy during our period of interest. In particular, we show (i) that the (log) number of marriages observed in Italy mirrors the distribution of singles across province-nationality-year cells, and (ii) that the effect of interest does not decline with greater diffusion of broadband Internet.

3.2.3 Effect on Cohabitation

We next investigate whether legal status acquisition produced "real" effects on the number of native-immigrant couples actually living together or, rather, just a substitution from official marriages into cohabitations of unmarried couples. To this purpose, we replicate our analysis by exploiting information of cohabiting unmarried couples, available from the 2001 and 2011 censuses.[16] If our effect of interest was entirely (or partly) driven by substitution of official marriages with cohabitations, we should observe a positive effect on cohabitations alone, as

[16]Cohabitations identify heterosexual love relations between partners who reside together. We do not have information regarding the starting date of the cohabitation. In order to retrieve a flow dimension, we thus select cohabitations of natives with migrants permanently residing in Italy in the last five years before the two censuses, i.e. from 1997 to 2001 for the 2001 census, and from 2007 to 2011 for the 2011 census.

well as a zero (or weaker) effect on the total number of couples living together (i.e. the sum of married and unmarried couples).

Overall, the results highlight that the enlargement produced important effects on the actual number of couples formed between natives and new EU citizens. Even though we document that, to some extent, official marriages are replaced by cohabitations with females from new EU countries, the size of the substitution effect is too limited to alter substantially our main conclusion. Specifically, columns (1) and (4) of Table 4 report a negative and significant estimated coefficient for official marriages formed in the restricted sample of years before the 2001 and 2011 censuses. By focusing on cohabitations alone, we observe that the EU enlargement leads to an increase in gains to cohabitation between native males and females from new EU countries (column 2), while there is no significant effect for cohabitations between native females and males from new EU countries (columns 5). In any case, when adding cohabitations to official marriages in the numerator of the gains to marriage, our effect of interest is still negative and sizable in magnitude (columns 3 and 6).

3.2.4 Matching on Other Characteristics

So far, we have documented how successive EU enlargements have affected the number of mixed marriages. In addition to cultural origins, individuals also match on other observable characteristics, such as age and education. Figure 8 shows the average age (top row) and education (bottom row) of spouses for different types of marriages during the period 1998-2002 (i.e., before EU enlargement). The first graph shows the average age of spouses when they both come from the same country, by area of origin. Husbands are on average older than wives, by two to four years. The gap increases considerably for intermarriages formed by native husbands and foreign wives (second graph), while the opposite is true for intermarriages formed by native wives and foreign husbands (third graph). Turning to education, wives are on average more educated than husbands (fourth graph in Figure 8). The gap widens for intermarriages between native husbands and foreign wives, while it is reduced for intermarriages between native wives and foreign husbands.

This shows that sorting in the marriage market is multidimensional and that individuals match by trading off different characteristics of their potential spouses. To the extent that individuals prefer on average to match with younger and more educated spouses, this evidence is consistent with immigrants trading off spouse's age and education for legal status acquisition. The Appendix Table C.4 provides additional evidence in this respect by estimating a difference-in-differences specification for spouses' age and education in intermarriages with spouses from new EU and other countries, respectively, before and after the EU enlargement.

In Section 4, we incorporate these trade offs into a multidimensional matching model of the marriage market. Before doing that, we present the evidence on separations.

3.3 Separations: data and methodology

ADELE provides access to rich administrative data on separation records from civil courts' registries. Such data cover the universe of separations in Italy from 1998 to 2012, providing detailed information (among other things) on separation proceedings, date and place of marriage, and date and place of birth for both spouses. Separation is the formal act that starts the divorce proceeding. Until 2015, a minimum period of 3 years of legal separation was required in order to eventually obtain divorce. For this reason, separations provide a more accurate representation of the timing of marital instability.

We matched marriage and separation records using the exact date of marriage and the exact dates and places of birth of both spouses, which are available in both registries. The combination of these characteristics allows an exact one-to-one matching for 99.5% of couples, and we discard the remaining fraction. The final dataset includes over 200 thousand separations over the period 1998-2012 (see Panel B. of Table 1).

We follow each married couple over time until potential separation. Following the popular approach by Cox (1972), we assume that the hazard rate is a log-linear function of observable covariates and an arbitrary baseline hazard common to all couples:

$$h(d, Z) = \lambda(d) \exp(\gamma' Z), \tag{3}$$

where $h(d, Z)$ is the hazard rate of separation after d years of marriage, conditional on the vector of covariates Z; $\lambda(d)$ is the baseline hazard; and γ is the vector of covariates' coefficients. Letting the baseline hazard be unrestricted, we can estimate γ by partial maximum likelihood. This approach remains very tractable while allowing for considerable flexibility in the baseline hazard rate $\lambda(d)$. In particular, we allow the baseline hazard to vary by province, year, and between homogamous native and mixed couples, respectively. In this way, the baseline hazard absorbs, among other things, systematic changes (if any) in the risk of divorce for mixed couple after two years of marriage, i.e. when the foreign spouse can apply for Italian citizenship.[17] As for our main effect of interest, the effect of EU enlargement is identified off differential changes in the hazard rate of separation between new EU citizens and other immigrants, before and after the enlargement.

[17] We do not detect any systematic shift in the hazard rate of separation after two years of marriage, see Figure C.1. This is likely due to the fact that, while foreign spouses can apply for citizenship after two years of marriage, there is considerable uncertainty regarding the duration of the procedure and the final outcome.

3.4 The effect of EU enlargement on separations

Table 5 shows the estimated effect of EU enlargement on the hazard rate of separations, modeled as in equation (3). The specification in columns (1) and (5) includes on the right-hand side the dummy *newEU*, its interaction with dummies for the period after the enlargement, and calendar year fixed effects. We include separate interactions for the year after the enlargement and for the following years, respectively, as the decrease in gains to marriage should produce an immediate increase in separations immediately after the enlargement. This is indeed the case. The hazard rate of separation between native males and females from new EU countries increases by 23 percent in the year immediately after the enlargement. The effect is lower (15 percent) and not statistically significant for marriages between native females and males from new EU countries.

Marriages formed after the enlargement are particularly solid. This is shown in columns (2) and (6), in which we interact *newEU* with dummies for marriages formed before and after the enlargement period – respectively, 1998-2002 and 2007-2012. Other things equal, marriages formed between natives and immigrants from new EU countries after the enlargement period have a 35 percent lower probability of breaking up relative to other marriages. All results are confirmed when including all interactions with *newEU* in the same specification and allowing for both calendar year fixed effects and different baseline hazards by year of marriage (columns 3 and 7). Finally, they are also robust to controlling for the number of potential matches from the same country of origin as the foreign spouse (columns 4 and 8)

4 Multidimensional marital matching model

By leveraging the successive enlargements of the EU, the previous section has shown that access to legal status reduced the probability of immigrants intermarrying with natives, it profoundly changed the composition of mixed marriages leading to patterns of substitution across cultural groups, and it hampered marital stability. The results point to an important role for legal access to work and cultural preferences for marriage and separation choices, together with age and education differences. However, all these factors affect the equilibrium into the marriage market and later separation choices simultaneously. Thus, the identification of the precise contribution of each of these different factors on outcomes, requires us to specify and estimate a multidimensional equilibrium model of marital matching and subsequent separations. We then exploit the model to investigate the implications of highly debated and controversial immigration policies via counterfactual simulations.

4.1 Setup

We consider a transferable utility (TU) marital matching model in a frictionless – but local – marriage market. The TU assumption captures the idea that spouses implicitly transfer utility between each other in absence of transaction costs. Transfers are endogenously determined as equilibrium outcomes, as they depend not only on the quality of the specific match, but also on the whole set of available matches in the market. Moreover, in absence of frictions, we assume that any individual has complete and costless information about all subjects present in that market and their characteristics.

We extend the model to a multi-market framework along two dimensions of interest. First, we exploit the longitudinal structure of the data focusing on two time periods. Let t denote the time dimension where $t \in \{t_1, t_2\}$, with t_1 indicating the period before the EU enlargements (1998-2002) and t_2 the period after (2007-2012). Second, we assume that each province p corresponds to a specific local marriage market.[18] Given the temporal and geographical heterogeneity, we end up with $TP = 20$ separate and independent marriage markets.

Each marriage market is a two-sided market, with a population of men denoted by $i \in I$ and women $j \in J$, residing in a given province p at time t. Men and women are heterogeneous along a vector of relevant attributes for the marriage market. In particular, each man $i \in I$ is characterized by a vector of observable attributes $x_i \in X$, while each woman j is characterized by a vector of attributes $y_j \in Y$. In our empirical application x_i and y_j represent a bundle of personal and socio-economic characteristics,

$$x_i = \{x_i^A, x_i^{Ed}, x_i^{Orig}, x_i^H\}, \quad y_j = \{y_j^A, y_j^{Ed}, y_j^{Orig}, y_j^H\},$$

comprising respectively age, educational attainment, geographic area of origin, and wealth (home-ownership).[19] Given I men and J women, $I \times J$ matches are potentially observed in each market p at each point in time t. A *matching* defines who is matched with whom and who remains unmatched. Specifically, a matching is a measure $\mu_{tp}(i, j)$ over the $I \times J$ space,

[18] We focus on $P = 10$ different provinces. Those provinces are Milano, Torino, Bologna, Genova, Firenze, Perugia, Rome, Napoli, Bari and Palermo. These provinces were chosen to get the largest ones and in order to have a range of provinces across northern, central and southern parts of the country.

[19] Home-ownership is not recorded on marriage certificates, but this information is recorded in the Census, together with the other characteristics in x_i or y_j. This allows us to compute the conditional probability of home-ownership that we denote $\pi_t^W(\bar{x}_i)$ and $\pi_t^W(\bar{y}_j)$, where $\bar{x}_i = \{x_i^A, x_i^{Ed}, x_i^{Orig}\}$ and $\bar{y}_j = \{y_j^A, y_j^{Ed}, y_j^{Orig}\}$ are the set of characteristics excluding home ownership. In our estimation method, we use those probabilities to integrate out housing when computing marriage rates. This allows for another determinant for migrants to marry natives which could confound the role of legal status.

such that $\mu_{tp}(i,j) = 1$ if man i is matched with woman j from the reference population in market p at time t, and zero otherwise. By considering a one-to-one matching framework, any individual in the market can be matched to only one person, the matching measure thus needs to satisfy the following feasibility constraints:

$$\sum_{J} \mu_{tp}(i,j) \leq 1 \quad \forall i \in I, \qquad \sum_{I} \mu_{tp}(i,j) \leq 1 \quad \forall\, j \in J. \tag{4}$$

In addition, we define $\mu_{tp}(i,0) = 1$ if man i is single and similarly $\mu_{tp}(0,j) = 1$ if woman j is single in the same reference population.

4.1.1 Marriage surplus and optimal matching problem

Let $\tilde{\Phi}_{tp}(i,j)$ denote the joint utility generated by assigning man i to woman j, residing in area p in period t. Denote $\omega_{tp}(x_i)$ and $\omega_{tp}(y_j)$ the outside option of remaining single for man i of characteristics x_i and woman y_j, respectively. The joint marital *surplus* generated from the (i,j) marriage is thus, $\Phi_{tp}(i,j) = \tilde{\Phi}_{tp}(i,j) - \omega_{tp}(x_i) - \omega_{tp}(y_j)$ and a marriage takes place only if the joint net surplus is positive: $\Phi_{tp}(i,j) > 0$. Thus, under the assignment $\mu_{tp}(i,j)$, the total surplus generated within each market is equivalent to: $\sum_{IJ} \mu_{tp}(i,j)\Phi_{tp}(i,j)$. The *optimal* matching turns out to be the solution of the following welfare maximization problem over all potential matches in the market, including the options of singlehood:

$$\max_{\mu_{tp}(i,j)} \quad \sum_{IJ} \mu_{tp}(i,j)\Phi_{tp}(i,j) \tag{5}$$

subject to standard non-negativity and feasibility constraints in (4). The solution of the primal problem in (5) corresponds to a *stable* matching (Shapley and Shubik, 1971). A matching is stable if nobody would prefer to deviate from the assignment, i.e. neither a man i nor a woman j who are currently married would rather be single, nor a woman j and a man i who are not currently married together would both rather be married with other partners than remain in their current situation (i.e. absence of blocking pairs, Chiappori and Salanié, 2016). We solve the optimal matching from the maximization problem in (5) numerically, given the absence of a closed form solution to our model. We detail this below.

4.1.2 Surplus specification

We characterize the joint utility generated within the marriage to include both systematic and idiosyncratic components. In particular, the joint marital surplus comprises four sys-

tematic components denoted by $\phi_t^k(x_i, y_j)$ with $k = \{A, Ed, Orig, W\}$, describing the effect of age, education, geographic area of origin, and wealth of a match between man i of characteristics x_i and woman j of characteristics y_j, at time t. In addition, the surplus depends on a time varying component $\beta_{tp}(x_i, y_j)$, which represents the value of legal status obtained through marriage.

The surplus also depends on a match specific random component, $\varepsilon_t(i, j)$, which rationalize that observationally identical agents, in equilibrium, will have different types of partners. By introducing an idiosyncratic component to the surplus generated by matching man i with woman j, we specifically allow for sorting on unobserved characteristics –"love"– on both sides of the market. We interpret $\varepsilon_t(i, j)$ as a random love component between man i and woman j in period t, which is observed by the individuals, but unobservable from an econometric perspective.[20] We assume it follows an exponential normal distribution, with zero mean and variance σ_ε. In this respect, our model represents a considerable departure from the literature originating with Choo and Siow (2006b), which relies on individual and separable idiosyncratic shocks over observed characteristics of mates only. Such an assumption leads to a tractable model and offers a transparent identification of the determinants of marriage. However it also rules out complementarity between unobserved characteristics (Chiappori and Salanié, 2016) and imposes strong restrictions of the substitution patterns across different types of spouses (Decker et al., 2013). Compared to the standard additive structure, we allow the shock $\varepsilon_t(i, j)$ to enter multiplicatively in the surplus function. "Love" is therefore complementary to other observable characteristics. A final advantage of having a couple specific unobserved component is that it allows to explain subsequent separations through the evolution of that shock as detailed below.

The surplus is represented as follows:

$$\Phi_{tp}(i, j) = \varepsilon_t(i, j) \cdot \beta_{tp}(x_i, y_j) \cdot \prod_{k=A,Ed,Orig,W} \phi_t^k(x_i, y_j) - \omega_{tp}(x_i) - \omega_{tp}(y_j). \tag{6}$$

We discretize each of the characteristics x_i^k and y_j^k and we allow for N_k groups, indexed by g and g' respectively. For age, we group individuals in six five-year groups, between the age of 22 and 50. We allow for two groups for education (more than high school or not) and two groups for wealth, whether single individuals own property or not. We assign

[20] The idiosyncratic component might also be interpreted as an idiosyncratic non-monetary return from marriage. A different approach to rationalize the observed heterogeneity in marital sorting is to introduce some frictions in the market and model explicitly a meeting technology. The presence of frictions implies that any individual has imperfect and costly information about potential mates in the market. As stated in Chiappori and Salanié (2016), randomness on the meeting technology guarantees that similar agents, in equilibrium, will have different types of partners.

individual cultural identities based on $N_{Orig} = 8$ geographic areas, namely Italy, EU15, EU2004/07, Rest of Europe, Asia, Africa, South-America and Other OECD countries. We denote $I_{x^k=g,y^k=g'}$ an indicator variable equal to one if the k-th characteristic of both partners belongs to the group g and g' respectively. We parametrize the $\phi_t^k(x_i, y_j)$ components of the surplus as follows:

$$\phi_t^k(x_i, y_j) = \sum_{g,g'}^{N_k} \alpha_{t,g,g'}^k I_{x^k=g,y^k=g'} \quad , \quad k = \{A, Ed, Orig, W\} \tag{7}$$

where the parameters $\alpha_{t,g,g'}^k$ account for the strength of mutual attractiveness across spouses' observable characteristics. We allow the $\alpha_{t,g,g'}^k$ coefficients pertaining to geographical origin to change over time, to account for potential variation in preferences due to differences in selection into migration on unobservable characteristics following the enlargement of the EU. As discussed below, identification of the variation over time of these coefficients comes from jointly observing marriages and separations, before and after the enlargement.

The marriage surplus above includes a potential penalty for not having legal access to the labor market, $\beta_{tp}(x_i, y_j)$. Natives and citizens of the EU countries have full access to the labor market, as well as their spouses. We normalize this coefficient to one for couples where both partners have legal access to the labor market when single. This includes homogamous marriages between Italians or EU15 citizens before the enlargement, homogamous marriages of citizens from EU2004/07 after the enlargement, but also mixed marriages between Italians or EU15 citizens before the enlargement and with those from the new accession countries after the enlargement. For couples where neither spouses have legal access to the labor market, we assume that the match carries a penalty $\beta_{tp}(x_i, y_j) = \underset{\sim}{\beta}_p \leq 1$, which is potentially province dependent. It is possible that in the South of Italy, where informal work is more prevalent, legal access may not be worth as much, so the penalty coefficient $\underset{\sim}{\beta}_p$ may be closer to one, compared with provinces in the North.[21] Finally, for couples where, as singles, one member has access to the legal market and the other does not (e.g. a mixed marriage consisting of an Italian and an Asian spouse), we allow the surplus to vary by a factor $\beta_{tp}(x_i, y_j) = \bar{\beta}_p^{\male}$ or $\bar{\beta}_p^{\female}$ depending on whether the Italian spouse is male or female.[22]

Figure 9 gives a descriptive explanation of how we model the surplus related to legal status and cultural affinity, and describes how identification is achieved.[23] Marriage data

[21] The Appendix Figure C.4 shows the estimated incidence of the shadow economy across Italian regions.

