Marriage and Divorce: The Role of Labor Market Institutions*

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Abstract

Marriage and divorce decisions are influenced by the institutional environment in which they are made. In this paper, we empirically investigate how labor market institutions shape economic incentives to get or remain married, using the example of the unemployment insurance system. To identify institutional effects on marriage and divorce decisions, we exploit a reform of household-level means testing in Germany that altered said incentives. Means-testing exemption amounts were sharply reduced in January 2003 and this increased the extent to which spouses have to insure each other against unemployment. We argue that the extent to which (potential) spouses were affected by this reform varies with individuals' migration background. Using the universes of marriages and divorces in Germany between 1997 and 2013, we find that increased means-testing made the formation of interethnic marriages significantly less attractive. At the same time, it increased marital stability: interethnic marriages formed after the reform are more stable than interethnic marriages marriages formed before the reform.

Keywords: Marriage, Divorce, Interethnic Marriage, Marital Surplus, Unemployment Insurance, Labor Market Reforms, EU Expansion
JEL Classifications: J11, J12, J15, J64, J65

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1 Introduction

Living in a union with another individual has many benefits. Besides companionship and mutual affection, there is arguably an economic dimension to partner choice and household formation. Economies of scale can be realized by joint consumption (Browning et al., 2013). Moreover, the partner's time endowment, employed either in home production or through the labor market, can provide utility for multiple household members.[1] Labor supply is a joint decision due to implications for the whole household (Chiappori, 1992; Chiappori et al., 2002). Thus, marriage and labor markets interact (Grossbard-Shechtman, 1984).

In addition to its effect on current consumption, the spouse's employment and income stream may also provide insurance during times of economic hardship, e.g. prolonged unemployment. This form of risk pooling, however, does not exclusively take place within households. In many countries, the social insurance system provides a substitute for within-household insurance: with good unemployment insurance coverage one does not need to rely on one's spouse. The role of the family and partnership formation (or dissolution) decisions, therefore, depend on the institutional environment. It influences *marital surplus*, that is, the economic rents that are gained and shared by individuals who form a union.[2]

In this paper, we empirically study the household insurance channel, its interaction with the generosity of the public unemployment insurance system, and implications for marriage formation and stability.[3] We estimate marital surplus using the transferable utility marriage market matching model of Choo and Siow (2006). Suppose unemployment benefits are generous such that there is no need for within-household insurance against unemployment. This increases marital surplus and, therefore, leads to more marriages and higher marital stability. If unemployment benefits are low, for example due to means-testing against the partner's income, shocks have to be absorbed within the household to a larger extent, lowering marital surplus.

[1] The traditional specialization of one individual in market work while a second individual focuses on home production can be understood as a policy that maximizes joint household utility in this setting (Becker, 1981).

[2] In equilibrium models of the marriage market, the marital surplus governs marriage formation and marital stability, see Goussé et al. (2017) and Gayle and Shephard (2019) for two recent examples.

[3] In principle, all of our arguments also apply to unmarried cohabitation and same-sex couples. The nature of our data, however, forces us to focus on legally married heterosexual couples in this paper.

Means testing, a common feature of many social insurance systems, makes it costly in expectation to marry a partner who is exposed to high unemployment risk. We study a large-scale institutional reform in Germany that changed the rules of means testing and, thus, the generosity of unemployment insurance for couples. In January 2003, the first part of the comprehensive German labor market reforms, the so-called "Hartz reforms", was implemented.[4] One specific element of the reform was a tightening of means testing exemptions, implying a sharp increase in the need for within-household insurance during a period of very high unemployment risk. In 2003, the German unemployment rate stood at 10% with an increasing trend.

We identify the effect of this labor market reform on marital surplus and stability in a differences-in-differences framework under the assumption that interethnic marriages, that is, marriages with one German spouse and one spouse of foreign nationality, were more exposed to unemployment risk as compared to marriages with two German spouses. We find support for this identifying assumption in German social security data.[5] We find that the labor market reform had a sizable negative impact on the marital surplus of interethnic marriages in Germany. Accordingly, the intermarriage rate of German men and women declined by about 30% between 2003 and 2008. This feedback effect of the German labor market reforms on the marriage market, and on interethnic marriages in particular, constitutes and important finding of high policy relevance. Interethnic marriages can be an important vehicle for the integration of migrants (Adda et al., 2019; Azzolini and Guetto, 2017). An institutional environment that makes this kind of marriage relatively unattractive may therefore hinder the success of migration policy.

An important confounding factor that we have to take into account to identify the effect of the labor market reform is the Eastern expansion of the European Union (EU) in May 2004. The EU expansion granted the right to live and work in any EU country to citizens of eight Eastern European countries, Malta, and Cyprus (the EU10 countries). Most member states opened their labor markets straight away. Germany and Austria, however, implemented a seven-year transitional period during which free movement of workers for citizens of the new member states was only gradually introduced.

[4]Named after the chairman of the commission that worked out the reform package, Peter Hartz, who was at that time director of human resources at Volkswagen. We provide more details in Section 2.

[5]Caucutt et al. (2018), who investigate racial differences in marriage market outcomes in the US, make a similar identification argument related to the unemployment and incarceration rates of black men.

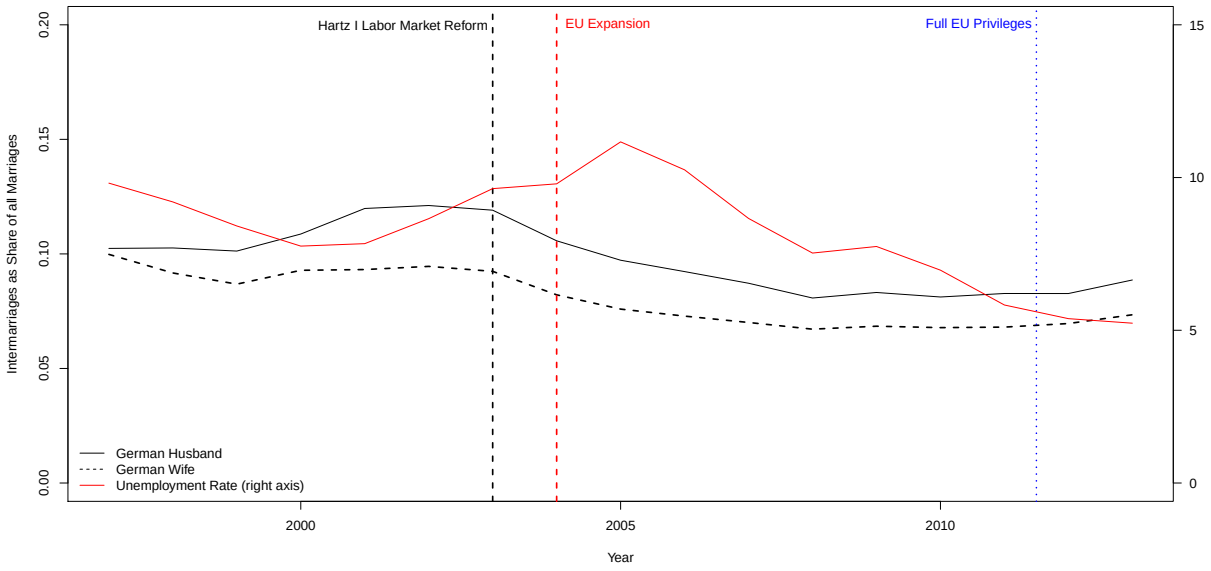
It is likely that the EU expansion had by itself an impact on the German marriage market, similar to what Adda et al. (2019) find in the Italian context. From a theoretical perspective, the marital surplus of interethnic marriages between Germans and citizens of the new EU member states was negatively affected by the EU expansion. The reason is that marrying a German citizen was in principle no longer necessary to obtain the right to reside and work in Germany. Due to the gradual opening of the German labor market, however, one would expect to find a smaller effect in Germany as compared to Italy, a country that immediately granted full labor market access.

We control for the effect of the EU expansion on marital surplus and stability in a double differences-in-differences setting. That is, we estimate the effect of the EU expansion conditional on the impact of the aforementioned labor market reform using a second set of treatment and control groups. We compare marriages of Germans with a EU10 spouses (treatment group) with marriages of Germans with natives of countries outside Europe (nonEU, control group). Taking into account the effect of the labor market reform, we find no statistically significant effect of the EU expansion on marital surplus and stability of interethnic marriages. For the German case, this finding seems reasonable,

The main sources of micro data we use in this study are the German marriage and divorce registers. Between 1997 and 2013, we observe all legal marriages and divorces in Germany that were formed or dissolved with daily precision and a rich set of covariates. We are not aware of any other research paper in the literature on marriage market and family economics that uses these data. As complementary data sources, we use the German Microcensus, the largest household survey in Europe, and linked employer-employee data drawn from the social security registers at the German Federal Employment Agency.

Figure 1 depicts the development of the German intermarriage rates between 1997 and 2013 using the marriage register, along with the unemployment rate, to highlight the interaction of marriage market outcomes and unemployment risk. Intermarriage rates evolve almost in parallel for men and women. The level of the marriage rate is always higher for German men marrying foreign women as compared German women marrying foreign men, so men are more likely to marry a partner of foreign nationality. Note that, after increases around the year 2000, the German intermarriage rates essentially became flat. This was a period of rising unemployment in Germany. The unemployment rate

Figure 1: Intermarriage Rates in Germany



Notes: The black dashed vertical line indicates the year in which the Hartz I Reform became effective (2003), the red dashed vertical line marks the year in which the EU expansion took place (2004). *Data*: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Marriage Registry, 1997-2013, own calculations. The unemployment rate is extracted from OECD data.

increased from 7.8% in 2001 to a maximum of 11.2% in 2005. The negative correlation between intermarriage and unemployment rates in this time period suggests a potential link between marriage market decisions and labor market conditions, which is what we study in this paper. Note that once the "Hartz I" labor market reform had been implemented (black dashed line), intermarriage rates started to fall for both German men and women. The negative trend was hardly affected by the EU expansion (red dashed line) and intermarriage rates only started increasing again around the year 2011, when the German unemployment rate had reached a historical low.

There is a large literature in family economics on the long-run interaction between marriage and labor markets, see Greenwood et al. (2016), Chiappori et al. (2018), and Greenwood et al. (2017) for a survey of this literature. The steep increase of female educational attainment and labor force participation in most developed economies after World War II has been a revolution according to Goldin (2006) and was without doubt a source of enormous economic growth. Our paper complements this literature by providing evidence for short-run interactions between marriage and labor markets, identified through interethnic marriages and institutional change. Other papers have documented that unemployment, especially male unemployment, is associated with an increase in the

divorce rate.[6] Also, we know that marriage and divorce rates are negatively correlated with the unemployment rate over the business cycle.[7] Regarding the interaction of social insurance systems and marriage, Persson (2020) finds that the elimination of survivor insurance in Sweden affected marriage formation, divorces and the degree of assortativeness on the marriage market. Lastly, there is also a relatively large literature (Basu, 2015; Dribe and Nystedt, 2015; Furtado and Theodoropoulos, 2009; Kantarevic, 2005; Meng and Gregory, 2005; Meng and Meurs, 2009) on intermarriage and labor outcomes with mixed results.

In a related paper, Adda et al. (2019) show that intermarriage rates in Italy have been falling relative to the increasing number of foreign residents since the eastern expansions of the EU in 2004 and 2007.[8] Large groups of immigrants received immediate and full access to the Italian labor market. Adda et al. (2019) argue that lower intermarriage rates between Italians and foreigners after the expansions reflect that marrying an Italian spouse was no longer necessary to gain labor market access in Italy. Thus, if immigrants react to obtaining labor market access by marrying among themselves to a larger extent rather than natives of the host country, the labor market access of immigrants might paradoxically interfere with their integration in the host country instead of fostering it.

