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Essays on Matching Markets

Mário Vozár

Dissertation

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Abstract

The first chapter of this work develops a theoretical model of marriage market which complements existing models explaining the phenomenon of match separation. While existing models assume that agents' characteristics do not change over time, I account for the effect of aging on partners' wealth and physical attractiveness to introduce yet another explanation of the phenomenon of divorce. Furthermore, I use the model to analyze how increased female income prospects influence stability of the matches.

The objective of the second chapter is to analyze significance of different determinants of match separation proposed by matching market theory. First, we construct unique dataset from Czech ballroom dancing association records, which allows us to assess the quality of individual matches by evaluating dancers' performance throughout their career. Being able to observe the match quality helps us then to individually infer about the potential cause of match separation and to show that both prevalent theories of reason for match separation discussed in the theoretical literature, search frictions and initial uncertainty about match quality, play a significant role in reality and both should be taken into account when match separations are studied.

The last chapter concentrates on the effect of growing internet usage on the marriage hazard rate for first time marriages. First, I compute the age and gender specific marriage hazard rate for 21 European countries from 1990 to 2008. The consecutive panel data analysis reveals a negative impact of internet usage on both male and female marriage hazard rate for those in their twenties. In addition, I find that the identified effect is only slightly stronger for men but remains significant to higher age when compared women results.

Abstrakt

V první kapitole jsem sestavil teoretický model, který doplňuje dosavadní teorie vysvětlující rozpad manželství nebo předčasný konec pracovního vztahu. Existující modely vidí za těmito jevy buď existenci frikcí nebo nemožnost pozorovat kvalitu vztahu v době jeho vzniku. Zároveň však dosavadní teorie vycházejí z předpokladu stabilních charakteristik jedinců. Cílem první kapitoly je poukázat na fakt, že právě změny v charakteristikách jedinců mohou přitom být také jedním z důvodů rozchodů, a následně využít vyvinutý model k analýze vlivu ženské emancipace na stabilitu partnerských vztahů.

Cílem druhé kapitoly je analyzovat z empirického pohledu důležitost jednotlivých determinantů stojících za koncem vztahu, které již byly diskutovány v první kapitole. Pro tento účel jsme vytvořili unikátní dataset vycházející z dat Českého svazu tanečního sportu, který umožňuje ohodnotit kvalitu jednotlivých vztahů v každém bodě kariéry tanečníků. Právě možnost ohodnotit kvalitu vztahu je klíčová pro to, abychom mohli učinit závěry o vypovídací síle jednotlivých diskutovaných teorií vysvětlujících rozpad vztahů. Provedená analýza ukazuje na významnost obou teorií, tedy jak teorie vycházející z existence frikcí, tak i teorie odvolávající se na nemožnost ohodnotit kvalitu vztahu v době jeho vzniku.

V poslední kapitole se soustředím na vliv rychle rostoucího využívání internetu na načasování rozhodnutí lidí o vstupu do manželství. K tomuto účelu jsem vytvořil databázi vycházející primárně z dat Eurostatu, obsahující zejména průměrnou pravděpodobnost vstupu do manželství pro jednotlivé kombinace věku a pohlaví vypočtenou pro 21 evropských zemí. Panelová analýza ukázala, že rozšíření internetu je do jisté míry zodpovědné za prodlužování průměrného věku vstupu do prvního manželství, a to jak u mužů tak u žen. Tento efekt je o něco silnější pro muže v porovnání se ženami a zůstává statisticky významným o něco déle.

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Introduction

This thesis focuses on the issue of formation and separation of marriages and other types of partnerships. This topic, definitely not new, has been of interest of economists over the last forty years. During that time, several theories describing and modeling match formation and match separation have been developed and empirically tested. At the beginning most studies concentrated on describing the mechanisms behind match formation and analyzed the resulting structure with respect to the agents' characteristics. Later on, the focus of economists shifted to understanding forces behind match separation ,with several theories and models being introduced. In recent years, rapid changes in the information and communication sector, which definitely influence the search for perfect partner, draw attention to the effects of internet on the marriage market.

The dissertation thesis consists of three chapters. In the first two chapters I concentrate on the issue of match separation both from theoretical and empirical point of view. In the third chapter I study the timely topic of increasing internet usage on the timing of marital decisions and, based on my findings, I assess the implications for the future stability of marriages resulting from today's internet usage.

In the first chapter, I develop a theoretical model of a marriage market that accounts for the effect of aging on agents' wealth and physical attractiveness. I use the model to analyze how the structure and, more importantly, the stability of the marriage market is affected by increased female income prospects. First, I find that changes in wealth and physical attractiveness tied to aging can result in an incentive to re-match and thus provide yet another explanation of the phenomenon of divorce. Second, comparative statics show that an increase in female income prospects increases the divorce rate, which suggests that the stabilization effect of being more attractive to a current partner is dominated by the effect of increased female marriage market opportunities.

In the second chapter, which is a joint work with František Kopřiva and Pavla Nikolovová, we contribute to the understandings of different determinants of match separation proposed by matching market theory. We focus particularly on two main causes of match separation: search frictions and initial uncertainty about match quality. In addition, we look for evidence to support the theory introduced in the first chapter as well. For our analysis, we use a unique dataset (records from Czech ballroom dancing competition), which allows us characterize the quality of matches in a more accurate way than similar studies dedicated to labor and marriage market can achieve. In our particular market of dancers, the performance of the couple is evaluated regularly by referees on competitions in which couples participate, which provides us with a measure of objective match quality and its evolution over time. We use this measure to identify and describe different causes of match separation. We prove that both prevalent theories of reason for match separation discussed in the theoretical literature, namely search frictions and initial uncertainty about match quality, play a significant role and both of them should be taken into account. Moreover, we found some evidence that changes in agents' characteristics may cause the separation as well. However, this determinant has not been found to be dominant.

In the third chapter, I study the effect of rapid growth of internet usage on individuals' marital decisions. In particular I concentrate on the gender and age-specific marriage hazard rate for the first time marriages in Europe to assess whether the decreased cost of search for a partner results in lower or higher age at first marriage. Panel data analysis reveals a negative impact of internet usage on male's as well as female's marriage hazard rate for those in their twenties. In addition, I find that the identified effect is only slightly stronger for man but remains significant to higher age when results for men and women are compared.

Chapter 1

The Effect of Time in a Multi-Dimensional Marriage Market Model

1.1 Introduction

The significant impact the marriage market has on population growth, the labor supply of women, and the inequality of income has been of great interest to economists. Various theoretical models have been constructed, which attempt to describe matching behavior and equilibrium matching outcomes. Most of these models (with exception of Masters (2008)) assume that the agents' characteristics do not change over time, and thus, the results depend on this assumption. However, in the real world when choosing an optimal partner for marriage, people base their decision on several important characteristics or attributes, tangible as well as intangible, which clearly succumb to the effect of time.

In addition to the natural aging of agents over time, significant changes over the last forty years, in the female labor force participation followed by an increase in female income, have had an impact on agents' characteristics as well as on their marital decisions. Therefore, existing models of the marriage market, restricted by the property of time-stationary types, neglect important effects that these ongoing changes have on the agents' matching behavior and the equilibrium in matching outcomes.

I develop a theoretical matching framework that accounts for the effect of time on characteristics of agents. In particular, I construct a model in which men and women differ in two characteristics, wealth and physical attractiveness, with the effect of time to account for their appreciation and depreciation respectively. The choice of these characteristics is motivated by Becker (1973) who considered agents' characteristics such as human and physical capital to be important factors in determining the matching patterns and allocation of marital surplus. The need for a dynamic framework incorporating the effect of time is clear since these factors indeed change over time, either in a positive or a negative way. Therefore, equilibrium matching, as well as the incentive to re-match, would be consequently impacted by the effect of time as well.

This model suggests yet another explanation of the existence of divorce. According to the existing theoretical literature, re-matching occurs due to: a continuous search for a better partner in the presence of search frictions and the delayed realization of a low match quality. My approach proposes an alternative explanation. I argue, that even though at the time of marriage the match is stable and there are assumed to be no frictions, stability may be broken as partners age over time. As the result of aging, agents' preferences for their potential partners (as well as preferences of potential partners for them) may change and thus break the stability of the match.

This novel approach of incorporating the effect of time into the multidimensional matching environment allows me to theoretically investigate the impact of changes such as increased female labor force participation on the marriage market. I find that the increase in female income prospects increases the divorce rate. This suggests that increased female attractiveness on the marriage market has more a pronounced match de-stabilization effect due to increased female opportunities to find a better partner, as compared to the stabilization effect of increased attractiveness for the current partner.

The paper is organized as follows. In Section 2, I provide a review of literature relevant to my research, In Section 3 consisting of two parts; I first provide the solution to the baseline model containing the effect of aging symmetric to both genders. Thereafter, I provide a comparative statics analysis with respect to asymmetric gender aging. In Section 4, I summarize the results and discuss potential extension to the presented model.

1.2 Literature Review

The model possesses two main features, multi-dimensionality in the characteristics of agents and the effect of time. The literature review concentrates on each of these aspects separately. I employ the non-transferable utility approach mainly for two reasons. First and most important, this study concentrates on the changes in agents characteristics which may play a significant role when deciding for the matching partner. I assume that the agent's utility from the match depends on the partner's type and the agent's own type, which is determined by his/her characteristics. Moreover, as Rasul (2006) argues, empirical evidence suggests that households do not reach efficient bargaining, and thus, it is more reasonable to assume utility is non-transferable between partners.

The multidimensional approach I employ is different in several ways from the mainstream of the theoretical marriage market literature. In particular, the works of Bergstrom and Bagnoli (1993); Burdett and Coles (1997); Cornelius (2003); and Smith (2006) assume that agents differ only in one characteristic, which can be seen as their quality. This assumption directly implies the existence of a positive assortative matching in the equilibrium. It means that the agent with the highest quality is matched with a partner from the opposite gender with the highest quality, the agent with the second highest quality is matched with a partner from the opposite gender with the second highest quality etc. The property of positive assortativeness does not necessary hold when one accounts for the possibility that agents differ in multiple characteristics. As Mailath and Postlewaite (2006) show, the latter setup may result in different agents having different rankings over potential partners, which may break the perfectly positive assortative matching observed under the previous setup. While Mailath and Postlewaite assume that agents still value only one of the partner's characteristic, and the other one has no direct impact on an agents' utility, Bjerk (2009) assumes a multidimensional approach in which the utility of the agents depends on both partner's characteristics. Further, in the setup with the effect of aging, it is natural to assume agents are heterogeneous in more than one characteristic. In the real world, while aging, there are certain characteristics which appreciate over time and others that depreciate. A multi-dimensional framework, thus, allows me to take this fact into account rather than assuming that there is only one agent's characteristic seen as the match quality for the spouse, as for example, in Burdett and Coles (1997).

However, as mentioned before, neither of the above studies account for the effect of aging on the agents' characteristics. Although the effect of time itself has already been introduced into the marriage market literature by Bergstrom and Bagnoli (1993), in their study, aging only plays a role in revealing male quality and does not change his characteristics over time. The first researcher to account for the effect of aging itself is Masters (2008) but the fact that agents differ only in one attribute results in an unrealistic identical probability of divorce over a lifetime for all agents. As opposed to Masters (2008), my proposed multidimensional approach combining aging with ex-ante heterogeneous agents allows me to evaluate an agent's own marital decisions with respect to his or her own unique attributes.

1.3 The Model

To model the marriage market outcome with ex-ante heterogeneous agents and stochastic aging present, I employ the two-period, "overlapping generations" structure (OLG). At the beginning of each period, matching takes place, and the equilibrium is obtained by the standard Gale-Shapley matching framework.

Gale and Shapley (1962) developed a two-sided matching algorithm with several desirable properties. First, equilibrium matching is stable, so that there is no man and woman that would both prefer to be matched with each other rather than with their current partners. Even though there is the possibility that the set of stable allocations (core) contains multiple equilibria, the authors show that under truthful revelation of preferences, the equilibrium outcome is the best stable allocation for those that propose marriage and the worst stable allocation for those agents who must accept or reject the proposal. This implies that even though the equilibrium in general is not unique, one always knows which type of equilibrium was obtained with respect to the agents' welfare. Moreover, Eeckhout (2000) and Clark (2006) provide conditions for preferences that are sufficient for the uniqueness of the Gale-Shapley matching outcome, which is useful for meaningful comparative statics.

Even though one can argue that the search-based approach with frictions is a more realistic setup, the development of new search technologies like on-line dating diminishes the constraints on opportunities to meet prospective mates and at the same time decreases the search costs. Thus, as the search costs are decreasing, the outcome of search models becomes in the limit consistent with the Gale-Shapley algorithm outcome, as has been formally shown by Adachi (2003). Moreover, the Gale-Shapley approach, when compared to the search-based model, can be characterized by analytical simplicity with respect to obtaining an equilibrium and with respect to proving equilibrium existence and uniqueness.

The Gale-Shapley deferred acceptance algorithm consists of several rounds in which yet unpaired agents of an ex-ante chosen group make their matching proposals. Initially[1], I shall follow social norm as well as prevailing evidence from the on-line dating sites

[1] I shall show that given the preferences of agents, the matching outcome is unique and thus does not depend on the choice of the proposing group.

(Hitsch, Hortacsu, and Ariely (2010)) and assume that males make proposals and females either accept or reject them based on their preference profiles. The preference structure of the men can be described by the ordering matrix of men Ω_M and similarly for women Ω_W, where every man and every woman prefer to be married as opposed to remaining single.

The algorithm is as follows. In round i, every unmatched man makes a proposal to the highest ranked woman he has not proposed to yet based on his own ordering structure within Ω_M. Then, every woman who obtained a proposal and is yet unmatched tentatively accepts it since marriage is preferred to being single. In this case, the woman obtaining a proposal is already tentatively matched; she accepts or rejects the proposal based on her own ordering structure within Ω_W. In the case of acceptance, the woman's former partner becomes unmatched and again makes a proposal in the next round to his highest ranked woman he has not proposed to yet. This procedure continues until every man and woman are matched.

In the following, I will present the benchmark version of the model without gender asymmetry. The aim of this benchmark model is to demonstrate the ability of the model with the effect of aging to explain the phenomenon of divorce.