[22] Our parametrization is fully flexible and it does not collapse the multidimensional space of characteristics into a single index of attractivenesses, i.e. a unidimensional component aggregating the various observable attributes in such a way that all individuals share similar preferences regarding the other side of the market (Chiappori and Oreffice, 2008; Chiappori et al., 2012).

[23] We first describe the simplified case where cultural affinity is constant over time. Moreover, we abstract

after the enlargement allow us to identify the cultural affinity parameters of the marriage surplus for marriages involving natives with foreigners belonging to the EU. For all other types of marriages, their proportion depends on both cultural affinity and the value attached to legal access. Hence, a cross-section only allows for the separate identification of a subset of parameters, related to cultural affinity. However, by also exploiting longitudinal variation, i.e. marriage data before the enlargement, we can identify the effect of legal access separately from cultural affinity. For instance, the knowledge of the cultural affinity parameter between Italian men and women from the enlargement countries after the enlargement allows us to identify the coefficient $\bar{\beta}_p^{\sigma^{\prime}}$ by looking at such marriages before the enlargement. Then, in turn, this enable us to disentangle the cultural affinity parameters for Italian men married to women from other (groups of) countries. Exploiting a typical difference-in-differences research design allows us, therefore, to identify parameters relating not only to marriages involving spouses from the enlargement countries but also of any other origin.

The difference-in-difference design, just described, identifies model parameters under the assumption that the surplus related to cultural affinity is constant over time. This assumption is in our case dubious as the enlargement could have attracted migrants with different unobserved characteristics, altering significantly the composition of the pool of potential spouses over time. To account for such a change in composition, we also rely on separation data, where couples formed in the pre-enlargement period are followed through to the post-enlargement period. Those couples only have a change in the legal status component $\beta_{tp}(x_i, y_j)$ or in their "love component", but have a surplus related to the geographical origin that is fixed at time of marriage.

For identification purposes, we introduce the following coefficient restrictions. For homogamous native couples, we impose that $\alpha^k_{t,1,1} = 1$ for all $k = \{A, Ed, Orig, W\}$ and $t = t_1$. Thus, the surplus for a couple of Italians, with low education, both aged 22 and with no housing, residing in province p at time t is equal to $1 - \omega_{tp}(x_i) - \omega_{tp}(y_j)$. We model the outside option as a function of the share of available individuals from the same origin residing in the same province p, to capture potentially larger option value of waiting for individuals living in more segregated communities. The outside option coefficient will be determined in the estimation so as to match the marriage rate for this group in province p at time t, accounting for differential trends in marriage rates both over time and across provinces. The other coefficients $\alpha^k_{t,g,g'}$ are left free to vary to match the marriage rates for the other groups.

here from heterogeneity in age, education and wealth for expositional reasons.

4.1.3 Divorce

Given that our marriage model contains a couple specific "love" shock, $\varepsilon_t(i,j)$, it allows us to model subsequent divorces in a coherent way. Indeed, we introduce a dynamic structure at the level of the match specific random component. We rationalize it as an update of spouses' mutual love within marriage and we assume that it evolves as a random walk:[24]

$$\varepsilon_{t+1}(i,j) = \varepsilon_t(i,j) + \eta_{t+1}(x_i, y_j), \qquad \eta_{t+1}(x_i, y_j) \sim \mathcal{N}(0, \sigma^2_\eta(x_i, y_j)). \tag{8}$$

In contrast to the extant literature, in our model, divorce occurs from a change in the couple specific shock, not from a change in how broad attributes such as education or age are valued. Negative surprises potentially trigger divorce choices, but we assume that only a fraction $1-\delta$ of couples separate when the surplus become negative.

4.2 Estimation

Let $\boldsymbol{\theta}$ denote the vector of parameters describing the surplus of couples, defined above. We estimate the model parameters via a Method of Simulated Moments (MSM) estimator, matching a vector of observed moments from the data to a vector of theoretical moments predicted by the model, constructed through simulations. We denote by $\widehat{\Lambda}$ a vector of observed moments and by $\Lambda(\boldsymbol{\theta})$ the theoretical counterpart. The estimated surplus parameters are obtained as:

$$\hat{\boldsymbol{\theta}} = arg\min_{\boldsymbol{\theta}} \quad [\widehat{\Lambda} - \Lambda(\boldsymbol{\theta})]^\intercal \boldsymbol{W} [\widehat{\Lambda} - \Lambda(\boldsymbol{\theta})],$$

where $\boldsymbol{W}$ is a weighting matrix.

From data, we recover matching patterns over observables characteristics $\bar{x}$ and $\bar{y}$, $\hat{\mu}_{tp}(\bar{x}, \bar{y})$, by summing up all men i of characteristics $\bar{x}_i = \bar{x}$ matched to women j of characteristic $\bar{y}_j = \bar{y}$, in province p at time t. The vector $\widehat{\Lambda}$ contains observed marriage rates over observable characteristics $\hat{\mu}_{tp}(\bar{x}, \bar{y})$[25] stacked with data moments characterizing divorce patterns of two different cohorts of married couples that we follow through time. Both cohorts were married before the enlargement, the first one is observed entirely before the enlargement, while the second is followed through it. Comparing the separation patterns of the two cohorts allows us to evaluate the effect of the enlargement, separate from the propensity of separation of each type of couple.

Specifically, we construct separation rates for two cohorts, $c \in \{c_1, c_2\}$, that have been

[24] Voena (2015) assumes a similar stochastic structure when modelling divorce.

[25] We also account for the potential omission of homogamous foreign marriages celebrated abroad and, thus, not recorded in marital registries. See Appendix B for more details.

married for 2 to 4 years. The first cohort, c_1, consists of couples (of all origins) married in 1998-1999 and observed in 2000-01 when we see the status of their marriage. The second cohort, c_2, consists of couples married either in 2002-03 and followed in 2004-05 (couples involving either natives and/or migrants from the EU2004 enlargement) or married in 2005-06 and followed in 2007-08 (couples involving natives and/or migrants from the EU2007 enlargement). In the second cohort, citizens from the accession countries married to EU citizens may reconsider their initial marriage choice once they have legal access to the labor market granted through the enlargement of the EU. For each of these two cohorts, we regress an indicator variable D_{cij} equal to one if the (i, j) couple separate on a set of indicator variables coding for mixed marriages between Italians and new (or future) accession countries, between Italians and other countries of origin, for marriages involving a wife that is ten years younger or older than the husband and for marriages involving partners with the same level of education. Let Z_{cij} denote this set of regressors. The excluded category, captured by a constant, is for homogamous marriages. For each cohort c, we estimate the auxiliary parameters γ_c on the observed data from:

$$D_{cij} = Z_{cij}\gamma_c + u_{cij}. \tag{9}$$

Therefore, the vector of observed moments is:

$$\widehat{\Lambda} = \{\hat{\mu}_{tp}(\bar{x}, \bar{y}), \hat{\gamma}_c\}, \quad t \in \{t_1, t_2\}, \;\; c \in \{c_1, c_2\}, \;\; p = 1, \ldots, P.$$

In total, once normalization restrictions are imposed, we have a total of 100 parameters to describe $(N_A.N_{Ed}.N_{Orig}.P)^2 = 92,160$ marriage types per period, as well as 14 moments describing separation choices.

Theoretical moments are computed as follows. We recover marital matching moments through simulations. For each period t and province p, we simulate N marriage markets of I men and J women. The distribution of individual characteristics in the simulated market parallels the distribution of observed traits for men and women, $m_{tp}(\bar{x})$ and $f_{tp}(\bar{y})$ at time t in province p that we observe in the data.[26] We use the observed probabilities of home ownership $\pi_t(\bar{x}_i)$ and $\pi_t(\bar{y}_j)$ to derive $m_{tp}(x)$ and $f_{tp}(y)$, the proportion of available men and women conditional on age, education, area of origin and wealth. We compute for all possible $I \times J$ matches the resulting surplus, and then solve for the optimal allocation in (5), using the mathematical programming solver Gurobi.[27]

[26] We recover population vectors, $m_{tp}(\bar{x})$ and $f_{tp}(\bar{y})$, in order to satisfy standard feasibility constraints. A graphical representation of the distribution of observed traits by gender is reported in Figure C.2.

[27] More information on Gurobi is available from http://www.gurobi.com/.

In practice, some of the marriage types are rare, especially those involving minorities and for some educational groups. As in Dupuy and Galichon (2014), we assume that not all individuals interact together. Instead, we construct two pools where individuals meet. The first is exclusively composed of natives, whereas the second pool consists of natives and foreigners. The second pool is such that there are at least as many natives as foreigners, so that in principle all foreigners could find a native match. This procedure allows us to have a boost sample of foreigners, and to reduce the number of simulations. Formally, we assume that a fraction λ of Italians meet only Italians on the marriage market. The remaining fraction $1-\lambda$ meet foreigners and match according to both cultural, socio-economic characteristics and unobserved characteristics. We derive marital matching patterns, $\mu^{\boldsymbol{\theta}}_{tp}(\bar{x},\bar{y})$, by recording as married any allocated match with a positive surplus and consequently derive the theoretical distribution of single individuals, $\mu^{\boldsymbol{\theta}}_{tp}(\bar{x},0)$ and $\mu^{\boldsymbol{\theta}}_{tp}(0,\bar{y})$.

We consider $N = 12$ markets per province p, with size $I = J = 500$, half of them with foreigners. This amounts to considering 60,000 simulated males and females per period who can potentially marry. Increasing N leads to more stable results as the sample size gets larger and more marriages between rarer types are observed. A larger N increases the computational time (in a linear way). The choice of I is undoubtedly arbitrary, but fixed both by considering computing time and the stability of the estimates. Increasing I increases the computing time in a quadratic way. It also implies that each individual i samples more partners and therefore more shocks $\varepsilon_t(i,j)$, and hence has a larger chance of finding a suitable match. Holding the value of remaining single, ω_{tp}, fixed as I goes to infinity, everyone in the economy would get married. In other terms, the model is not scale invariant. However, once the value of remaining single is free to adjust with I, we observe that for a large enough I there are few changes in the overall allocation. Our choice of I reflects this fact, and allows for a tractable computing time.[28]

We construct the model counterpart of the separation rates defined in equation (9) by simulating two different cohorts. For the first cohort, the term $\beta_{tp}(x_i,y_j)$ remains constant through time. For this cohort only changes in the match-specific random component account for separations. The second cohort sees a change of the surplus penalty term $\beta_{tp}(x_i,y_j)$ after their marriage decision in addition to the revision in their match specific random component. For a given choice of $\boldsymbol{\theta}$, we estimate the auxiliary parameters $\gamma^{\boldsymbol{\theta}}_c$ from (9) on simulated data, separately for each cohort c.

[28]Such a setup can be rationalized with non-linear and convex search costs.

4.3 Model fit

We first start with the fit of the model. We estimate 100 parameters in total. Out of those parameters, 35 of them pertain to the contribution of age to the marriage surplus and as many to the contribution of cultural affinity. The remaining parameters characterize the value of being single (11), the value of housing (6), the effect of legal status (6), education (3) and separations (4). Those parameters serve to describe 184,320 types of marriage rates across all characteristics, provinces and time periods as well as 14 moments pertaining to separation rates. Figure 10 displays the fit regarding marriage patterns. The correlation between the observed and predicted marriage rates is equal to 0.86 before and after the enlargement. The predictions of the model regarding separation rates for cohorts followed before or during the enlargement process are displayed in Table 6. The model captures the general patterns of separation across cohorts and country of origin, although few parameters that we estimate have a direct impact on separations in the model. Those are essentially the four parameters describing the variance of the innovation of the idiosyncratic shock defined in equation (8) and two parameters capturing the fraction of couples who do not take into account the marriage surplus in their decision to stay married. The effect of the enlargement comes from the change in legal access, $\beta_{tp}(x_i, y_j)$, although that term serves also to match marriage choices before and after the enlargements.

While it is reassuring that the model can fit the data moments we target in the estimation, we additionally validate our estimates by predicting specific patterns observed in the data that were not directly targeted. We investigate the ability of our estimated model to reproduce a particular marginal effect. Denote R_{lk} the percentage marginal effect of the number of individuals of type l in a market on the number of singles of type k. We compute those elasticities by exploiting province level variation for the period before the enlargement and we compare them with the elasticities computed trough our model by varying the share of men of a given type and solving for the counterfactual outcomes. Moreover, we compare the elasticities derived from our model with those implied by the Choo and Siow (2006b) model. Decker et al. (2013) show that in the Choo and Siow (2006b)'s model the functional form imposes (i) symmetry: $R_{lk} = R_{kl}$ and (ii) sign restrictions such as $R_{lk} > 0$ or $R_{lk} < 0$ when considering the effect of a variation in the number of men on single men and on single women, in turn. The results are depicted in Figure 11 which plots the elasticity R_{lk} as a function of R_{kl}. The two top graphs depict the data estimates. The general shape is more like a cross with no detectable slope. The elasticities are as likely to be negative or positive, they are far from symmetric and do not obey the sign restrictions implied by the Choo and Siow model. The two bottom graphs display the predictions of our model. Interestingly, the

model is able to match the elasticities from the data, reproducing the cross shape for both men and women. This shows that the assumptions that govern the stochastic component in the Choo and Siow model are too strong for the marriage market we analyse, and that our specification can match many features of the data, both on marriages and separations.

4.4 Estimated parameters

We find strong preferences for positive assortative mating along age, education and wealth lines. Our estimates mirror the evidence presented in the literature (among many others, Choo and Siow, 2006b; Hitsch et al., 2010; Siow, 2015; Chiappori et al., 2012; Dupuy and Galichon, 2014; Chiappori et al., 2017; Galichon and Salanié, 2017; Low, 2019). We refer the reader to Appendix B for a description of the parameters relating to age, education and wealth differences, while in the following section we focus on parameters related to legal access and cultural affinity.

The coefficients regarding legal access are displayed in the first panel of Table 7. The estimates of the penalty for lack of legal status ($\underline{\beta}$) show geographical heterogeneity. The absence of legal status leads to a reduction in the marriage surplus ranging from about 15 percent in the North of Italy to 7 percent in the South of Italy - where informal work makes legal status less valuable. Couples where one of the spouses grants legal status to the other have a larger surplus, except in the case of a native wife and a foreign husband in the North, where there is a reduction in the surplus of about 7 percent. This parameter reflects the lower rate of mixed marriages where the wife is native, documented in Figure 3, and the subsequent analysis in Section 3.

Panel B of Table 7 displays the effect of cultural affinity on the marriage surplus. This effect derives essentially from revealed preferences by observing the choice of spouses across periods and markets. The coefficient for homogamous marriages (along the diagonal) has been normalised to one. We find that cultural affinity among mixed couples are lower than homogamous ones.[29] The penalty for cultural heterogamy ranges from 7 percent (for couples involving Italians and other EU15 citizens) to 40 percent for couples formed of a South American and a citizen of "Other European" countries. We find evidence of an asymmetric surplus as couples formed of Italian males with foreign women have a higher surplus than couples with Italian females and foreign males. Finally, we find a very small decline in the cultural affinity between Italians and EU2004/07 citizens once the enlargement takes place of about one percent. We refer the reader to appendix B.3, for a comparison between our

[29]Similar evidence arises in the speed dating experiments as shown in Fisman et al. (2006) or Fisman et al. (2008).

cultural affinity parameters and commonly used measures of cultural distance.

Combining the parts of the surplus related to cultural affinity and to legal access, we can now revisit the effect of the enlargement. Figure 12 depicts the surplus for a women from the EU2004/07 countries, married to a man from a different origin (we abstract for the other components affecting the surplus). After the accession, the legal access coefficient β_{tp} is set to one, and only cultural differences matter. The highest surplus is reached for a homogamous couple, followed by a couple where the husband is Italian. The lowest surplus is achieved with an Asian husband. Before the enlargement, the ordering of the surplus is different as it is higher when the husband is Italian, followed by a EU citizen. The surplus of a homogamous couple is only ranked third. This reversal of the ranking of surplus, due to changes in the legal status, explains the large change in marriage markets during that period.

4.5 Enlargement of the EU and welfare effects

The changes in marital choices induced by the enlargement of the EU likely generated heterogeneous changes in marital surplus. In this section, we evaluate the overall welfare effect of granting legal status to citizens of "new EU" countries and we measure the change in surplus for natives and foreigners. We consider a baseline, consisting in the situation before the enlargement. We then compute a counterfactual with a distribution of males and females identical to the baseline, but where citizens of "new EU" countries have a legal right to reside and work. In doing this, we isolate the legalization effect from a change in the composition of men and women, some that may be due to the policy itself and some to other factors affecting the Italian economy in the 2000s.

Our model specify a marital surplus, but not individual welfare, as, so far, we did not have to detail how the surplus is shared within the household.[30] As we want to compute the welfare separately for different types of individuals, we now take a stand on how this surplus is shared. Denote $\tilde{\Phi}_{Sp}(i,j)$ and $\omega_{Sp}(x_i)$ the marital surplus if man i is married to woman j and the value of being single in scenario $S = \{B, C\}$ - indicating the baseline or the counterfactual. We assume that the share of the surplus going to man i is pro-rata the value of staying single:

$$\tilde{\Phi}_{Sp}(i) = \tilde{\Phi}_{Sp}(i,j)\frac{\omega_{Sp}(x_i)}{\omega_{Sp}(x_i) + \omega_{Sp}(y_j)}, \quad S = B, C. \tag{10}$$

For a given individual, welfare may differ between the baseline and counterfactual for two

[30] Identifying the sharing rule would require additional intra-household information.

reasons. First, there is a direct effect through a change in $\beta_{Sp}(x_i, y_j)$ affecting marital surplus. Second, there are general equilibrium effects as individuals married under the baseline may end up single in the counterfactual and vice-versa and married individuals in the baseline may be married with someone different in the counterfactual, with a different marital surplus, but also different allocation weights. The evolution of individual welfare is therefore complex.