We find no significant effect of the EU expansion on interethnic marriages in Germany, conditional on the effect of the earlier labor market reform.[9] There are two main differences between Italy and Germany to consider in this context. First, labor market access for citizens of the countries that joined the EU in 2004 and 2007 was restricted in Germany until 2011.[10] Thus, the channel highlighted in Adda et al. (2019) (an Italian spouse was no longer necessary to obtain labor market access in Italy) should be much weaker in Germany. Second, Germany has a very different history of receiving migrants as compared to Italy and intermarriages have been relatively common for a long period of time. While large-scale immigration is a relatively new phenomenon in Italy[11], Germany

[6] See Jensen and Smith (1990), Hansen (2005), and Amato and Beattie (2011) among others.

[7] See Schaller (2013), González-Val and Marcén (2017a), and González-Val and Marcén (2017b) among others.

[8] The 2007 expansion admitted Bulgaria and Romania to the European Union, which is of special importance in the Italian context due to the geographic proximity.

[9] We cannot identify what the EU expansion's effect would have been in the counterfactual scenario absent the labor market reform. We do find, however, that the expansion's effect on marital surplus is negative and significant (as in Adda et al. (2019)) if we estimate the EU effect in isolation.

[10] Even though it is debatable how much bite those restrictions had, see Section 2.

[11] As Adda et al. (2019) report, the share of foreign residents in Italy had been below 2% during the 1990s and started increasing during the 2000s. It reached around 9% in 2013.

has experienced sizable inflows of migrants since guest worker programs started in the 1950s/60s. During the 1990s and 2000s, the period we study in this paper, the share of residents without German citizenship was stable at around 8–9% of the population, a level that Italy did not reach until 2013.[12] Adda et al. (2019) report an intermarriage rate among newly formed marriages of below 3% for Italian men with foreign wives and around 1% for Italian women with foreign husbands in 1996, the first year of their data. In Germany, about 10% of all new marriages in 1997, the first year of our data, were intermarriages. This high baseline level of intermarriages in Germany might make the EU expansion "shock" quantitatively less important.

Our finding of a significant and quantitatively important negative effect on the marital surplus of interethnic marriages in Germany as a result of the labor market reform, however, leads to a conclusion similar in spirit to Adda et al. (2019): if natives react to labor market reforms by marrying each other rather than foreigners, paradoxically, reforms that are intended to lower the unemployment rate might interfere with the integration of foreigners, at least in the short-run.

The remainder of our paper is structured as follows. Section 2 describes the institutional background and Section 4 our data. Section 3 reviews the Choo and Siow (2006) marriage market matching model that we use to estimate marital surplus. Section 5 takes the model to the data and presents our empirical strategy with the main results. Section 7 provides a concluding discussion of the findings.

2 Institutional Background

2.1 The Labor Market Reform

Our empirical analysis builds on a distinct change to the institutional environment in which individuals decide who to marry or stay married to in Germany. The change was a specific element of the so-called *Hartz reforms*, a comprehensive labor market reform package that was worked out by a commission chaired by Peter Hartz, who was at that time director of human resources at Volkswagen. The commission's work took place

[12]The share increased from 3% in 1967 to around 8% by the time of reunification. After the period of relative stability between 8–9%, the share surpassed 10% in 2014 and stood at more than 13% by the end of 2018. The recent increase is mainly related to prolonged recessions in Southern Europe and the inflow of refugees. All numbers are according to the federal statistical office.

during the first half of 2002 and results were presented to the public on August 16, 2002. The Hartz reforms consisted of four reform packages that came into force consecutively. The reform packages were designed to increase labor demand (Hartz I and II), matching efficiency (Hartz III), and labor supply (Hartz II and IV).[13]

We focus on the Hartz I reform package, which came into force on January 1, 2003. The reform package was passed in parliament only shortly before, on December 23, 2002. Anticipation effects that would influence marriage-related decisions can thus expected to be minimal. As it was mainly designed to increase labor demand, the most prominent policy changes in the package liberalized temporary employment and subcontracted labor in Germany. Less prominently, however, Hartz I also severely tightened exemptions from household-level means-testing in the long-term unemployment benefits system, thereby increasing the extent to which spouses have to insure each other against unemployment.

Traditionally, the German social security system featured three types of transfers. The first transfer, unemployment benefits[14], is a social insurance benefit that replaces 60 to 67% of the previous net salary. It is not means-tested. Prior to 2005, the duration varied between 12 and 36 months depending upon age and work history. Since 2008, the duration of these benefits has been restricted to 12 months for workers below the age of 50.[15] Upon exhaustion of unemployment benefits, a second transfer, unemployment assistance[16], followed prior to 2005. Unemployment assistance claims had to be renewed yearly, but receipt was not time-limited otherwise. This transfer was tax-financed and amounted to 53 to 57% of the last net salary. It was, however, means-tested against the partner's income for both married and cohabitating individuals.[17] The threshold above which the partner's income reduced transfer entitlements was lowered substantially by the Hartz reforms.

From January 1 2003, the Hartz I reform lowered the partner-income threshold by

[13]Hartz I, liberalized temporary employment and subcontracted labor in addition to the changes to means testing. Hartz II introduced subsidies for one-person companies ("Me-inc"), reformed marginal employment legislation by introducing new forms of tax-exempt part-time employment (so-called mini and midi jobs), and made it easier for firms to lay off workers. Hartz III reorganized the Federal Employment Agency to improve the process of offering suitable jobs to unemployed workers. Hartz IV heavily reformed the unemployment benefit system, mainly by shortening the duration of unemployment benefits and merging long-term unemployment assistance with means-tested social assistance.

[14]"Arbeitslosengeld" in German. The "Hartz IV" reform renamed it to "Arbeitslosengeld I" in 2005.

[15]For older workers, it is 15 months below 55, 18 months below 58, and then 24 months.

[16]"Arbeitslosenhilfe" in German.

[17]From 2001 onward, the partner's income above a threshold of 520 Euros per year of age of the partner was taken into account. The maximum value of the exemption was 33800 Euros for partners of age 65 and above.

more than 60% from 520 to 200 Euros per year of age with a maximum of 13000 Euros. This is the primary reform cutoff we exploit in our empirical analysis. Two years later, Hartz IV effectively set the means-testing threshold to zero when the long-term unemployment assistance program was discontinued. From January 1 2005, only tax-financed social benefits, traditionally the third and lowest tier of transfer payments in the German social security system, were available for unemployed individuals who exhausted their primary unemployment benefits. These social benefits[18] are strictly means-tested and additional sources of income, including the partner's income, are counted against benefit entitlements from the first Euro.

2.2 Non-Natives in the German Labor Market

Immigrants and non-natives often face obstacles on the labor market[19], resulting in labor market dynamics that differ substantially by citizenship status. Consequently, labor market reforms may also affect non-natives differently than natives. In this particular setting, this would be the case of non-natives are exposed to worse labor market conditions — measured for example in a higher risk of becoming unemployed — than natives.

The SIAB[20] data allows us to formally test this identifying assumption. To this end, we estimate labor market transition probabilities conditional on gender and nationality (German, non-German). We do not observe marital status in the SIAB data. Additionally, we stratify by education. To test whether non-natives face a higher unemployment risk in Germany, both in terms of transitions into unemployment and duration, we estimate Cox proportional hazard models (Cox, 1972).

This Cox model assumes a baseline hazard that is common to both employed and unemployed individuals along with a log-linear function of covariates.[21] With stratification, the five different education groups are allowed to have different baseline hazards.[22]

[18] "Arbeitslosengeld II" or simply "Hartz IV" in colloquial German.

[19] e.g. language barriers, labor market access, discrimination, etc.

[20] For a detailed description of the SIAB, see Section 4.

[21] The hazard rate for transitions out of and into unemployment after a number of days, d, with the vector of covariates Z is denoted $h(d, Z)$. γ indicates the vector of coefficients to be estimated and $\lambda(d)$ the baseline hazard and v is an error term. Thus, the hazard model can be specified as $h(d, Z) = \lambda(d) \cdot \exp(\gamma' Z) \cdot v$.

[22] Separate Cox models for each education group are estimated with stratification under the assumption that coefficients are the same across strata and that each education group has its own baseline hazard for job loss and job findings, respectively. As education is unobserved in the marriage and divorce data, we also estimate hazard rates without stratification, see Table A.2 in the Appendix. The conclusions are unchanged.

Table 1: Labor Market Hazard Rates

	Transitions into Unemployment				Transitions into Employment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
German	-0.130***	-0.144***	-0.184***	-0.199***	0.025**	-0.025***	-0.005	-0.052***
	(0.012)	(0.011)	(0.010)	(0.010)	(0.010)	(0.009)	(0.008)	(0.008)
	[0.878]	[0.866]	[0.832]	[0.820]	[1.025]	[0.975]	[0.995]	[0.949]
Female	-0.191***	-0.125***	-0.188***	-0.116***	-0.161***	-0.143***	-0.160***	-0.143***
	(0.009)	(0.008)	(0.010)	(0.008)	(0.011)	(0.011)	(0.010)	(0.010)
	[0.826]	[0.882]	[0.829]	[0.890]	[0.851]	[0.867]	[0.852]	[0.867]
N	1,857,659	1,857,659	1,857,659	1,857,659	1,232,908	1,232,908	1,232,908	1,232,908
Stratified by Education	✓	✓	✓	✓	✓	✓	✓	✓
Year FE		✓		✓		✓		✓
Region FE			✓	✓			✓	✓

Notes: robust standard errors (clustered by region) in parentheses. Hazard rates reported in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We calculate hazard rates for transitions into unemployment and into new employment out of unemployment. Table 1 presents the results. The covariates of interest are nationality and gender of the employed/unemployed individuals. Columns (1)–(4) of table 1 present the hazard rates for job loss (transitions into unemployment) and columns (5)–(8) present the hazard rates for job findings (transition into employment). We find that the hazard of transitioning from employment into unemployment is significantly higher for non-natives as compared to Germans. Thus, as we conjectured, non-natives face a higher risk of becoming unemployed. Our preferred specification includes both year and labor market region fixed effects, see columns (4) and (8). German nationals have a job loss hazard rate that is 20% lower than the respective hazard rate for workers without German citizenship, who are thus on average more likely to lose their jobs. For transitions into employment, the hazard rate of Germans is 5% lower than the hazard rate for foreigners. Thus, workers without German citizenship find new jobs out of unemployment quicker than Germans, their unemployment duration is on average shorter. An explanation for this finding are lower reservation wages, for example due to lower unemployment benefit entitlements or because for some nationalities continued employment is a necessary requirement for residence status.[23]

Note that the estimated hazard rates reflect differences between Germans and a diverse group of individuals without German citizenship. One would expect that labor market transition probabilities vary greatly across individuals of different foreign nationalities.

[23]Selection also plays a role: upon job loss, some foreign workers might simply leave the German labor market and return to their home country, so we don't observe those individuals transitioning back into employment.

For example, citizens of other EU15 countries face no legal barriers to employment in Germany and unemployment benefit entitlements can be transferred across countries. Thus, they might be more comparable to German workers in terms of labor market attachment than workers from non-EU countries are. The hazard rate differences we find can therefore be interpreted as a lower bound for the differential exposure to labor market risk for workers without German or EU15 citizenship.

Finally, women are 12% less likely to become unemployed and about 14% less likely to move into employment according to our preferred specification. That is, women are on average employed longer, but it takes them longer to find a new job out of unemployment. Thus, the need for additional insurance after the reform might be higher for women.

3 Theory

To formally investigate how changes to labor market institutions affect decisions in the marriage market, we rely on a marriage market matching model that lends us structure. Choo and Siow (2006) derive a simple non-parametric estimator of the *marriage surplus*, using a static matching model with transferable utility between spouses in the spirit of Becker (1973, 1974). Choo and Siow (2006) generate the market demand for marriages using the extreme-value logit random utility model of McFadden (1974), which yields characteristic functional forms.

3.1 Marriage Surplus

The marriage surplus reflects the gains from marriage for both partners, and those gains may change systematically in response to changes in the institutional environment. The marriage surplus is calculated using market clearing conditions and, thus, depends on the relative numbers of married and single individuals of a particular type.

