Online Appendix

Marriage and Divorce: The Role of Unemployment Insurance

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A Derivation of Marital Surplus

The marital surplus reflects the gains from marriage for both partners, and those gains depend on their observable types. In our application the types i and j of men and women, respectively, are is a combination of age and nationality. I and J denote the total numbers of male/female types, i.e., age-nationality combinations. For each type, the total number of individuals (married and single) in the marriage market is denoted M_i for males and F_j for females, respectively. Two accounting identities hold:

$$\mu_{i0} + \sum_{j=1}^{J} \mu_{ij} = M_i \ \forall i, \quad \mu_{0j} + \sum_{i=1}^{I} \mu_{ij} = F_j \ \forall j, \tag{A.1}$$

where $\mu_{ij} \geq 0$, $\mu_{i0} \geq 0$, and $\mu_{0j} \geq 0$, are the numbers of ij marriages, single men of type i, and single women of type j, respectively.

Following Choo and Siow (2006), the utility of a type i man indexed g who is married to a type j woman is denoted V_{ijg}:

$$V_{ijg} = \tilde{\alpha}_{ij} - \tau_{ij} + \epsilon_{ijg}. \tag{A.2}$$

Utility consists of a systematic component, $\tilde{\alpha}_{ij}$, the utility transfer from a type i man to a type j woman, τ_{ij}, and a random component, ϵ_{ijg}. The gain from marriage for the man is given by $\tilde{\alpha}_{ij} - \tau_{ij}$. This gain is independent of both spouses' identity but it depends on observable characteristics. The random component ϵ_{ijg} is an identity-specific idiosyncratic shock that allows for unobserved heterogeneity through deviations from the systematic utility gain for any combination of types. It is assumed that ϵ_{ijg} is i.i.d. with a type I extreme-value distribution. The systematic component for a female of type j who is married to a type i man is similarly defined and denoted $\tilde{\gamma}_{ij}$.

Observing all potential levels of utility, a male (female) individual g chooses whom to

marry in the frictionless marriage market by simply picking the highest attainable utility:

$$V_{ig} = \max_j \{V_{i0g}, ..., V_{ijg}, ..., V_{iJg}\}, \tag{A.3}$$

where V_{i0g} denotes the utility from remaining single. As shown by McFadden (1974), this random utility model, together with the assumed type I extreme-value distribution of the idiosyncratic component and large numbers of men and women, yields a simple quasi-demand function for the number of ij marriages demanded by type i men:

$$\begin{aligned} \ln \mu_{ij}^d &= \ln \mu_{i0}^d + \tilde{\alpha}_{ij} - \tilde{\alpha}_{i0} - \tau_{ij} \\ &= \ln \mu_{i0}^d + \alpha_{ij} - \tau_{ij}, \end{aligned} \tag{A.4}$$

which depends on the number of type i singles and $\alpha_{ij} = \tilde{\alpha}_{ij} - \tilde{\alpha}_{i0}$, which is the systematic gross return to a type i man from being in a type ij marriage relative to being unmarried. Similarly, $\gamma_{ij} = \tilde{\gamma}_{ij} - \tilde{\gamma}_{i0}$ is the systematic gross return to a type j woman from being in a type ij marriage relative to being unmarried. The number of ij marriages demanded by type j women is given by the quasi-supply function:

$$\ln \mu_{ij}^s = \ln \mu_{0j}^s + \gamma_{ij} + \tau_{ij}. \tag{A.5}$$

The marital surplus for a type i man and type j woman, our object of interest, can be calculated by adding up equations (A.4) and (A.5). The utility transfer cancels out and the two systematic components, α_{ij} and γ_{ij}, remain.

$$\frac{\alpha_{ij} + \gamma_{ij}}{2} = \ln \mu_{ij} - \frac{\ln \mu_{i0}^d + \ln \mu_{0j}^s}{2}, \tag{A.6}$$

where the LHS is the average systematic gain, which we refer to as marital surplus, Φ_{ij}:

$$\Phi_{ij} = \ln \left(\frac{\mu_{ij}}{\sqrt{\mu_{i0}\ \mu_{0j}}} \right). \tag{A.7}$$

The number of marriages between type i men and type j women, μ_{ij}, in the numerator is scaled by the geometric average of the numbers of single men and single women of the respective types, μ_{i0} and μ_{0j}. Thus, according to the Choo and Siow (2006) model, the surplus of marriage for any ij pair is high if we observe many ij marriages relative

to the respective single populations. The measure exploits that the observed number of singles of a given type is informative about the gains for this type in the marriage market. However, due to market clearing, the surplus does not depend on the availability of other types of men and women.