Figure 13 displays the results, for native or foreign men and women. The figure displays on the left the total change in welfare for each group of individuals and shows considerable heterogeneity. Native men, married in the baseline, experience a decline in welfare of about 1 percent. Married native women have a smaller decline of about 0.8 percent. Citizens from the "new EU" countries experience an increase in their welfare, with an increase of 2 percent for men and 0.5 percent for women. We next display a Oaxaca decomposition of those welfare changes, in four distinct categories. The first two are for those who are married both in the baseline and counterfactual, and consist of a change in the marital surplus, holding allocation weights fixed and a change in allocation weights, keeping the marital surplus fixed. The next two sets of results are the contribution to the change in welfare of individuals going from married to single and vice-versa. The figure reveals that the negative effect for native males is mostly coming from both a change in allocation weights and being single in the counterfactual. Indeed, native males are more likely to marry foreigners in the baseline and get a higher share of the surplus. In the counterfactual, they are more likely to be single. For native women, the change in welfare is less due to being single, and more to a positive change in the surplus and a negative change in the allocation weights. This is because in the counterfactual, they are more likely to be married to native men, which provides a higher marital surplus because of cultural homogamy, but comes along with more equal sharing weights.

For men from the "new EU" countries, the biggest welfare effect is from getting married, as they are more likely to enter into homogamous marriages once they have legal status, which provides some increased welfare, but also more equal sharing weights. For women of those countries, the gain is not stemming from a change in surplus, but from having more equal sharing of the surplus, as they are more likely to marry men from the same origin.

Hence, general equilibrium effects induced by the enlargement had unintended redistributional consequences both within the market across different matches but also within a family across spouses. Overall, the policy redistributed marital surplus, with a loss for natives and a gain for the foreign citizens, but also with a marked gender imbalance.

4.6 How does policy affect marriage markets?

We investigate two counterfactual policies using our estimated model. The first one is a granting of legal access to a broader set of individuals and the second is allowing a particular set of migrants into the country.

4.6.1 Generalized legal access

Many countries periodically grant amnesties to legalize irregular migrants. The leading example is the US Immigration Reform and Control Act in 1986, which granted legal status to about 3 million migrants. Related policies have been enacted in France and Spain. The goal of these amnesties is to integrate irregular migrants by granting them legal residence and allowing them to access labor markets legally. While many studies have focused on their effects on wages and employment (Cobb-Clark et al., 1995; Phillips and Massey, 1999; Amuedo-Dorantes et al., 2007; Lozano and Sorensen, 2011), or crime (Mastrobuoni and Pinotti, 2015; Baker, 2015; Pinotti, 2017), there is no evidence on their longer run impact on marriage markets.

We assess the effect of generalized legalization on marriage markets using our estimated model and simulating a counterfactual where all foreigners present at the beginning of the period are granted legal status. Note that the variation we use to identify the model is closely related to such a policy. In the counterfactual, we assume that $\underline{\beta} = \bar{\beta}^{\female} = \bar{\beta}^{\male} = 1$ for everyone in the economy. We solve the model with this new feature and compare it to the baseline. We report the change in marriage rates following the generalised access in Figure 14. The policy lead to a small decrease in marriage rate in the whole economy (by about 0.5 percent) as well as a small increase in homogamous marriages involving natives (of about 0.3 percent). These small effects of the policy mask some important changes in other markets as there is a sharp decrease in mixed marriages by about 50 percent, mirrored by an even sharper increase in homogamous marriages among foreigners by about 110 percent.

While a legalization policy fosters the inclusion of foreigners in the labor market, it has also the unintended effect of reducing mixing in marriages. Given the strong intergenerational links in the transmission of cultural values within homogamous households, such a policy thus hamper the cultural integration of first generations immigrants with potentially severe and long-lasting consequences also on successive generations (Glazer et al., 1970; Suárez-Orozco and Suárez-Orozco, 2009; Schiller et al., 1995; Bisin and Tura, 2019).

4.6.2 Surge in African immigration

In recent years, there has been a marked increase in European countries of migrants crossing through the Mediterranean. This has caused dissensions among European countries and a debate on the long-term effect of such migration. While part of the argument revolves around the possible economic and cultural assimilation of those migrants, its impact on marriage market is not a prominent one. However, there are reasons to believe that marriage outcomes may lead to important issues. One such issue is the gender asymmetry in the marriage surplus and its consequences on marriage rates. Indeed, in Section 4.4, the marriage surplus in heterogamous marriages is larger when the native spouse is a man than a woman. This could lead to uneven marriage patterns for migrants by gender.

To test this hypothesis, we simulate the impact on the Italian marriage market of a surge in migration from Africa where we look at the marriage outcome of new migrants taken to be young and of low education, but balanced across sexes. Figure 15 displays the results for those new migrants distinguishing between men and women. We find that African women are much more likely to marry. About 11 percent of them get married, in contrast with only 4 percent of men. For women, the fraction married results in a small share married with an Italian spouse (about 2 percent), the remaining marriages occurring with foreign spouses (mainly from the same origin). For migrant men, almost none marry an Italian spouse and few marry foreign spouses, so that the vast majority of men remain unmarried.

There is a large literature detailing the consequences of marriage on a range of outcomes such as earnings (marriage premium) but also on crime and assimilation (Edlund et al., 2013). Hence, it is likely that the increase in migrants may result in a group of single foreign men, who will face difficulties in the labor market and more generally in integration into the host country society and economy.

5 Conclusion

In this paper, we exploit a natural experiment, the successive enlargements of the European Union, that shifted the incentives of some foreigners to marry natives. We show that the accession of the Eastern European countries changed profoundly the composition of mixed marriages. The migrants from the new European countries turned away from natives, to marry more within their own communities. In turn, the natives changed their pattern of marriages towards migrants who did not (yet) have legal access to the labor market. Our analysis therefore stresses both the importance of legal access to the labor market in marriage decisions and how it can overcome differences in cultural affinity.

Our analysis relies both on reduced-form techniques and on a more structural approach. Both methods exploit not only marriage data over time and across geographical areas, but also separation rates of couples followed over time. The identification is achieved through a difference-in-differences design in a multi-market framework. While the first part of the analysis presents a transparent research design, it only allows to study one outcome at a time. The second part of the analysis puts more restriction on the data by parameterizing the surplus function, but allows us to exploit jointly all data on marriages and separations to decompose the marriage surplus into a component that relates to the value of legal access or cultural affinity, among others.

We develop and structurally estimate a multidimensional equilibrium model of both marriage and separations, allowing for trade-offs between cultural distance, legal status, and other socio-economic spousal characteristics, such as age, educational attainment and wealth. We extend the current literature on marriage models to a multi-market framework and to accommodate couple-specific random components affecting marriage surplus. We show how such a model can be brought to data using simulation techniques.

We find that legal status is an important determinant of mixed marriages. The estimation of the model also allows us to identify the cultural affinity aspect of marriage surplus. Cultural affinity is obtained through a revealed preference argument, by looking at substitution patterns in marriage choices. We find stark differences in preference towards spouses from various areas of origin. Interestingly, these preferences are correlated with genetic distance, but that measure explains only a fraction of the variability in preferences.

Importantly, while access to legal status grant a labor market premium, to access formal employment and more valuable jobs, it also entails a penalty in the marriage market in term of reduction of mix marriages, which is consequential in terms of cultural integration of minorities. However, from a marital perspective, legalization likely increased the marital surplus of the foreigners, while decreasing the one of natives.

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Figure 1: Intermarriage rate across European countries, 2015

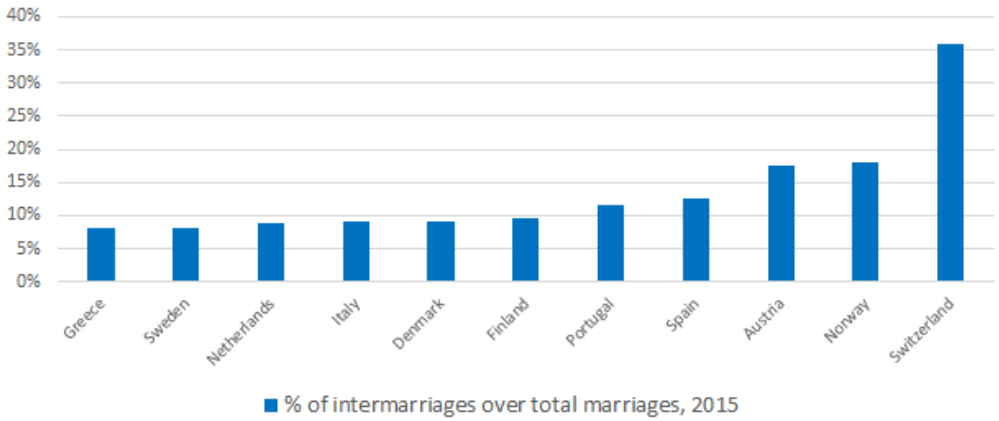


Figure 2: Number of foreign residents in Italy by area of origin (millions), 1994-2017

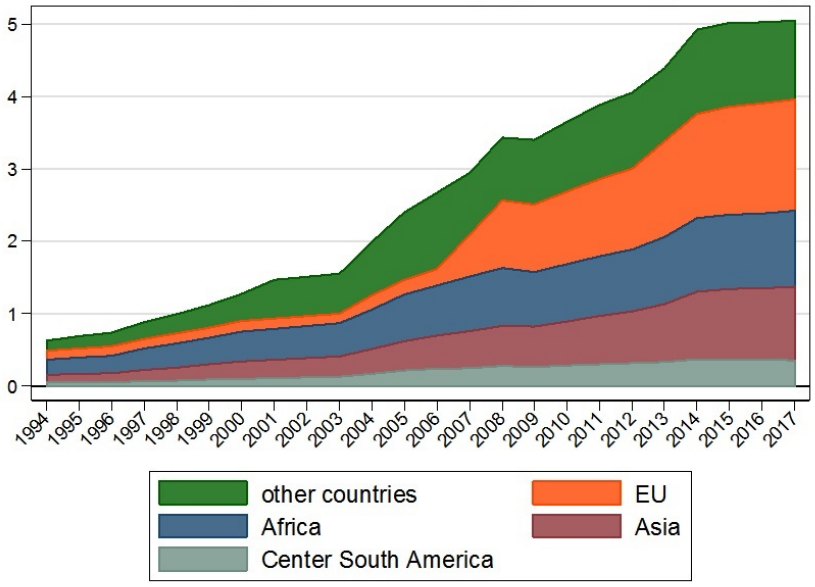
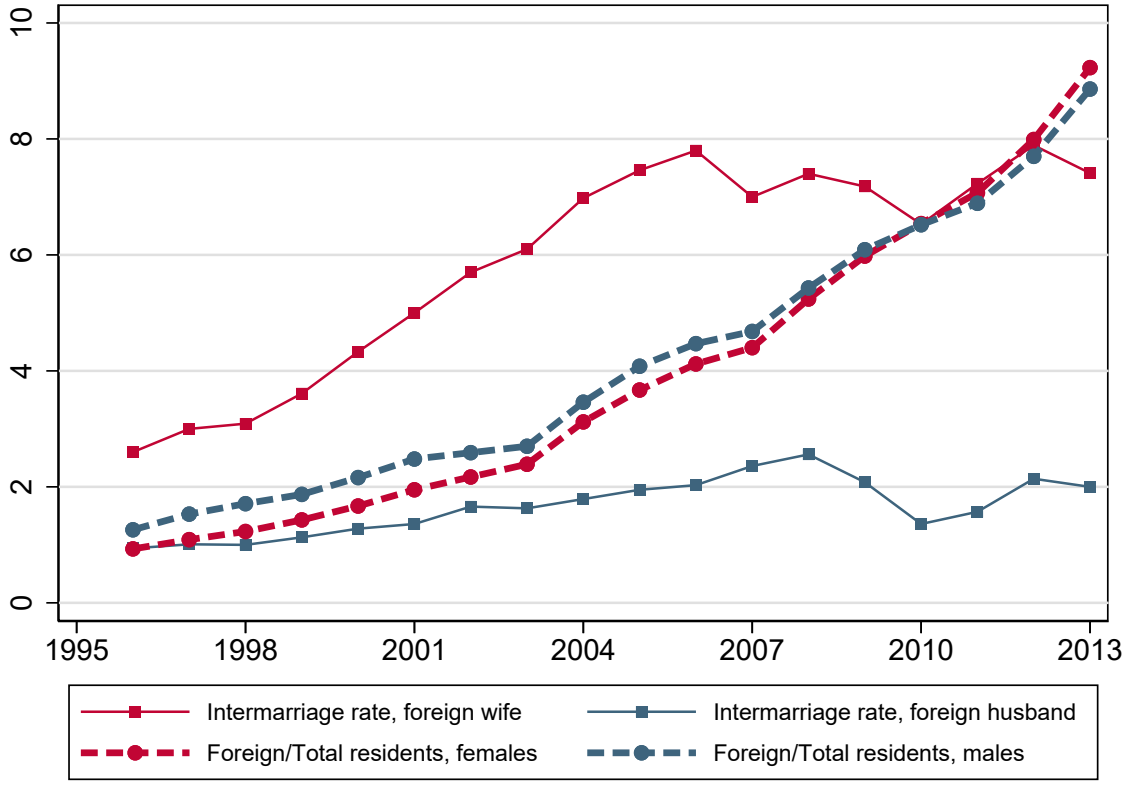


Figure 3: Intermarriage rate and ratio of foreign residents over total population, 1996-2013



Notes: This figure shows the evolution over time of the intermarriage rate in Italy, computed as the ratio between the number of intermarriages formed in a given year over the total number of marriages formed in the same year. The intermarriage rate is reported separately for intermarriages between an Italian husband and a foreign-born wife and an Italian wife and a foreign-born husband. The figure also shows the ratio of foreign over total residents, separately for females and males. *Source:* ISTAT, marriage records from vital statistics registries and movements of foreign residents, 1996-2013.

Figure 4: Timeline of the 2004 and 2007 EU enlargements

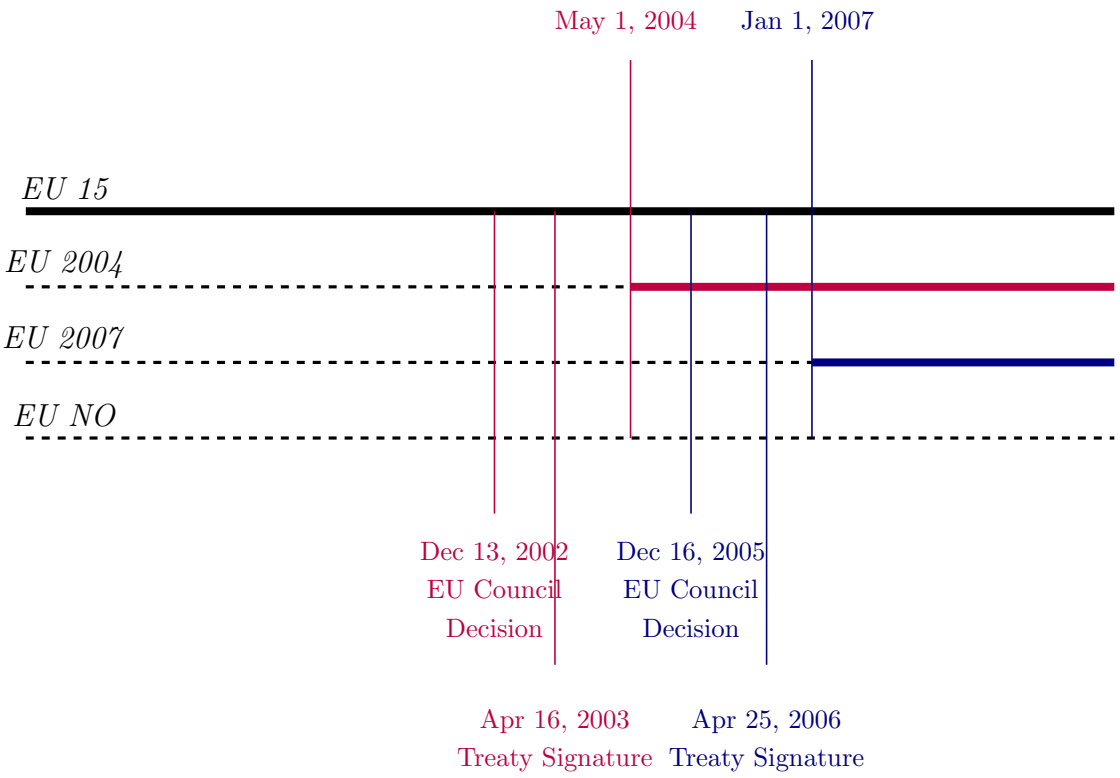
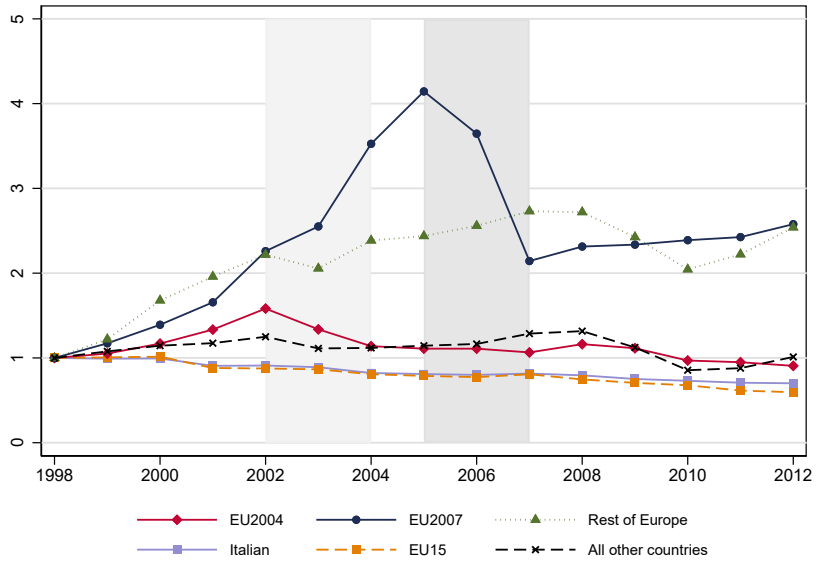
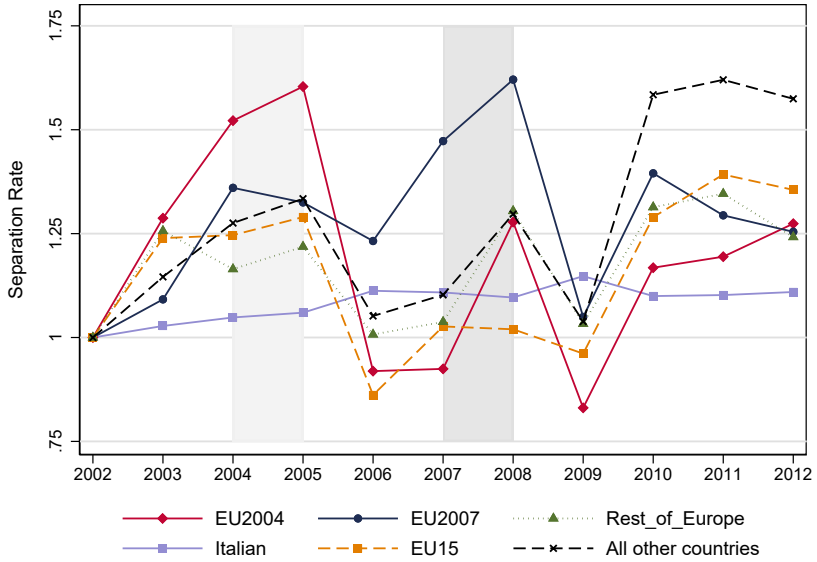