1.3.1 Setup

The simple model I present below illustrates a matching structure and the potential for divorce in a multidimensional setting with the effect of time in the form of stochastic aging. To keep things tractable, the basic setup with respect to the agents' characteristics follows Bjerk (2009) with agents ex-ante heterogeneous in wealth w and beauty b, where each can be either of a high or low level, and these are independently realized at the moment the agent enters the market and are observable by other agents on the market.

The agent is born with high wealth ($\overline{w}$) individual with the probability $x < 1/2$ and with high beauty ($\overline{b}$) with the probability $z < 1/2$. Moreover, I assume that $x < z$, which reflects the distribution of these two attributes in the society, since wealth distribution is considered to possess heavier right tail than distribution of the Body Mass Index, which can be considered to be an example of a proxy for beauty. Thus, each agent is characterized by his or her combination of characteristics (w, b), and the distribution of types within gender at the time of entering the marriage market can be described with the following probabilities: $\left(\overline{w}, \overline{b}\right)$ with probability $\pi_1 = xz$; $(\overline{w}, \underline{b})$ with probability

$\pi_2 = x(1-z)$; $(\underline{w}, \overline{b})$ with probability $\pi_3 = (1-x)\,z$; and finally, $(\underline{w}, \underline{b})$ with probability $\pi_4 = (1-x)(1-z)$. The initial assumption on x and z thus implies $\pi_1 < \pi_2 < \pi_3 < \pi_4$.

To employ the effect of time, I introduce the OLG structure with two generations, young and old. Old agents are marked with subscript or superscript o, while young agents are recognized by subscript or superscript y. Agents in the older cohort, again possess a high or a low level of wealth w and beauty b with the following transition probabilities conditional on their levels when young: $Prob\left(\overline{w}_o \left|\overline{w}_y\right.\right) = 1$; $Prob\left(\underline{b}_o \left|\underline{b}_y\right.\right) = 1$; $Prob\left(\overline{w}_o \left|\underline{w}_y\right.\right) = p < 1/2$; and $Prob\left(\overline{b}_o \left|\overline{b}_y\right.\right) = q < 1/2$.

Thus, in this simple example I consider to be a benchmark case, I assume there is no gender asymmetry with respect to the aging patterns or to the distribution of their types. The Markov matrix of the type transition for the old agents is summarized in Table 1.1.

Density		$(\overline{w}, \overline{b})_o$	$(\overline{w}, \underline{b})_o$	$(\underline{w}, \overline{b})_o$	$(\underline{w}, \underline{b})_o$
π_1	$(\overline{w}, \overline{b})_y$	q	$1-q$		
π_2	$(\overline{w}, \underline{b})_y$		1		
π_3	$(\underline{w}, \overline{b})_y$	pq	$p(1-q)$	$(1-p)\,q$	$(1-p)(1-q)$
π_4	$(\underline{w}, \underline{b})_y$		p		$1-p$

Table 1.1: Markov matrix of type transition

In order to obtain equilibrium matching, I rely on the Gale-Shapley matching algorithm described in the previous section. However, there is a need to assign preferences for the potential spouses to each individual. In addition, due to the OLG structure of the model, the inter-temporal behavior of the agents has to be specified. In this context, I assume zero divorce costs, even though due to the discrete structure of the model, the results would be robust to small but positive divorce costs. There are several reasons supporting this assumption. Most importantly, in the case where divorce costs are not present, there is no difference between agents behaving in a myopic and forward-looking way. This is because there is no punishment for leaving the match or for being left; the agent does not have to care about what his/her actions today imply for his or her future. Since matching takes place at the beginning of each period, agents care only about the current period matching. Moreover, the introduction of divorce costs would require an introduction of some form of utility function and connection of the divorce costs to this utility form. However, introduction of the utility function would add another layer of complexity, which is not yet desirable for this simple demonstrative exercise.

Following Bjerk (2009), I assume a truthful revelation of preferences conditional on the individual's level of wealth. Moreover, as I argued in the previous paragraph, in the presence of zero divorce costs, the agent cares only about the current period match, and thus, every agent possesses the following preferences conditional on his/her own wealth level:

$$for \quad \overline{w} \mid \; \left(\overline{w}, \overline{b}\right) > \left(\underline{w}, \overline{b}\right) > \left(\overline{w}, \underline{b}\right) > \left(\underline{w}, \underline{b}\right) \tag{1.1}$$

$$for \quad \underline{w} \mid \; \left(\overline{w}, \overline{b}\right) > \left(\overline{w}, \underline{b}\right) > \left(\underline{w}, \overline{b}\right) > \left(\underline{w}, \underline{b}\right). \tag{1.2}$$

To provide an intuition for the proposed preference structure, I follow the reasoning of Bjerk (2009). As the author states, it is reasonable to assume that after the agents match, they enjoy the utility from the total household wealth which is seen as the public good. On the other hand, the partner's beauty is seen as a private good and benefits only the spouse. Further, the assumption of diminishing marginal utility from the household wealth implies that the marginal rate of substitution between a partner's beauty and a partner's wealth increases as one's own wealth level increases. In my model, as can be seen in the preference structure (1.1) and (1.2), a high wealth individual thus prefers a partner with high beauty rather than with a high wealth level.

In addition, the given preference structure ensures that the equilibrium matching is unique, which is formally stated and proven by the following proposition.

Proposition 1*: Given the preference ordering described by 1.1 and 1.2, there is a unique stable matching derived by the Gale-Shapley algorithm for any given distribution of agents' characteristics.*

Proof: *In Appendix 1*

Even though the equilibrium matching is unique given the distribution of agents' types and their aging patterns, on the micro level, ties the agents exhibit exist between potential partners with the same characteristics. Without any additional assumption, these ties would be resolved by chance. However, one can argue that in real life agents choose a partner both with respect to a partner's characteristics, and with respect to a partner's age as well. Therefore, I impose a condition under which each agent prefers a partner of the same age as herself if there are two potential partners who are of different ages but otherwise equal in wealth and beauty. Therefore, the preference structure described by equations *1.1* and *1.2* can be re-written to the following system of preferences.

$$for \quad \overline{w}_y \mid \quad \left(\overline{w},\overline{b}\right)_y > \left(\overline{w},\overline{b}\right)_o > \left(\underline{w},\overline{b}\right)_y > \left(\underline{w},\overline{b}\right)_o > \left(\overline{w},\underline{b}\right)_y > \left(\overline{w},\underline{b}\right)_o > \left(\underline{w},\underline{b}\right)_y > \left(\underline{w},\underline{b}\right)_o ;$$

$$for \quad \overline{w}_o \mid \quad \left(\overline{w},\overline{b}\right)_o > \left(\overline{w},\overline{b}\right)_y > \left(\underline{w},\overline{b}\right)_o > \left(\underline{w},\overline{b}\right)_y > \left(\overline{w},\underline{b}\right)_o > \left(\overline{w},\underline{b}\right)_y > \left(\underline{w},\underline{b}\right)_o > \left(\underline{w},\underline{b}\right)_y ;$$

$$for \quad \underline{w}_y \mid \quad \left(\overline{w},\overline{b}\right)_y > \left(\overline{w},\overline{b}\right)_o > \left(\overline{w},\underline{b}\right)_y > \left(\overline{w},\underline{b}\right)_o > \left(\underline{w},\overline{b}\right)_y > \left(\underline{w},\overline{b}\right)_o > \left(\underline{w},\underline{b}\right)_y > \left(\underline{w},\underline{b}\right)_o ;$$

and

$$for \quad \underline{w}_o \mid \quad \left(\overline{w},\overline{b}\right)_o > \left(\overline{w},\overline{b}\right)_y > \left(\overline{w},\underline{b}\right)_o > \left(\overline{w},\underline{b}\right)_y > \left(\underline{w},\overline{b}\right)_o > \left(\underline{w},\overline{b}\right)_y > \left(\underline{w},\underline{b}\right)_o > \left(\underline{w},\underline{b}\right)_y .$$

Moreover, it is natural to assume that an agent who is indifferent between staying with a current partner or remarrying, chooses to stay in the current relationship, which can be seen as the limit case of the divorce cost approaching zero. Both of these conditions allow me to observe the stability of the matches as well as the re-matching patterns. Furthermore, the addition of this lexicographic element of the preferences does not influence the uniqueness of the stable matching, and the proof would simply be an extension of the proof of Proposition 1.

Given the distribution of agents types, the agents' inter-temporal behavior, and their preference ordering for the potential spouses, I can finally employ the Gale-Shapley deferred acceptance algorithm to obtain stable matches. Since I use Gale-Shapley within the two-period framework, it is important to note that this achieved stability means that there is no man and woman currently not matched together who would prefer to be matched with each other in the current period. It is important to see that this within-period stability does not ensure inter-temporal stability, since as agents age, their characteristics change and thus agents' preferences for potential partners are subject to change as well. As a consequence, aging may lead to potential re-matching in the second period. Since at this stage I assume that the distribution as well as the size of the newborns' cohort do not change over time, the equilibria in each period coincide.

As mentioned above, the equilibrium matching is unique conditional on the distribution of agents' types and given the aging patterns. In particular, it is reasonable to expect that two societies, sufficiently different from each other, may exhibit different equilibrium matching. This is indeed the case in this benchmark model, where two equilibria exist conditional on the choice of model parameters (x, y, p, q). These two equilibria, denoted as Case 1 and Case 2, are formalized in Lemma 1 and Lemma 2 respectively.

Lemma 1: *The equilibrium matching is unique and has the structure described by Table 1.2 under the condition* $\pi_1(1-q)+\pi_2+\pi_3 p(1-q)+\pi_4 p-\pi_3(1-p)q>\pi_3-\pi_2$ *(Case 1).*

Proof: *In Appendix 1*

***Lemma** 2: The equilibrium matching is unique and has the structure described by Table 1.3 under the condition* $\pi_1(1-q)+\pi_2+\pi_3 p(1-q)+\pi_4 p-\pi_3(1-p)q<\pi_3-\pi_2$ *(Case 2).*

Proof: *In Appendix 1*

Both Table 1.2 and Table 1.3 show that even though inter-generational marriages can be observed, the majority of matches are observed between agents of the same age. Moreover, agents with both characteristics being of the high or low level are matched together and thus positive assortative matching applies for them. On the contrary, agents with mixed levels of characteristics exhibit negative assortative matching. These observations are expected and are given by the structure of the preference ordering. However, interesting findings, which are not directly observable from Table 1.2 and Table 1.3, are linked to the stability of marriages, the overall measure of match separations and its distribution across the groups. In the next paragraph, I shall provide the analysis of match stability for each of the presented equilibria.

Equilibrium Matching without Gender Asymmetry (Case 1)

M/W	$(\overline{w},\overline{b})_y$	$(\overline{w},\underline{b})_y$	$(\underline{w},\overline{b})_y$	$(\underline{w},\underline{b})_y$	$(\overline{w},\overline{b})_o$	$(\overline{w},\underline{b})_o$	$(\underline{w},\overline{b})_o$	$(\underline{w},\underline{b})_o$
$(\overline{w},\overline{b})_y$	π_1							
$(\overline{w},\underline{b})_y$			π_2					
$(\underline{w},\overline{b})_y$		π_2				$\pi_3-\pi_2$		
$(\underline{w},\underline{b})_y$				π_4				
$(\overline{w},\overline{b})_o$					$\pi_1 q+\pi_3 pq$			
$(\overline{w},\underline{b})_o$			$\pi_3-\pi_2$			$A-(\pi_3-\pi_2)$	$\pi_3(1-p)q$	
$(\underline{w},\overline{b})_o$						$\pi_3(1-p)q$		
$(\underline{w},\underline{b})_o$								B

Table 1.2: Equilibrium matching,

where

$$A=\pi_1(1-q)+\pi_2+\pi_3 p(1-q)+\pi_4 p-\pi_3(1-p)q$$

$$B=\pi_3(1-p)(1-q)+\pi_4(1-p).$$

Equilibrium Matching without Gender Asymmetry (Case 2)

M/W	$(\overline{w},\overline{b})_y$	$(\overline{w},\underline{b})_y$	$(\underline{w},\overline{b})_y$	$(\underline{w},\underline{b})_y$	$(\overline{w},\overline{b})_o$	$(\overline{w},\underline{b})_o$	$(\underline{w},\overline{b})_o$	$(\underline{w},\underline{b})_o$
$(\overline{w},\overline{b})_y$	π_1							
$(\overline{w},\underline{b})_y$			π_2					
$(\underline{w},\overline{b})_y$		π_2	$(\pi_3-\pi_2)-A$			A		
$(\underline{w},\underline{b})_y$				π_4				
$(\overline{w},\overline{b})_o$					$\pi_1 q+\pi_3 pq$			
$(\overline{w},\underline{b})_o$			A				$\pi_3(1-p)q$	
$(\underline{w},\overline{b})_o$						$\pi_3(1-p)q$		
$(\underline{w},\underline{b})_o$								B

Table 1.3: Equilibrium matching,

where

$$A=\pi_1(1-q)+\pi_2+\pi_3 p(1-q)+\pi_4 p-\pi_3(1-p)q$$

$$B=\pi_3(1-p)(1-q)+\pi_4(1-p).$$

To determine the probability of match separation in equilibrium denoted as Case 1, one has to analyze the stability for each of the four types of matches between the young agents pictured in the second quadrant of Table 1.2. For the equilibrium denoted as Case 2, one has to analyze the stability for each of the five type of matches between the young agents pictured in the second quadrant of Table 1.3. To illustrate this analysis, I will discuss the stability of the match between men $\left(\overline{w}, \overline{b}\right)_y$ and women of the same type in Case 1 equilibrium, which is summarized in Table 1.4.

Potential matches of $\left(\overline{w}, \overline{b}\right)_y$ with $\left(\overline{w}, \overline{b}\right)_y$ (when old)

Men	Women	prob. of occurrence	remain together
$\left(\overline{w}, \overline{b}\right)_o$	$\left(\overline{w}, \overline{b}\right)_o$	q^2	Yes
$\left(\overline{w}, \overline{b}\right)_o$	$\left(\overline{w}, \underline{b}\right)_o$	$q\,(1-q)$	No
$\left(\overline{w}, \underline{b}\right)_o$	$\left(\overline{w}, \overline{b}\right)_o$	$(1-q)\,q$	No
$\left(\overline{w}, \underline{b}\right)_o$	$\left(\overline{w}, \underline{b}\right)_o$	$(1-q)^2$	Yes

Table 1.4: Transition to old cohort matches and their stability

First, it is important to realize that even though both agents possess the same levels of wealth and beauty, in the second period each partner may transition into the $\left(\overline{w}, \overline{b}\right)_o$ or $\left(\overline{w}, \underline{b}\right)_o$ state. Thus, in the second period, four possible match realizations may occur with probabilities conditional on the given aging patterns. However, the fourth quadrant of Table 1.2 shows that match realizations between type $\left(\overline{w}, \overline{b}\right)_o$ and type $\left(\overline{w}, \underline{b}\right)_o$ are not possible, and thus, the probability of match separation for the match between male $\left(\overline{w}, \overline{b}\right)_y$ and female of the same type is $2q\,(1-q)$.