B Microcensus Sampling Change

In 2005, the statistical offices in Germany changed their sampling procedure for the Microcensus by conducting interviews over the whole course of the year instead of using a fixed reference week. This lead to distortions in the sampling procedure during the first couple of years after the change (2005–2009). Specifically, the sample weights for households that were "hard to reach" for the interviewers at their private address became temporarily unreliable.[36] For details of the change and the irregularities it caused, see Statistisches Bundesamt (2012).

To make sure that these artificial breaks in the data do not affect our results, we impute values in the affected data range (2005–2009) at the cell (Nationality × Gender × Age) level using 5 different imputation methods: Cubic Interpolation, Linear Interpolation, Natural Cubic Spline Interpolation, Piecewise Cubic Hermite Interpolation, and Inverse Distance Weighted Interpolation. In the main analysis, we report results based on the Piecewise Cubic Hermite Interpolation. Results using other imputations techniques or raw data are consistent with the baseline findings and available upon request.

[36] An example of affected households are single individuals who live alone but are at work all day.

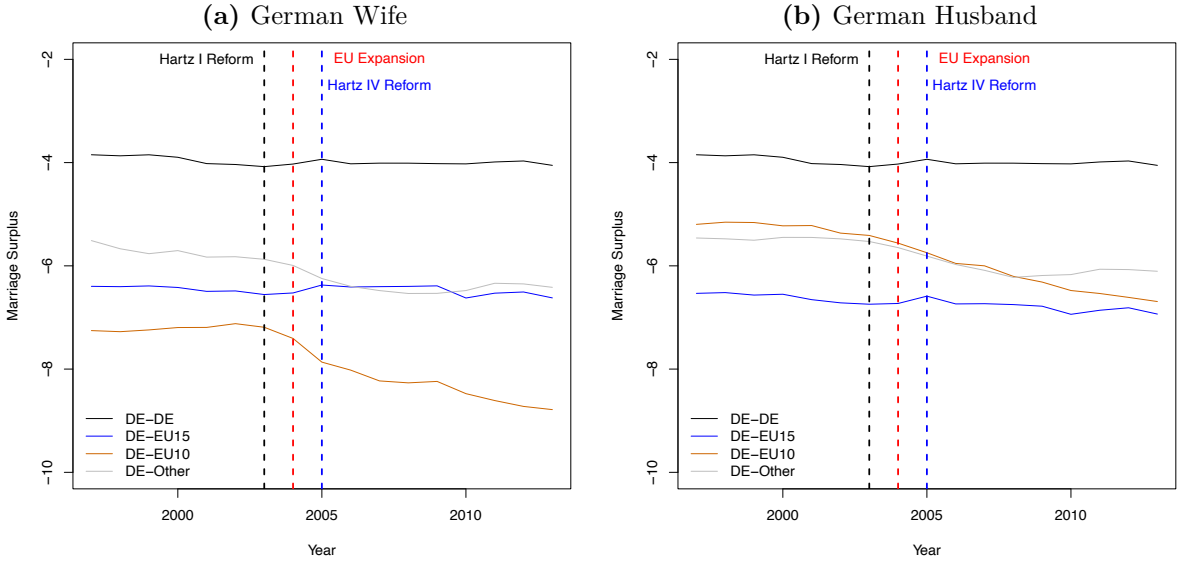
C Additional Results

Table C.1: Education Distribution

Educational Level	Lower secondary		Higher secondary		Tertiary
Vocational training	No	Yes	No	Yes	–
Panel A (Sample of Employed Individuals)					
German Men	10.8%	73.3%	1.2%	5.9%	8.8%
Foreign Men	38.1%	52.0%	2.0%	3.7%	4.3%
German Women	14.5%	66.9%	1.4%	8.4%	8.8%
Foreign Women	46.1%	40.3%	2.6%	5.4%	5.6%
Panel B (Sample of Unemployed Individuals)					
German Men	11.3%	72.9%	1.4%	6.6%	7.9%
Foreign Men	37.8%	52.7%	2.1%	4.3%	3.2%
German Women	14.1%	66.0%	1.4%	9.5%	8.9%
Foreign Women	44.6%	40.9%	2.6%	6.8%	5.1%