Figure 5: Marriages and separations, homogamous native couples and heterogamous couples formed by natives and immigrants, by area of origin of the foreign spouse

(a) Marriage rates (index=1 in 1998)



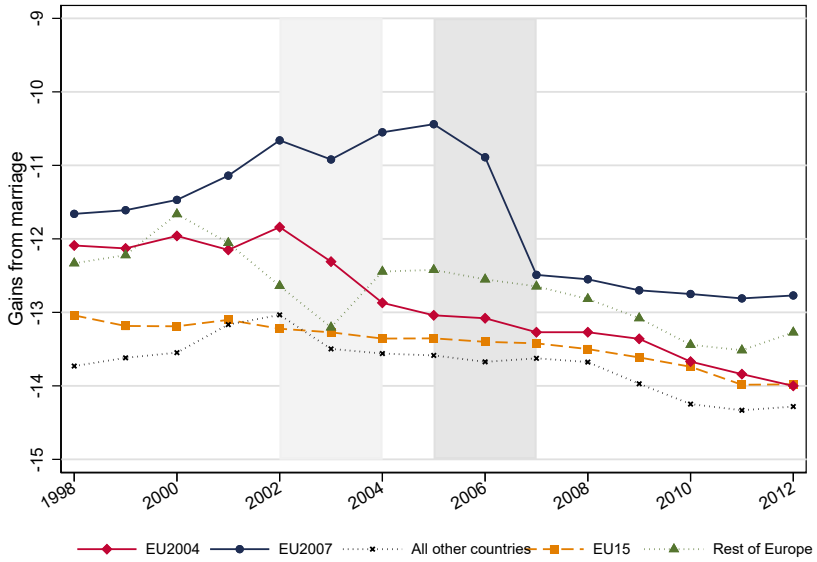
(b) Separation rates, marriages formed since 1998 (index=1 in 2002)



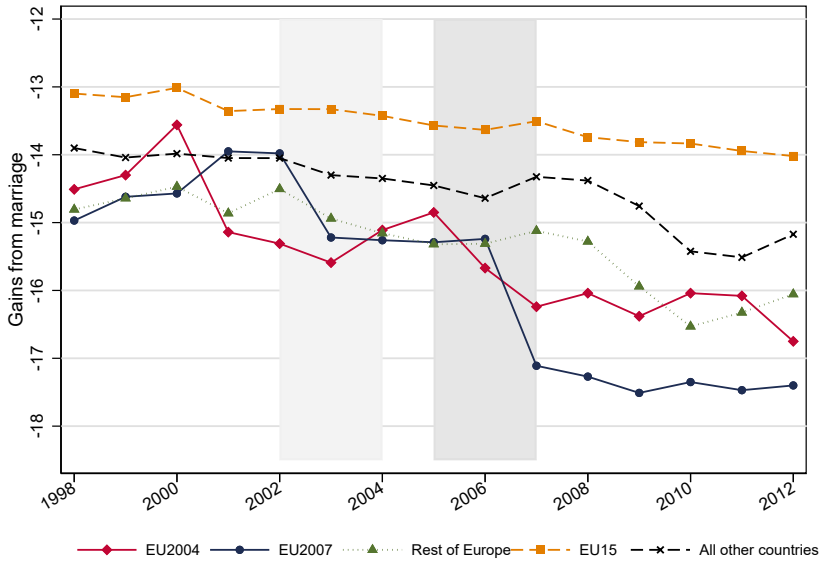
Notes: Panel (a) shows the share of marriages in which (at least) one spouse was Italian, by area of origin of the other spouse. For these same marriages, Panel (b) shows the share of separations by area of origin. All series are standardized to 1 in 1998. The classification of countries is reported in Table C.1.

Figure 6: Gains to marriage, heterogamous couples formed by natives and immigrants, by area of origin of the foreign spouse

(a) Native husband – foreign wife



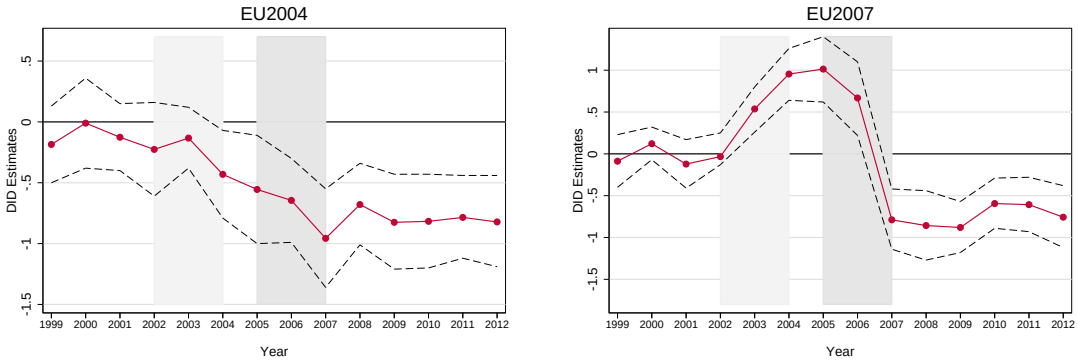
(b) Native wife – foreign husband



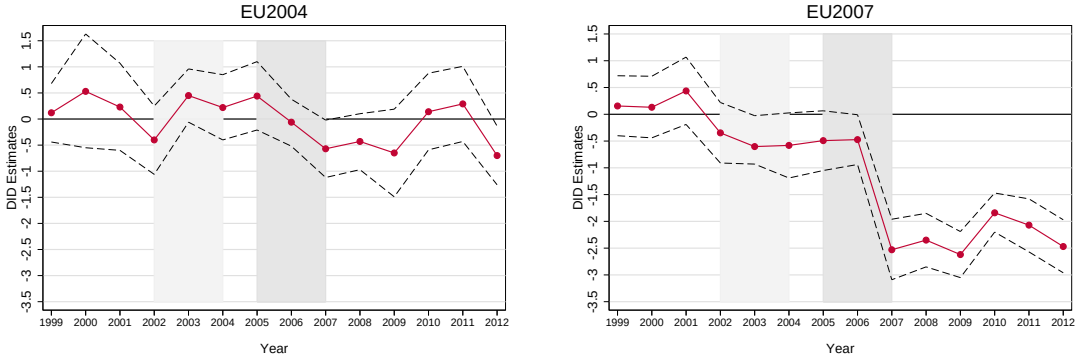
Notes: The graphs plot the gains to marriage over the period 1998-2012 by immigrants' area of origin and gender of the foreign spouse. The shaded areas denote the periods between the announcement and implementation of the EU enlargements. Gains to marriage are measured as in equation (1). The classification of countries is reported in Table C.1. *Source*: ISTAT, marriage records from vital statistics registries (1998-2012) and individual Census data.

Figure 7: Changes in gains to marriage between natives and new EU citizens, flexible year-specific estimates

(a) Native husband – foreign wife

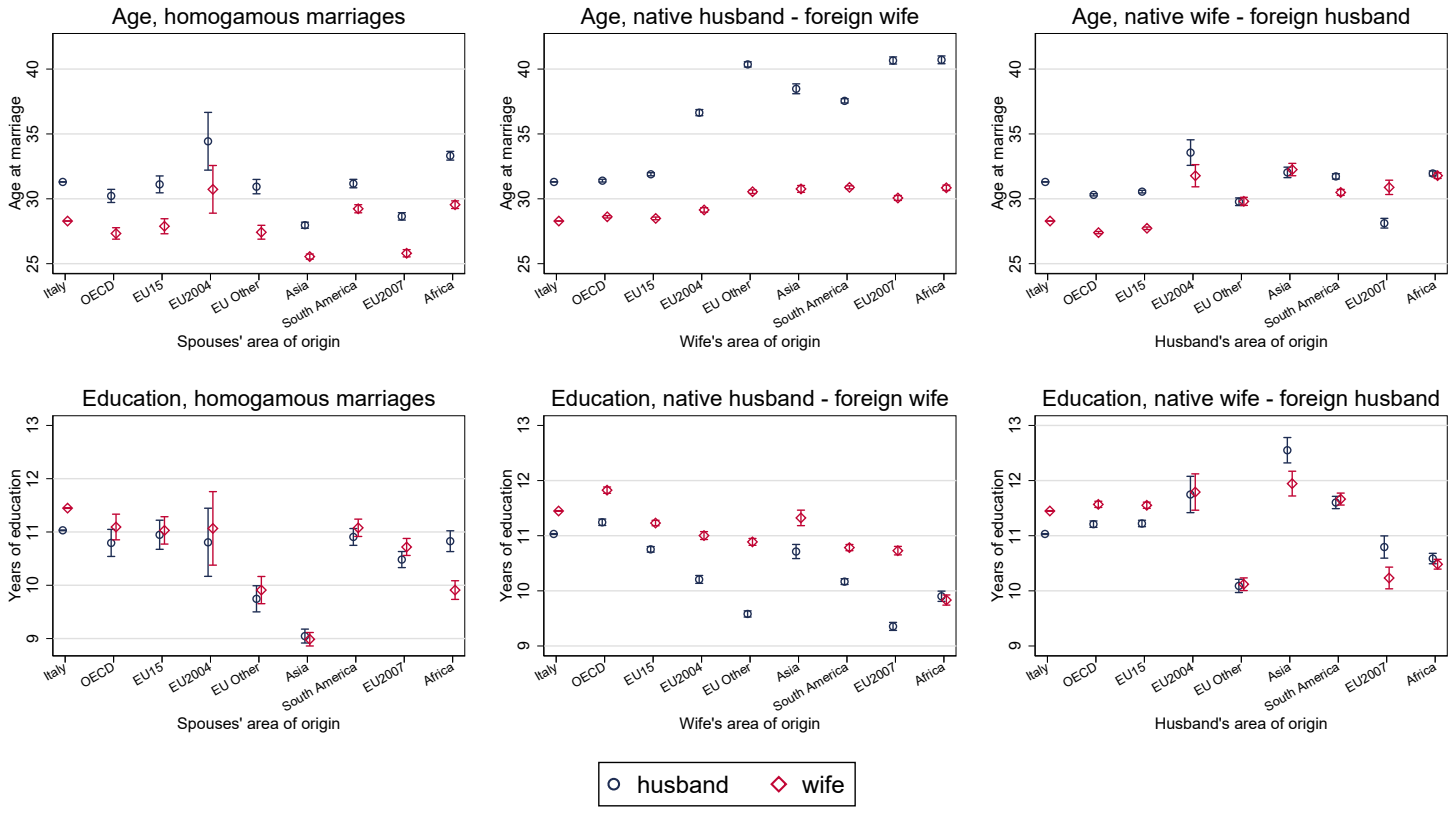


(b) Native wife – foreign husband



Notes: This figure shows the estimated effect of admission to the EU on gains to marriage, computed as in equation (1), across cells defined by nationality of the foreign spouse, province, and year. The main explanatory variables are interactions between dummies for intermarriages between natives and new EU citizens ($EU2004$ and $EU2007$) and a full set of year fixed effects. The graphs plot the estimated coefficients and associated confidence intervals, based on standard errors clustered at the province level. Regressions include nationality, province, and year fixed effects, and are weighted by province population.

Figure 8: Spouses' characteristics in homogamous marriages and intermarriages, pre-enlargement period (1998-2002)



Notes: The graphs show the average age (top row) and education (bottom row) of husbands and wives in homogamous marriages (left column) and intermarriages (center and right columns), by area of origin. 90% confidence intervals are also reported. *Source:* ISTAT, marriage records from vital statistics registries (1998-2002).

Figure 9: Marital surplus related to legal access and cultural affinity and its variation with policy

Before enlargement:

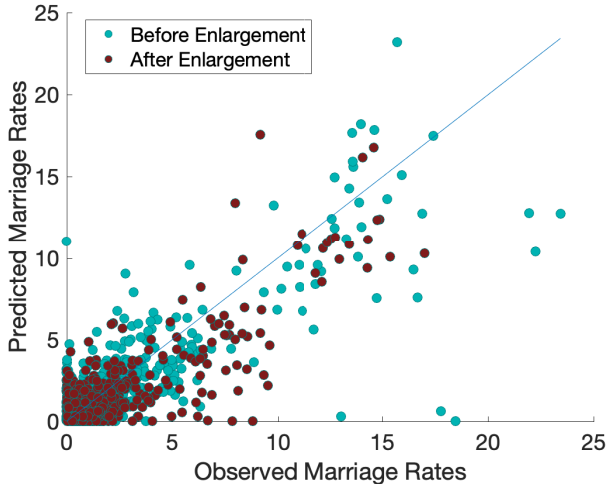
		Women: Italian	Women: New EU	Women: Other
Men	Italian	1	$\bar{\beta}^{\male}\alpha_{I/N}$	$\bar{\beta}^{\male}\alpha_{I/O}$
Men	New EU	$\bar{\beta}^{\female}\alpha_{N/I}$	$\underline{\beta}$	$\underline{\beta}\alpha_{N/O}$
Men	Other	$\bar{\beta}^{\female}\alpha_{O/I}$	$\underline{\beta}\alpha_{O/N}$	$\underline{\beta}$

After enlargement:

Women: Italian	Women: New EU	Women: Other
1	$\alpha_{I/N}$	$\bar{\beta}^{\male}\alpha_{I/O}$
$\alpha_{N/I}$	1	$\bar{\beta}^{\male}\alpha_{N/O}$
$\bar{\beta}^{\female}\alpha_{O/I}$	$\bar{\beta}^{\female}\alpha_{O/N}$	$\underline{\beta}$

Notes: Each cell shows the marital surplus associated with legal access to work and with culture for spouses of different origins. $\alpha_{x/y}$ are cultural affinity parameters affecting marriage surplus, $\underline{\beta}$ is the penalty for no legal access, $\bar{\beta}^{\female}$ and $\bar{\beta}^{\male}$ parameterize the surplus when either the woman or the man is an EU citizen while the other would not have legal access as single. The surplus has been normalized to one for homogamous marriages.
indicates couples who do not have legal access to work in that period.
indicates couples where one of the spouses would not get legal access if single in that period.

Figure 10: Fit of model across marriage markets

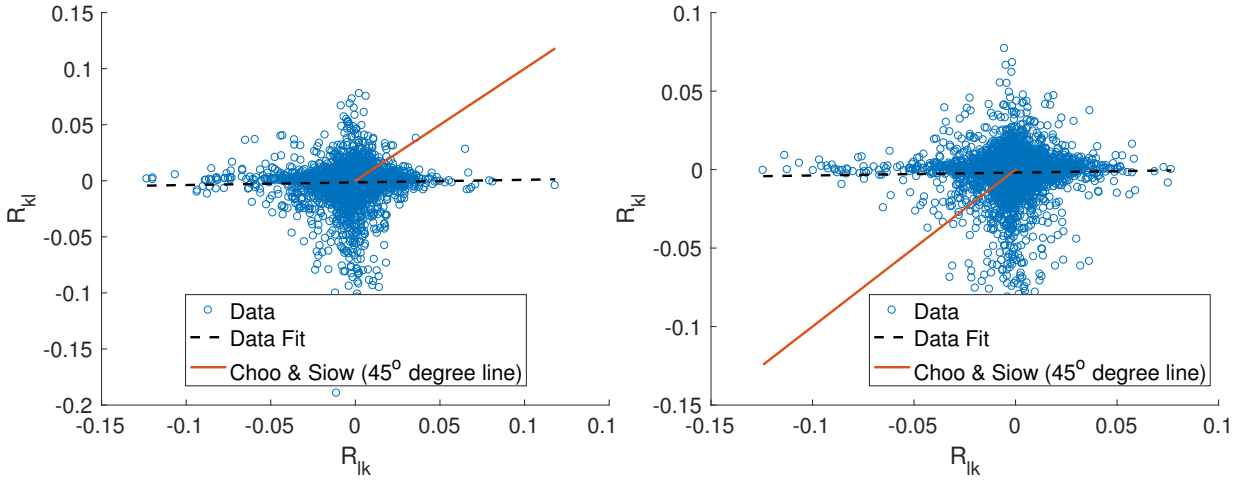


Notes: Each dot represents a particular marriage market, defined by nationality, age, education and province of residence of the spouses. Marriage rates have been multiplied by 1000 for ease of reading.