The complete type specific measures of divorces for Case 1 equilibrium can be found in Table 1.5 and for Case 2 equilibrium in Table 1.6.

Stability of matches (measures)

Men	Women	# of matches	prob. of divorce
$\left(\overline{w}, \overline{b}\right)_y$	$\left(\overline{w}, \overline{b}\right)_y$	π_1	$2q\,(1-q)$
$\left(\overline{w}, \underline{b}\right)_y$	$\left(\underline{w}, \overline{b}\right)_y$	π_2	$pq + (1-p)\,(1-q)$
$\left(\underline{w}, \overline{b}\right)_y$	$\left(\overline{w}, \underline{b}\right)_y$	π_2	$pq + (1-p)\,(1-q)$
$\left(\underline{w}, \underline{b}\right)_y$	$\left(\underline{w}, \underline{b}\right)_y$	π_4	$2p\,(1-p)$

Table 1.5: Match separation measures (Case 1)

Stability of matches (measures)

Men	Women	# of matches	prob. of divorce
$\left(\overline{w},\overline{b}\right)_y$	$\left(\overline{w},\overline{b}\right)_y$	π_1	$1-q^2$
$\left(\overline{w},\underline{b}\right)_y$	$\left(\underline{w},\overline{b}\right)_y$	π_2	$1-(1-p)\,q$
$\left(\underline{w},\overline{b}\right)_y$	$\left(\overline{w},\underline{b}\right)_y$	π_2	$1-(1-p)\,q$
$\left(\underline{w},\overline{b}\right)_y$	$\left(\underline{w},\overline{b}\right)_y$	$(\pi_3-\pi_2)-A$	$1-p^2q^2-2pq\,(1-p)\,(1-q)-(1-p)^2\,(1-q)^2$
$\left(\underline{w},\underline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_y$	π_4	$1-(1-p)^2$

Table 1.6: Match separation measures (Case 2)

Thus, to sum up, both equilibria in the benchmark model with no gender asymmetry show that the effect of aging can result in the incentive to re-match even though there are no frictions, and the quality of the match is observable. Thus aging, modeled via the changes in the agents' characteristics, provides yet another explanation of the phenomenon of divorce and thus complements the existing theories of divorce. Moreover, I found that the probability of match separation is conditional on the type of the agent as well as on the type of the partner. In other words, the match separation is more likely to occur if partners age along different trajectories. This suggests, that changes in gender asymmetry in the aging growth paths can play a significant role in divorce rate changes.

Therefore, in the following sub-section, I shall concentrate on the comparative statics with respect to differences between the genders' wealth growth prospects, which I believe reflect labor market asymmetry between males and females. I shall discuss how the presence of and as changes in gender asymmetry with respect to growth of wealth influences the stability of the equilibrium matching.

1.3.2 Comparative Statics with Respect to Gender Aging Asymmetry

The goal of this section is to analyze how the increasing female income prospects influence the equilibrium matching. Over the last 40 years, we observe the continuous closing of the wage gap between males and females. In addition to the increases of the female labor force participation over the years, female income prospects have improved. Various empirical studies (Bremmer and Kesselring (2004); Kalmijn and Poortman (2006); Teachman (2010)) suggest that an increase in a wife's earnings increases the probability of divorce.

In the benchmark case of the model presented above, the gender asymmetry is not present. In this section, I concentrate on the case in which I assume a lower female labor force participation and thus smaller changes in female wealth status over time.

The distribution of the characteristics of agents as well as aging patterns for males' wealth and beauty remain unchanged in the model with gender asymmetry present. Therefore, the transition of young males to the second period is described by Table 1.1. However, the aging pattern of females' wealth changes assume that $Prob\left(\overline{w}_o \left| \underline{w}_y \right.\right) = r < p$. The Markov matrix of the young females' transition to the second period is described by Table 1.7.

Density		$\left(\overline{w}, \overline{b}\right)_o$	$\left(\overline{w}, \underline{b}\right)_o$	$\left(\underline{w}, \overline{b}\right)_o$	$\left(\underline{w}, \underline{b}\right)_o$
π_1	$\left(\overline{w}, \overline{b}\right)_y$	q	$1-q$		
π_2	$\left(\overline{w}, \underline{b}\right)_y$		1		
π_3	$\left(\underline{w}, \overline{b}\right)_y$	rq	$r\left(1-q\right)$	$\left(1-r\right)q$	$\left(1-r\right)\left(1-q\right)$
π_4	$\left(\underline{w}, \underline{b}\right)_y$		r		$1-r$

Table 1.7: Markov matrix of type transition for women

Similar to the benchmark model, the uniqueness of the equilibrium is conditional on the distribution of agents' types in both periods. Overall, three equilibria exist. To characterize them, I first denote the expression $C = \pi_1\left(1-q\right) + \pi_2 + \pi_3 r\left(1-q\right) + \pi_4 r - \pi_3\left(1-p\right)q$. Together with the previously denoted expression $A = \pi_1\left(1-q\right) + \pi_2 + \pi_3 p\left(1-q\right) + \pi_4 p - \pi_3\left(1-p\right)q$, I can write the following conditions separating these three equilibia

$$\pi_3 - \pi_2 < C < A \qquad (Case\; 3); \tag{1.3}$$

$$C < A < \pi_3 - \pi_2 \qquad (Case\; 4); \tag{1.4}$$

and

$$C < \pi_3 - \pi_2 < A \qquad (Case\; 5). \tag{1.5}$$

These three equilibria together with the respective measure of divorces for each case are formalized in Lemma 3.

Lemma *3: Given the distribution of agent characteristics and aging patterns supported by Case 3, Case 4, and Case 5 conditions, the equilibrium matching is unique and has the structure described by Table 1.8, Table 1.9, and Table 1.10 respectively.*

Proof: *In Appendix A*

Equilibrium Matching with Gender Asymmetry (Case 3)

M/W	$(\overline{w},\overline{b})_y$	$(\overline{w},\underline{b})_y$	$(\underline{w},\overline{b})_y$	$(\underline{w},\underline{b})_y$	$(\overline{w},\overline{b})_o$	$(\overline{w},\underline{b})_o$	$(\underline{w},\overline{b})_o$	$(\underline{w},\underline{b})_o$
$(\overline{w},\overline{b})_y$	π_1							
$(\overline{w},\underline{b})_y$			π_2					
$(\underline{w},\overline{b})_y$		π_2				$\pi_3-\pi_2$		
$(\underline{w},\underline{b})_y$				π_4				
$(\overline{w},\overline{b})_o$					$\pi_1 q+\pi_3 rq$		$\pi_3(p-r)q$	
$(\overline{w},\underline{b})_o$			$\pi_3-\pi_2$			$C-(\pi_3-\pi_2)$	$\pi_3(1-p)q$	$A-C$
$(\underline{w},\overline{b})_o$						$\pi_3(1-p)q$		
$(\underline{w},\underline{b})_o$								B'

Table 1.8: Equilibrium matching,

where

$$B'=\pi_3(1-r)(1-q)+\pi_4(1-r)-(A-C)$$

$$\#\,of\ divorces=2\pi_1 q(1-q)+\pi_2[rq+(1-r)(1-q)]+\pi_2[pq+(1-p)(1-q)]++\pi_4[(1-p)r+p(1-r)]-\min\{\pi_3(p-r)(1-q)+\pi_4(p-r)\ ,\ \pi_2(1-r)(1-q)+\pi_4 p(1-r)\}.$$

Equilibrium Matching with Gender Asymmetry (Case 4)

M/W	$(\overline{w},\overline{b})_y$	$(\overline{w},\underline{b})_y$	$(\underline{w},\overline{b})_y$	$(\underline{w},\underline{b})_y$	$(\overline{w},\overline{b})_o$	$(\overline{w},\underline{b})_o$	$(\underline{w},\overline{b})_o$	$(\underline{w},\underline{b})_o$
$(\overline{w},\overline{b})_y$	π_1							
$(\overline{w},\underline{b})_y$			π_2					
$(\underline{w},\overline{b})_y$		π_2	$(\pi_3-\pi_2)-A$	$A-C$		C		
$(\underline{w},\underline{b})_y$				$\pi_4-(A-C)$				$A-C$
$(\overline{w},\overline{b})_o$					$\pi_1 q+\pi_3 rq$		$\pi_3(p-r)q$	
$(\overline{w},\underline{b})_o$			A				$\pi_3(1-p)q$	
$(\underline{w},\overline{b})_o$						$\pi_3(1-p)q$		
$(\underline{w},\underline{b})_o$								B

Table 1.9: Equilibrium matching

$$\#\,of\ divorces = \pi_1-\pi_1 q^2+\pi_2-\pi_2(1-p)q+\pi_2-\pi_2(1-r)q+(\pi_4-A+C)\left[1-(1-p)(1-r)\right]+$$
$$+(\pi_3-\pi_2-A)\left[1-prq^2-pq(1-r)(1-q)-(1-p)rq(1-q)-(1-p)(1-r)(1-q)^2\right]+$$
$$+(A-C)\left[1-(1-p)rq(1-q)-(1-p)(1-r)(1-q)^2\right]-\min\left\{(\pi_3-\pi_2-A)\left[pq^2(1-r)\right],\pi_3(p-r)q\right\}.$$

Equilibrium Matching with Gender Asymmetry (Case 5)

M/W	$\left(\overline{w},\overline{b}\right)_y$	$\left(\overline{w},\underline{b}\right)_y$	$\left(\underline{w},\overline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_y$	$\left(\overline{w},\overline{b}\right)_o$	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_o$	$\left(\underline{w},\underline{b}\right)_o$
$\left(\overline{w},\overline{b}\right)_y$	π_1							
$\left(\overline{w},\underline{b}\right)_y$			π_2					
$\left(\underline{w},\overline{b}\right)_y$		π_2		$\pi_3-\pi_2-C$		C		
$\left(\underline{w},\underline{b}\right)_y$				$\pi_4-(\pi_3-\pi_2-C)$				$(\pi_3-\pi_2)-C$
$\left(\overline{w},\overline{b}\right)_o$					$\pi_1 q+\pi_3 rq$		$\pi_3(p-r)q$	
$\left(\overline{w},\underline{b}\right)_o$			$\pi_3-\pi_2$				$\pi_3(1-p)q$	$A-(\pi_3-\pi_2)$
$\left(\underline{w},\overline{b}\right)_o$						$\pi_3(1-p)q$		
$\left(\underline{w},\underline{b}\right)_o$								B

Table 1.10: Equilibrium matching

$$\#\, of\ divorces = \pi_1-\pi_1 q^2+\pi_2-\pi_2(1-p)\,q+\pi_2-\pi_2(1-r)\,q+(\pi_3-\pi_2-C)\left[1-(1-p)(1-r)(1-q)-rq(1-p)\right]+$$
$$+(\pi_4-\pi_3+\pi_2+C)\left[1-(1-p)(1-r)\right]-$$
$$-\min\left\{\pi_2(1-r)(1-q)+(\pi_3-\pi_2-C)\,p\,(1-q)(1-r)+\left[\pi_4-(\pi_3-\pi_2-C)\right]p\,(1-r)\,,A-(\pi_3-\pi_2)\right\}.$$

The aim of this section is to provide the reader with comparative statics with respect to the gender asymmetry in future income prospects. To present a consistent analysis, Case 3 and Case 5 equilibria must be compared with the benchmark Case 1 equilibrium since inequalities 1.3 as well as 1.5 imply $\pi_3 - \pi_2 < A$. On the other hand, Case 4 equilibrium must be compared with the benchmark Case 2 equilibrium, since inequality 1.4 implies $A < \pi_3 - \pi_2$. I concentrate especially on the changes in the divorce rate as a result of increasing female income prospects represented by the shift from the asymmetric case with female $Prob\left(\overline{w}_o \left|\underline{w}_y\right.\right) = r < p$ to the symmetric scenario with $Prob\left(\overline{w}_o \left|\underline{w}_y\right.\right) = p$ valid for both genders.

Since the overall number of marriages does not change over the time between the discussed equilibria, to analyze the change in the divorce rates as the effect of asymmetric aging, it is sufficient to compare the measures of divorces. To compute the measure of divorces, the same approach as in Case 1 was employed, and thus, it will not be described here in detail. However, it is important to note that particularly in Case 3 as well as in the remaining equilibria, matches exist such as between $(\overline{w}, \underline{b})_o$ and $(\underline{w}, \underline{b})_o$ with the measure $A - C = (p-r)\left[\pi_3(1-q) + \pi_4\right]$, which goes to zero as $r \to p$. Therefore, the overall measure of match separations has to account for this fact since both matches between $(\overline{w}, \underline{b})_y$ and $\left(\underline{w}, \overline{b}\right)_y$ and between $(\underline{w}, \underline{b})_y$ and $(\underline{w}, \underline{b})_y$ can potentially age into the match between $\left(\underline{w}, \overline{b}\right)_o$ and $(\underline{w}, \underline{b})_o$, which may be sufficient to accommodate all of these matches. The respective measures of divorces for Case 3, 4, and 5 equilibria are presented below Tables 1.8, 1.9, and 1.10 respectively and account for this fact by the inclusion of the minimum expression.

It is analytically straightforward to show that under condition (1.3) when Case 1 and Case 3 equilibria are compared, the measures of divorces are larger in Case 1. Moreover, this relationship is monotonic since the greater the value of r, characterizing female earning opportunities, the greater the measure of divorces is observed under condition (1.3). For the remaining two comparisons, precisely the comparisons between Case 2 and Case 4 equilibria and the comparison between Case 1 and Case 5 equilibria, I rely on simulation techniques over the whole range of feasible choices of x, z, p, q and r. I found that these two remaining comparative statics are qualitatively the same as for the comparative statics between Case 1 and Case 3 equilibria. Therefore, I formalize this result without proof[2] in Proposition 2.