Notes: Lower secondary corresponds to at least compulsory schooling (9 or 10 years). Higher secondary corresponds to 12 or 13 years of schooling. Tertiary includes undergraduate and graduate programs at technical colleges and universities. Panel (A) is based on the sample of employed individuals uses to study transitions into unemployment (Columns 1 and 2 in Table 1. Panel (B) is based on the sample of unemployed individuals uses to study transitions into employment (Columns 3 and 4 in Table 1. *Data Source*: RDC of the Institute for Employment Research (IAB) at the Federal Employment Agency, SIAB SUF 7514. own calculations.

Figure C.1: Marital Surplus ($\hat{\Phi}$) by Sex



Notes: Marital surplus for marriages where at least one spouse is German by nationality of the non-German spouse and by sex of the German spouse. The black dashed vertical line indicated the year in which the Hartz I and IV reforms became effective, the red dashed vertical line marks the year 2004 in which the EU expansion took place. *Data Source*: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Marriage Register and Microcensus, 1997–2013, own calculations.

C.1 Single Stock Regressions

We show that the single stocks did not change following both the labor market reform and the EU expansion. The regression specification is shown in Equation C.8, results are presented in Table C.2. The definition of the treatment and control group corresponds to the definition used for the main analysis. All regressions control for year, nation, sex and age-group fixed effects.

$$\begin{aligned} SingleStock_t(e,c,s) &= \beta_1 \cdot Treat_{HartzI}(e,c) + \beta_2 \cdot \mathbb{1}\{t \geq 2003\} \\ &+ \beta_3 \cdot Treat_{HartzI}(e,c) \cdot \mathbb{1}\{t \geq 2003\} \\ &+ \beta_4 \cdot Treat_{EU}(c) + \beta_5 \cdot \mathbb{1}\{t \geq 2004\} \\ &+ \beta_6 \cdot Treat_{EU}(c) \cdot \mathbb{1}\{t \geq 2004\} \\ &+ \alpha_t + \delta_c + \delta_s + u_t(e,c,s), \end{aligned} \tag{C.8}$$

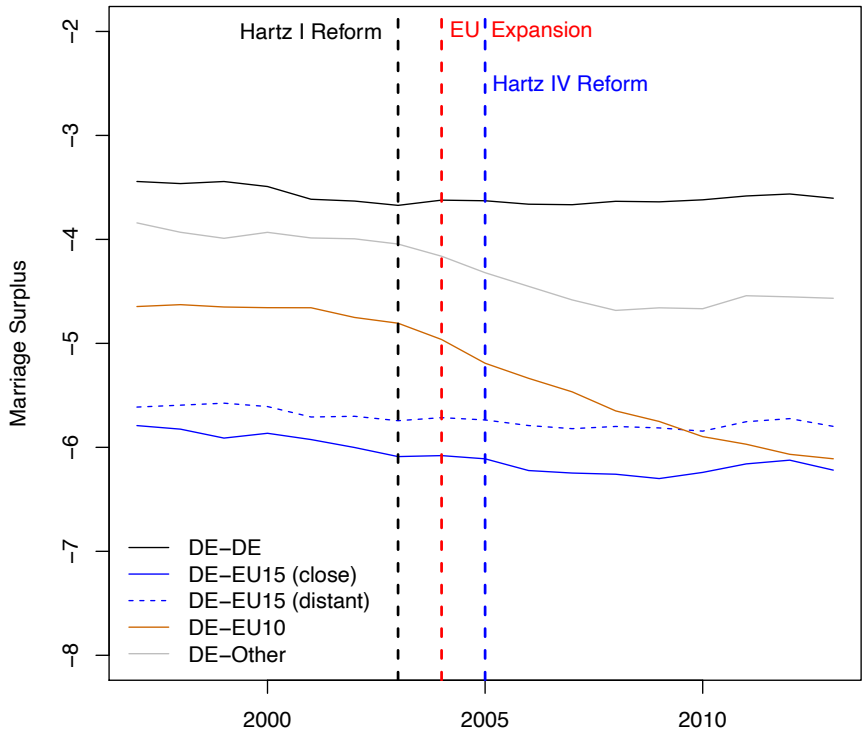
We estimate two specifications. In column (1), we abstract from the EU expansion and only include the terms related to the labor market reform. The negative and significant coefficient of the $Treat_{HartzI}$ dummy reflects that the number of singles for the treated nationalities is smaller compared to German and EU15 singles. Both the time dummy and the treatment interaction are statistically indistinguishable from 0, so the single stocks did not increase in the aftermath of the labor market reform, neither overall nor in the treatment group relative to the control group. It also worth mentioning that all individual year effects (not shown, expressed relative to 1997) are insignificant. In column (2), we include the EU expansion. Notably, the estimated coefficients of the labor market reform terms hardly change. The time dummy and the treatment interaction are also insignificant for the EU expansion, so the single stocks for citizens of the accession countries did not increase significantly in the aftermath fo the expansion.