Figure 11: Elasticities from Data and Model

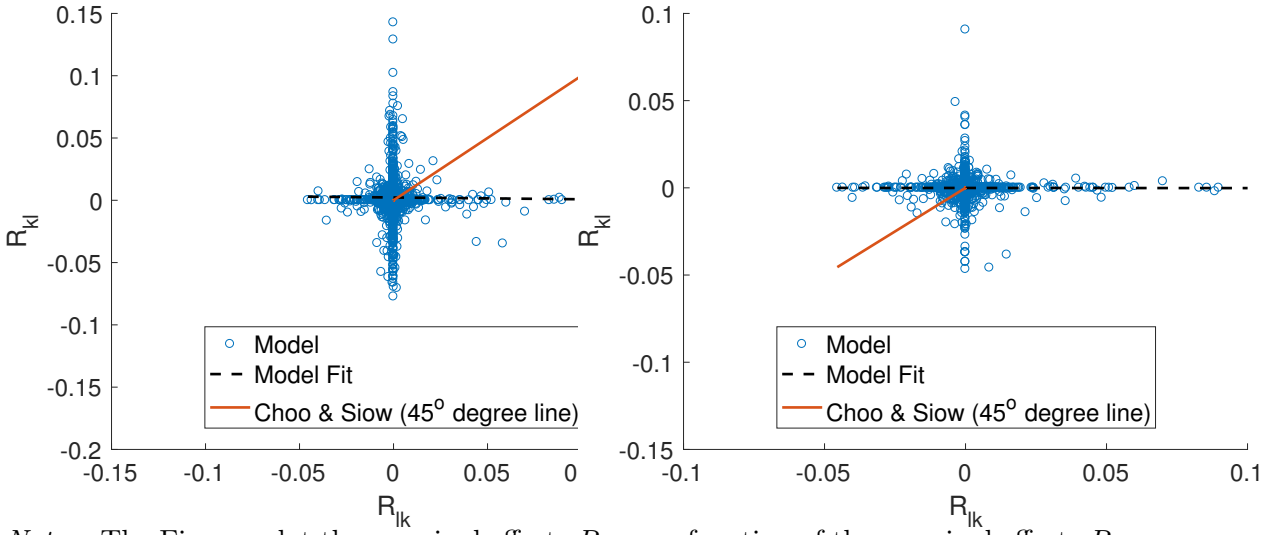
(a) Computed from data: effect of number of men of type k on log of single men of type l

(b) Computed from data: effect of number of men of type k on log of single women of type l



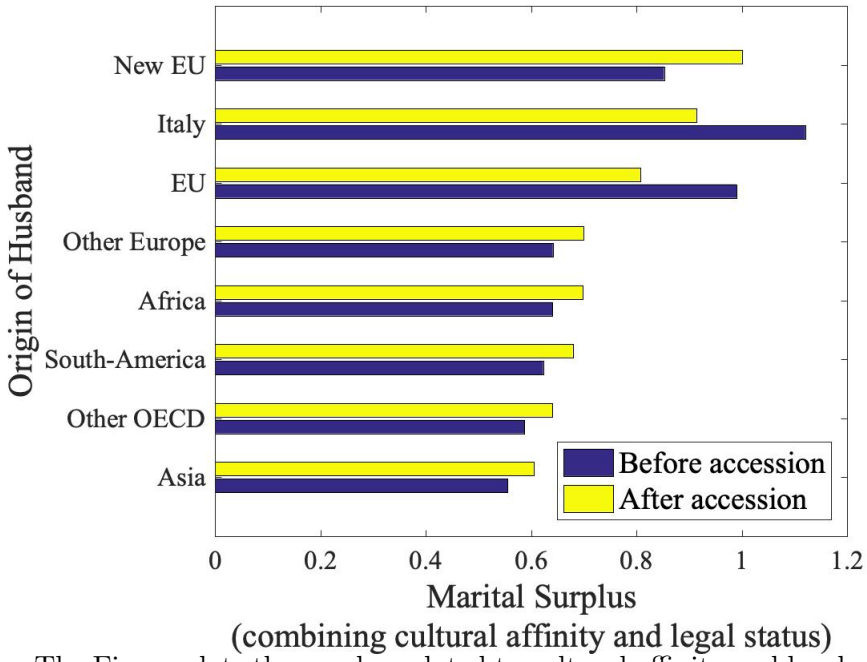
(c) Computed from model: effect of number of men of type k on log of single men of type l

(d) Computed from model: effect of number of men of type k on log of single women of type l



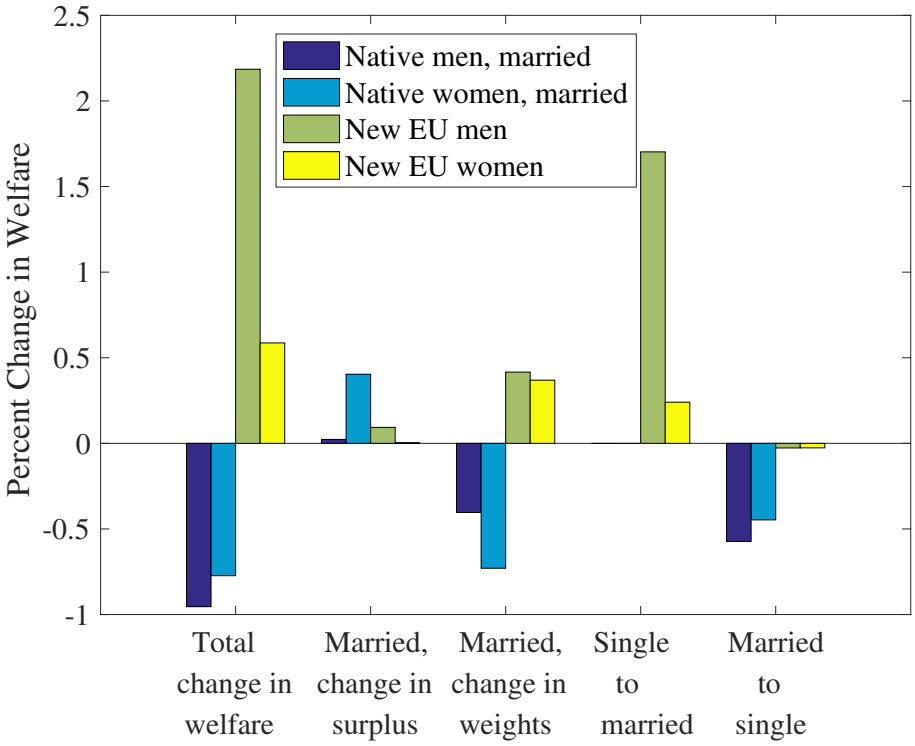
Notes: The Figures plot the marginal effects R_{lk} as a function of the marginal effects R_{kl}, where R_{lk} is the marginal effect of the number of males of characteristics k on the log of singles (male or female) of characteristics l. The Choo and Siow model imposes i) that $R_{lk} = R_{kl}$ which is depicted by the red 45 degree line, ii) that $R_{lk} > 0$ for the effects on single men and $R_{lk} < 0$ for single women.

Figure 12: Cultural affinity and legal status, women from New EU countries



Notes: The Figure plots the surplus related to cultural affinity and legal status for couples where the wife is a citizen from the New EU countries and the husband is from one of the listed origins. See equation (7) and Table 7 for definitions.

Figure 13: Change in surplus following the EU enlargement



Notes: The Figure plots the percentage change in the surplus between a baseline model where citizens of "new EU" countries are not granted legal rights to work and a counterfactual where they have legal rights. The figure displays the total change in welfare and a Oaxaca decomposition which is composed of four distinct element, summing up to the total component. The first two components are for individuals married in both the baseline and counterfactual with respectively the change in the surplus with fixed allocation weights and the change in allocation weights with fixed surplus (see equation (10)). The next components are the contribution to the welfare of individuals going from married to single and vice-versa.

Figure 14: Change in marriage rates following a generalized legal access

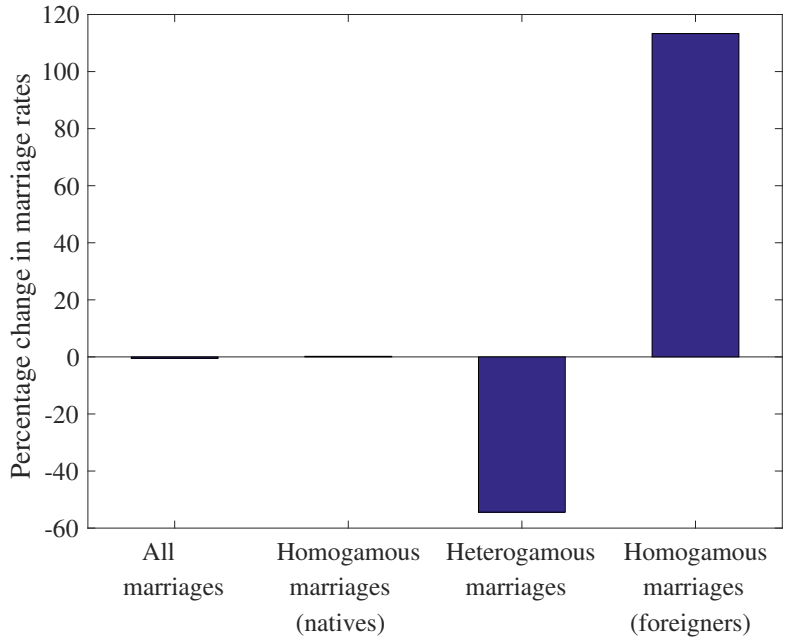


Figure 15: Marriage Patterns of Additional African Immigrants

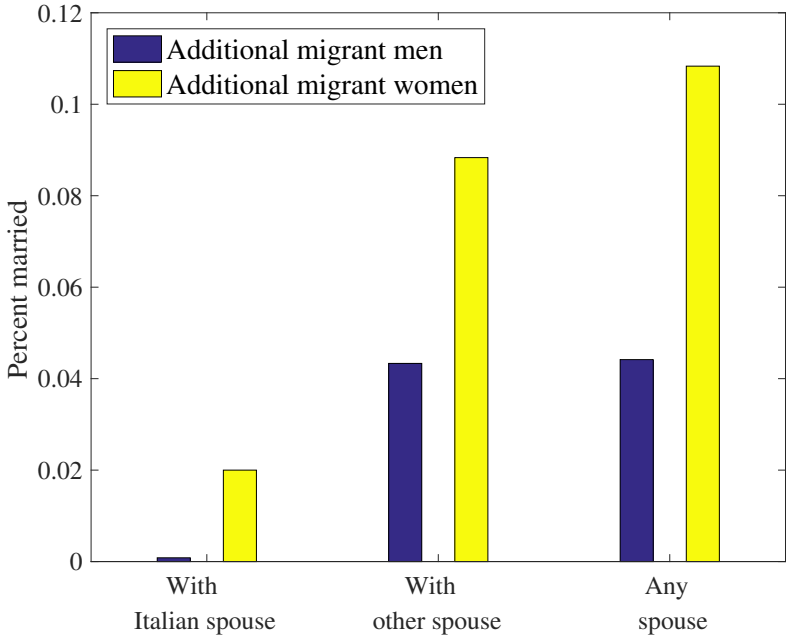


Table 1: Number of observations in the dataset and summary statistics

	Panel A. Marriages			**Panel B. Separations**		
	All	Males	Females	All	Males	Females
Number of observations:						
Natives	6,734,641	3,452,920	3,281,721	381,362	195,934	185,428
Total immigrants	582,941	205,871	377,070	34,762	12,128	22,634
NewEU	100,340	17,702	82,638	5,886	865	5,021
All	7,417,922	3,676,493	3,741,429	422,010	208,927	213,083
Average age:	*at marriage*			*at separation*		
Natives	32.0	33.7	30.2	36.0	37.7	34.2
Total immigrants	32.0	32.4	31.8	34.8	35.8	34.3
NewEU	31.1	30.4	31.3	33.1	33.6	33.0
Average years of education:						
Natives	11.6	11.3	11.9	11.3	11.0	11.6
Total immigrants	11.2	10.9	11.3	10.8	10.7	10.9
NewEU	10.9	10.4	11.1	10.7	10.6	10.8

	Panel C. Singles in 2001			**Panel D. Singles in 2011**		
	All	Males	Females	All	Males	Females
Number of observations:						
Natives	12,996,769	6,917,650	6,079,119	14,317,333	7,587,188	6,730,145
Total immigrants	799,389	428,058	371,331	1,668,957	749,279	919,678
NewEU	60,650	17,125	43,525	377,741	132,732	245,009
All	13,856,808	7,362,833	6,493,975	16,364,031	8,469,199	7,894,832
Average age:						
Natives	31.8	31.1	32.7	34.7	34.3	35.2
Total immigrants	32.0	30.8	33.4	34.9	32.6	36.8
NewEU	32.5	28.6	34.1	34.2	29.2	36.9
Years of education:						
Natives	10.8	10.6	11.0	11.8	11.5	12.1
Total immigrants	10.4	10.0	10.8	10.8	10.3	11.2
NewEU	10.6	9.4	11.0	11.1	10.3	11.5

This table shows the number of individuals included in the marriage and separation registries, and the count of singles in Census years 2001 and 2011; it also reports their average age and years of education.

Table 2: Gains from marriage before and after the EU enlargement, difference-in-differences estimates

	native male - foreign female			*native female - foreign male*		
	(1)	(2)	(3)	(4)	(5)	(6)
$newEU \times PostEU$	-0.676***	-0.862***	-1.058***	-1.249***	-1.027***	-1.182***
	(0.053)	(0.059)	(0.065)	(0.123)	(0.094)	(0.098)
Observations	50,349	50,349	50,341	31,125	31,125	31,119
R-squared	0.645	0.809	0.811	0.678	0.845	0.840
Year, prov, country FE	Yes	Yes	Yes	Yes	Yes	Yes
Country x trend	No	Yes	Yes	No	Yes	Yes
Province x trend	No	Yes	Yes	No	Yes	Yes
Province x country FE	No	Yes	Yes	No	Yes	Yes
Include irregular singles	Yes	Yes	No	Yes	Yes	No

Note: This table shows the effect of admission to the EU on gains to marriage, estimated using the difference-in-differences specification (2). The sample includes all heterosexual marriages formed between 1998 and 2012 in which at least one of the spouses is Italian. Columns (1)-(3) and (4)-(6) present the results for couples formed by native males and females, respectively. The dependent variable is gains to marriage, computed as in equation (1), across cells defined by province, year, and foreign spouse's country of origin. The main explanatory variable is the interaction between a dummy for marriages between natives and new EU citizens ($newEU$) and a dummy for the years following their admission to the EU ($postEU$). All specifications include country of origin, province, and year fixed effects; specifications in columns (2-3) and (5-6) include, in addition, linear trends interacted with province and country of origin fixed effects as well as province $\times$ country of origin fixed effects. In columns (3) and (6), the dependent variable is computed excluding (imputed) irregular immigrants at the denominator of the gains from marriage in equation (1). Regressions are weighted by province population. Standard errors clustered at the province level are reported in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Gains to marriage before and after the EU enlargement, difference-in-differences estimates (robustness to controlling for the number of singles)

	native male (IT) - foreign female (y)				native female (IT) - foreign male (x)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$newEU \times PostEU$	-0.857***	-0.955***	-0.936***	-0.983***	-0.878***	-1.038***	-0.916***	-1.017***
	(0.066)	(0.084)	(0.086)	(0.092)	(0.105)	(0.090)	(0.108)	(0.141)
$\ln(SingleMales)$	-0.991***		-1.000***		-0.808***		-0.842***	
	(0.012)		(0.026)		(0.040)		(0.041)	
$\ln(SingleFemales)$	-0.749***		-0.750***		-1.151***		-1.189***	
	(0.032)		(0.029)		(0.132)		(0.142)	
$\ln(SingleMales_y)$		-0.121***	0.089***					
		(0.037)	(0.027)					
$\ln(SingleFemales_x)$						-0.158***	0.180***	
						(0.056)	(0.022)	
Observations	50,439	44,721	44,721	44,721	31,125	29,539	29,539	29,539
R-Squared	0.826	0.817	0.831	0.837	0.860	0.848	0.861	0.866
Interacted FEs & trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nationality x Singles	No	No	No	Yes	No	No	No	Yes