[2]The simulations to compare the measure of divorces for the respective equilibria were conducted for the space of parameters x, z, p, q, and r with the step 0.01.

Proposition 2: *The increase in the wife's income perspectives increases monotonically the overall measure of divorces. The divorce hazard increases for all types of matches with the exception of matches between the individuals of* $\left(\overline{w}, \overline{b}\right)_y$ *type.*

These findings, derived from the theoretical model I presented, are consistent with the empirical findings of Bremmer and Kesselring (2004); Kalmijn and Poortman (2006), 2006; Teachman (2010) and others, who found that an increase in the wife's earnings results in an increased divorce hazard. Moreover, the results indicate the monotonic relationship between female income perspectives and the measure of divorces since the greater the value of r, characterizing female earning opportunities, the greater the measure of divorces is observed. This suggests that the destabilizing effect of the increased opportunity to find a better partner is due to women becoming more desirable than the stabilizing effect of remaining desirable enough for the current partner.

1.4 Conclusion

The multidimensional model presented above introduces the concept of aging into the theoretical marriage market literature. I have shown that changes in agents' wealth and beauty over time as a representative of positive and negative aging effects can result in the incentive to re-match, and the probability of match separation is conditional on the type of agent. Therefore aging, modeled via changes in the characteristics of agents, provides yet another explanation for the phenomenon of divorce and thus complements existing theories explaining divorce mainly as a result of the on-the-job search or delayed realization of the match quality.

In addition, the concept presented in this paper provides a mechanism to account for effects such as increasing female labor force participation and the diminishing wage gap between males and females on the structure and, more importantly, on the stability of the marriage market, which has not been possible using previous models in which the characteristics of the agents do not vary across time. Several important real world observations can be described by my model. First, the equilibrium structure and the stability of the marriage market depend on the distribution of agents' types. Second, the increase in female income prospects increases the divorce rate, which is in line with the empirical findings.

This paper thus demonstrates the possibilities of the presented concept to evaluate the effects continuing gender labor market equalization have on the marriage market. However, further research concentrating on the gender asymmetry in agents' wealth distribution can be a valid extension of the paper.

1.A Appendix 1

Proof of Proposition 1:

The proof relies on Eeckhout (2000), who showed that if men and women can be assigned ranks in such a way that any man and any woman with the same rank prefer each other above any other partner with a lower rank, then stable matching is unique. The particular ordering that satisfies this condition is presented in the following table:

	Men	Women
1.	$(\overline{w}, \overline{b})$	$(\overline{w}, \overline{b})$
2.	$(\overline{w}, \underline{b})$	$(\underline{w}, \overline{b})$
3.	$(\underline{w}, \overline{b})$	$(\overline{w}, \underline{b})$
4.	$(\underline{w}, \underline{b})$	$(\underline{w}, \underline{b})$

Table 1.11: Rank ordering

Proof of Lemma 1:

The matching mechanism follows the deferred acceptance algorithm introduced by Gale and Shapley (1962). An agent's ordering of potential partners follows Formula 1.1 or Formula 1.2, conditional on the agent's level of wealth. As stated in Proposition 1, equilibrium matching is unique for the given distribution of agents' types, which implies that Male Best Equilibrium is equal to the Female Best Equilibrium. Therefore, the choice of group proposing the match in the Gale-Shapley algorithm does not play a role in the equilibrium outcome. The distribution of agents' types of age 2 is given in Table 1.1.

The step-by-step matching procedure following Gale-Shapley algorithm with men proposing, under the restrictions stated in Lemma 1, is outlined in Table 1.12.

Proof of Lemma 2:

Again the matching mechanism follows the deferred acceptance algorithm introduced by Gale and Shapley (1962). An agent's ordering of potential partners follows Formula 1.1 or Formula 1.2, conditional on the agent's level of wealth. As in the previous case, the equilibrium is unique given the distribution of the agents' types, and therefore, the choice of group proposing the match in the Gale-Shapley algorithm does not play a role in the equilibrium outcome.

The step-by-step matching procedure following the Gale-Shapley algorithm with men proposing, under the restrictions stated in Lemma 2, is outlined in Table 1.13.

Proof of Lemma 3:

The matching mechanism follows the deferred acceptance algorithm introduced by Gale and Shapley (1962). An agent's ordering of potential partners follows Formula 1 or Formula 2, conditional on the agent's level of wealth. As stated in Proposition 1, the equilibrium matching is unique for the given distribution of agents' types, which implies that the Men Best Equilibrium is equal to the Women Best Equilibrium. The distribution of agents' types of age 2 for men, is given by Table 1 and for women by Table 7. The step-by-step matching procedures following the Gale-Shapley algorithm with men proposing, under the restrictions stated in Lemma 3, are outlined in Tables 1.14, 1.15, and 1.16 for Case 3, 4, and 5 respectively.

Round	Man type[a]	Woman type	Measures of proposing types[b]
1.	$(\overline{w},\overline{b})_y$	$(\overline{w},\overline{b})_y$	$\pi_1 = \pi_1$
1.	$(\overline{w},\overline{b})_o$	$(\overline{w},\overline{b})_o$	$\pi_1 q + \pi_3 pq = \pi_1 q + \pi_3 pq$
2.	$(\overline{w},\underline{b})_y$	$(\underline{w},\overline{b})_y$	$\pi_2 < \pi_3$
2.	$(\overline{w},\underline{b})_o$	$(\underline{w},\overline{b})_o$	$\pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p > \pi_3 (1-p) q$
2.	$(\overline{w},\underline{b})_o$	$(\underline{w},\overline{b})_y$	$A = \pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p - \pi_3 (1-p) q > \pi_3 - \pi_2$
2.	$(\underline{w},\overline{b})_y$	$(\overline{w},\underline{b})_y$	$\pi_3 > \pi_2$
2.	$(\underline{w},\overline{b})_o$	$(\overline{w},\underline{b})_o$	$\pi_3 (1-p) q < \pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p$
2.	$(\underline{w},\overline{b})_y$	$(\overline{w},\underline{b})_o$	$\pi_3 - \pi_2 < \pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p - \pi_3 (1-p) q = A$
3.	$(\overline{w},\underline{b})_o$	$(\overline{w},\underline{b})_o$	$A - (\pi_3 - \pi_2) = A - (\pi_3 - \pi_2)$
4.	$(\underline{w},\underline{b})_y$	$(\underline{w},\underline{b})_y$	$\pi_4 = \pi_4$
4.	$(\underline{w},\underline{b})_o$	$(\underline{w},\underline{b})_o$	$\pi_3 (1-p)(1-q) + \pi_4 (1-p) = \pi_3 (1-p)(1-q) + \pi_4 (1-p)$

Table 1.12: The Gale-Shapley algorithm (Case 1)

[a] lists only those whose proposal has been accepted by the woman to whom the men propose.
[b] the first expression denotes the measure of men proposing, while the second expression denotes the measure of women, who received the proposal.

Round	Man type[a]	Woman type	Measures of proposing types[b]
1.	$(\overline{w},\overline{b})_y$	$(\overline{w},\overline{b})_y$	$\pi_1 = \pi_1$
1.	$(\overline{w},\overline{b})_o$	$(\overline{w},\overline{b})_o$	$\pi_1 q + \pi_3 pq = \pi_1 q + \pi_3 pq$
2.	$(\overline{w},\underline{b})_y$	$(\underline{w},\overline{b})_y$	$\pi_2 < \pi_3$
2.	$(\overline{w},\underline{b})_o$	$(\underline{w},\overline{b})_o$	$\pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p > \pi_3 (1-p) q$
2.	$(\overline{w},\underline{b})_o$	$(\underline{w},\overline{b})_y$	$A = \pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p - \pi_3 (1-p) q < \pi_3 - \pi_2$
2.	$(\underline{w},\overline{b})_y$	$(\overline{w},\underline{b})_y$	$\pi_3 > \pi_2$
2.	$(\underline{w},\overline{b})_o$	$(\overline{w},\underline{b})_o$	$\pi_3 (1-p) q < \pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p$
2.	$(\underline{w},\overline{b})_y$	$(\overline{w},\underline{b})_o$	$\pi_3 - \pi_2 > \pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p - \pi_3 (1-p) q = A$
3.	$(\underline{w},\overline{b})_y$	$(\underline{w},\overline{b})_y$	$A - (\pi_3 - \pi_2) = A - (\pi_3 - \pi_2)$
4.	$(\underline{w},\underline{b})_y$	$(\underline{w},\underline{b})_y$	$\pi_4 = \pi_4$
4.	$(\underline{w},\underline{b})_o$	$(\underline{w},\underline{b})_o$	$\pi_3 (1-p)(1-q) + \pi_4 (1-p) = \pi_3 (1-p)(1-q) + \pi_4 (1-p)$

Table 1.13: The Gale-Shapley algorithm (Case 2)

[a] lists only those whose proposal has been accepted by the woman to whom the men propose.
[b] the first expression denotes the measure of men proposing, while the second expression denotes the measure of women, who received the proposal.

Round	Man type[a]	Woman type	Measures of proposing types[b]
1.	$\left(\overline{w},\overline{b}\right)_y$	$\left(\overline{w},\overline{b}\right)_y$	$\pi_1 = \pi_1$
1.	$\left(\overline{w},\overline{b}\right)_o$	$\left(\overline{w},\overline{b}\right)_o$	$\pi_1 q + \pi_3 pq > \pi_1 q + \pi_3 rq$
2.	$\left(\overline{w},\overline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_o$	$\pi_3 (p-r)\, q < \pi_3 (1-r)\, q$
2.	$\left(\overline{w},\underline{b}\right)_y$	$\left(\underline{w},\overline{b}\right)_y$	$\pi_2 < \pi_3$
2.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_o$	$\pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p > \pi_3 (1-p)\, q$
2.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_o$	$A = \pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p - \pi_3 (1-p)\, q > \pi_3 - \pi_2$
2.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\overline{w},\underline{b}\right)_y$	$\pi_3 > \pi_2$
2.	$\left(\underline{w},\overline{b}\right)_o$	$\left(\overline{w},\underline{b}\right)_o$	$\pi_3 (1-p)\, q < \pi_1 (1-q) + \pi_2 + \pi_3 r (1-q) + \pi_4 r$
2.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\overline{w},\underline{b}\right)_o$	$\pi_3 - \pi_2 < \pi_1 (1-q) + \pi_2 + \pi_3 r (1-q) + \pi_4 r - \pi_3 (1-p)\, q = C$
3.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\overline{w},\underline{b}\right)_o$	$A - (\pi_3 - \pi_2) > C - (\pi_3 - \pi_2)$
4.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\underline{b}\right)_o$	$\pi_3 (p-r)(1-q) + \pi_4 (p-r) < \pi_3 (1-r)(1-q) + \pi_4 (1-r)$
4.	$\left(\underline{w},\underline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_y$	$\pi_4 = \pi_4$
4.	$\left(\underline{w},\underline{b}\right)_o$	$\left(\underline{w},\underline{b}\right)_o$	$\pi_3 (1-p)(1-q) + \pi_4 (1-p) = \pi_3 (1-p)(1-q) + \pi_4 (1-p)$

Table 1.14: The Gale-Shapley algorithm (Case 3)

[a] lists only those whose proposal has been accepted by the woman to whom the men propose.
[b] the first expression denotes the measure of men proposing, while the second expression denotes the measure of women, who received the proposal.

Round	Man type[a]	Woman type	Measures of proposing types[b]
1.	$\left(\overline{w},\overline{b}\right)_y$	$\left(\overline{w},\overline{b}\right)_y$	$\pi_1 = \pi_1$
1.	$\left(\overline{w},\overline{b}\right)_o$	$\left(\overline{w},\overline{b}\right)_o$	$\pi_1 q + \pi_3 pq > \pi_1 q + \pi_3 rq$
2.	$\left(\overline{w},\overline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_o$	$\pi_3 (p-r) q < \pi_3 (1-r) q$
2.	$\left(\overline{w},\underline{b}\right)_y$	$\left(\underline{w},\overline{b}\right)_y$	$\pi_2 < \pi_3$
2.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_o$	$\pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p > \pi_3 (1-p) q$
2.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_y$	$A = \pi_1 (1-q) + \pi_2 + \pi_3 p (1-q) + \pi_4 p - \pi_3 (1-p) q < \pi_3 - \pi_2$
2.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\overline{w},\underline{b}\right)_y$	$\pi_3 > \pi_2$
2.	$\left(\underline{w},\overline{b}\right)_o$	$\left(\overline{w},\underline{b}\right)_o$	$\pi_3 (1-p) q < \pi_1 (1-q) + \pi_2 + \pi_3 r (1-q) + \pi_4 r$
2.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\overline{w},\underline{b}\right)_o$	$\pi_3 - \pi_2 > \pi_1 (1-q) + \pi_2 + \pi_3 r (1-q) + \pi_4 r - \pi_3 (1-p) q = C$
3.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\underline{w},\overline{b}\right)_y$	$(\pi_3 - \pi_2) - C > (\pi_3 - \pi_2) - A$
4.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_y$	$A - C < \pi_4$
4.	$\left(\underline{w},\underline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_y$	$\pi_4 > \pi_4 - (A - C)$
4.	$\left(\underline{w},\underline{b}\right)_o$	$\left(\underline{w},\underline{b}\right)_o$	$\pi_3 (1-p)(1-q) + \pi_4 (1-p) < \pi_3 (1-r)(1-q) + \pi_4 (1-r)$
4.	$\left(\underline{w},\underline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_o$	$A - C = \pi_3 (p-r)(1-q) + \pi_4 (p-r)$

Table 1.15: The Gale-Shapley algorithm (Case 4)

[a]lists only those, whose proposal has been accepted by the woman to whome the men propose.
[b]the first expression denotes the measure of men proposing, while the second expression denotes the measure of women, who received the proposal.