The independent utility of a type i man g married to a type j women is given by equation 1.[24] It consists of a systematic gross return ($\tilde{\alpha}_{ij}$) that depends on the particular type combination, a systematic utility transfer from the man to the woman (τ_{ij}) and an independently and identically distributed random variable with a type I extreme-value

[24] In our empirical implementation, type i and j are a combination of nationality and age. See Section 5 for more details.

distribution (ϵ_{ijg}). Thus, the systematic gain from marrying a type j for a type i man is given by $\tilde{\alpha}_{ij} - \tau_{ij}$.

$$V_{ijg} = \tilde{\alpha}_{ij} - \tau_{ij} + \epsilon_{ijg} \tag{1}$$

Symmetrically, for a female of type j the systematic gain from marrying a type i man is denoted $\tilde{\gamma}_{ij}$. Following the notation of Choo and Siow (2006) the sign of the utility transfer (τ_{ij}) is positive for women. A male (female) individual g will choose the type of the marriage partner type j (i) according to

$$V_{ig} = \max_j \{V_{i0g}, ..., V_{ijg}, ..., V_{iJg}\}. \tag{2}$$

Following McFadden (1974) and assuming a large number of men and women, this translates into a quasi-demand function for type i, j marriages demanded by type i men:

$$\begin{aligned} \ln \mu^d_{ij} &= \ln \mu^d_{i0} + \tilde{\alpha}_{ij} - \tilde{\alpha}_{i0} - \tau_{ij} \\ &= \ln \mu^d_{i0} + \alpha_{ij} - \tau_{ij}, \end{aligned} \tag{3}$$

where $\alpha_{ij} = \tilde{\alpha}_{ij} - \tilde{\alpha}_{i0}$ is the systematic gross return to a type i man for a type i, j marriage relative to being unmarried. Symmetrically, the supply of type i, j marriages by women j is given by:

$$\ln \mu^s_{ij} = \ln \mu^s_{0j} + \gamma_{ij} + \tau_{ij}. \tag{4}$$

In equilibrium—when all $I \times J$ submarkets of the marriage market clear—the joint surplus generated by a marriage between a type i man and type j woman can be calculated by adding equations (3) and (4). The utility transfers between both spouses cancel out and only the two systematic components, α_{ij} and γ_{ij}, remain:

$$\ln \mu_{ij} - \frac{\ln \mu^d_{i0} + \ln \mu^s_{0j}}{2} = \frac{\alpha_{ij} + \gamma_{ij}}{2}, \tag{5}$$

so the joint surplus for both partners consists solely of the systematic gains from marriage.

The LHS of equation (5) can be rewritten as

$$\Phi_{ij} = \ln\left(\frac{\mu_{ij}}{\sqrt{\mu_{i0}\ \mu_{0j}}}\right). \tag{6}$$

Choo and Siow (2006) refer to this expression as the *marriage market matching function*: the number of marriages between type i men and type j women is given by μ_{ij} in the numerator. It is scaled by the the number of single men and single women of the same type, μ_{i0} and μ_{0j}, in the denominator, so the expression is scaled by the observed population vectors. Intuitively, the total systematic gain (surplus) to marriage per partner for any i, j pair can be expected to be high if we observe many i, j marriages relative to the respective single populations.

For a constant marriage surplus Φ_{ij}, a percentage increase in the stock of available singles of a particular type (μ_{i0} and μ_{0j}) should result in a percentage increase of marriages that include this particular type (μ_{ij}). Consequently, changes in the marriage surplus are deviations from this constant relationship between marriages and single stocks.[25] Thus, any inflow of singles of a certain type should—in case the systematic factors underlying the marriage surplus did not change—result in a proportional increase of marriages that include this particular type.

3.2 Reform Effects on Marital Surplus

The labor market reform we consider in this paper lowered the generosity of social insurance in case of prolonged unemployment. The need to self-insure within the household increased. Thus, the systematic component of the marriage surplus changed, assuming that married individuals take into account that they may have to support their partner.

From the male perspective, the reform affected both $\tilde{\alpha}_{ij}$ and $\tilde{\alpha}_{i0}$ in the model. On the one hand, the lower generosity of social insurance reduced $\tilde{\alpha}_{i0}$ and thus increased incentives to get married due to the need for additional insurance through a partner. On the other hand, stricter means testing decreased $\tilde{\alpha}_{ij}$, the gains from being married, because of the larger need to support the partner in case of unemployment. From the female perspective, the reform affected $\tilde{\gamma}_{ij}$ and $\tilde{\gamma}_{i0}$ in the same way.

[25] Implicitly, the marriage surplus is always defined relative to the value of being single. Thus all changes that affect both the value of being single as well as the value of being married to the same extend will not alter the marriage surplus.

The net effect of the changes to both model objects is a priori unclear. We evaluate it empirically in Section 5 by exploiting the reform-induced variation in observed marriage rates and the estimated surplus for different types of individuals.

Note that, according to the model, utility transfers, τ_{ij}, do not matter for marital surplus and, thus, do not have to be observed to study the reform's effect on marital surplus. In theory, however, they are part of an important adjustment mechanism. Utility transfers change relative gains to marriage for both partners by transferring resources to one partner at the expense of the other. For example, the loss of systematic gains from marriage for a certain type of women may have to be compensated by men through a larger transfer to keep the marriage preferable to singlehood for both partners. If increasing the transfer sufficiently is infeasible, a lower number of marriages of that particular type i, j, and, potentially, more divorces (which are not modeled here) would be the consequence.

3.3 Expected Gains to Entering the Marriage Market

In addition to the marriage surplus, the Choo and Siow (2006) model also provides functional forms for the expected gains to marriage that can be computed directly from the data. The labor market reform arguably also affected gains to entering the marriage market for both genders, due to the aforementioned insurance considerations. Thus, we will also study how these gains evolved over time in conjunction with the institutional changes in the labor market.

Starting from the demand for marriages, equation (3) above, the expected value of entering the marriage market for a type i man g before all individual realizations of ϵ_{ijg} is

$$\mathbb{E}V_{ig} = c + \tilde{\alpha}_{i0} + \ln\left(\frac{m_i}{\mu_{i0}^d}\right), \tag{7}$$

where c is a constant and $\tilde{\alpha}_{i0}$ the gains from being single of this particular type. The value of entering the marriage market is proportional to the log of the number of type i men who enter the marriage market, m_i, divided by the number of type i men who remain single. The last term can thus be interpreted as the expected gains to entering the marriage market for type i men, denoted

$$Q_i = \ln\left(\frac{m_i}{\mu_{i0}^d}\right). \tag{8}$$

By symmetry, the expected gains to enter the marriage market for women are

$$Q_j = \ln\left(\frac{f_j}{\mu^s_{0j}}\right), \tag{9}$$

where f_j is the number of type j women who enter the marriage market.

3.4 Taking the Model to the Data

Using the Choo and Siow (2006) model, one can compute the marriage surplus from a single cross section of data. Our data has a time dimension, so we adapt this approach by calculating the marriage surplus annually using the flow of new marriages relative to the number of available singles in that particular year. Essentially, this measures the flow out of singlehood.[26]

In the data, we interpret the individual types i and j of men and women as a combination of age and nationality. Thus, we let $\hat{\Phi}(f_{a,n}, m_{a,n})_t$ denote the estimated surplus of a marriage between a man of age a and nationality n and a woman of age a and nationality n in year t in our data. We estimate it using equation (6):

$$\hat{\Phi}\left(f_{a,n}, m_{a,n}\right)_t = \ln\left(\frac{\mu(f_{a,n}, m_{a,n})_t}{\sqrt{\mu(0, f_{a,n})_t \ \mu(m_{a,n}, 0)_t}}\right), \tag{10}$$

where the marriage surplus in any particular year t depends on the observed numbers of females $f_{a,n}$ and males $m_{a,n}$ of a certain age a and nationality n who get married, $\mu(f_{a,n}, m_{a,n})_t$, relative to the geometric average of the available singles of the same types, $\mu(0, f_{a,n})_t$ and $\mu(m_{a,n}, 0)_t$. The more new marriages we observe for given population vectors, the higher is the estimated marriage surplus for this particular age-nationality combination. As our data inputs, we use observed new marriages in the MR data and single stocks in the MC data for six age groups (18-25, 26-32, 33-39, 40-46, 47-54, 55-68) and eight nationalities (Germany, EU15 (excluding Germany), Poland, Turkey, EU10 (excluding Poland), Romania, former Yugoslavia, Rest of the World) as explained in Section 4.

Moreover, we estimate the gains to entering the marriage market for both men ($\hat{Q}_{m_n}$) and women ($\hat{Q}_{f_n}$) of all nationalities n (irrespectively of age, for brevity) according to

[26] This approach is also used by Adda et al. (2019), who estimate the Choo and Siow (2006) model using Italian census data.

equations (8) and (9), respectively:

$$\hat{Q}_{f_n} = \ln\left(\frac{f_n}{\mu(0, f_n)_t}\right), \ \hat{Q}_{m_n} = \ln\left(\frac{m_n}{\mu(0, m_n)_t}\right). \tag{11}$$

The numerator in both expressions represents the total number of women and men by nationality, respectively. The denominators ($\mu(0, f_n)_t$, $\mu(0, m_n)_t$) represent the respective numbers of singles. We approximate the total numbers of all male and female individuals in the marriage market by adding to the number of singles from the MC the number of individuals for which we observe a marriage in the same year.[27]

4 Data and Descriptive Evidence

4.1 Marriage and Divorce Registers

The marriage and divorce registers, MR and DR in the following, cover the universe of marriages and divorces in Germany. Data access is provided through the Research Data Centers (FDZ) of the statistical offices of the German federal states. The marriage and divorce registers are two separate sources of process-generated micro data that originate from the German civil registry offices and divorce courts, respectively. Both data sources contain information on legally registered marriages of different-sex couples only. Although same-sex couples could form a civil union in Germany starting in 2001, these unions are not included in the marriage and divorce registers.[28]

Both data sets are organized at the level of the couple and contain information on the birth dates of both spouses, the date of marriage, and, in the DR, the date of divorce. Additionally, the data contain various covariates including religion and citizenship of both spouses, place of residence, number of children (before marriage and at the time of divorce), as well as who filed for divorce and the court's ruling. There is no information about education or other indicators of socioeconomic status.

Due to strict German data protection legislation, it is illegal to link the MR and DR registers at the level of the individual couple. Thus, we first use the MR data only

[27] This is only an approximation since the MC data is survey-based and individuals could potentially get married in the same year after reporting in the survey that they are singles. The numbers of individuals might thus be somewhat upward biased due to double counting.

[28] Same-sex marriages were fully legalized in Germany only in 2017.

and study marriage formation at the couple level. We estimate marital surplus based on the Choo and Siow (2006) transferable utility model of marriage-market matching, introduced in Section 3. To this end, we combine the flow of new marriages observed in the MR with stocks of unmarried individuals for different nationalities and age groups obtained from the German Microcensus (MC, described below).

To study marital stability and the incidence of divorce, we need to link the MR and the DR data. We do so by counting in both data sets the number of marriages in cells formed by the marriage date in quarterly terms and the nationality of both spouses. We can then merge both data sets at the quarter-nationality-nationality level to estimate survival models for different types of marriages that were formed before and after the institutional change.

The marriage and divorce data are organized as separate yearly files. We have access to all waves from 1991–2013 (MR) and 1995–2013 (DR). A few federal states did not report data prior to 1997, so we start our analysis in 1997 and merge the single yearly files for marriages and divorces into one data set, respectively. We clean the yearly MR and DR files from missing and inconsistent observations, that is, we remove duplicates, observations with missing marriage and birth dates, and marriages formed outside Germany. The latter should be removed for conceptual reasons because the two spouses matched on a different marriage market. Furthermore, marriages formed outside of Germany were not recorded before 2008.[29] Furthermore, we disregard cases in which one of the individuals' birth date implies an age at marriage below 18. Most of these marriages were formed abroad, although this was a legal possibility in Germany during our period of observation.[30]

Table 2 shows the distribution of nationalities in the new marriages we observe between 1997–2013 for men and women, respectively. We observe a total of 6,626,083 marriages. Roughly 6 million of these marriages have at least one spouse with German nationality. The largest groups of non-Germans who get married in Germany are citizens of the other EU15 member states, Turkish men, and Polish women. Interestingly, the numbers of Turkish women and Polish men, respectively, are much smaller. For most

[29]Marriages formed abroad represent only 0.15% of all marriages after 2008. Some descriptive information on marriages formed abroad can be found in Appendix A.1.