Note: This table shows the effect of admission to the EU on gains to marriage, estimated using the difference-in-differences specification (2). The sample includes all heterosexual marriages formed between 1998 and 2012 in which at least one of the spouses is Italian. Columns (1)-(4) and (5)-(8) present the results for couples formed by native males and females, respectively. The dependent variable is gains from marriage, computed as in equation (1), across cells defined by province, year, and foreign spouse's country of origin. The main explanatory variable is the interaction between a dummy for marriages between natives and new EU citizens ($newEU$) and a dummy for the years following their admission to the EU ($postEU$). All regressions include year fixed effects, linear trends interacted with province and country of origin fixed effects, and province $\times$ country of origin fixed effects. In addition, columns (1) and (3) include the logarithm of the number of single females in each cell; columns (2) and (3) include the logarithm of the number of single males from country y; and column (4) include all these variables interacted with country of origin fixed effects. Analogously, columns (5) and (7) include the logarithm of the number of single males in each cell; columns (6) and (7) include the logarithm of the number of single females from country x; and column (8) include all these variables interacted with country of origin fixed effects. All regressions are weighted by province population. Standard errors clustered at the province level are reported in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Gains from marriage and cohabitation before and after the EU enlargement, difference-in-differences estimates

	native male - foreign female			*native female - foreign male*		
	marriages	cohabitations	both	marriages	cohabitations	both
	(1)	(2)	(3)	(4)	(5)	(6)
$newEU \times PostEU$	-1.290***	0.575***	-0.872***	-1.554***	-0.543	-1.316***
	(0.118)	(0.191)	(0.086)	(0.362)	(0.383)	(0.291)
Observations	11,758	8,740	12,360	8,499	5,421	9,118
R-squared	0.909	0.905	0.910	0.900	0.928	0.899
Interacted FEs & trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table shows the effect of admission to the EU on gains from marriage and cohabitation, estimated using the difference-in-differences specification (2). The sample includes all heterosexual marriages (columns 1 and 4), cohabitations outside a legal relationship (columns 2 and 5) and the sum of the marriages and cohabitations (columns 3 and 6) formed between 1998 and 2012 in which at least one of the spouses is Italian. Columns (1)-(3) and (4)-(6) present the results for couples formed by native males and females, respectively. The dependent variable is gains from marriage, computed as in equation (1), across cells defined by province, year, and foreign spouse's country of origin. The main explanatory variable is the interaction between a dummy for marriages between natives and new EU citizens ($newEU$) and a dummy for the years following their admission to the EU ($postEU$). All specifications include year fixed effects, linear trends interacted with province and country of origin fixed effects, and province $\times$ country of origin fixed effects. Regressions are weighted by province population. Standard errors clustered at the province level are reported in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Hazard rate of separations before and after the EU enlargement, semi-parametric Cox model

Dependent variable:	**Separations**							
	native male, female from country y				*native female, male from country x*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
newEU	0.063***	0.005	0.079	0.068	0.401***	0.351***	0.461***	0.238
	[1.065]	[1.005]	[1.082]	[1.070]	[1.493]	[1.420]	[1.586]	[1.269]
	(0.023)	(0.046)	(0.050)	(0.051)	(0.064)	(0.131)	(0.148)	(0.162)
newEU × first year post enlarg.	0.227***		0.161***	0.158***	0.149		0.12	0.06
	[1.255]		[1.175]	[1.171]	[1.161]		[1.127]	[1.062]
	(0.050)		(0.054)	(0.054)	(0.144)		(0.154)	(0.158)
newEU × 2 + years post enlarg.	-0.026		-0.130***	-0.140***	-0.02		-0.165**	-0.335***
	[0.974]		[0.878]	[0.869]	[0.980]		[0.848]	[0.715]
	(0.030)		(0.033)	(0.034)	(0.088)		(0.093)	(0.098)
newEU × married pre enlarg.		0.288***	0.268***	0.276***		0.237***	0.196	0.399***
		[1.334]	[1.307]	[1.318]		[1.267]	[1.217]	[1.490]
		(0.044)	(0.045)	(0.046)		(0.131)	(0.134)	(0.144)
newEU × married post enlarg.		-0.352***	-0.380***	-0.375***		-0.466***	-0.505***	-0.407***
		[0.703]	[0.684]	[0.687]		[0.628]	[0.604]	[0.666]
		(0.035)	(0.036)	(0.036)		(0.119)	(0.123)	(0.128)
share of residents from country y				0.031				
				[1.031]				
				(0.026)				
share of residents from country x								0.499***
								[1.647]
								(0.030)
Observations	11,182,250	11,182,250	11,182,250	11,176,994	10,683,818	10,683,818	10,683,818	10,681,099
Year FE	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Stratified by year of marriage	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Pool at risk (marriages)	3,426,235	3,426,235	3,426,235	3,424,486	3,255,923	3,255,923	3,255,923	3,255,087
Separations	195,879	195,879	195,879	195,777	185,356	185,356	185,356	185,300

Note: This table shows the effect of admission to the EU on hazard rate of separation, modeled using a semi-parametric Cox model. The sample includes all marriages formed between 1998 and 2012 in which at least one of the spouses is Italian. Columns (1)-(4) present the results for couples in which the husband is native, whereas columns (5)-(8) present the results for couples in which the wife is native. The main explanatory variables of interest are a dummy for intermarriages between natives and new EU citizens (*newEU*) and its interactions with dummies for the first year after the enlargement; the subsequent years; couples formed before the enlargement; and couples formed after the enlargement. The specifications in columns (4) and (8) also include on the right-hand side the share of population in the province from the same country of origin as the foreign spouse. The baseline hazard rate is stratified by native-native vs. native-immigrant couples and province in all specifications, and by year of marriage in columns (2)-(4) and (6)-(8). Calendar year fixed effects are included in columns (1), (3)-(4), (5), and (7)-(8). Hazard ratios are reported in brackets and robust standard errors clustered by marriage are reported in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Divorce regressions, observed and predicted coefficients

	Before enlargement		During enlargement	
	Observed	Predicted	Observed	Predicted
Italian-New EU	0.0071 (0.0022)	0.0046	0.0098 (0.0025)	0.012
Italian-Others	0.0018 (0.013)	0.0055	0.0039 (0.0142)	0.0084
Non Italian - Non Italian	-0.0047 (0.0342)	-0.0123	-0.0036 (0.0196)	-0.0123
Woman >10 year younger	0.0011 (0.0094)	0.0008	0.0019 (0.0085)	0.0039
Woman >10 year older	0.0029 (0.4)	0.0002	0.0099 (0.438)	0.0029
Same education	0.0001 (0.0722)	0.0026	0.0011 (0.0504)	0.0029
Constant	0.0122 (0.0052)	0.0089	0.0108 (0.0037)	0.0094

Note: The table displays the auxiliary coefficients in a linear regression of an indicator variable equal to one if a couple separate within 3-4 years after marriages. Two separate regressions are run for couples married and followed before the enlargements and for couples married before and followed through the enlargements. The regression is defined in equation (9). Standard errors are displayed in parenthesis.

Table 7: Estimated parameters: surplus linked to legal access and cultural affinity

Parameter	Value
Panel A: legal access	
No legal access ($\underline{\beta}$), North	0.852
No legal access ($\underline{\beta}$), South	0.932
Legal access, native husband - foreign wife ($\bar{\beta}^{♂}$), North	1.23
Legal access, native wife - foreign husband ($\bar{\beta}^{♀}$), North	0.929
Legal access, native husband - foreign wife ($\bar{\beta}^{♂}$), South	1.17
Legal access, native wife - foreign husband ($\bar{\beta}^{♀}$), South	1.06

Panel B: Cultural affinity

		Women							
		Italian	EU15	New EU	Other Europe	Africa	Asia	South America	OECD
Men	Italian	1	0.93	0.91	0.88	0.87	0.8	0.83	0.86
	EU	0.93	1	0.81	0.79	0.8	0.64	0.74	0.77
	New EU	0.86	0.81	1	0.75	0.75	0.65	0.73	0.69
	Oth. Europe	0.81	0.79	0.75	1	0.75	0.84	0.6	0.64
	Africa	0.8	0.8	0.75	0.75	1	0.79	0.88	0.69
	Asia	0.68	0.64	0.65	0.84	0.79	1	0.76	0.88
	S America	0.73	0.74	0.73	0.6	0.88	0.76	1	0.84
	OECD	0.77	0.77	0.69	0.64	0.69	0.88	0.84	1

Note: The table displays in Panel A the part of the surplus associated with legal access obtained through marriage. Panel B displays the part of the surplus associated with country of origin. See equation (6) and Figure 9 for a description.

APPENDIX

A Imputation of the total number of unmatched singles

In this section we describe the procedure we use to impute the total number of unmatched singles, both among official and unofficial immigrants, at the denominator of the gains to marriage in equation (1). Unmatched singles are defined throughout as individuals aged between 18 and 60 who are not married.

A.1 Official immigrants

We obtained from the Italian Census the exact number of singles by age, gender, nationality, and province in years 1991, 2001, and 2011, and combined these data with migration inflows at the same level of aggregation during the period 1995-2012 to estimate the stock of immigrants in each cell. Let S_{ct} denote the number of migrant singles in year $t = 1991, 2001, 2011$, for cell c (age, nationality, gender, province); and M_{ct} denote the total number of migrants for cell c in years from 1995 to 2012 (irrespective of marital status). Moreover, let $\Delta S_{c,(t-s)}$ and $\Delta M_{c,(t-s)}$ the changes in S and M between any two years, t and s.

Consider first the period 2001-2011. We assume that the yearly change in the number of singles in each cell between any two consecutive years, as a share of the total change over the period 2001-2011, equals the corresponding change for total migrants:

$$\frac{\Delta M_{c,(t-(t-1))}}{\Delta M_{c,(2011-2001)}} = \frac{\Delta S_{c,(t-(t-1))}}{\Delta S_{c,(2011-2001)}}.$$

From the above equation, we recover the number of single migrants over time starting from $S_{c,2001}$ and adding up the yearly variation,

$$\Delta S_{c,(t-(t-1))} = \Delta M_{c,(t-(t-1))} * \Delta S_{c,(2011-2001)} / \Delta M_{c,(2011-2001)}.$$

This procedure allows us to account for potential non-linear increase in the presence of singles over time. We implement the same procedure for the earlier period exploiting information on total migrants and singles in census years 1991 and 2001 as well as migration inflows over the period 1995-2001.

A.2 Unofficial immigrants

As discussed in Section 3.2.2, neglecting unofficial migrants would bias upward the estimated gains to marriage in equation (1). Most importantly, the bias would be asymmetric between new EU citizens and other immigrants, before and after the EU enlargements. We thus adjust the number of immigrant singles for the presence of irregulars using information from three sources: (i) number of singles and non-singles among regular immigrants by cell (as defined, e.g., by province and nationality) in years 1991, 2001, and 2011, from the national census; (ii) number of singles and non-singles among irregular immigrants by cell in year 2002, from applications to a generalized amnesty; (iii) total (estimated) number of irregular immigrants.

We next discuss our method for imputing irregular immigrants, and the data on irregular immigrants that we use to implement such method.

A.2.1 Methodology

Let S^R_{c,t^*} and S^I_{c,t^*} be the number of singles among regular and irregular immigrants, respectively, by cell c in a benchmark year t^*. Therefore, the total number of singles among immigrants in year t^* is $S_{c,t^*} = S^R_{c,t^*} + S^I_{c,t^*}$. Moreover, let M^R_t and M^I_t be the number of regular and irregular immigrants (including both singles and non-singles) in year t, so $M_t = M^R_t + M^I_t$ is the number of total immigrants in the same year. We impute the (unobserved) number of irregular immigrant singles outside the benchmark year, $S^I_{c,t}$ $\forall t \neq t^*$, based on knowledge of $S^R_{c,t}$, M^R_t, and M^I_t, under the following assumptions.

Assumption 1: The share of irregulars among singles is proportional to the share of irregulars among total immigrants:

$$\frac{S^I_t}{S_t} = \gamma \frac{M^I_t}{M_t}, \tag{11}$$

where $S^I_t = \sum_c S^I_{c,t}$ and $S_t = \sum_c S_{c,t}$, and γ is a constant.

Assumption 2: The ratio of irregulars to regulars among singles follows common trends across cells:

$$\frac{S^I_{c,t}}{S^R_{c,t}} = \alpha_c \beta_t, \tag{12}$$

where α_c and $beta_t$ are cell-specific and sector-specific constants.

In the next section, we provide indirect evidence consistent with these two assumptions. Under such assumptions, we impute the total number of immigrant singles (including both regular and irregular immigrants) in three steps. First, we use the total number of regular and irregular immigrants in the benchmark year $t^* = 2002$ – the latter being estimated from

amnesty applications – to compute γ in equation (11):

$$\gamma = \frac{S^I_{t^*}/S_{t^*}}{M^I_{t^*}/M_{t^*}}$$

Second, we aggregate individual-level data on regular and irregular immigrants by cell and normalize $\beta_{t^*} = 1$ to obtain

$$\alpha_c = \frac{S^I_{c,t^*}}{S^R_{c,t^*}}, \ \forall c.$$

Third, we combine (11) and (12) to compute the β's for all other years:

$$\beta_t = \frac{\gamma M^I_t/M_t}{1-\gamma M^I_t/M_t} \frac{\sum_c S^R_{c,t}}{\sum_c \alpha_c S^R_{c,t}}, \ \forall t.$$

All terms on the right-hand side of the last equations are either data or parameters estimated in previous steps.

Finally, the total number of immigrants (including both regular and irregular immigrants) in cell c and year t equals

$$S_{c,t} = (1 + \alpha_c \beta_t) S^R_{c,t}.$$

A.2.2 Data

In general, it is difficult to precisely quantify the number of irregular immigrants, as the latter typically hide from administrative authorities. Generalized amnesties of irregular immigrants represent an important exception, as in these occasions applicants can obtain a residence permits under relatively mild conditions. The number of applications thus provides a fairly accurate estimate of the number of irregular immigrants.

In Italy, five such amnesties were granted in 1986, 1990, 1995, 1998 and 2002. We obtained individual-level data on all applicants to the 2002 amnesty, which granted residence and work permits to about 700 thousand immigrants – the largest number ever legalized in Italy.[31] We use the total number of applications to estimate the total number of irregular immigrants in the benchmark year $t^* = 2002$, $M^I_{t^*}$.

We estimate S^I_t and S^I_{c,t^*} using additional information on gender, marital status, age, province of residence, country of origin, hours of work, and monthly wage of applicants, also contained in the amnesty files.[32] Since the cells in our model (i.e., $\bar{x}$ and $\bar{y}$ in Section 4)

[31] We thank Francesco Fasani for kindly sharing these data; see Fasani (2009) for a detailed description of generalized amnesties in Italy.

[32] Table C.6 provides some descriptive statistics, separately for male and female applicants – 377 and 318 thousand individuals, respectively.

are defined also by education, but the amnesty files do not report applicants' educational attainment, we compute the predicted probability of having a college degree, conditional on other individual characteristics. Specifically, we estimate such probability using data from a representative survey of irregular immigrants conducted by the Institute for Multi-ethnic Studies (ISMU).

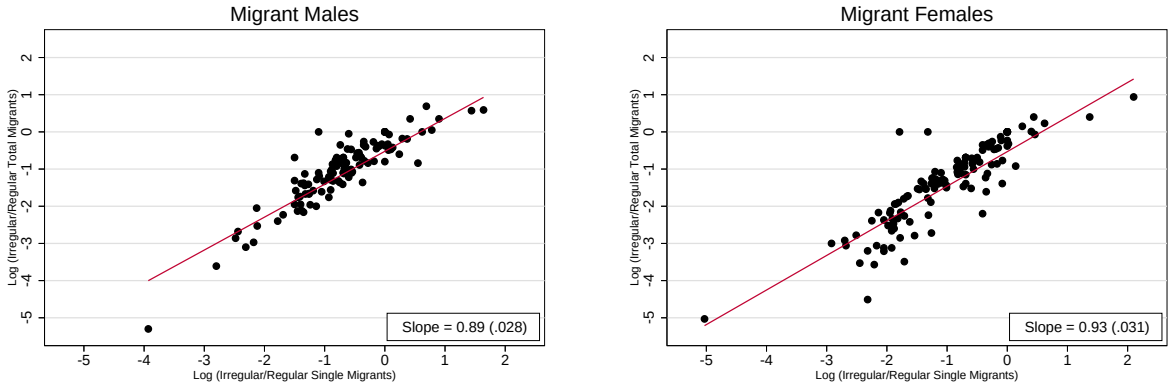
ISMU is a research institute collecting data on immigrants in Italy, focusing in particular on undocumented migrants. Starting in 2001, it has been conducting an annual survey on a representative sample of about 8,000 regular and irregular migrants residing in the Italian region of Lombardy. This survey is specifically designed to elicit truthful reporting of legal status. In addition, the survey contains detailed information on other individual characteristics, including gender, age, education, country of origin, marital status, employment, wage and province of residence.[33] We thus regress a dummy for college education on gender, age, age squared, wage class and country of origin fixed effects, and we use the estimated coefficients to impute college education across amnesty applicants. ISMU also provides an estimate of the total number of irregular immigrants in each year since 1991 (Figure C.5), which we use to measure $M_t^I,\ \forall t \neq t^*$.

A.2.3 Indirect evidence

We present some empirical evidence, which supports the validity of our assumptions. On the one hand, we estimate the cross-sectional relationship between the ratio of irregulars over regulars among singles and among total migrants, across ethnic groups for the year 2002 of the Amnesty. Figure A1 plots the cross-sectional log-log relationship for male and female migrants, separately. The Figure shows a strong positive and significant correlation between the ratio of single irregular migrants and the ratio of irregulars among total migrants, in line with our assumption. On the other hand, we explore the log-log relationship between S^I and S^R exploiting variability across ethnic groups in year 2002. Figure A2 shows a strong positive association between the two variables of interest for both male and female migrants. Moreover, we do not reject the null hypothesis that the estimated elasticity is different from one, strongly supporting our second assumption of proportionality.