Round	Man type[a]	Woman type	Measures of proposing types[b]
1.	$\left(\overline{w},\overline{b}\right)_y$	$\left(\overline{w},\overline{b}\right)_y$	$\pi_1 = \pi_1$
1.	$\left(\overline{w},\overline{b}\right)_o$	$\left(\overline{w},\overline{b}\right)_o$	$\pi_1 q + \pi_3 pq > \pi_1 q + \pi_3 rq$
2.	$\left(\overline{w},\overline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_o$	$\pi_3 \left(p-r\right) q < \pi_3 \left(1-r\right) q$
2.	$\left(\overline{w},\underline{b}\right)_y$	$\left(\underline{w},\overline{b}\right)_y$	$\pi_2 < \pi_3$
2.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_o$	$\pi_1 \left(1-q\right) + \pi_2 + \pi_3 p \left(1-q\right) + \pi_4 p > \pi_3 \left(1-p\right) q$
2.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\overline{b}\right)_y$	$A = \pi_1 \left(1-q\right) + \pi_2 + \pi_3 p \left(1-q\right) + \pi_4 p - \pi_3 \left(1-p\right) q > \pi_3 - \pi_2$
2.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\overline{w},\underline{b}\right)_y$	$\pi_3 > \pi_2$
2.	$\left(\underline{w},\overline{b}\right)_o$	$\left(\overline{w},\underline{b}\right)_o$	$\pi_3 \left(1-p\right) q < \pi_1 \left(1-q\right) + \pi_2 + \pi_3 r \left(1-q\right) + \pi_4 r$
2.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\overline{w},\underline{b}\right)_o$	$\pi_3 - \pi_2 > \pi_1 \left(1-q\right) + \pi_2 + \pi_3 r \left(1-q\right) + \pi_4 r - \pi_3 \left(1-p\right) q = C$
3.	$\left(\underline{w},\overline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_y$	$\left(\pi_3 - \pi_2\right) - C < \pi_4$
3.	$\left(\overline{w},\underline{b}\right)_o$	$\left(\underline{w},\underline{b}\right)_o$	$A - \left(\pi_3 - \pi_2\right) < \pi_3 \left(1-r\right)\left(1-q\right) + \pi_4 \left(1-r\right)$
4.	$\left(\underline{w},\underline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_y$	$\pi_4 > \pi_4 - \left[\left(\pi_3 - \pi_2\right) - C\right]$
4.	$\left(\underline{w},\underline{b}\right)_o$	$\left(\underline{w},\underline{b}\right)_o$	$\pi_3 \left(1-p\right)\left(1-q\right) + \pi_4 \left(1-p\right) < \pi_3 \left(1-r\right)\left(1-q\right) + \pi_4 \left(1-r\right) - \left[A - \left(\pi_3 - \pi_2\right)\right]$
4.	$\left(\underline{w},\underline{b}\right)_y$	$\left(\underline{w},\underline{b}\right)_o$	$\left(\pi_3 - \pi_2\right) - C = \pi_3 \left(p-r\right)\left(1-q\right) + \pi_4 \left(p-r\right) - \left[A - \left(\pi_3 - \pi_2\right)\right]$

Table 1.16: The Gale-Shapley algorithm (Case 5)

[a]lists only those whose proposal has been accepted by the woman to whom the men propose.

[b]the first expression denotes the measure of men proposing, while the second expression denotes the measure of women, who received the proposal.

Chapter 2

Let's Dance. With Someone Else? Empirical Evidence on Determinants of Match Separation

Co-authored with František Kopřiva and Pavla Nikolovová[1]

2.1 Introduction

Over the last forty years, the interest of economists in the issue of the formation and separation of marriages and other types of partnership has been rising, and several theories of search and matching have been developed to describe and model these phenomena. Particular attention has been given to the study of reasons for which partnership end, and two competing theories have been developed to explain the phenomenon of match separation. The first theory explains match separation as given by a continuous search for a better partner in situations in which match quality is directly observable. The second theory sees match separation as caused by the inability to observe the match quality at the beginning of the relationship, but when it is only revealed over time. In the former case, match quality is said to be a search good, in the latter case, it is considered to be an experience good. For both theories, the match quality is the key element of the model, based on which agents decide whether to enter a relationship, to stay in the relationship or separate.

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Obviously, the two presented cases are extreme, since we cannot assume that match quality would be a purely search or purely experience good. Therefore, various studies ask which of the two points of view describes better the reality, i.e., to what extent the sub-optimality of a match can be explained by continuous search for a better partner or by initial uncertainty. To find an answer, empirical studies have been conducted using data from labor and marriage markets. These studies have to deal with the question of how to measure the quality of a match, which proves to be problematic. While in the case of labor market, wage can be to some extent considered as an indicator of match quality, as Mortensen (1988) states, "unfortunately, in the case of marriage, no indicator of match quality seems to exist..." (p. S239). Hence, especially in case of marriage market, empirical studies use socioeconomic proxies to substitute for match quality both in the search good and in the experience good approach.

To gain a better understanding about which of these two competing theories better explains existence of divorces one would have to find a matching market that would contain both basic characteristics of the marriage market and a measure of match quality. Therefore, we propose an empirical analysis of the data from Czech ballroom dancing competitions. In such an environment, the formation and separation of couples very much resembles the mechanisms of the marriage market, and at the same time, results from competitions provide a reliable measure of match quality. This is why we believe that our extensive database of the results from competitions in Czech ballroom dancing provides suitable data to analyze the importance of the presence of search frictions and of initial uncertainty about match quality on the match separation.

However, the richness of the data containing information not only about historical but also about future partners and their results at any given time allow us to answer additional questions often asked in the marriage market literature. More precisely, we concentrate on the process of match creation, time of search and the structure of realized matches conditional on the true quality of individuals revealed only throughout their. Obtained results are then used to support the main analysis of the discussed determinants of match separation.

2.2 Literature Review

The current empirical literature studies the effects of match separation in two markets: labor and marriage market.

A representative labor market study aiming to To measure the extent to what the sub-optimality of a match can be explained by search costs or by initial uncertainty was provided by Topel and Ward (1992). The authors study the impact of job experience (in current and all previous jobs) and job tenure on wages and consequently on the duration of job occupation for the first 10 years of a workers' career. They claim that if the match quality is a search good, only job experience should have impact on the wage, whereas if it is an experience good, only job tenure should have impact on the wage. The authors find that both experience and tenure matter for the probability of match separation. Thus, it cannot be said that match quality is purely an experience or purely a search good in the studied context. It has to be said, though, that Topel and Ward (1992) perform their analysis only on wages, which they consider to be a measure of the match quality. We think that it is at least questionable to assume, that especially during the early stage of workers' career, wage could serve as a perfect measure of match quality, since there is aconsiderable uncertainty on both sides of the market. In addition, one can argue that wage is position specific rather than worker specific, with wage being determined by the situation on the labor market.

The treatment of match quality presented by Topel and Ward (1992) is in sharp contrast with marriage market empirical studies devoted to the determinants of divorce. A representative paper in this field is Weiss and Willis (1997), which builds closely on Becker (1973) and Becker, Landes, and Michael (1977). Weiss and Willis consider ex-ante heterogeneous agents whose utility from marriage is given by a production function where the characteristics of the agents enter as inputs together with the unobserved quality of the match. The need to treat the match quality as unobserved constitutes the main contrast of this study compared to the Topel and Ward (1992). Nevertheless, Weiss and Willis still find support for both presented explanation of match sub-optimatility in the context of marriage market.

Match quality is treated as unobservable by Brien, Lillard, and Stern (2006) as well. While Weiss and Willis (1997) assume match quality to be a composition of the unobserved expected quality of match at the time of marriage and of an i.i.d. shock with zero mean, Brien, Lillard, and Stern (2006) employ a more realistic approach and assume that even though stationary match quality is unobservable at the time of marriage, partners' learn about it through a noisy signal that follows an AR(1) process. The authors find that agents need to learn about potential partners through cohabitation experience, which supports the hypothesis of match quality being an experience good.

A different approach to the determinants of divorce is taken by Kalmijn and Poortman (2006). They explicitly assume match quality to be a search good which can be proxied by indicators such as age at the time of marriage, acquaintance period or the degree of momogamy. Alongside the effect of match quality on divorce, Kalmijn and Poortman analyze the effects of a wife's employment, financial situation of the household and the presence of children. However, one can argue that while the authors consider match quality to be a search good, the latter three determinants can all be seen as indicators of the match quality in the sense of experience good.

To sum up, it is clear that both theoretical and empirical studies consider match quality to play a significant role in partners' decision to marry as well as in the stability of a relationship. Unfortunately, as this literature review illustrated, it is very difficults if not impossible to observe the match quality on both marriage and labor markets, and thus analyze the importance of search frictions and the initial uncertainty about the quality of the match as possible explanations of match separation.

2.3 Data

For the purpose of our research, we use the database of results from competitions in Czech ballroom dancing in years 2001 to 2010. While this data is publicly available at the web page of Czech Dance Sport Federation (http://csts.cz), it is not in a database format which would allow for straightforward download. The web page containing the data is organized as a standard web page with data available behind distinct links. For better understanding of the problem we had to deal with, visit at `http://www.csts.cz/www/vysledky/ukaz_soutez.php?vysledky/ukaz_soutez.php?key=3000311&vrok=2010`.

To obtain the data for the analyzed time period for all participants and competitions, we created an automated program. This program went systematically through the links to competitions, downloading the data into a database form. On average, there are more than 10 such competitions per month, which provides us with an exceptionally rich and detailed dataset. For each competition, the data includes information about all couples that participated, their category, their class and the ranking that they achieved at this competition. Each competition is divided into two disciplines, Standard dances and Latin dances, and the couples compete and are evaluated in the two disciplines separately. Some competitions are of qualification type, which means that couples are also attributed points upon which they are consequently assigned in different performance classes within their age categories. In total, there are 9 age categories and 5 performance classes.

2.3.1 Data Cleaning

After the download, we checked the data for consistency. First, since it is essential to correctly identify individuals, we checked for the consistency between individuals' names and identification numbers and we corrected for any potential typos and spelling errors. Second, we checked and corrected for any typos in the number of points individuals were awarded throughout their dancing career. The typical mistake was the inconsistency between number of points awarded at the given competition and the sum of the achieved points.

Further, the data contains information about the individuals' club affiliation. Therefore, we assigned to each club the city, county and region it is located in, which allows us to observe the flow of individuals between geographical units. We used this information to better identify exogenous reasons of match separation (such as moving to a different city).

2.3.2 Data Characteristics

For each couple, the data includes information about their age category and the class in which they compete, their achieved ranking at the competition, the type and the importance of the competition, and finally their affiliation to a dancing club. There are two disciplines, Standard dances and Latin dances, and the couples compete and are evaluated in the two disciplines separately. Some competitions are of qualification type, which means that couples are attributed points upon which they are consequently assigned to different performance classes within their age categories. In fact, results from these particular competitions will be of our focus while trying to construct a measure of match quality based on the achieved results.

In total, there are 9 age categories and 5 performance classes, organized as indicated in Table 2.1. Thus, for some individuals we are able to observe their progress over several years and age categories.

Whereas the transition between age categories is automatically given by the age of the two partners, the transition between classes is conditional on the performance of the couple in qualification competitions. What counts is the number of participations in final round and the number of points that the couple accumulates. The necessary condition

Category	Age	Class D	Class C	Class B	Class A	Class M
Juvenile I	< 10	Yes	No	No	No	No
Juvenile II	$10 - 12$	Yes	Yes	No	No	No
Junior I	$12 - 14$	Yes	Yes	Yes	No	No
Junior II	$14 - 16$	Yes	Yes	Yes	No	No
Youth	$16 - 19$	Yes	Yes	Yes	Yes	Yes
Adult	$19 - 35$	Yes	Yes	Yes	Yes	Yes
Senior I	$35 - 45$	Yes	Yes	Yes	Yes	Yes
Senior II	$45 - 55$	Yes	Yes	Yes	Yes	Yes
Senior III	> 55	Yes	Yes	Yes	Yes	Yes

Table 2.1: Categories and classes

to pass to higher class is to achieve 5 participations in final round and 200 points with no time constraint. However, there is a possibility to fall to the lower class as well if the couple does not participate at the competitions for a longer time period. Since such demotion is based on the clear rule and not on poor performance, it is easy to control for such occurrence. When a dancing couple separates, the class, the number of points and the number of final rounds in the current class is left to the man and to his potential future partner, whereas the woman will share these characteristics with her potential future partner. Nonetheless, we believe that woman carries the signal about her past performance as well.

For the purpose of this paper, our unique dataset allows us to observe the evolution of performance of each couple from its formation to its dissolution, creation of new couples with new partners and their subsequent performance. It is an unbalanced panel containing approximately 150, 000 observations (if only Czech couples are taken into account), which allows us to control for the tenure of each couple (the time this couple has been dancing together), the experience of each individual (the time he/she has been dancing overall), the joint performance measured by achieved points, the class, the category and the affiliation to a dancing club. In this paper, we focus only on the category of adults, which is in our opinion more heterogenous and still represents some 90, 000 observations.

Since the main aim of our paper is to evaluate the importance of various determinants of match separation, it is essential to show that the data are suitable for this task. Therefore, we present the number of partners that each agent is matched with during his or her dancing career. The distribution of this characteristic is visualized in Figure 2.1 separately for men and women. As can be seen, even though the number of people who have only one partner in their dancing career is not negligible, a significant share of individuals have two partners or more: this is why we think the rate of match separation in the dataset is sufficiently high to allow us to address the topic of our interest.