[30]Before 2017, it was in legal in Germany to form marriages in which there is one adult spouses and the other is between 16 and 18 years old. However, this type of marriage needed to be approved by a family court.

Table 2: Number of Marriages by Nationality and Gender

Nationality	Men	Women
German	6,090,937	5,978,700
EU15 (w/o Germany)	121,023	83,040
Poland	13,380	81,368
Turkey	100,981	55,487
EU10 (w/o Poland)	1,446	15,644
Romania	4,214	24,472
Former Yugoslavia	5,184	33,647
Rest of the World	255,304	313,680
Total	6,626,083	6,626,083

Data: German Marriage Registry, 1997–2013. EU15 (w/o Germany) countries are Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. EU10 (w/o Poland) countries are Cypress, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Slovakia and Slovenia.

nationalities, the foreign spouse is more often the wife. Exceptions are EU15 and Turkey, for which the number of husbands is higher. Marriages in which at least one spouse is non-European ("Rest of the World" in Table 2) also make up a significant share of all observed marriages in Germany.

Table 3 provides a closer look at the marriage data by showing the number of observations for all combinations of the four most numerous (groups of) nationalities: German, EU15, Polish, and Turkish. It also shows the mean ages of both spouses along with the mean age difference. Marriages where none of the spouses is a German citizen are rare. They constitute less than 1% of the total number of marriages for the subsample in Table 3. 0.36% are marriages among Turkish citizens. In 8.2% of all marriages, at least one spouse is German. There are slighty more marriages between German women and foreign men than there are between German men and foreign women. However, German men who marry a non-German woman are on average older compared to German-German couples, although they are much younger in case the wife is Turkish. German women who marry a non-German man are on average younger compared to German-German couples, and much younger in case the husband is Turkish.

Age differences between men and women are almost always positive, that is, the husband is on average older than the wife in almost all nationality combinations. We observe a slightly negative average age difference for couples of EU15 women and Polish men, but this estimate is likely noisy due to the small subsample. The largest average age differences exist between Polish women and German or EU15 men. In these marriages,

Table 3: Number of Marriages by Nationality Combination and Age

		Wife German	Wife EU15 (w/o Germany)	Wife Polish	Wife Turkish
Husband German	Mean Age Husband	35.82	36.18	37.40	30.34
	Mean Age Wife	32.91	33.21	31.08	26.37
	Difference	2.91	2.96	6.32	3.97
	N	5,587,615	52,736	70,377	29,429
Husband EU15 (w/o Germany)	Mean Age Husband	35.89	30.92	35.62	30.16
	Mean Age Wife	32.87	27.83	28.90	26.54
	Difference	3.02	3.09	6.72	3.62
	N	82,425	22,331	2,585	1,002
Husband Polish	Mean Age Husband	30.32	29.27	33.01	30.00
	Mean Age Wife	29.68	29.76	29.72	27.46
	Difference	0.64	-0.49	3.29	2.54
	N	9,236	79	3,747	13
Husband Turkish	Mean Age Husband	27.94	27.23	32.46	27.17
	Mean Age Wife	27.79	26.24	27.55	24.51
	Difference	0.14	0.99	4.91	2.67
	N	71,014	1,754	1,077	21,929

Data: German Marriage Registry, 1997 - 2013. Total number of observations for the shown sub-sample 5,957,349.

the woman is on average more than 6 years younger than the man. This is more than twice the unconditional average age gap of about 3 years in our sample. Overall, the descriptive evidence from the MR data points towards substantial differences in marriage market matching behavior across the different nationalities present in the German marriage market.

For the empirical analysis, we follow the marriage market matching model by Choo and Siow (2006), which uses the number of marriages relative to the number of available singles (see Chapter 3). To comply with the German data protection law, we can only extract these single stocks for groups that are sufficiently large. This criterion is met for citizens of Germany, EU15 (excluding Germany), Poland, Turkey, EU10 (excluding Poland), Romania, former Yugoslavia, and "Rest of the World". We use the age groups 18-25, 26-32, 33-39, 40-46, 47-54, and 55-68. Finally, we merge the number of marriages obtained from the MR with the single stocks obtained from the German Microcensus.

4.2 The German Microcensus

The German Microcensus (MC) is an annual survey that delivers representative statistics on the German population and labor force. Data access is provided through the Research data centers (FDZ) of the statistical offices of the German federal states. The MC samples

1% of the population, consisting of all persons legally residing in Germany.[31] It is the largest household survey in Europe. Participation is mandatory[32] and only a subset of questions can be answered on a voluntary basis.

In the survey, one household member responds for all individuals living in the household, including the spouse, children, and other cohabitants if applicable. The survey program of the MC consists of a set of core questions that remains the same in each wave, covering general demographic and socioeconomic characteristics like marital status, education, employment status, individual and household income, among many other things. In addition to that, every yearly wave has a special topic on which specific questions are asked.

We select all individuals between 18 and 68 years of age who live in private households.[33] For the period after German reunification (1993–2013), this MC sample is representative of a roughly constant population of about 53 million individuals.[34] 47% are men and 53% women. 72% of men and 64% of women are married. The average labor force participation rates are 62% for men and 46% for women.[35]

For the questions we seek to answer in this paper, the MC data alone would be insufficient, however. For married individuals, they contain only the year of marriage, so the length of marital spells can only be calculated imprecisely. Also, this information is no longer collected since a redesign in 2005. Finally, the MC is not a panel data set, so studying at the individual level how marriage and divorce behavior has changed in connection with the institutional reforms considered in this paper is not possible.

Instead, we use the MC data to identify the respective populations of singles out of which new marriages are formed, by nationality and age. To this end, we select all adult individuals of ages 18 to 68 who live in private households as singles, either alone or with cohabitants. This includes never-married, divorced, and widowed individuals. We use the age groups 18-25, 26-32, 33-39, 40-46, 47-54, and 55-68. We compute the single stocks

[31]The MC survey design relies on single-stage stratified cluster sampling. The primary sampling units are artificially delimited districts with a number of neighboring buildings. All households residing in these buildings are interviewed (principal residence). Since 1990 the average number of buildings has been 9, the targeted number of individuals is 15. Larger buildings are subdivided.

[32]According to the German Microcensus law, non-response may be fined.

[33]The MC also samples individuals who are in the military and live in barracks.

[34]Extrapolated from information on 8,426,756 surveyed individuals using sample weights. The average number of observations per wave is 443,513. The population increases somewhat after reunification and reaches a maximum of almost 55 million people in 2007. Afterwards it starts declining.

[35]The participation-age profiles are hump-shaped. In the 2006 MC wave, participation for men is highest in the age bracket 35-39 (88%) and the maximum for women (77%) is reached for ages 40-44.

for the following nationalities/nationality groups for which we have sufficient numbers of observations in the MC: Germany, EU15 (excluding Germany), Poland, Turkey, EU10 (excluding Poland), Romania, and former Yugoslavia. Moreover, we form a residual group of nationalities denoted "Rest of the World".

4.3 Sample of Integrated Labour Market Biographies

The Sample of Integrated Labour Market Biographies (SIAB) is an administrative data set provided by the Research Data Center (FDZ) of the Institute for Employment Research (IAB) at the German Federal Employment Agency. We use these data to test a central assumption of our empirical analysis: interethnic marriages were disproportionately affected by the labor market reform. The idea is that non-German workers face a higher risk of becoming unemployed. They and their partners are thus more affected by the tightening of means-testing thresholds in the unemployment insurance system.

The SIAB data cover a 2% random sample of the German social security registers. One observation in the data corresponds to a time period (spell) with at least one of the following characteristics: (i) employment subject to social security (in the data since 1975), (ii) marginal part-time employment (in the data since 1999), (iii) benefit receipt[36], (iv) officially registered job-seekers at the German Federal Employment Agency or (planned) participation in programs of active labor market policies (in the data since 2000). We observe these (un)employment spells with daily precision.

(Un)employment Spells end either by a change of employment status, employer or always at the end of calender year. The duration variable (tenure) is the accumulated time from the beginning of employment. We are interested in estimating conditional rates of job loss (firings/quits) and job finding (hirings). To identify the rate of job loss, we count transitions from employment into unemployment and from employment into inactivity. Transitions from unemployment into employment, both full and part time, identify the job finding rate. Changes from full to part-time employment (and vice versa) and transitions between employers are treated as continuous employment. The SIAB data also include information about, among other things, gender, nationality (German, non-German), regional identifiers, and education.[37]

[36] According to the German Social Code: SGB III since 1975 and SGB II since 2005, The introduction of SGB II was part of the implementation of the Hartz IV reform.

[37] The education variable in German social security data suffers from missing values and inconsistencies,

4.4 Trends on the Marriage Market

Figure 2 plots the estimated marriage surplus for different nationality combinations of spouses over time. We focus on marriages where at least one partner is German. To increase visibility, we separately show the surplus for marriages in which both partners are German (black line) one spouse is an EU15 citizen (blue line), one spouse is an EU10 citizen (orange line). We pool all other nationalities in the "Rest" (of the world) category (gray line).

From 1998 until the announcement date of the labor market reform (black dashed line), we observe a slow but steady decline in marriage surplus for all combinations of spouses. Afterwards, trends diverge. We observe a steep decline in the estimated surplus for marriages in which one partner is of EU10 or "Rest of World" type.[38] According to our hypothesis, these marriages were disproportionately negatively affected by the reform due to higher unemployment risk. Conversely, the marriage surplus for German couples and between Germans and EU15 citizens, arguably the groups with lower unemployment risk, increases slightly.

It is challenging to isolate the marriage market impact of the labor market reform in January 2003 due to the Eastern enlargement of the EU. Ten new member states joined in May 2004 (red dashed line in Figure 2) and this was anticipated. For citizens of these countries, marrying a German was no longer necessary to obtain access to the German labor market following the enlargement.[39] Thus, the EU expansion could have had an impact on the marriage market in itself, as argued by Adda et al. (2019) in the Italian context. To take this confounding factor into account, we control for the EU expansion in our main analysis by using separate treatment and control groups to isolate its effect in our differences-in-differences setup.

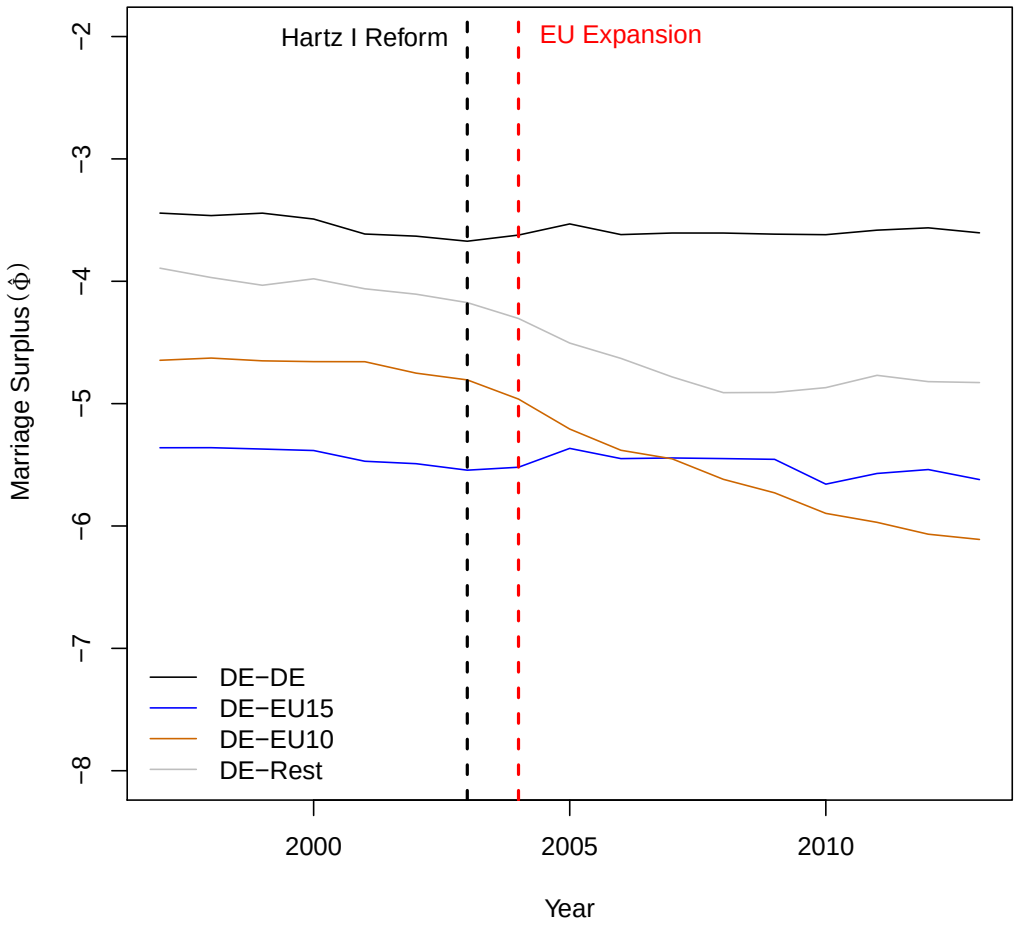
In Figure 2, the trends described above did not change around the date of the EU expansion. On the contrary, the divergence between German/German-EU15 and German-

essentially because misreporting has no negative consequences. We impute missing and inconsistent observations using the methodology proposed by Fitzenberger et al. (2006). We use five levels of education: Lower secondary education without/with vocational training, higher secondary education without/with vocational training and tertiary education (University, University of Applied Sciences).