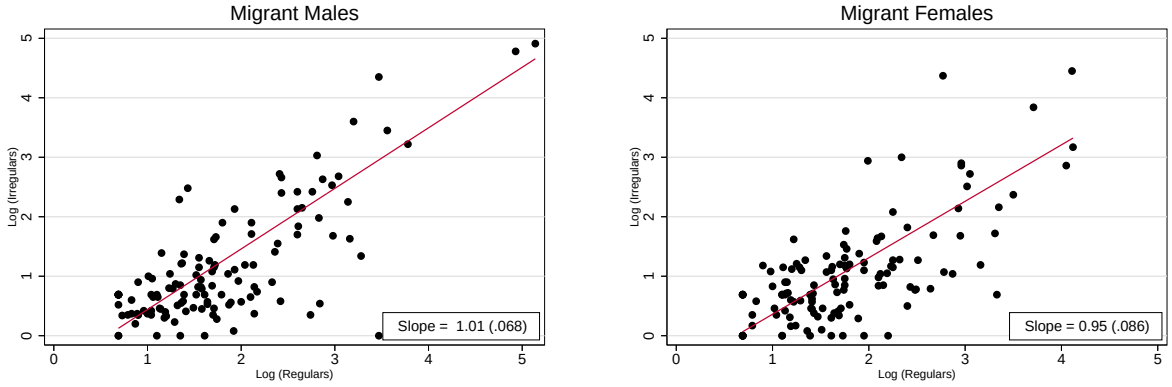
[33] Table C.7 provides descriptive statistics on individual characteristics for regular and irregular migrants. These data have been used, among others, by Dustmann et al. (2017) and Guriev et al. (2016) Additional information is available through the website www.ismu.org.

Figure A1: Test First Assumption: Regular and Irregular Migrants



Notes: This figure plots the relationship between the (log) ratio between the number of irregular over regular among *single* migrants against the (log) ratio between the number of irregular over regular among *total* migrants by ethnic group of origin, separately for male (left panel) and female (right panel)– after weighting by the number of provinces where each ethnic group is living.

Figure A2: Test Second Assumption: Regular and Irregular Migrants



Notes: This figure plots the relationship between the (log) number of single irregular migrants against the (log) number of single regular migrants by ethnic group of origin, separately for male (left panel) and female (right panel)– after weighting by the number of provinces where each ethnic group is living.

B Data and Additional Estimated Parameters

B.1 Data

Our data cover the universe of marriages formed in Italy. Hence, we might potentially omit to consider those marriages that, despite being part of the Italian market, have been celebrated abroad. Of particular concern are homogamous marriages of foreign spouses, which for any reasons, are more likely to be underestimated. The omission of foreign homogamous marriages might affect our estimates, in particular in case we systematically underestimate the number of homogamous marriages between new EU countries before the EU enlargement with respect to the after period. To have a sense of the importance of this bias, we recover the number of married couples living in Italy by exploiting marital status information from censuses 2001 and 2011 and we limit our self to marriages celebrated in the years right before the censuses. We compare the number of marriages in our registry data and the number of marriages in census data, and we correct our estimates by the difference in marriages observed between the two sources. TableB.1 reports estimates of the missing marriage rate.

Table B.1: Missing Marriage Rates by Ethnic Group and Census Year

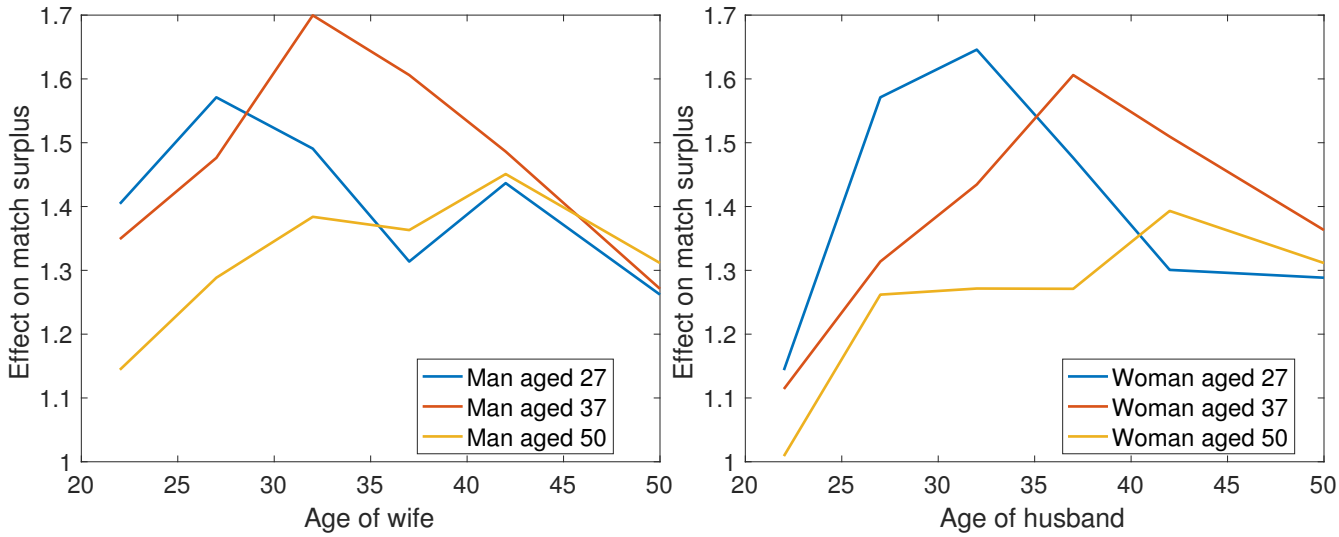
	Census 2001	Census 2011
EU15	0.86	0.53
EU2004/2007	1.52	1.36
EU_Other	1.78	1.55
Africa	1.74	0.97
Asia	1.63	1.22
South America	1.12	1.29
OECD Other	0.88	0.43

B.2 Additional Estimated Parameters

We start by presenting the parameters related to age, which are displayed in Figure B.1. The surplus is the highest for a couple where both partners are between 32 and 37, reflecting the higher marriage rates of this age category. The profiles are mostly hump-shaped, with a maximum when the spouses are the same age, or when the husband is slightly older. The lowest surplus component is for men aged 22 and women aged 50. The profiles are also asymmetric by gender. Couples where women are matched with a young man generate lower surplus, whereas the surplus profiles for men with younger spouses are flatter.

Table B.2 displays the parameters pertaining to education and house ownership. We find mild assortative mating along education, with a higher surplus for couples with the same level of education. However, when education differs, the surplus is only 4 to 10 percent lower. We find much stronger effects for housing. When both partners are Italian, having one of them being a homeowner increases the surplus by about 60 to 80 percent. The increase in the surplus is about 80 percent if both have property. We find effects of similar or slightly higher magnitude if one of the partners is non-Italian. The probability of owning property among non-natives is rather low, especially at younger ages. For non-natives from poorer countries (outside of the EU15 and OECD) the probability ranges between 10 to 30 percent, whereas for natives above the age of 30, the rate is at least two thirds. The results in Table B.2 have two implications. First, given the asymmetry in the surplus associated with housing, mixed couples are more likely to include a native man and a foreign woman. Second, given the rate of ownership by groups, this aspect of the surplus tends to favor marriages between older native men (with home ownership) and younger non-native women (without home ownership). The increase in the surplus compensates for part of the cultural and age differences among those couples.

Figure B.1: Marriage surplus, age component by gender



Notes: Parameter estimates of the marital surplus related to age, as defined in equation (7).

Table B.2: Estimated parameters, marriage surplus linked to education and home ownership

		Women					
		Education					
		Low	High				
Men	Low	1.09	0.89	Housing, natives			
	High	0.96	1	No	Yes		
			No	1	1.77	Housing, non natives	
			Yes	1.6	1.77	No	Yes
					No	1	1.08
					Yes	1.17	2.01

Note: The table displays the part of the surplus associated with education and housing, as defined in equation (6)

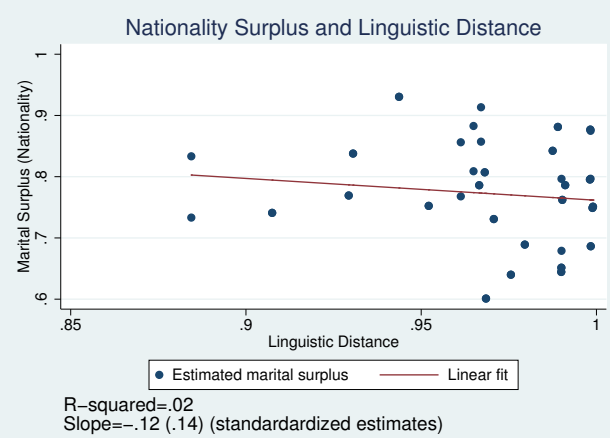
B.3 Marital surplus and cultural distance measures

The coefficients of the cultural affinity component of the surplus derive essentially from revealed preferences by observing the choice of spouses across periods and markets. It is interesting to relate this measure to other measures of cultural affinity commonly used in the literature: language, religion, values and genetics.[34] We show in Figure B.2 how our measure of cultural affinity of the marital surplus relates to those alternative measures. Greater distance along cultural lines as measured in those four different ways is systematically associated with a lower residual surplus from marriage. However, our measure of surplus is only weakly related to linguistic and genetic differences. Those two measures only explain 2 percent of the variation in the surplus. The World Values Survey and religious distance explain each 9 percent of the variance. For those two measures, a one standard deviation cultural distance decrease the marital surplus by about 0.3 standard deviations.

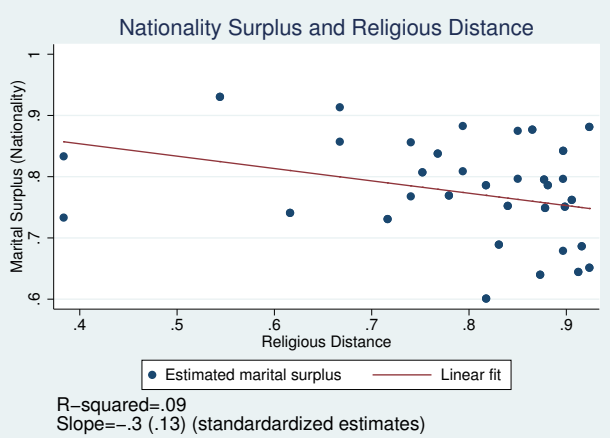
[34]Linguistic distance is based on the language tree classification, which groups languages into families based on perceived similarities: the lower the number of common nodes between two languages, the higher the distance between them. In a similar vein, religious distance originates from a tree-based representation of religions. Values measure distance in cultural norms, values and attitudes based on answers to the World Values Survey. Finally, genetic distance measures the probability that two alleles selected at random in two populations will be different: the higher the genetic distance between two populations, the longer they have been apart from each other, and the larger would be the difference in culture. We refer to Spolaore and Wacziarg (2016) for an accurate description of these four measures of cultural distance.

Figure B.2: Marriage surplus and cultural distance

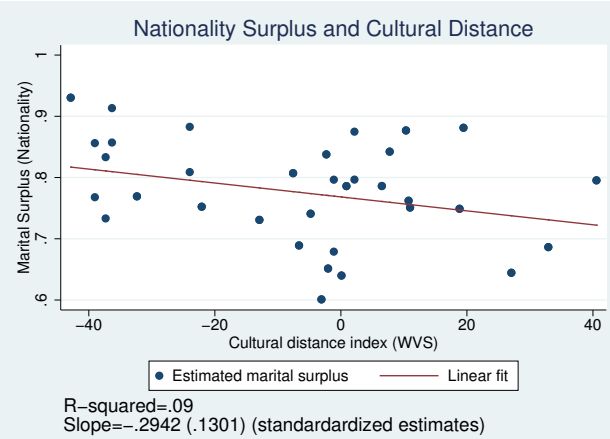
(a) Linguistic Distance



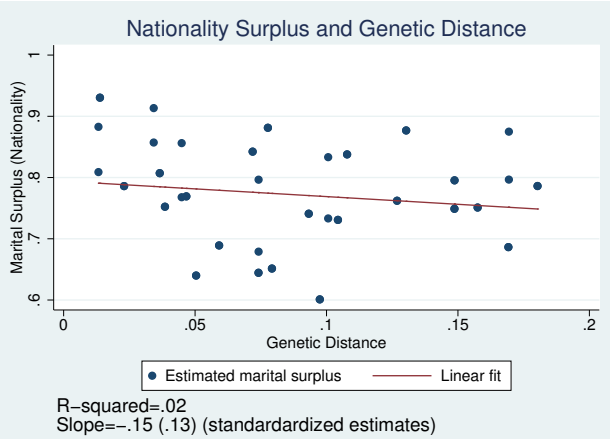
(b) Religious Distance



(c) WVS Distance



(d) Genetic Distance



Notes: The Figure plots the relationship between four ex-ante measures of cultural distance from Spolaore and Wacziarg (2016) and the estimated cultural-based component of marriage surplus estimated from the model (see equation 7 and Panel B of Table 7).

C Additional figures and tables

Table C.1: Classification of countries by geographic area of origin

EU15	Austria, Belgium, Denmark, Finland, Germany, Ireland, Luxembourg, Netherlands, United Kingdom, Sweden, France, Greece, Portugal, Spain.
EU2004	Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia, Slovenia.
EU2007	Bulgaria, Romania.
EU Other	Andorra, Belarus, Isle of Man, Liechtenstein, Norway, Monaco, Republic of Moldova, Russian Federation, San Marino, Ukraine, Vatican City State, Albania, Bosnia and Herzegovina, Croatia, Iceland, Kosovo, Macedonia (FYROM), Serbia, Montenegro, Turkey.
Africa	Algeria, Egypt, Libyan Arab Jamahiriya, Marocco, Tunisia, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, The Democratic Republic of Congo, Cote D'Ivoire, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Dijbouti, Guinea, Guinea-Bisseau, Equatorial Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Swaziland, United Republic of Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Asia	Afghanistan, Saudi Arabia, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, United Arab Emirates, Georgia, India, Islamic Republic Of Iran, Iraq, Israel, Kazakhstan, Kyrgyzstan, Kuwait, Lebanon, Maldives, Nepal, Oman, Pakistan, Qatar, Syrian Arab Republic, Sri Lanka, Tajikistan, Palestinian Territory, Turkmenistan, Uzbekistan, Yemen, Brunei Darussalam, Cambodia, China, Democratic People's Replica of Korea, Philippines, Jordan, Indonesia, Lao Pepople's Democratic Republic, Malaysia, Mongolia, Myanmar, Singapore, Taiwan, Thailand, East Timor, Vietnam, Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Solomon Islands, Samoa, Tonga, Tuvalu, Vanuatu.
South America	Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Plurinational State of Bolivia, Brazil, Canada, Costa Rica, Cuba, Chile, Colombia, Dominica, Dominican Republic, Ecuador, El Salvador, Jamaica, Grenada, Guatemala, Guyana, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and The Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela.
OECD Other	Australia, Canada, Japan, Republic of Korea, New Zealand, Norway, Switzerland, United States.

Table C.2: Gains from marriage before and after the EU enlargement, difference-in-differences estimates (non-weighted)

	native male - foreign female			*native female - foreign male*		
	(1)	(2)	(3)	(4)	(5)	(6)
$newEU \times PostEU$	-0.676***	-0.862***	-1.058***	-1.249***	-1.027***	-1.182***
	(0.053)	(0.059)	(0.065)	(0.123)	(0.094)	(0.098)
Observations	50,349	50,349	50,341	31,125	31,125	31,119
R-squared	0.645	0.809	0.811	0.678	0.845	0.840
Year, prov, country FE	Yes	Yes	Yes	Yes	Yes	Yes
Country x trend	No	Yes	Yes	No	Yes	Yes
Province x trend	No	Yes	Yes	No	Yes	Yes
Province x country FE	No	Yes	Yes	No	Yes	Yes
Include irregular singles	Yes	Yes	No	Yes	Yes	No

Note: This table shows the effect of admission to the EU on gains to marriage, estimated using the difference-in-differences specification (2). The sample includes all heterosexual marriages formed between 1998 and 2012 in which at least one of the spouses is Italian. Columns (1)-(3) and (4)-(6) present the results for couples formed by native males and females, respectively. The dependent variable is gains to marriage, computed as in equation (1), across cells defined by province, year, and foreign spouse's country of origin. The main explanatory variable is the interaction between a dummy for marriages between natives and new EU citizens (*newEU*) and a dummy for the years following their admission to the EU (*postEU*). All specifications include country of origin, province, and year fixed effects; specifications in columns (2-3) and (5-6) include, in addition, linear trends interacted with province and country of origin fixed effects as well as province $\times$ country of origin fixed effects. In columns (3) and (6), the dependent variable is computed excluding (imputed) irregular immigrants at the denominator of the gains from marriage in equation (1). Standard errors clustered at the province level are reported in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table C.3: Gains to marriage before and after the EU enlargement, difference-in-differences estimates allowing for announcement effects and for substitution across nationalities

	native male - foreign female		*native female - foreign male*	
	(1)	(2)	(3)	(4)
$EU2004 \times Post2003$	-0.011	-0.038	0.215	-0.071
	(0.073)	(0.081)	(0.188)	(0.204)
$EU2004 \times Post2004$	-0.224***	-0.244***	-0.099	-0.196
	(0.073)	(0.080)	(0.189)	(0.194)
$EU2004 \times Post2006$	-0.163**	-0.134*	-0380**	-0.519***
	(0.066)	(0.072)	(0.163)	(0.150)
$EU2004 \times Post2007$	-0.109*	-0.243***	-0.238	-0.191
	(0.064)	(0.075)	(0.149)	(0.192)
$EU2007 \times Post2003$	0.600***	0.543***	-0.671***	-0.697***
	(0.090)	(0.100)	(0.129)	(0.163)
$EU2007 \times Post2004$	0.494***	0.451***	0.151	0.192
	(0.082)	(0.093)	(0.135)	(0.147)
$EU2007 \times Post2006$	-0.402***	-0.502***	-0.020	-0.028
	(0.075)	(0.087)	(0.143)	(0.164)
$EU2007 \times Post2007$	-1.311***	-1.467***	-1.738***	-1.780***
	(0.075)	(0.090)	(0.134)	(0.205)
Observations	50,349	50,349	31,125	31,125
R-squared	0.612	0.781	0.691	0.852
Year, prov, country FE	Yes	Yes	Yes	Yes
Interacted FEs & trends	No	Yes	No	Yes