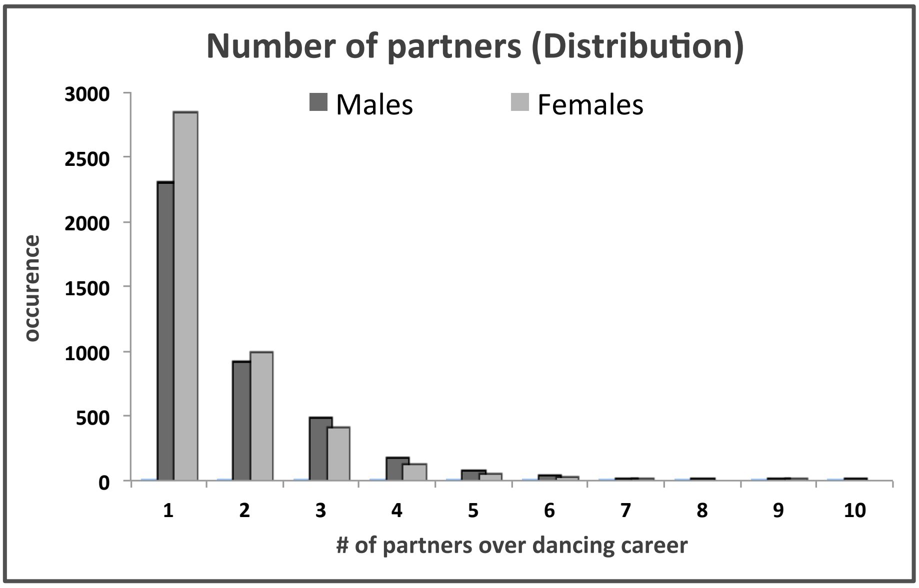


Figure 2.1: Distribution of Number of Partners Over Dancing Career

2.4 Measurable Characteristics Computed from the Data

As explained in Section 2.2, theoretical literature distinguishes two main causes of match separation. The first is an initial uncertainty about the match quality implying possible subsequent dissatisfaction with the match. The second one is the presence of search frictions, which may result in a dancer not being matched with the most suitable partner right from the beginning and finding a better partner later on. The aim of this paper is to test whether realization of unsatisfactory match quality and finding a better partner are relevant causes of match separation, and what characteristics of the match and/or of the two partners play an important role in each of these two scenarios. To do so, we will first explain how we evaluate the characteristics of the match and of the two partners based on our data.

2.4.1 Match Quality

Our first task is to evaluate the quality of the match, which is a crucial characteristic determining the satisfaction of the two partners and thus also the stability of the match. In brief, we claim that the key variable defining the quality of the match for a couple is its performance in dancing competitions. Obviously, we do not rule out the possibility that the two partners may find satisfaction in other attributes of their dancing activity, but since the individuals we are studying have self-selected into the pool of participants in dancing competitions, it is not unreasonable to assume that their achievements in the competitions is what they are interested in.

The first raw indicator of performance is the class in which the couple is dancing. Thus we always define couples dancing in higher classes as having higher match quality. Within each class, a more precise indicator of a couple's performance is their number of points and achieved finals accumulated at the competitions.

Every time a couple participates in a competition, they are awarded a certain amount of points and they can also gain one participation in the final round. The Czech Dance Sport Federation uses an algorithm, which states how high the number of points should be. The algorithm is defined as follows:

$$\#\text{ of points} = DC + 2 \cdot QHR + BON \quad ,$$

where DC stands for the number of defeated couples, QHR for the number of qualifications to higher rounds of the competition and BON for the bonus for 1^{st}, 2^{nd} or 3^{rd} place. This shows that the number of points is directly correlated with final round participation. However, since the necessary condition to pass to a higher category is to achieve 5 participations in final round and 200 points, both characteristics are important and it would be misleading to consider only the number of points when assessing the performance of the couple. The importance of both characteristics is further supported when one looks at the distribution of couples in adult age group that have satisfied one of the two conditions and are just “waiting“ to satisfy the other to pass to a higher class. We found that 53% of couples achieved the limit of 200 points but do not have 5 final round participations yet and 47% of opposite cases.

Since the two characteristics are strongly correlated, it is not clear how to combine them in order to construct a single measure of match quality. However, I can be assumed that the ultimate goal of each couple is to pass from their current class to a higher one as quickly as possible and thus the measure of their match quality might be expressed as the time it takes the couple to achieve this goal, given their current standing. In technical terms, we imagine the match quality to be the expected time remaining before the couple passes to a higher class, conditioned on their current number of points and final round participations.

Thus, to construct the measure of match quality, we compute the time remaining before the couple passes to higher class for those couples who actually pass to a higher class, and we regress it on the number of points and final round participations the couple has at that moment. We measure time as the number of competitions rather than real time, because it could be biased by the number of competitions the couple can participate in for geographical or other reasons. Then we use the estimated coefficients to predict how many additional competitions the couple in question has to participate in before it passes to higher class. This number thus expresses the average number of competitions remaining conditioned on the couple's current number of points and final round participations.

Since only couples who actually pass to a higher class can be used for our estimation, and we have reasons to believe that the performance of these is generally in the upper tail of the distribution, we use Heckman's selection model. In the selection equation (which determines who passes at some time to higher class and who never achieve this goal), we include variables that reflect the speed at which the couples get to the position they have: current number of points and number of finals both normalized by the number of competitions at which the couple have participated so far.

The coefficients from the selection equation are of expected signs and can be provided upon request. In this paper, only the coefficients from the main equation are displayed. They can be understood as beta coefficients, because we normalize both points and finals by corresponding standard deviations of these variables for easier comparison.

Table 2.2 summarizes these beta coefficients separately for Latin and Standard dances and for different classes. All are statistically significant at 1% level except for the coefficients on points for class A in Latin dances. With the exception of class A, the coefficients

Type	Latin				Standard			
Class	D	C	B	A	D	C	B	A
Points	-3.005	-3.625	-3.636	-0.073	-5.240	-5.591	-5.488	2.039
Finals	-2.750	-2.840	-2.580	-5.106	-1.505	-1.568	-1.081	-5.346

Table 2.2: Beta coefficients for determinants of time remaining to higher class

are rather intuitive. The more points and final round participations the couple has, the less competitions remain to be attended before achievement of a higher class. For class A, we obtain an unexpected positive coefficient for points in Standard dances, but this is because the only class where dancers from class A can pass to is the professional class, and it may be that not every couple is aiming to reach this goal.

2.4.2 Personal Quality

In addition to the match quality discussed in the previous section, each individual can be characterized by his or her personal quality as well. Such personal quality is a crucial criterium in the moment of the formation of the couple, when each individual makes his or her decision about the future partner.

Given the structure of our data, where we observe the performance of couples in competitions, we possess direct information only about the current joint quality of the couple: the dancers perform in the competition as a couple, and we cannot say if both of them contributed to the result equally or if one of them was better than the other. Hence, the question is how to identify the personal quality of each dancer, how to separate it from the match quality and how to show that this quality can be considered to be a signal which is observable by the potential partners before the couple is formed.

Fortunately, we observe not only the current performance of the couple, but we also have the information about the whole career of each dancer. Among other things, we know in which class each person was when he or she ended his/her dancing career. We propose the highest class each individual achieved to be the measure of his or her personal quality. This means that rather than evaluating individuals' potential just by their past and present performance, we look at their overall career and and how high a level they achieved.

One obvious advantage of such measure of personal quality is that it is not perfectly correlated between the two partners. Since a large percentage of dancers dance with two or more different partners during their career, we observe a significant number of matches where each of the two partners has achieved a different highest level - simply because they achieve this highest class later with someone else. Even in the case when this highest class is the same for both partners, for couples that are going to break up this would mean that both partners have the same potential, but this potential is not given by their joint performance (because it is realized while dancing with someone else). Therefore, the highest achieved class allows us to disentangle the performance of the couple from the individual potential at least to some extent.

Even though the data allows us to observe this measure based on the future performance of the dancers, the question arises whether individuals, when looking for the right match, are able to observe this potential personal quality and even more importantly, whether they make their matching decisions accordingly and in line with the positive assortative matching theory. To answer this question, we analyzed the structure of matches with respect to partners' personal quality defined as the highest achieved class[2].

In Figure 2.2, we present two histograms. In the first histogram, all realized matches are represented; in the second, we omit those matches in which both partners have been matched only with each other throughout their career. Comparing these two histograms, we observe a significant drop in the number of matches when both partners were not able to reach a higher class than D. This suggests that a significant number of matches when both individuals have been matched only with each other are such that the partners found it either difficult to progress or left the market.

But most of all, both histograms show very strong positive assortative matching with respect to personal quality of the partners measured as the highest achieved class.

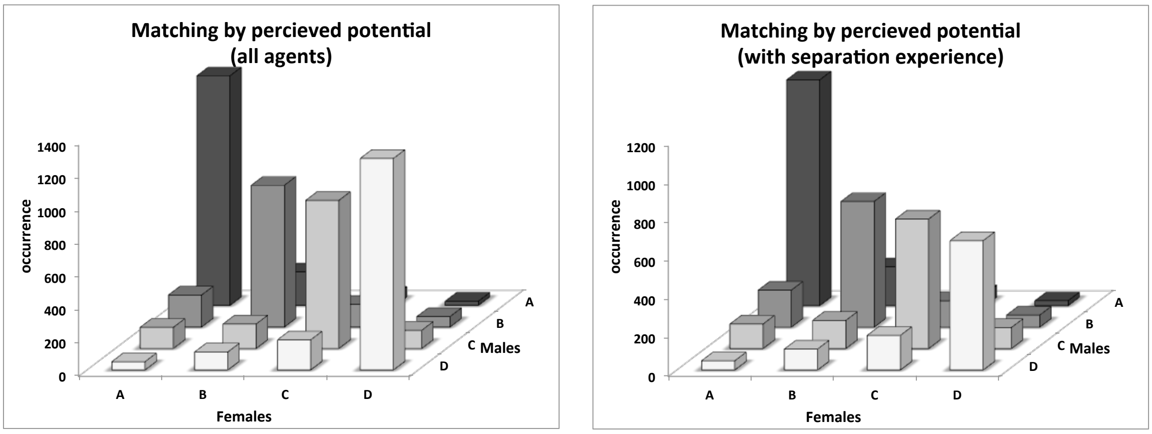


Figure 2.2: Matching Structure by Highest Achieved Class of Each Partner

This leads us to believe that when looking for a match, individuals are indeed able to observe the perceived potential of their future partner and they base their matching decisions on this indicator, i.e., the highest achieved class can be considered as a signal observable before the match is formed.

[2]For conducting this analysis, we omit individuals whose observations are censored due to the end of the observed time period, since we believe they had not reached their best class standing yet.

The strong positive assortative matching presented in Figure 2.2 is in line with theoretical models of matching markets, e.g. Becker, Landes, and Michael (1977), and their predictions about matching structure of partners with heterogeneous personal quality. According to these models, there is a positive assortative matching between agents based on their preferences for the quality of their future partner. The fact that the highest achieved class mimics this structure gives us confidence that it is a good representation of personal quality as used in theoretical models [3].

Unfortunately, defining personal quality only as the highest achieved class of the individual is rather restrictive, because we have only four possible achieved classes and so the evaluation of the dancers in this sense is very rough. Therefore, for purposes of our analysis, we will combine the highest achieved class with other observable characteristics when necessary for more detailed comparison of agents.

2.5 Causes of Match Separations

In the remaining of this chapter, we will first identify endogenous causes of match separations. Only then we will provide reasoning and econometric tests in support of each of these endogenous causes of match separations. To do so, several variables helping to describe dancers' matching behavior will be proposed. The analysis will be presented in several steps, with each step further supporting our claims.

2.5.1 Identification of Endogenous Causes of Match Separations

The two reasons for breakup that we focus on (unsatisfactory realization of match quality and finding a better partner) can be called "endogenous", because they stem directly from the nature of the match. First, we explain why not all match separations we observe in our sample are endogenous, and how we proceed to detect only those that we can treat as endogenous.

To do so, it is important to realize that the career of a dancer is limited and might be ended for some exogenous reasons, i.e., reasons that may not be correlated with the characteristics of the partner's match. For example, people might stop dancing because they become too old, because they have a demanding job or because they start a family

[3] We analyzed the structure of matching with respect to more detailed characteristics than class levels (number of achieved points, finals, expected time to achievement of higher class). However, we did not observe any sort of assortative matching on these levels.

and they have no time to train and to go to competitions. Such people leave the dancing market and end their matches, even though they might have been satisfied with their partner and would not leave him or her for any of the endogenous causes mentioned above. Such cases we consider to be exogenous match separations.

Further, there may be certain changes in peoples' lives (related to studies, profession or personal life), that may require the person to move to a different city. In that case, he or she would need to break up with his/her dancing partner and either quit the dancing market or find a new match in the new location. We consider such breakups and possible re-matches to be exogenous as well.

Clearly, exogenous and endogenous reasons for match separation are not mutually exclusive and in some cases we cannot accuretely separate them in our data. Some dancers might be more inclined towards ending their career if they are not satisfied in their current match. Some people break up their current match for endogenous reasons and then search for a new partner, but if they are not able to find him (or her), they may end their dancing career even if originally they did not intend to do so. Therefore, we cannot really say that dancers who end their career do so only for exogenous reasons.

On the other hand, we claim that people who stay in the pool of the dancers and within the same geographical region have no exogenous reasons for breaking up. Hence, we believe, that by focusing only on matches in which both dancers continue their career after being separated and who do not move across regions, we are studying only the endogenous mechanisms of match separation. This is what we will do in the rest of our analysis: we exclude all matches where the breakup might be exogenous to leave only the matches for which we are positive that the cause of separation is endogenous.

Even though the majority of matches end due to exogenous causes, we are still left with more than 600 matches which we believe ended because of an endogenous reason. Among those, we aim to identify the proportions of breakups motivated by unsatisfactory match quality and by finding a better partner.

Because the collected data do not state explicitly the cause of match separation, the described identification is only partially possible. When the new match was formed with a better partner after the breakup, it cannot be directly inferred that finding a better partner is indeed the reason for separation. On the other hand, if none of the former partners found a better partner to form a new match, then obviously finding a better partner could not be the reason for the separation, and we can say that such a match ended due to unsatisfactory match quality.

For such identification, it is crucial to assess whether a dancer found a "better match" than the previous one. In the following section, we explain how we define a dancer who found a better new partner and why we can say that this was indeed the reason for leaving the previous match.

Finding a Better Partner

As explained in section 2.4.2, we measure the personal quality as the highest achieved dance class. Since we have only four classes, this leaves us with only four categories of personal quality, which would limit significantly the comparison between dancers. Therefore, when comparing agents, we combine the dancer's personal quality with his/her current class standing. In this sense, we define lexicographic preferences of the potential partners by assuming that each dancer prefers a partner with higher personal quality, and if he or she has to chose between two partners with the same highest achieved class, s/he will prefer the partner with a higher actual class. There are interesting implications of this definition of lexicographic preferences that will be discussed further in the next section, but for now it is sufficient to say that intuitively, we find it natural that each dancer would prefer a partner with higher potential first. Such an assumption is underpinned by Figure 2.3 visualizing the number of matches formed with respect to the current class of men and women at the moment of the match formation.