[38] By far the largest group of EU10 immigrants are Poles. Figure A.1 in the Appendix separates the surplus of German-Polish marriages and German-Other-EU10 marriages, The trend is broadly the same, the decrease somewhat less steep for Poles.

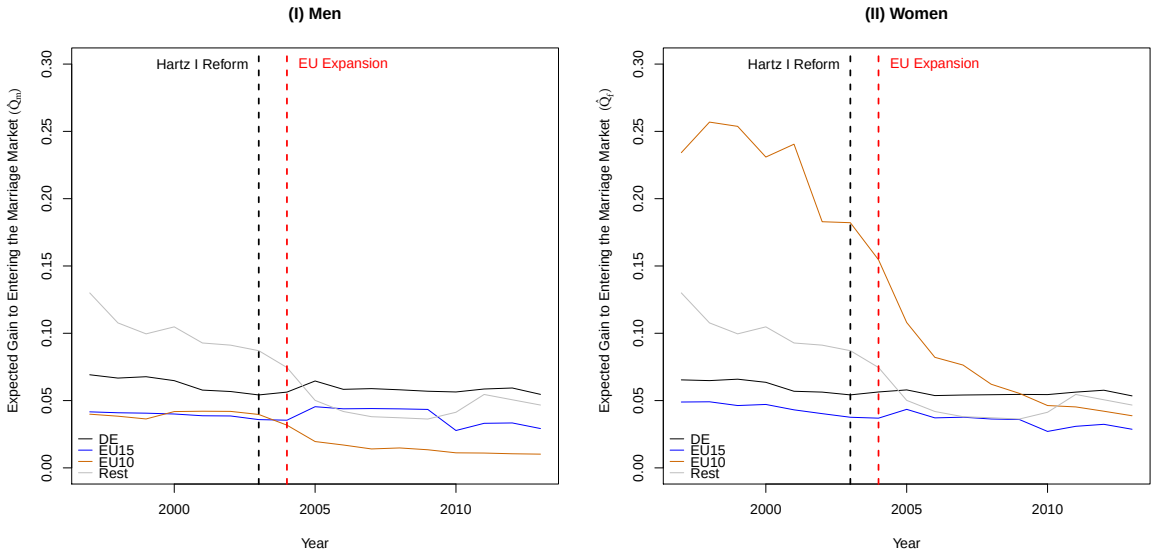
[39] Although access to the German labor market for migrants from the new EU member states was initially restricted.

Figure 2: Development of Marital Surplus ($\hat{\Phi}$) over Time



Notes: Marriage surplus for marriages where at least one spouse is German by nationality of the non-German spouse. The black dashed vertical line indicated the year in which the labor market reform became effective, the red dashed vertical line marks the year 2004 in which the EU expansion took place. *Data*: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Marriage Registry, survey year(s) 1997-2013, own calculations.

Figure 3: Expected Gains to Entering the Marriage Market ($\hat{Q}$)



Notes: Expected gains to entering the marriage market for men (left sub-figure) and women (right sub-figure).

EU10/German-Rest marriages became more pronounced. The surplus of marriages between Germans and between Germans and EU15 citizens continued to increase before flattening out in 2005. EU10 citizens were directly affected by the EU expansion and, accordingly, their marriage surplus with Germans decreased at a steeper rate as compared to German-Rest marriages, especially after 2007. This makes intuitive sense: arguably, the surplus from marrying a German for EU10 citizens reflected to some extent the obtainment of a residence permit and labor market access before 2004. Due the EU expansion, this part of the marital surplus was erased.

The declining marriage surplus for interethnic marriages with non-EU15 spouses is also reflected in the estimated expected gains to entering the marriage market, see Figure 3, which plots these gains for men (left sub-figure) and women (right sub-figure). Recall that, according to Equation 11, the estimated gains of marriage only depend on the total number of individuals relative to singles of any particular type. As before, they are shown for German men/women in black, for EU15 men/women in blue, for EU10 men/women in orange and gray for all remaining nationalities.

Notably, the gains to marriage decrease more substantially for foreign women than for foreign men and this is mainly driven by EU10 women, who had very high gains in the beginning of our sample that rapidly decreased thereafter. This is in line with the fact that we observe relatively many women from Poland and other EU10 countries who get

Table 4: Treatment and Control Groups

Type of Marriage	"Hartz" Treatment (Jan 01, 2003)	EU Treatment (May 01, 2004)	"Hartz"-Effect	Controls (EU-Effect)
German-German	No	No	Control	—
German-EU15	No	No	Control	—
German-EU10	Yes	Yes	Treatment	Treatment
German-nonEU	Yes	No	Treatment	Control

married in Germany as compared to men from these countries, recall Table 2. For EU10 men the gains are essentially flat before the labor market reform, decrease in 2003/2004, and reach another relatively stable level. Rest-of-the-world men's and women's gains are very similar. They start decreasing before the reform, but the negative trend accelerates in 2003–2005.

5 Empirical Results

In this empirical section, we aim to illustrate the effect of a mayor institutional change that affected the German marriage market. The institutional change is the labor market reform in 2003. We run an empirical specification including difference-in-difference terms to estimate the effect of the institutional change on the treated population. Furthermore, we extensively control for the 2004 EU expansion. We restrict our sample to marriages where at least one spouse is German. Table 4 illustrates the treatment and control groups for the evaluation of the labor market reform (see Column 4), and the control variables that control for the EU expansion in 2004 (see Column 5), which may also have affected the marriage surplus for a sub-group of the non-native population.

The Labor Market Reform: The labor market reform increased the need to self-insure within the marriage in case of unemployment, which is more likely for interethnic marriages as non-natives have a higher unemployment risk compared to natives. This is causing a decrease in the demand of interethnic marriages from natives, as the marriage with a non-native spouse becomes riskier. As a result, we expect fewer interethnic marriages relative to the single stocks, which will result in a lower marriage surplus. For the difference-in-difference specification, we compare marriages formed between spouses

where both have unrestricted labor market access (German, EU15) with marriages where the non-native spouse had worse labor market access (Polish, Turkish, Romanian, other EU-2004, former Yugoslavia, Rest of the World) before and after the date the law became effective. Thus, the variable $Hartz$ takes on the value of 1 for marriages where the non-native partner is not from a EU member country[40]. The variable $PostHartz$ takes on the value of 1 for marriages formed after January 1, 2003.

Empirical Specification: Formally, we estimate the effect of the labor market reform using a differences-in-differences specification:

$$\Phi_{c_h,c_w,a_h,a_w,t} = \beta_1 \times Hartz_{c_h,c_w} + \beta_2 \times PostHartz_t + \beta_3(Hartz_{c_h,c_w} \times PostHartz_t) + \gamma X_{c_h,c_w,t} + \alpha_t + \delta_c + u_{c_h,c_w,a_h,a_w,t}, \quad (12)$$

where c_h and c_w are country of origin for husband and wife. a_h , a_w and t represent age of husband, age of wife and year, respectively. α_t and δ_c are time and country of non-German spouse fixed effects. $\Phi_{c_h,c_w,a_h,a_w,t}$ is the marriage surplus for a particular combination of age and country or origin for both partners in a given year t. Standard errors $u_{c_h,c_w,a_h,a_w,t}$ are at the level of the marriage surplus, which depends on the combination of age and nationality of both spouses in each year. $X_{c_h,c_w,t}$ is a vector of control variables that extensively controls for the 2004 EU expansion that may have also affected the marriage surplus at approximately the same time. A detailed analysis of this vector of control variables is discussed in Section 5.2. The coefficients of interest for the treatment effect on the treated of the labor market reform is β_3.

5.1 Main Results

We quantify the effect illustrated in Figure 2 using the empirical model captured in Equation 12. The baseline estimation results are presented in Table 5. Columns 1 and 2 include all marriages where at least one spouse is German. Columns 3 & 4 and 5 & 6 present the results for the sub-samples where the husband or wife are German, respectively. Columns 1, 3 and 5 include year and nationality of the non-German spouse fixed effects, whereas columns 2, 4, and 6 additionally control for age fixed effects of both

[40]The analysis focuses on marriages with at least one German spouse.

Table 5: Baseline Results for Marriage Formation

Dependent Variable	Marriage Surplus ($\hat{\Phi}$)					
	All Marriages		German Husband		German Wife	
Hartz x PostHartz	-0.441^{***}	-0.473^{***}	-0.370^{**}	-0.443^{***}	-0.519^{***}	-0.535^{***}
	(0.119)	(0.106)	(0.154)	(0.133)	(0.157)	(0.137)
Constant	-6.237^{***}	-6.055^{***}	-6.275^{***}	-6.498^{***}	-6.191^{***}	-5.987^{***}
	(0.144)	(0.154)	(0.169)	(0.194)	(0.167)	(0.191)
Year, Nation FE	✓	✓	✓	✓	✓	✓
Age FE (both)		✓		✓		✓

Notes: Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

spouses. The difference-in-difference coefficients of interest for the effect of the labor market reform on the treatment group are $Hartz \times PostHartz$. Robust standard errors are reported in parenthesis.

The baseline specification for the full sample shows a 0.44 log point decrease in the gains of marriage for marriages formed between a native and a non-EU15 spouse as a reaction to the 'labor market reform. The specification controls for year fixed effects and nationality of the non-German spouse fixed effects. Year fixed effects control for the generally declining marriage rates in Germany, while the nationality fixed effects control for any confounding factors that are specific to marriage formation with particular nationalities. The results are a clear indication that the labor market reform negatively influenced interethnic marriage formation and, thus, had a substantial negative influence on the integration of immigrants into society. In particular, existing barriers on the labor market that already made interethnic marriages riskier than marriages between spouses where both partners had full labor market access were intensified through the reforms.

After additionally controlling for age fixed effects of both spouses, the effect size slightly increases in magnitude to -0.473. We estimate the model separately for marriages where the husband is German and where the wife is German. We find larger negative effects of the labor market reform for marriages where the husband is non-native compared to when the wife is non-native. The results for the sub-sample analysis are consistent with classic gender roles in Germany, where the husband is often seen as the main bread-winner. Since the husbands income is relatively speaking more important for the total household income, the effect sizes are larger for marriages where the husband is exposed to the labor market reform treatment.

Interethnic marriages are often interpreted as a sign of integration of ethnic minorities and immigrants into society. By negatively affecting the interethnic marriage rates, these unintended consequences of the labor market reform post a serious threat to social integration of immigrants, who already face more difficulties on the labor market. In fact, given the literature on labor market outcomes of immigrants[41] that result from interethnic marriage formation, these reforms may have substantially hurt immigrants labor market participation though the marriage formation channel as well.