Note: This table shows the effect of admission to the EU on gains from marriage and cohabitation, estimated using the difference-in-differences specification (2). The sample includes all heterosexual marriages formed between 1998 and 2012 in which at least one of the spouses is Italian. Columns (1)-(2) and (3)-(4) present the results for couples formed by native males and females, respectively. The dependent variable is gains from marriage, computed as in equation (1), across cells defined by province, year, and foreign spouse's country of origin. The main explanatory variables are interactions between dummies for marriages between natives and new EU citizens ($EU2004$ and $EU2007$) and dummies for the periods after the announcement ($P2003$ and $P2006$) and implementation of each enlargement ($P2004$ and $P2007$). All specifications include year fixed effects, linear trends interacted with province and country of origin fixed effects, and province $\times$ country of origin fixed effects. Regressions are weighted by province population. Standard errors clustered at the province level are reported in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table C.4: Spouses' characteristics, before and after the EU enlargement

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	**difference in age**		**years of education**		**educ(male)>educ(female)**	
female from NewEU x PostEU	-0.487***	-0.296***	0.058	0.030	0.028**	0.025**
	(0.103)	(0.104)	(0.066)	(0.074)	(0.011)	(0.012)
male from NewEU x PostEU	0.531***	1.554***	-0.078	-0.527***	-0.031**	-0.106***
	(0.203)	(0.441)	(0.085)	(0.145)	(0.014)	(0.025)
Constant	3.331***	3.334***	-0.396***	-0.404***	-0.073***	-0.075***
	(0.015)	(0.015)	(0.006)	(0.007)	(0.001)	(0.001)
Observations	3,268,228	3,201,479	3,268,228	3,201,479	3,268,228	3,201,479
all marriages	x		x		x	
at least 1 native spouse		x		x		x
R-squared	0.072	0.072	0.004	0.004	0.002	0.002

Note: This table shows the effect of the EU enlargement on differences in age and education between husband and wife. The dependent variable in columns (1) and (2) is the difference in age; in columns (3) and (4), it is the difference in years of education; and in columns (5) and (6) it is an index equal to 1 if the husband is more educated than the wife, 0 if they have the same level of education, and -1 if the wife is more educated than the husband. The equation is estimated at the marriage level and the sample includes all marriages formed during the period 1998-2012 (odd columns) or only marriages in which at least one of the spouses is a native (even columns). The explanatory variables of interest are dummies equal to 1 when the husband or the wife is a citizen from new EU countries, interacted with a dummy equal to 1 for the years after the EU enlargement. Fixed effects for spouses' nationality pairs are included in all specifications. Robust standard errors clustered by nationality pair-year cell are reported in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table C.5: Internet diffusion and intermarriages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	native male, female from country y				native female, male from country x			
	log n. marriages		gains from marriage		log n. marriages		gains from marriage	
$\ln(SingleFemales_y)$	0.122***	0.152***						
	(0.015)	-0.018						
$\ln(SingleFemales_y) \times internet$		-0.002***						
		(0.000)						
$\ln(SingleMales_x)$					0.075***	0.092***		
					(0.022)	(0.017)		
$\ln(SingleMales_x) \times internet$						-0.001		
						(0.001)		
$newEUxPostEU$			-0.972***	-0.013			-1.072***	-1.988***
			(0.075)	(0.190)			(0.143)	(0.279)
$newEU \times PostEU \times internet$				-0.074**				0.069**
				(0.015)				(0.027)
Observations	39,313	39,313	39,313	39,313	23,793	23,793	23,793	23,793
R-squared	0.928	0.928	0.818	0.819	0.929	0.929	0.853	0.853
Interacted FEs & trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table shows the effect of Internet diffusion on the formation of marriages between natives and foreigners, across cells defined by nationality of the foreign spouse, province, and year. The dependent variable in columns (1)-(2) and (5)-(6) is the log number of marriages in each cell, whereas in columns (3)-(4) and (7)-(8) the dependent variable is gains from marriage, computed as in equation (1). The variable *Internet* is the share of population with access to broadband internet connection in each region and year, as collected by the ISTAT survey *Aspects of Daily Life Survey*. The other explanatory variables are defined as in Table 3. All specifications include year fixed effects, linear trends interacted with province and country of origin fixed effects, and province × country of origin fixed effects. Regressions are weighted by province population. Standard errors clustered at the province level are reported in parentheses (99 provinces in total). Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table C.6: Characteristics of applicants to the generalized amnesty of 2002

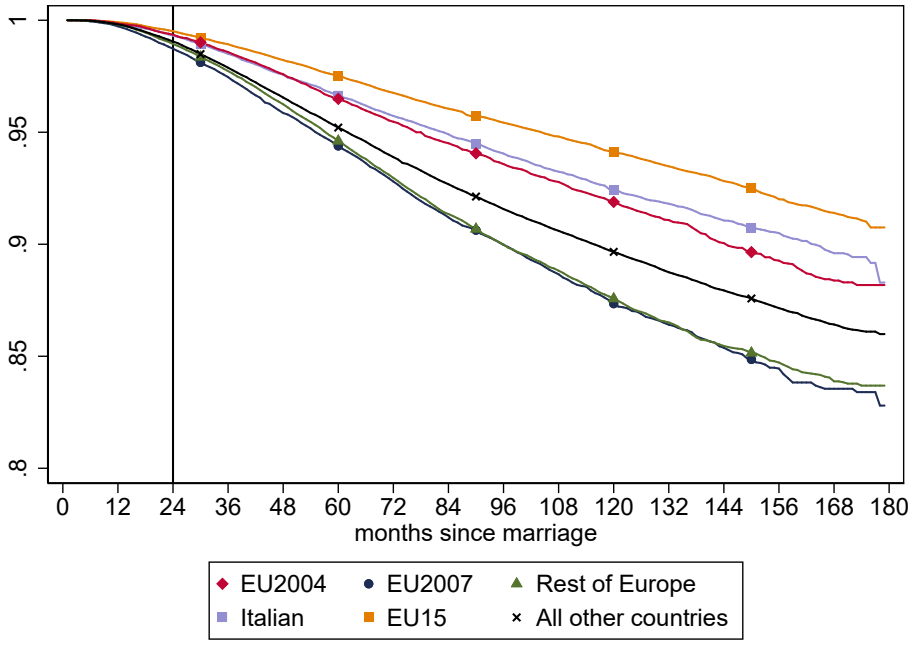
	Males		Females	
	Mean	Std. Dev.	Mean	Std. Dev.
Individual characteristics				
Age	30.04	7.62	35.16	9.97
Married	0.424	0.490	0.546	0.500
Geographic area of origin				
EU2004	0.024	0.150	0.093	0.290
EU2007	0.219	0.410	0.215	0.410
EU Other	0.229	0.420	0.414	0.490
Africa	0.271	0.440	0.053	0.220
Asia	0.188	0.390	0.077	0.270
South America	0.068	0.250	0.146	0.350
OECD	0.001	0.030	0.001	0.040
Area of residence in Italy				
North	0.549	0.500	0.483	0.500
Center	0.271	0.440	0.314	0.460
South	0.180	0.380	0.203	0.400
Observations	376,840		317,964	
Total Observations	694,804			

Table C.7: ISMU survey, summary statistics for regular and irregular immigrants

	Regular migrants				*Irregular migrants*			
	Males		Females		Males		Females	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Individual characteristics								
Age	35.56	8.33	35.36	8.70	30.18	7.03	33.83	9.22
Married	0.625	0.480	0.633	0.480	0.286	0.450	0.389	0.490
Children (#)	1.270	1.400	1.360	1.210	0.596	1.130	1.100	1.240
High Education	0.519	0.500	0.608	0.490	0.452	0.500	0.596	0.490
Employed	0.886	0.320	0.644	0.480	0.731	0.440	0.777	0.420
Legal Job	0.813	0.390	0.550	0.500	0.059	0.240	0.067	0.250
Illegal Job	0.073	0.260	0.094	0.290	0.672	0.470	0.710	0.450
Income (Euro)	998.94	697.50	533.71	553.06	553.29	547.53	580.91	519.93
Geographic area of origin								
EU2004	0.004	0.060	0.021	0.140	0.002	0.040	0.005	0.070
EU2007	0.040	0.200	0.077	0.270	0.052	0.220	0.080	0.270
EU Other	0.136	0.340	0.209	0.410	0.135	0.340	0.342	0.470
Africa	0.525	0.500	0.321	0.470	0.561	0.500	0.166	0.370
Asia	0.223	0.420	0.169	0.380	0.141	0.350	0.084	0.280
South America	0.072	0.260	0.203	0.400	0.109	0.310	0.324	0.470
OECD	0.000	0.010	0.000	0.020	0.000	0.002	0.000	0.000
Observations	51,181		38,897		7,835		3,822	
Total Observations	90,078				11,657			

Note: ISMU (2001-2016) data, Lombardy. Individual level data.

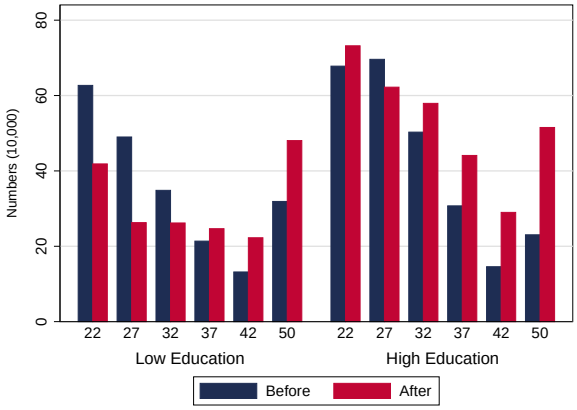
Figure C.1: Survival function of marriages



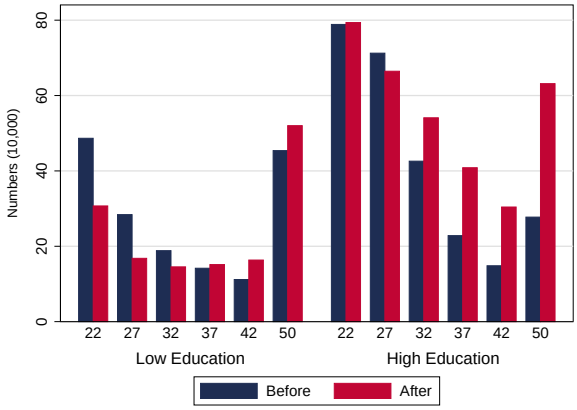
Notes: This graph shows the survival function of marriages in which (at least) one spouse was Italian, by area of origin of the other spouse. The vertical line indicates the period after which the foreign spouse can apply for Italian citizenship

Figure C.2: Distribution of population vectors, by age and area of origin

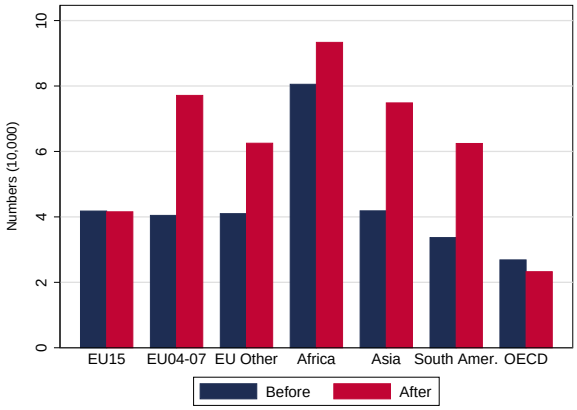
(a) Men by Age and Education



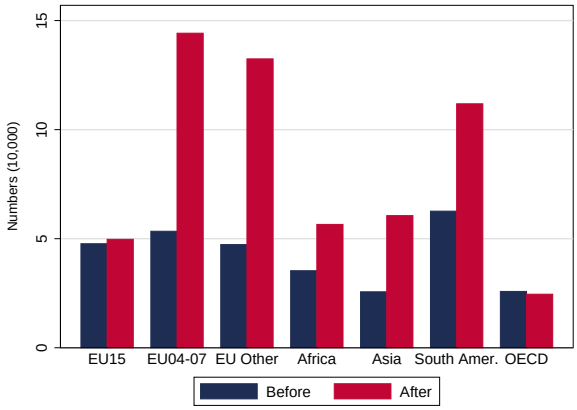
(b) Women by Age and Education



(c) Men by area of origin



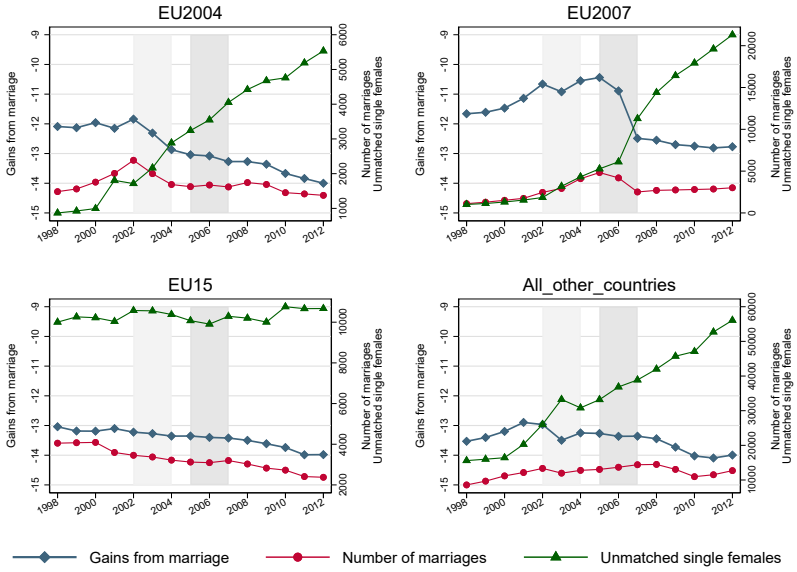
(d) Women by area of origin



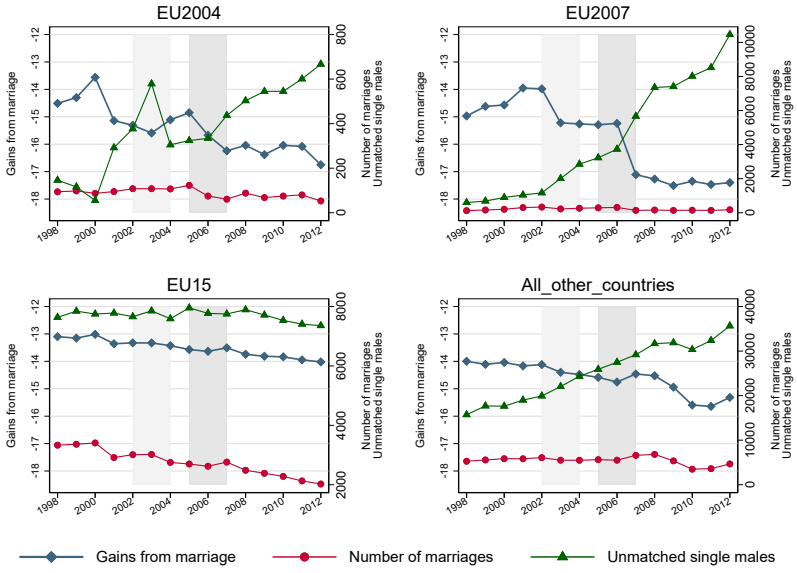
Notes: Marriage (1998-2002 and 2007-2012) and individual census (2001, 2011) data, Italy. The Figures report the distributions of men and women population vectors by age and education and area of origin, separately.

Figure C.3: Unmatched singles, marriages, and gains to marriage by area of origin, 1998-2012

(a) Native husband – foreign wife

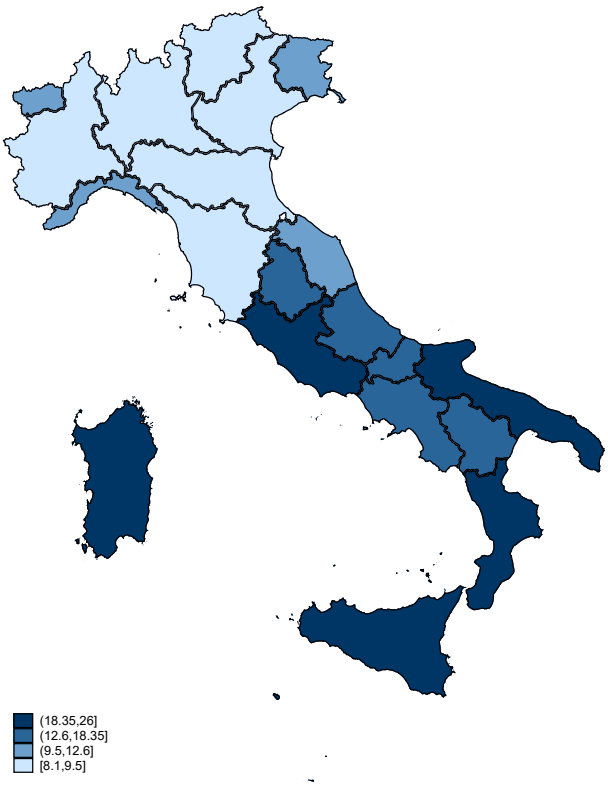


(b) Native wife – foreign husband



Notes: The graphs plot the number of unmatched singles, the number of marriages, and the gains to marriage over the period 1998-2012 by area of origin of the foreign spouse. The shaded areas denote the periods between the announcement and implementation of the EU enlargements. Gains to marriage are measured as in equation (1). The classification of countries is reported in Table C.1. *Source*: ISTAT, marriage records from vital statistics registries (1998-2012) and individual Census data.

Figure C.4: Size of the shadow economy across Italian regions



Notes: The map shows the size of the shadow economy across Italian regions in 2002, as measured by the estimated fraction of irregular workers over total workers. *Source:* Istat Shadow Economy Dossier (2010), Italy.

Figure C.5: Regular and irregular immigrants, 1991-2013