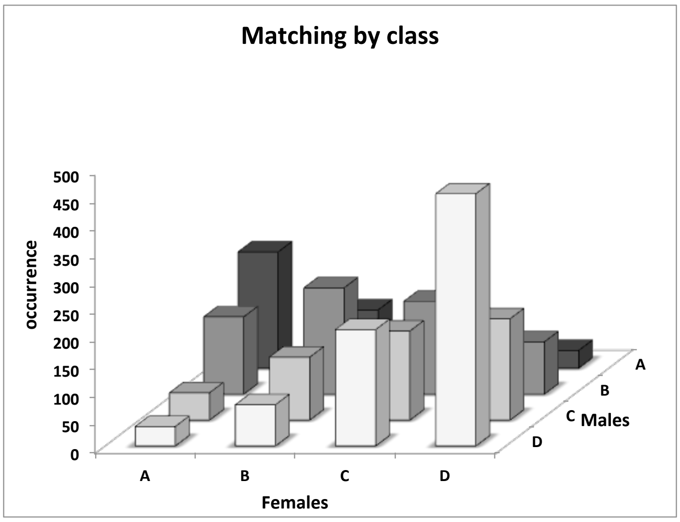


Figure 2.3: Matching Structure by Current Achieved Class of Each Partner

We observe that a significant number of matches are formed along the diagonal, supporting the positive assortative matching theory. Even if this pattern is not as strong as in Figure 2.2, where we do the same exercise for the highest achieved class, it suggests that when forming the match, dancers also take into account the current class standing of their partner, even though it is less important than his or her observed potential.

Once we made clear how we assess a new partner as better than the previous one, we show that finding a better partner is indeed a cause of match separation and that it corresponds to the theory of "on the job" search. To provide this evidence, we analyze the individuals' time between a separation and their reappearance in competitions. We assume that this time consists of two periods: a period of searching for a new partner and a period of practicing with the newfound partner before being ready to compete. If finding a better partner is the reason for match separation, the search period should not exist: in such a case, the underlying theory of "on the job search" assumes that the new partner was found while the dancer was still matched with his/her earlier partner. Therefore, our hypothesis is that the time to reappearance should be shorter in the case when the individual is matched with a better partner after the separation.

We test this hypothesis within a simple linear regression model: the dependent variable of our regression is the time to reappearance in competitions (measured in days) and the treatment variable is a dummy equal to one if the dancer found a better partner in the new match. Further, we control for personal quality of the dancer as well as his new partner to be able to rule out the possibility that the period of practicing is shorter simply because the quality of the dancers is higher (note that both own and partner's personal quality are represented as dummy variables). Our controls include the dummies representing the class in which the couple is going to dance to allow for longer practicing when preparing for a higher and more competitive class. In addition, the number of previous matches of each individual is added into the regression, since we believe that people who change partners more often may be more used to practicing with a new partner. The results are presented in Table 2.3 separately for males and females.

From these results, it is clear that on average, dancers who found a better partner than their former one, required a significantly shorter time to reappear in competitions. This result is consistent for both male and female dancers. The remaining explanatory variables have expected signs; we do not display all the coefficients for practical reasons (too many dummy variables), but they are available upon request. Our test leads us to believe that if a better partner was found, it was the result of on-the-job searching process and not of a search following the break up. Hence, finding a better partner is a

	Males	Females
Better partner found	-55.252***	-39.080*
	(19.572)	(22.975)
# of current partner	-8.474***	-3.254
	(3.177)	(3.140)
Own personal quality dummies	Yes	Yes
Partner personal quality dummies	Yes	Yes
Class dummies	Yes	Yes
N	2608	2077

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 2.3: Effect of finding a better partner on time to reappearing on the competitions

cause for match separation and not its consequence[4].

Yet, there is one additional remark that should be made at this point with respect to the proposed method for comparing dancers' preferences over potential partners. The determinants influencing dancers' preferences of the potential partners change with time, allowing us thus to test effects on the stability of matches for this change. We will address this topic in the following subsection.

Change of Class

The method for identification of a "better partner" we proposed consists of two components: one is stable and the other varies over time. The stable component is the personal quality which can also be named potential (given by the highest achieved class) and the time-variable component is the actual standing. As already explained, we account for the actual standing in the specification of dancers' preferences to allow for even more detailed

[4]Obviously, we are aware of the fact that since we are not able to strictly identify the true cause of separation, in our sample we may have dancers who broke up because of unsatisfactory realization of the match quality and then found a better partner. These individuals would bias our results, but this bias would only lead to underestimating the effect we are searching for. Since we observed a statistically important difference between dancers who found a better partner and those who did not, our conclusions are still valid.

preference structure comparison. In addition, we showed that this variable has a clear impact on the matching structure (see again Figure 2.3). However, such an assumption challenges the majority of traditional theoretical models of matching markets, in which partners' characteristics are assumed to be constant over time.

This assumption of the stability of agents' characteristics seems somewhat restrictive and unrealistic; this is what motivated Vozar (2010) to propose a theoretical model where the separation of a match can be explained by a change in characteristics of one or both partners. Since in our data, we are able to observe a characteristic that has an obvious impact on the matching structure and is time variant, we have a unique opportunity to formally test the predictions of the model by Vozar (2010), as an addition to our primery goal, i.e. testing of the two traditional theories. The question is thus whether the achievement of a higher class influences the stability of matches.

The data indeed indicates, that the achievement of a higher class has an impact on match stability; a significant share of separations occur right after the couple is promoted to a higher class. This result is graphically represented in Figure 2.4.

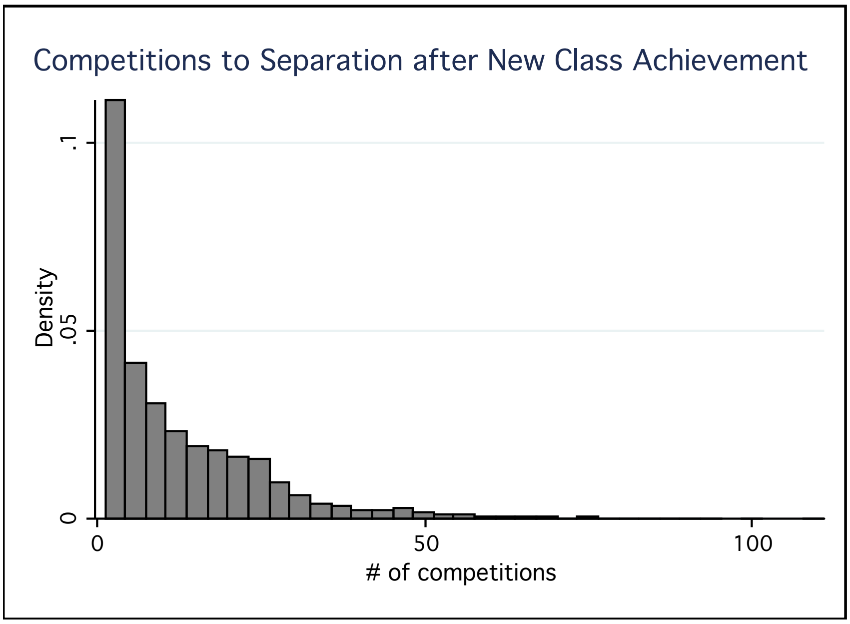


Figure 2.4: Separation After New Class Achievement

The cause of separations occurring immediately after promotion to a higher class also requires discussion. Two possible explanations are evident. First, it may be that the separation actually occurred due to the promotion to a higher class. The intuition is that with the higher class achieved, both partners can signal higher overall quality (as explained in section 2.4.2. He or she can thus reach a new pool of potential partners not accessible before. Such separation is in line with the theoretical model proposed by Vozar (2010) and would thus confirm that a change in a dancer's characteristics may lead to match separation.

Second, the couple might separate for some other reason, but decide to postpone their separation until their promotion due to various reasons (finishing a job, reaching a milestone together, etc). In that case, promotion to a higher class could not be considered to be a direct cause of match separation and the theoretical model proposed by Vozar (2010) would not be supported by our data.

To determine which of the two potential explanations seems more plausible, we analyze the length of relationship for two different groups of matches. In Group 1, we focus on couples that split up just after achieving a higher class. In Group 2, we include couples that split up within a class, i.e., not just after the achievement of a higher class. In both groups, both partners find a new match after the separation and continue their dancing career - we thus eliminate dancers who were motivated to separate for additional exogenous reasons as explained earlier. For each group, we compute the average length of the ended relationship, conditional on the class which was achieved to control for the potential influence of varying difficulty and level of competition across classes. The results are summarized in Table 2.4.

Average length	Group 1	Group 2
Class A	**15.23**	**25.12**
Class B	**14.17**	**23.02**
Class C	**12.30**	**19.39**

Table 2.4: Average length of relationship (in number of competition) after controlling for latest achieved class standing

Before we discuss these results, we should explain why the length of a relationship can help us to tell which of the two above presented explanations is valid. If the second explanation was valid, i.e., if separations right after the change of class are just postponed separations driven by other motives, we should expect that the average length of a relationship is longer for Group 1 than for Group 2. If the first explanation was valid, we should observe the opposite: no difference or shorter relationships in Group 1.

The results presented in Table 2.4 indicate that relationships in Group 1 tend to be shorter than in Group 2. Indeed, when we perform the formal statistical test, we reject the null hypothesis that the average length of relationships is larger in Group 1 than in Group 2. This finding supports the validity of the theory that changes in partners' characteristics may be an incentive for match separation, at least in cases where both partners stay on the market after separation. Based on these results, we can conclude that the characteristics of our matching market are in line with the predictions of the theoretical model proposed by Vozar (2010).

This also means that we should not include matches that ended just after the achievement of a new class in our analysis of match separations given by unsatisfactory realization of the match quality or finding a better partner: separations that occurred right after the achievement of a new class might be motivated by a different factor. Therefore, we omit such matches from our data as well as all matches that were dissolved for exogenous reasons, which leaves 627 couples to be further analyzed.

We divide these couples who separated for one of the two main endogenous reasons formally into two groups. Dancers in the first group did not find improved new partners; here, we can say with certainty that the cause of separation would be the realization of unsatisfactory match quality. In the second group, at least one of each set of partners found a new partner who was better than his/her current partner. In this group, the cause of separation may be either realization of unsatisfactory match quality or search frictions that impeded the search for the best partner.

We summarize the distribution of the two groups in Figure 2.5.

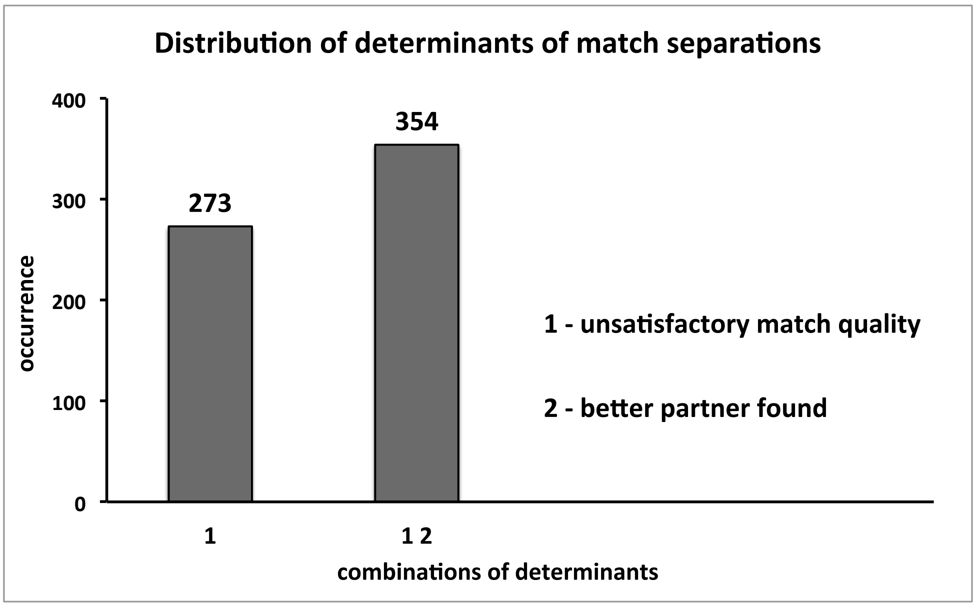


Figure 2.5: Distribution of determinants of match separations

As can be seen, a significant fraction of couples break up due to unsatisfactory realization of match quality. All dancers in the first group and an unknown percentage of the second group fit this description. The remaining percentage of the second group is formed by matches which broke up because at least one of the dancers found a better partner. From our previous analysis, we know that finding a better partner is indeed a significant reason for match separation, but it may not necessarily have been the reason for all matches in the second group. In the rest of the paper, we will provide further evidence that for this group, finding a better partner is not only significant, but is the dominant reason for match separation.

Stability of the Match - Basic Model

Firstly, we will demonstrate the effects of personal and match specific characteristics discussed in previous sections on the hazard of match separation. In particular we use the match quality (expected number of competitions needed to achieve a higher class), the personal quality of both partners and the actual class standings as explanatory variables in a Weibull duration model, which we run separately for each of the two groups of matches. We expect that match quality, defined as the expected number of competitions needed to achieve a higher class will have a negative effect on the match stability, while personal quality should have a positive effect on match stability. The aim of this basic model is to verify this hypothesis and also to see if the effects are different for the two groups.

The resulting marginal effects on the predicted median length of relationship can be found in Table 2.5. Personal quality of the two dancers is represented by dummy variables for the highest achieved class.

We believe this table is informative in two aspects. First, the coefficient on the match quality is significant only for Group 1 and second, the coefficients for personal quality of women are significant only for Group 2. This indicates that differences exist between Group 1 and Group 2. In the following sections, we will explore further the implications of these findings in order to better understand how they are related to our research question and how to develop our model.

Match Quality

The coefficient on the match quality measure is significant and negative for Group 1 only. This indicates that the better the quality of the match, the longer the relationship

		Group 1	Group 2
Match quality		-0.152**	0.003
		(0.068)	(0.040)
Man personal quality dummies	A	12.864**	12.743***
		(5.157)	(3.613)
	B	16.993**	7.659***
		(7.592)	(2.066)
	C	0.471	4.020**
		(3.700)	(1.557)
Woman personal quality dummies	A	3.296	10.178***
		(4.289)	(2.624)
	B	-5.064	8.963***
		(2.986)	(2.178)
	C	0.983	7.036***
		(4.305)	(2.247)
Current class dummies		Yes	Yes
N		273	354

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 2.5: Marginal effects on the predicted median length of relationship

and the smaller the hazard of separation[5]. This is completely in line with the matching theory defining the match quality as an experience good and predicting that the better the revelation of the match quality, the more stable the match. Hence, for Group 1, this result is not surprising.