5.2 EU Expansion & Robustness Checks

5.2.1 2004 EU Expansion

The importance of institutional factors in marriage formation has already been investigated by other studies. Adda et al. (2019) for example study the effect of the EU expansion on interethnic marriage formation in Italy and find that the EU expansion negatively influenced interethnic marriage formation. Germany differs from Italy in some crucial dimensions, which make a similar analysis more complicated. First, Germany had a substantial share of non-natives in the total population even before the EU expansion took place in 2004. Second, following the 2004 EU expansion, Germany did not grant full labor market access to citizens from newly entering countries. Nevertheless, the EU expansion may have substantially influenced marriage formation even in the case of Germany, which is why we control for the EU expansion extensively in previously reported regressions. In this subsection, we will further investigate the estimated parameter values of these control variables and compare them to the values obtained by Adda et al. (2019).

Institutional Background: The European Union (EU) is a political and economic union currently consisting of 28 member states (as of August 2019). Initially consisting of 12 member countries[42] (Maastricht Treaty, effective November 1, 1993), the EU was expanded in multiple steps. In 1995, Austria, Finland and Sweden joined the EU. In 2004, the largest expansion round admitted Cyprus, Malta, and eight Eastern European countries to the EU: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland,

[41] See for example: Basu (2015); Dribe and Nystedt (2015); Furtado and Theodoropoulos (2009); Kantarevic (2005); Meng and Gregory (2005); Meng and Meurs (2009)

[42] Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and the United Kingdom.

Slovakia, and Slovenia. In 2007, Bulgaria and Romania followed and Croatia joined in 2013.

The main objective of the EU is the development of a common internal market. This is achieved through common policies that ensure free movement of people, goods, services, and capital. Citizens of any EU member state have the right to live and work in any of the other member states, under the same conditions as the native citizens of that particular country. Following the 2004 EU expansion, the old member states (EU15) and new member states (EU10) negotiated a transitional period of up to 7 years in which labor movement was restricted in order to "protect" the labor market of the old member states.[43] Some countries, such as the UK and Italy (Adda et al., 2019), opened their labor market immediately, whereas other countries, such as Germany and Austria, restricted the inflow of workers until all limitations were lifted in 2011. This had a sizable effect on the direction of migration flows.

The main difference between Germany and Italy is that citizens of the new EU member states, as the case of the Poles illustrates, already had legal ways of working in Germany before the EU expansion. Even with labor market access restrictions, arguably, those ways continued to exist. While in Italy labor markets access changed, in exaggeration, from completely closed to completely open almost instantly, in Germany labor market access changed much more gradually until all restrictions were lifted in 2011.[44]

Theoretical considerations: For the effect of the 2004 EU expansion, let's follow the example of a German man and an EU10 woman. After the EU expansion, the EU10 woman no longer hat to marry a German husband to obtain access to the German labor market. This is reflected in a lower value of $\tilde{\gamma}_{ij}$. In addition, the EU10 woman had labor market access also as a single woman, which increased $\tilde{\gamma}_{i0}$. Both changes lower the gains to marriage for this particular type of i, j marriage. The German potential husband can offset this lower value of marriage by a larger transfer ($\tau_{i,j}$) to the potential wife whenever feasible. However, when this change in transfer may become too large, other

[43]There was a fear that the EU expansion would lead to a large scale migration of lower wage workers from newly admitted countries to old member countries, with substantial labor market consequences.

[44]Between 2007 and 2009, when unemployment rates started to fall, Germany began granting labor market access to migrants in specific occupations, for example, IT specialists, engineers and medical doctors, and to college graduates seeking employment in their field of study. These exemptions from the initial restrictions and the bilateral agreements show that the German labor market was in fact not completely inaccessible.

types of marriages become more attractive, leading to fewer particular type i, j marriages in equilibrium.

One issue with the EU expansion is the some countries (including Germany) only slowly introduced full access of new EU citizens to the German labor market. While services and self employed work could freely be provided, regular employment was initially restricted and restrictions were lifted in a staggered fashion. Important for the understanding of the marriage surplus, it is important to understand the parameter values (e.g. $\tilde{\gamma}_{ij}$) as an expected gain over the lifetime. Simply speaking, both spouses discount all future (potential) benefits from a certain type of marriage.

Empirical Specification: Following the EU expansion, it was no longer necessary to marry a natives in order to get access to the German labor market for citizens of EU10 states. This is causing a decrease in the demand for interethnic marriage from the immigrants. As a result, we expect fewer interethnic marriages relative to the single stocks, which will result in a lower marriage surplus. For the difference-in-difference specification, we compare interethnic marriages where the non-native spouse is from a country that joined the EU in 2004 with marriages where the non-native spouses is from a country that was not affected by the EU expansion. The resulting effect is conditional on the labor market reform effect, which precedes the EU expansion. Thus, we compare marriages formed between Germans and new EU members with marriages formed between Germans and never EU members. Conditional on the labor market reform effect, we compare marriages where the non-native spouse is from a Post-Hartz-New-EU country (EU10) to marriages where the non-native spouse is from a Post-Hartz-Non-EU country (Turkey, Romania, former Yugoslavia, Rest of the World). Since the data, in particular the single stocks taken from the MC, is only available on an annual basis, all marriages formed in 2004 will be counted as part of the treatment group.[45]

Results of the EU Expansion: For the investigation of the control variables for the 2004 EU expansion, let's illustrate the control parameters (previously $\gamma X_{c_h,c_w,t}$). The additional difference-in-difference coefficient (see Equation 13) of interest is $NewEU \times PostEU$ for the effect of the EU expansion. The treatment and control group of the difference-in-difference specification are illustrated in Column 4 of Table 4. The results

[45] Traditionally relatively few marriages are formed during the winter month in Germany.

Table 6: Baseline Results for the EU Expansion

Dependent Variable	Marriage Surplus ($\hat{\Phi}$)					
	Panel A: Baseline Control for EU Expansion					
	All Marriages		German Husband		German Wife	
NewEU x PostEU	−0.107	−0.167*	−0.222	−0.201	−0.072	−0.157
	(0.103)	(0.093)	(0.161)	(0.142)	(0.114)	(0.100)
	Panel B: Without Labor Market Reform Coefficients					
	All Marriages		German Husband		German Wife	
NewEU x PostEU	−0.223**	−0.291***	−0.334**	−0.334**	−0.251**	−0.341***
	(0.101)	(0.092)	(0.159)	(0.141)	(0.111)	(0.099)
	Controls (Both Panels)					
Year, Nation FE	✓	✓	✓	✓	✓	✓
Age FE (both)		✓		✓		✓

Notes: Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

for the control variables are reported in Panel A of Table 6. Robust standard errors are reported in parenthesis.

$$\begin{aligned}\Phi_{c_h,c_w,a_h,a_w,t} = \beta_1 \times Hartz + \beta_2 \times PostHartz + \beta_3(Hartz \times PostHartz) \\ + \beta_4 \times NewEU + \beta_5 \times PostEU + \beta_6(NewEU \times PostEU) \\ + \alpha_t + \delta_c + u_{c_h,c_w,a_h,a_w,t}, \quad (13)\end{aligned}$$

Contrary to Adda et al. (2019) for the case of Italy, we do not find significant effects of the EU expansion on interethnic marriages in Germany. Throughout all specifications and sub-samples, we find negative coefficients. However, apart from one single specification that is significant to the 10% level, all specifications do not indicate statistical significance. Consequently, we find the large negative effect of the labor market reform to overshadow the EU expansion effect for the case of Germany.

To illustrate the importance of the labor market reform effect, in particular when assessing the effect of the EU expansion on interethnic marriages in Germany, we run the difference-in-difference specification above without including the labor market reform effect. The results are reported in Panel B of Table 6. Using the miss-specification, we find a significant and negative effect of the EU expansion on interethnic marriages in Germany. Without prior knowledge about the labor market reform and the effect on

Table 7: Robustness Checks for Marriage Formation

Dependent Variable	Marriage Surplus ($\hat{\Phi}$)								
	All Marriages			German Husband			German Wife		
Hartz x PostHartz	-0.411^{***}	-0.456^{***}	-0.438^{***}	-0.255	-0.373^{**}	-0.258^{*}	-0.518^{***}	-0.697^{***}	-0.681^{***}
	(0.119)	(0.119)	(0.120)	(0.157)	(0.153)	(0.157)	(0.149)	(0.156)	(0.148)
log(female singles)	-0.123^{***}		-0.049	-0.290^{***}		-0.289^{***}	-2.208^{***}		-2.180^{***}
	(0.010)		(0.047)	(0.090)		(0.090)	(0.096)		(0.100)
log(male singles)		0.124^{***}	0.076		0.422^{***}	0.421^{**}		0.580^{***}	0.532^{***}
		(0.010)	(0.046)		(0.164)	(0.164)		(0.059)	(0.057)
Constant	-4.564^{***}	-7.930^{***}	-6.606^{***}	-2.323^{*}	-12.031^{***}	-8.072^{***}	23.969^{***}	-14.101^{***}	16.315^{***}
	(0.198)	(0.198)	(1.261)	(1.220)	(2.219)	(2.612)	(1.309)	(0.815)	(1.609)
Year, Nation FE	✓	✓	✓	✓	✓	✓	✓	✓	✓

Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

interethnic marriages that result from it, one might conclude that the EU expansion had a negative effect on interethnic marriages also in the case of Germany.

5.2.2 Availability of Singles

The framework by Choo and Siow (2006), see Equation 12, assumes that a percentage increase in the available number of singles results in a percentage increase in the number of marriages for a constant value of the gains to marriage. Thus, the marriage surplus can change for two reasons: (i) underlying factors that fundamentally change the attractiveness of a certain combination of spouses and (ii) mechanically due to a larger availability of spouses of such type. So far, the main focus has been on the former, ignoring the latter.

In the robustness check, we include the number of available singles (log) to the main specification in order to control for the purely mechanical effect of the larger availability of the particular type of single in the population. This is in particular important as we compute the marriage surplus from the stock of available singles and the flow of marriages. A sudden inflow of singles decreases the marriage surplus instantly, whereas the flow of marriages can realistically be expected to react with a certain lag. Table 7 provides an overview of the robustness check when step-wise adding the available female (log) and male singles (log) of the particular type of marriage formed.

For the effect of the labor market reform in the full sample, we find relatively little differences compared to the baseline specification when step-wise adding the single stocks of both spouses.[46] The size of the coefficient in the main specification is -0.441. When

[46]Given that the marriage surplus function proposed by Choo and Siow (2006) already controls for

including the single stocks of both husband and wife, the effect slightly decreases to -0.438.

Regarding heterogeneity by gender of the German spouse, we find the effect of the labor market reform to be significant for marriages where either the husband or the wife are German. The size of the effect as well as the significance level, however, seem to be larger for marriages where the wife is German. The effect of the EU expansion on interethnic marriages becomes significant for marriages where the wife is German, once controlling for the number of available singles.

The issue of a large inflow of new singles is more of a concern for the EU expansion, as the EU expansion allowed free movement of citizens. However, for the coefficient size and significance of the EU expansion control variables, we find no substantial change when controlling for single stocks.

A different issue linked to the number of available singles is that changes in the availability of foreign singles could also affect the marriage decision of individuals. This issue is also stressed by Adda et al. (2019). In our setting, however, the large inflow of individuals only occurs after the labor market reform following the EU expansion, for which we control for extensively.

6 The Effect on Interethnic Marriage Stability

After illustrating the effect of the labor market reform on the marriage surplus for interethnic marriages, we follow those marriages over time and check for their marriage stability. As a result of the effects of the institutional changes, selection into marriage changed, confounding any estimation results. Nevertheless, a descriptive empirical investigation of marriage stability provides interesting insights, as marriage stability affects population dynamics.

In a first step, we graphically show how marriage stability changed following the introduction of the labor market reform. We focus on the largest group of immigrants that was affected by the institutional change.[47] In a second step, we quantify the effect

population vectors, these little changes when adding the single stocks are a good check for the validity of the marriage surplus function.