Table C.2: Single Stock Regressions

Dependent Variable	Available Singles	
	(1)	(2)
$Treat_{HartzI}$	-947264.5***	-947956.2***
	(22780.8)	(22785.8)
$\mathbb{1}\{t \geq 2003\}$	26846.4	27537.8
	(21216.8)	(21947.1)
$Treat_{HartzI} \cdot \mathbb{1}\{t \geq 2003\}$	-19149.0	-18080.0
	(14143.7)	(14300.1)
$Treat_{EU}$		-28683.4***
		(3717.8)
$\mathbb{1}\{t \geq 2004\}$		-624.6
		(13834.3)
$Treat_{EU} \cdot \mathbb{1}\{t \geq 2004\}$		-2939.7
		(4542.2)
	Controls	
Year, Nation, Sex, Age FEs	Yes	Yes
incl. EU Expansion	No	Yes
Observations	1632	1632

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Robust standard errors in parentheses. Single stocks based on piecewise cubic Hermite interpolation. *Data Source*: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Marriage Register and Microcensus, 1997–2013, own calculations.

Figure C.2: Marital Surplus ($\hat{\Phi}$) incl. Linguistic Distance over Time



Notes: Marital surplus for marriages where at least one spouse is German by nationality of the non-German spouse when separating EU15 nationalities by linguistic distance to German. The black dashed vertical line indicated the year in which the Hartz I and IV reforms became effective, the red dashed vertical line marks the year 2004 in which the EU expansion took place. *Data Source*: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Marriage Register and Microcensus, 1997–2013, own calculations.

Table C.3: Treatment and Control Groups with Linguistic Distance

Nationalities of Spouses (c_h, c_w)	Hartz Treatment (Jan 01, 2003)	EU Treatment (May 01, 2004)	Treatment Dummy $Treat_{HartzI}$	$Treat_{EU}$
Panel A				
German-German	No	No	$= 0$	$= 0$
German-EU15 (close)	No	No	$= 0$	$= 0$
German-EU15 (distant)	No	No	$= 0$	$= 0$
German-EU10	Yes	Yes	$= 1$	$= 1$
German-Other	Yes	No	$= 1$	$= 0$
Panel B				
German-German	No	No	$= 0$	$= 0$
German-EU15 (close)	No	No	$= 0$	$= 0$
German-EU15 (distant)	Yes	No	$= 1$	$= 0$
German-EU10	Yes	Yes	$= 1$	$= 1$
German-Other	Yes	No	$= 1$	$= 0$
Panel C				
German-German	No	No	$= 0$	$= 0$
German-EU15 (close)	Yes	No	$= 1$	$= 0$
German-EU15 (distant)	No	No	$= 0$	$= 0$
German-EU10	Yes	Yes	$= 1$	$= 1$
German-Other	Yes	No	$= 1$	$= 0$
Panel D				
German-German	No		$= 0$	
German-EU15 (close)	Yes		$= 1$	
German-EU15 (distant)	Yes		$= 1$	