[47]Technically, the largest non-EU15 group would be Turks. However, given that the guest worker programs for Turks started in the 1960's, many of the individuals that are recorded as Turks are 2nd or 3rd generation immigrants who always lived in Germany.

of the institutional change using a cox proportional hazard model on the full dataset.[48]

6.1 Kaplan Meier Plots

We plot the Kaplan Meier hazard rates for German-Polish couples around the cutoff date to graphically analyze marriage stability. We use these descriptive illustrations to compare marriages formed one year before the cutoff with marriages formed one year after the cutoff date. For the case of the labor market reform - years 2002 and 2003 - both are unaffected by the EU expansion, so we observe only differences in the divorce hazard due to the labor market reform. The different separation hazards are captured in Figure 4.

The Kaplan Meier hazard of divorce of the after reform year (red) is parallel shifted below the divorce hazard of marriages formed before the reform (black). The lower survival rate indicates that marriages formed after the cutoff have a higher separation rate than marriages formed before the cutoff. Regarding heterogeneity by gender of the German spouse, we find the effect of the labor market reform to apply roughly equally to marriages where the husband or the wife are German (Table A.2 in the Appendix). However, marriages where the husband is Polish seem to be affected more by the labor market reform than marriages where the husband is German.

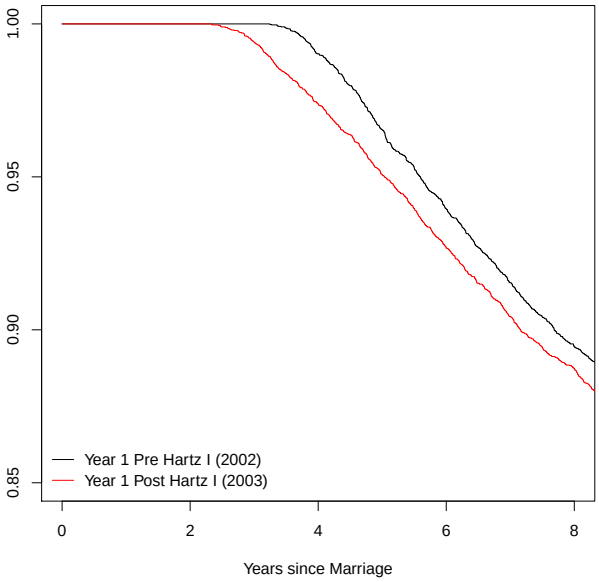
6.2 Survival Models

A major shortcoming of the illustrative Kaplan-Meier plots in Figure 4 is that the differences in divorce hazards are only conditional on the two investigated groups. All other possibly important factors, such as the labor market, are absent. In particular, the introduction of the 'labor market reform affected both marriages formed before and after the law was introduced. The law effectively made both types of marriages more "risky" through the more restrictive application of means testing in unemployment assistance. The only difference between those two groups depicted in the Kaplan-Meier plots above is, that the post-introduction group was aware of the changed law before marriage formation and the pre-introduction group was not.

We estimate the identical difference-in-difference specification we used to identify the

[48]In order to comply with the German data protection laws, the number of marriages per quarter are obtained from the universe of marriages and then matched to the universe of divorces.

Figure 4: Divorce Hazard of German-Polish Marriages (Kaplan Meier Plots)



The black line plots the Kaplan Meier hazard rates for the pre-year. The red line plots the Kaplan Meier hazard rates for the post-year. *Data*: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Marriage Registry, survey year(s) 1997-2013, own calculations. Sample restricted to include only German-Polish marriages.

effect of the policy change on marriages rates in a Cox proportional hazard setting to overcome this issue. In this setting, the hazard rated (d,Z) indicates the divorce hazard of the marriage after d years and the vector of covariates (Z). γ indicates the vector of coefficients and $\lambda(d)$ the baseline divorce hazard common to all marriages. The coefficients of interest are $Hartz \times PostHartz$, which compares marriages where one partner is non-native before the reform with marriages of that type after the reform. As before, we extensively control for the effects of the EU expansion. The results are presented in Table 8.

Column 1 of Table 8 illustrates the results for the difference-in-difference hazard rates without taking year fixed effects into account. The results indicate that the divorce hazard for marriages that are treated by the labor market reform increases by 9% following the introduction of the reform. The issue with this specification is, that it ignores year-specific situations that contributed to the separation of marriages. Such situations could be related to the labor market situation. In fact, the introduction of the labor market reform has substantially changed the importance of labor market situations for partnerships.

Column 2 presents the results when adding year fixed effects to the specification. Once controlling for year fixed effects, the effect of the labor market reform becomes negative, resulting in a divorce hazard below one. This means, that marriages where one spouse

Table 8: Divorce Hazard - Diff-in-Diff Estimates

Dependent Variable	Duration until Divorce								
	All Marriages			German Husband			German Wife		
Hartz x PostHartz	0.089***	−0.306***	−0.456***	−0.085***	−0.388***	−0.453***	0.178***	−0.280***	−0.475***
	(0.010)	(0.009)	(0.010)	(0.016)	(0.016)	(0.016)	(0.012)	(0.012)	(0.012)
	[1.093]	[0.736]	[0.634]	[0.919]	[0.678]	[0.636]	[1.195]	[0.756]	[0.622]
Divorce Year FE		✓			✓			✓	
Stratified by Divorce Year			✓			✓			✓
Observations	6,592,292	6,592,292	6,592,292	6,417,362	6,417,362	6,417,362	6,431,657	6,431,657	6,431,657
R^2	0.022	0.262	0.186	0.022	0.257	0.184	0.023	0.260	0.186

Notes: Robust standard errors in parenthesis. Hazard rates in square brackets.
* p<0.1, ** p<0.05, *** p<0.01

is from a non-EU15 country have a lower separation rate after the introduction, when controlling for year specific factors in the divorce decision.

Column 3 presents the results when stratifying by divorce year. In this setting, every divorce year has it's own baseline hazard, which captures year specific factors that may influence the baseline hazard. [49] The results are similar to the results reported in column 2. We find a divorce hazard below 1, indicating a lower divorce hazard of interethnic marriages following the labor market reform.

Columns 2 and 3 support the hypothesis that the remaining interethnic marriages that are formed after the labor market reform became effective are positively selected. In the estimation of the marriage surplus, we have shown that the marriage surplus dropped as a result of the introduction of the labor market reform. The marriages that are formed despite the drop in marriages relative to the respective population shares are more stable than marriages of the same type formed before the change in law became known and effective. The introduction of the labor market reform resulted in fewer but more stable interethnic marriages. We confirm the same trends for the sub-samples of marriages where the husband is German and where the wife is German. There is always a large drop in the divorce hazard once controlling for year fixed effects or stratifying by divorce year.

The effect of the labor market reform in the spirit of Choo and Siow (2006) is essentially a transition to a new equilibrium. We would expect an initial large jump shortly

[49] There are potentially two ways to stratify the data here, each making an assumption on the baseline hazard. When stratifying by marriage year, one assumes that all couples married in a certain year face the same baseline hazard due to some sort of selection that is specific to that particular year. When stratifying by divorce year, one assumes that all couples are exposed to the same environment (in this case: the same aggregate labor market situation and legal framework) in a particular year, leading to a different baseline divorce hazard for every potential divorce year. Given the importance of the labor market in our setting and the constant improvement of the labor market following the introduction of the reforms, we have decided to stratify by divorce year rather than by marriage year.

Table 9: Divorce Hazard - Treatment Years

Dependent Variable	Duration until Divorce								
	All Marriages			German Husband			German Wife		
Hartz	0.135***	0.183***	0.172***	0.038***	0.100***	0.094***	0.177***	0.219***	0.210***
	(0.005)	(0.005)	(0.005)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)
	[1.145]	[1.201]	[1.188]	[1.039]	[1.105]	[1.099]	[1.194]	[1.245]	[1.234]
Hartz x 1 year post Hartz	0.682***	1.142***	1.269***	0.483***	0.971***	1.134***	0.802***	1.207***	1.304***
	(0.015)	(0.015)	(0.015)	(0.026)	(0.026)	(0.026)	(0.019)	(0.019)	(0.019)
	[1.978]	[3.133]	[3.557]	[1.621]	[2.641]	[3.108]	[2.230]	[3.343]	[3.684]
Hartz x 2+ years post Hartz	0.762***	1.617***	1.901***	0.643***	1.475***	1.771***	0.829***	1.650***	1.897***
	(0.011)	(0.011)	(0.012)	(0.020)	(0.020)	(0.020)	(0.014)	(0.014)	(0.014)
	[2.143]	[5.038]	[6.693]	[1.902]	[4.371]	[5.877]	[2.291]	[5.207]	[6.666]
Divorce Year FE		✓			✓			✓	
Stratified by Divorce Year			✓			✓			✓
Observations	6,592,292	6,592,292	6,592,292	6,417,362	6,417,362	6,417,362	6,431,657	6,431,657	6,431,657
R^2	0.001	0.174	0.005	0.000	0.169	0.002	0.001	0.172	0.003

Notes: Robust standard errors in parenthesis. Hazard rates in square brackets.
* p<0.1, ** p<0.05, *** p<0.01

after the introduction and then an effect size that slightly increases in size as more and more individuals become aware (or fully comprehend) the effects of the institutional change. Furthermore, we would expect marriage formation to react stronger over time as marriage logistics typically require some planning, which generally take some time. To test this hypothesis, we interact the dummy of the $Hartz$ dummy with dummies for the first and all subsequent years after the introduction of the labor market reform. The results are reported in Table 9. Indeed, we observe an initial large jump followed by a slightly increasing effect size for subsequent years throughout all specifications.

7 Conclusion

In this paper, we empirically investigate the importance of the household insurance channel in marriage formation and stability. The analysis is performed in the specific context of the transferable utility marriage market matching model proposed by Choo and Siow (2006). We exploit a distinct legal change in the institutional environment in which marriages are formed, namely the so called "Hartz reforms" in 2003, to identify the effect. As a result of the reform, marriages where one partner had a substantially larger unemployment risk became more risky and, thus, less attractive. This affected in particular interethnic marriages, as non-natives have a substantially larger unemployment risk compared to natives.

We find a significant and quantitatively important negative effect on the marital surplus of interethnic marriages in Germany as a result of the labor market reform.

Our interpretation of the results are similar to the findings of Adda et al. (2019): if natives react to labor market reforms by marrying each other rather than foreigners, paradoxically, reforms that are intended to lower the unemployment rate might interfere with the integration of foreigners, at least in the short-run.

By following these interethnic marriage over time and investigating their marriage stability, we find that interethnic marriages formed after the introduction of the labor market reforms are more stable compared to interethnic marriages formed before the reform. Our interpretation of these findings is that the labor market reform resulted in fewer, but better selected interethnic marriages. The interethnic marriages formed after the reform became effective are more able to absorb economic shocks within marriage, resulting in fewer divorces.

Interethnic marriages are often seen as a measure of social integration. Thus, institutional changes directly influenced integration of immigrants, which can have large long run implications. The interpretation of the net effect on social integration of immigrants depends on the relative importance of the number of interethnic marriages versus the stability and duration of interethnic marriages in the assessment. While this is of substantial importance in social science, this is beyond the scope of this analysis and subject to future research.

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Table A.1: Number of Marriages formed Abroad by nationality of the non-German spouse (selection)

Partner	German	EU-15	Pol	TUR	EU-2004	Romania	Former Yugoslavia	Rus	Rest
German Husband	8,619	296	182	173	96	38	69	587	5,442
German Wife	8,619	428	20	528	9	5	71	65	3,315

Data: German Marriage Registry, 2008 - 2013. Total Number of Observations: 20,117

A Appendix

A.1 Marriages Formed Abroad

From 2008 onward, the German marriage registers include an indicator for marriages formed outside of Germany ("Auslandsehen"). In addition to German nationals who get married outside of Germany and register their marriage at home, this category also includes two other forms of marriages: (i) marriages of refugees or stateless individuals who reside in Germany and (ii) marriages formed in Germany by foreigners under the jurisdiction of a foreign country, for instance in case the marriage is conducted at an embassy in Germany. According to this definition, marriages formed abroad make up only about 0.15% of all marriages in the data between between 2008–2013. Table A.1 presents the number of marriages formed abroad by nationality of the spouse we observe between 2008–2013.

A.2 Labor Market Hazards

Table A.2: Labor Market Hazard Rates (Stratified by Education)

	Employment Duration (Firings)				Unemployment Duration (Hirings)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
German	-0.168***	-0.098***	-0.225***	-0.151***	0.100***	0.054***	0.069***	0.028***
	(0.013)	(0.011)	(0.011)	(0.010)	(0.010)	(0.009)	(0.008)	(0.007)
	[0.845]	[0.907]	[0.799]	[0.860]	[1.105]	[1.055]	[1.071]	[1.028]
Female	-0.178***	-0.123***	-0.174***	-0.115***	-0.158***	-0.139***	-0.156***	-0.138***
	(0.009)	(0.008)	(0.010)	(0.009)	(0.011)	(0.011)	(0.010)	(0.010)
	[0.837]	[0.884]	[0.804]	[0.891]	[0.854]	[0.870]	[0.856]	[0.871]
Year FE		✓		✓		✓		✓
Region FE			✓	✓			✓	✓
Observatons	1,957,289	1,957,289	1,957,289	1,957,289	1,343,678	1,343,678	1,343,678	1,343,678
Firings / Hirings	1,218,625	1,218,625	1,218,625	1,218,625	1,086,943	1,086,943	1,086,943	1,086,943

Robust standard errors (clustered by region) in parentheses

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

A.3 Additional Tables

Table A.3: Baseline Results for Marriage Formation

Dependent Variable	Marriage Surplus ($\hat{\Phi}$)					
	All Marriages		German Husband		German Wife	
Hartz x PostHartz	-0.441^{***}	-0.473^{***}	-0.370^{**}	-0.443^{***}	-0.519^{***}	-0.535^{***}
	(0.119)	(0.106)	(0.154)	(0.133)	(0.157)	(0.137)
Constant	-6.237^{***}	-6.055^{***}	-6.275^{***}	-6.498^{***}	-6.191^{***}	-5.987^{***}
	(0.144)	(0.154)	(0.169)	(0.194)	(0.167)	(0.191)
Year, Nation FE	✓	✓	✓	✓	✓	✓
Age FE (both)		✓		✓		✓

Notes: Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: Baseline Results without the "Hartz" Effect

Dependent Variable	Marriage Surplus					
	All Marriages		German Husband		German Wife	
NewEU:PostEU	-0.223^{**}	-0.291^{***}	-0.334^{**}	-0.334^{**}	-0.251^{**}	-0.341^{***}
	(0.101)	(0.092)	(0.159)	(0.141)	(0.111)	(0.099)
Constant	-6.034^{***}	-5.834^{***}	-6.115^{***}	-6.304^{***}	-5.983^{***}	-5.769^{***}
	(0.133)	(0.145)	(0.154)	(0.182)	(0.153)	(0.180)
Year, Nation FE	✓	✓	✓	✓	✓	✓
Age FE (both)		✓		✓		✓

Notes: Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: Separation Hazard for German-Polish Couples

	duration								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
factor(year)2003	0.052	2.559***	2.511***	0.049	2.554***	2.519***	0.078	0.270*	2.486***
	(0.047)	(0.066)	(0.070)	(0.052)	(0.053)	(0.079)	(0.103)	(0.127)	(0.156)
Divorce Year FE		✓			✓			✓	
Stratified by Divorce Year			✓			✓			✓
Observations	12,294	12,294	12,294	10,621	10,621	10,621	1,673	1,673	1,673

Notes: Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.6: Separation Hazard for German-Polish Couples

Dependent Variable	Marriage Duration until Divorce								
	All Marriages			German Husband			German Wife		
factor(year)2004	0.068	2.523***	2.494***	0.044	2.475***	2.432***	0.197*	2.750***	2.782***
	(0.049)	(0.068)	(0.074)	(0.055)	(0.055)	(0.082)	(0.108)	(0.112)	(0.188)
Divorce Year FE		✓			✓			✓	
Stratified by Divorce Year			✓			✓			✓
Observations	11,593	11,593	11,593	10,071	10,071	10,071	1,522	1,522	1,522

Notes: Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.4 Additional Divorce Hazard Rates

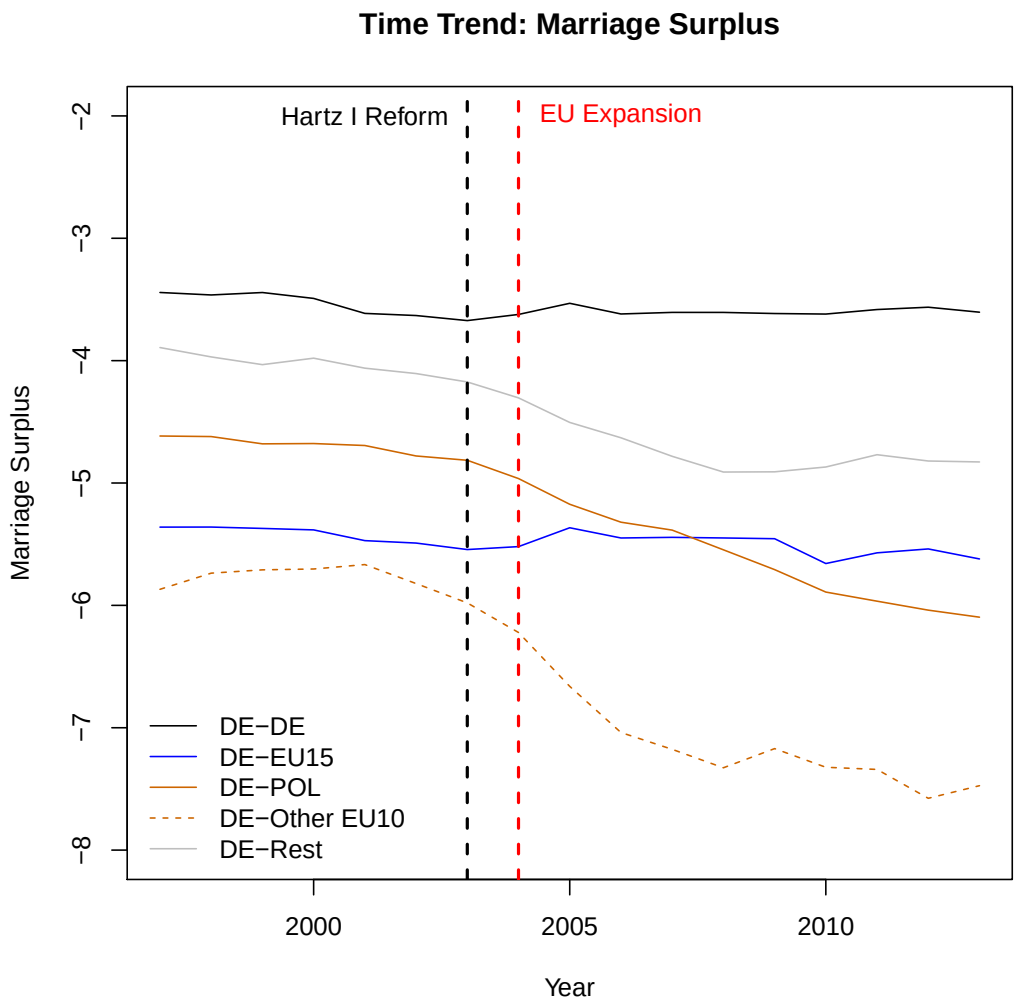
Table A.7: Separation Hazard Pre vs. Post Cuttoff Date

Dependent Variable	Duration until Divorce								
	All Marriages			German Husband			German Wife		
Hartz	0.135***	0.183***	0.172***	0.038***	0.100***	0.094***	0.177***	0.219***	0.210***
	(0.005)	(0.005)	(0.005)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)
	[1.145]	[1.201]	[1.188]	[1.039]	[1.105]	[1.099]	[1.194]	[1.245]	[1.234]
Hartz x 1 year post Hartz	0.682***	1.142***	1.269***	0.483***	0.971***	1.134***	0.802***	1.207***	1.304***
	(0.015)	(0.015)	(0.015)	(0.026)	(0.026)	(0.026)	(0.019)	(0.019)	(0.019)
	[1.978]	[3.133]	[3.557]	[1.621]	[2.641]	[3.108]	[2.230]	[3.343]	[3.684]
Hartz x 2+ years post Hartz	0.762***	1.617***	1.901***	0.643***	1.475***	1.771***	0.829***	1.650***	1.897***
	(0.011)	(0.011)	(0.012)	(0.020)	(0.020)	(0.020)	(0.014)	(0.014)	(0.014)
	[2.143]	[5.038]	[6.693]	[1.902]	[4.371]	[5.877]	[2.291]	[5.207]	[6.666]
Divorce Year FE		✓			✓			✓	
Stratified by Divorce Year			✓			✓			✓
Observations	6,592,292	6,592,292	6,592,292	6,417,362	6,417,362	6,417,362	6,431,657	6,431,657	6,431,657
R^2	0.001	0.174	0.005	0.000	0.169	0.002	0.001	0.172	0.003

Notes: Robust standard errors in parenthesis. Hazard rates in square brackets.
* p<0.1, ** p<0.05, *** p<0.01

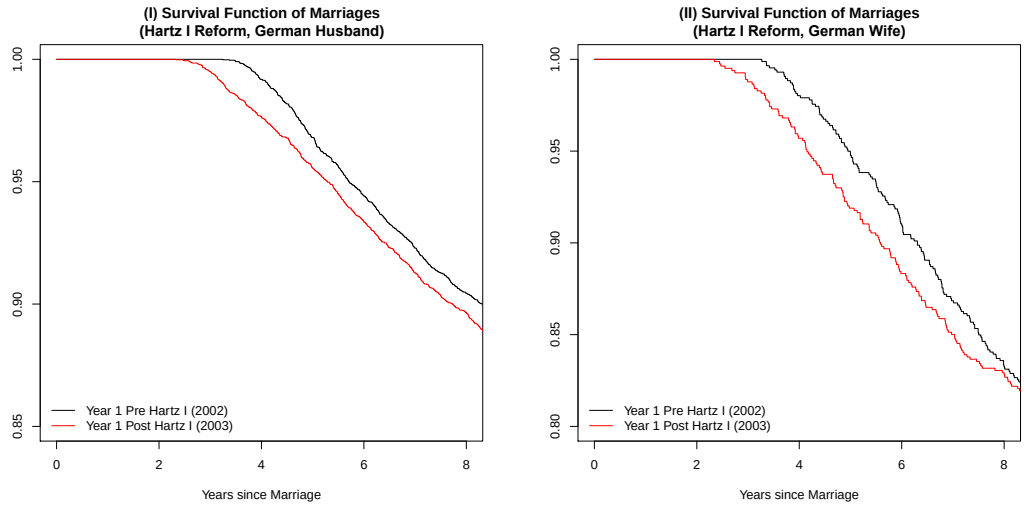
A.5 Additional Graphs

Figure A.1: Pre-Trend of Marriage Surplus ($(\hat{\Phi})$) - POL vs. Other EU-10



Notes Marriage surplus for marriages where at least one spouse is German by nationality of the non-German spouse. The black dashed vertical line indicated the year in which the "Hartz I" Reform became effective, the red dashed vertical line marks the year 2004 in which the EU expansion took place. *Data*: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Marriage Registry, survey year(s) 1997-2013, own calculations.

Figure A.2: Kaplan Meier Plots for "Hartz" Reform (DE-POL, by Gender)



The black line plots the Kaplan Meier hazard rates for the pre-"Hartz"-reform year (left plot: German husband, right plot: German wife). The red line plots the Kaplan Meier hazard rates for the post-"Hartz"-reform (left plot: German husband, right plot: German wife). *Data*: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Marriage Registry, survey year(s) 1997-2013, own calculations. Sample restricted to include only German-Polish marriages.