A more interesting question arises when we focus on Group 2: if the coefficient on the match quality is insignificant, does this mean that dancers in this group are not concerned with the quality of their matches? To answer this question, we need to realize that the match quality, as we defined it, measures the observed couple's performance, and so it is an experience good. Since for Group 2, we expect search frictions to play a role as well,

[5]Since our measure of match quality is the expected number of competitions needed to achieve a higher class, the lower the value, the better the quality of the match.

an insignificant coefficient on the match quality would mean the match quality should rather be seen as a search good for matches in Group 2. To support this hypothesis and to further highlight the differences between Group 1 and Group 2, we focus our attention on the coefficients on personal quality of men and women.

Personal Quality

To further identify the differences between Group 1 and Group 2 arising from the Table 2.5 coefficients on partners' personal qualities, we focused at the correlation between personal qualities of both partners. Very strong correlation of 0.74 between these two characteristics for matches in Group 1 has been found. On the other hand, for matches in Group 2, the correlation between personal quality of males and females is only 0.18. We believe that this finding explains the observed non-significance of the coefficients on women's personal quality in Group 1. Further, we compared the structure of matching with respect to personal quality of both partners between Groups 1 and 2. The respective histograms for each group can be found in Figure 2.6. They represent the matching within the old match (the match that is going to be dissolved) by the highest achieved class.

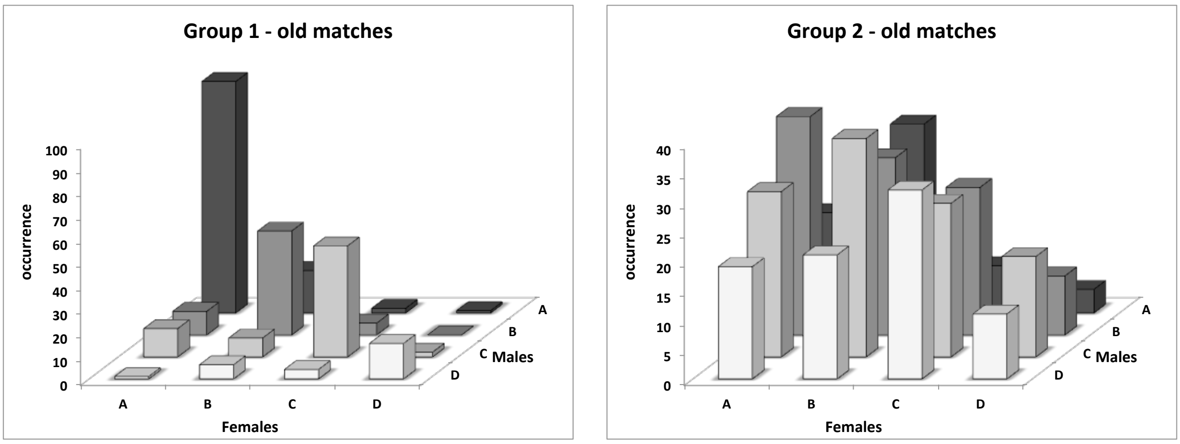
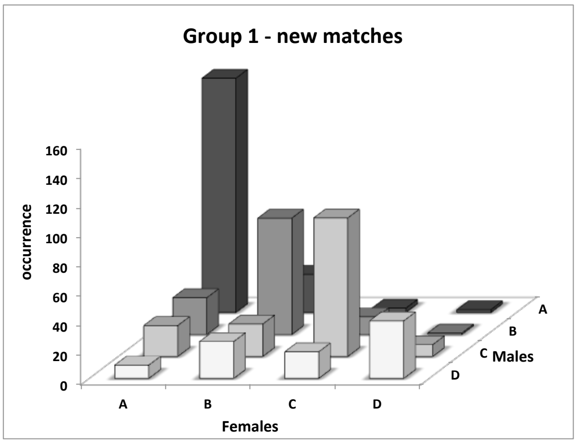


Figure 2.6: Matching Structure by Highest Achieved Class of Each Partner

As can be seen in this figure, there are clear differences between Group 1 and Group 2. Among couples that separated due to unsatisfactory match quality, there are only a handful of couples outside of the main diagonal. On the other hand, the distribution of matching in Group 2 provides a completely different picture of the structure of matching with a significant number of matches formed outside of the main diagonal as well. This suggests that a relationship may exist between the presence of search frictions as a cause of separation and a significant number of "mismatched" couples. To further support this



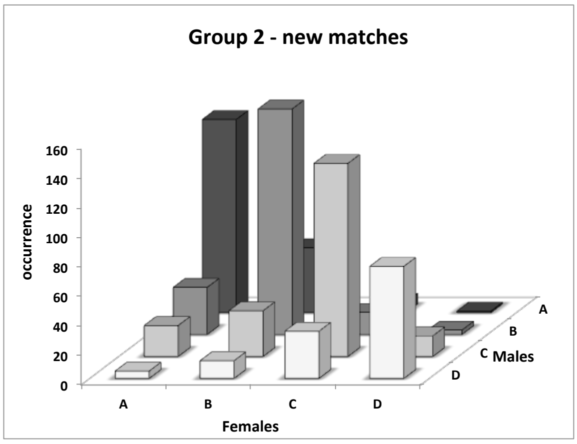


Figure 2.7: Matching Structure by Highest Achieved Class of Each Partner

finding, we illustrate in Figure 2.7 the structure of new matches which originated from these separations, both in Group 1 and Group 2.

A comparison of the old and consequent matches for Group 1 in Figures 2.6 and 2.7 shows that the structure of matching remains approximately the same. On the other hand, for Group 2, a clear positive assortative matching structure emerged in Figure 2.7 as opposed to Figure 2.6, suggesting that individuals in "mismatched" couples found a more appropriate partner with respect to their personal quality in the next iteration of matching. This result corresponds with the predictions of matching and search models and strengthens our belief that the presence of the search frictions is a dominant cause of separation for matches in Group 2.

Stability of the Match - Extended Model

Thus far, we have observed that Group 1 and Group 2 represent fundamentally different matches. As noted earlier, our ability to ex-ante distinguish the cause of breakup in Group 2 is limited. The measure of breakups due to the two discussed reasons may not, therefore, be exact. However, the results obtained lead us to believe that majority of matches in Group 2 dissolved due to the presence of search frictions and thus the division of matches into Group 1 and Group 2 fairly corresponds with the division of matches with respect to the cause of match separation. To reiterate, in Group 1 matches are formed mostly between partners of comparable personal quality and the stability of the match is influenced significantly by the competition results. This suggests that dancers in Group 1 see the match quality as an experience good. On the other hand, in Group 2 a very high proportion of mismatched couples with respect to their personal quality has been identified. This suggests that dancers in Group 2 broke up due to search frictions and on-the-job search.

To further support these findings, we decided to add a new explanatory variable into our model to reflect the chance of finding a better partner. This variable should indicate the outstanding quality of some dancers who have a relatively higher chance to be distinguished as good potential partners, reducing thus the problem of search frictions identification. Our hypothesis is that, while for the first group of match separations this indicator should not matter, since the first group includes only matches that dissolved due to unsatisfactory match quality, for the second group it should be very relevant. We believe the matches in Group 2 are influenced by search frictions, but for individuals with outstanding qualities these frictions might be reduced and the dancers might have a higher chance to find a better partner or to be found by a better partner to form a new match.

The construction of this new explanatory variable is built on the following reasoning. To succeed in finding a better partner or being found by a better partner, individuals have to signal they are performing better than others with comparable observables. Thus, we first create a matching with respect to the personal quality of both partners, the class in which they are dancing and the number of competitions attended in the current class; this means we divide the couples into categories so that within each category, the combination of these characteristics is the same for all couples. Within each such category, we construct a ranking of couples based on their performance (expected number of competitions needed to achieve a higher class). Since this ranking concerns only comparable couples within a category, we call it "relative ranking". To make interpretation easier, we define the relative ranking in descending order, i.e. so that the higher the relative ranking, the better the couple and the greater the chance to find a better partner.

Finally, we incorporate this newly constructed explanatory variable into our Weibull duration model to test its effect on the hazard of separation. We control again for the match quality, for the personal qualities of both partners, and for the actual class the couple is competing in. The results represented as marginal effects on the predicted median length of relationship can be found summarized in Table 2.6.

		Group 1	Group 2
Match quality		-0.163**	-0.005
		(0.070)	(0.040)
Relative ranking		-0.030	-0.026*
		(0.025)	(0.014)
Man personal quality dummies	A	12.518**	12.717***
		(5.150)	(3.633)
	B	16.582**	7.713***
		(7.566)	(2.066)
	C	0.106	3.978*
		(3.676)	(1.567)
Woman personal quality dummies	A	3.784	10.254***
		(4.365)	(2.658)
	B	-4.792	8.954***
		(3.061)	(2.197)
	C	1.436	7.003***
		(4.499)	(2.266)
Class Dummies		Yes	Yes
N		273	354

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 2.6: Marginal effects on the predicted median length of relationship

As can be seen in this table, the results support our claim that the relative ranking among peers does not play a significant role in match separation in Group 1, whereas in Group 2, the significant coefficient on relative ranking variable suggests that more outstanding the couple, the higher chance that they will break up. The sign and the significance of the remaining coefficients remain unchanged. This again supports our hypothesis that a dominant fraction of matches in Group 2 break up due to the presence of search frictions.

Overall, our results tell us that matches in Group 1 and Group 2 are of a very different nature. In the second group, we have a high proportion of mismatched couples, who could not find their ideal partner from the beginning due to search frictions (as explained in Section 2.5.1). These couples engage in on-the-job search (shown in Section 2.5.1), which results in finding a better partner, especially if the couple is of outstanding quality among their peers (proven by negative impact of relative ranking on the match stability).The structure of the new matches created after finding a better partner resembles much more closely the structure of Group 1, where couples are formed by individuals with comparable personal quality. The stability of these matches is then influenced by their joint performance, which determines the quality of the match. If this quality proves to be too low, the couple is likely to break up.

This description of formation and separation of matches summarizes the results of the analysis we provided in this paper. It shows that both search frictions and initial uncertainty about match quality are relevant and realistic causes of match separation, and that both of them should be taken into account in the matching market literature.

2.6 Conclusion

This paper aims to contribute to understanding of different determinants of match separation proposed by matching market theory. We focused particularly on two main causes of match separation search frictions and initial uncertainty about match quality, which are described in theoretical literature and which are tested in the context of marriage and labor markets. We claim that in these markets, it is difficult if not impossible for the researcher to observe the objective match quality and therefore it is problematic to assess its impact on the stability of the match.

To add a new perspective to this issue, we used a unique dataset containing records from Czech ballroom dancing competition. Ballroom dancing is a particular matching market that mimics several important characteristics of a marriage market: monogamous couples of individuals of opposite gender are formed in order to perform a common task from which both partners derive their utility. In addition, in this market, the performance of the couple is evaluated regularly by referees of competitions in which the couples participate, which provided us with a measure of objective match quality and its evolution over time. Moreover, we were able to observe the individuals' performance over their whole career and assess information about their potential talent.

After excluding exogenous causes of match separations such as the end of the career or migration to another city, we identified over 600 matches that ended due to the two determinants of match separations that are proposed by theoretical. Further, we were able to divide these matches into two groups of approximately the same size. Through a series of different test, we provided conclusive evidence that, whereas the first group contained only those matches that ended due to the unsatisfactory realization of match quality, in the second group, the dominant reason for match separation was the "on the job search" for better partner caused by the presence of search frictions.

These results lead us to believe that indeed both prevalent theories of match separation discussed in the theoretical literature, namely search frictions and initial uncertainty about match quality, are valid at least in our setup and both of them should be taken into account when match separations are studied.

Chapter 3

Marriage Dot EU: The Effect of Internet Usage on Marriage Hazard

3.1 Introduction

Over the last two decades, the Internet has become truly widespread, and there is no doubt that these new means of communication have influenced and profoundly changed many substantial aspects of our lives. Email usage has become standard, online dating sites have multiplied, and the popularity of social networks has been growing spectacularly. This is all evidence of the noteworthy role that online communication plays in our lives nowadays and of the very different opportunities we have now as compared to some twenty years ago.

Young people are known to be most likely to fully exploit these opportunities, and there are several ways in which the means of online communication may make their lives both easier and richer as compared to the generation of their parents. One particular situation might be the search for a life partner, who no longer must be found in ones' real-life surroundings, but who might be encountered on the Internet first. There are numerous examples of happy couples who met for the first time on a social network, a discussion forum or other web platform, or who found each other directly through the services of an online dating site. Considering these successfully formed partnerships, it is appropriate to ask whether the growth of Internet usage influences individuals' marital decisions in modern society, which is the research question of my paper.

I contribute to a growing number of studies exploring this topic, both from a sociological and an economic point of view. My study is positioned within the economic stream of literature, and there I present an econometric approach that allows me to estimate the effect of increasing Internet usage on individuals' marital decisions. I use a difference-in-differences identification strategy with a gender and age-specific marriage hazard rate at first marriage as the dependent variable, using across country variation in Internet penetration over the period 1990 to 2008. Extending the paper, I use the obtained results to shed some light on the effect of the increasing Internet usage on the divorce rate.

There are certainly many aspects of marriage that Internet usage can influence, but I decided to concentrate mostly on the beginning of the marital process. I am particularly interested to see if the reduction of search costs, given by the fact that through the Internet, more potential partners can be reached in a significantly shorter time, leads people to marry sooner or later. Both outcomes can be supported by the marriage market theory since reduced search costs allow people to meet acceptable partners sooner, but they also make it less risky to postpone the decision and to wait for even more suitable candidates. The results of my analysis confirm the latter hypothesis.

The paper is organized as follows. In Section 2, I provide a review of literature relevant to my research, Section 3 concentrates on the specification of my econometric model, and Section 4 contains a detailed description of the data I am using for my analysis. In Section 5, I summarize the results of the baseline model and provide further theoretical explanations to support them. In section 6, I present two extensions that further improve my analysis: cohort specific cumulative Internet exposure and the analysis of the effect of Internet usage on the divorce rate.

3.2 Literature review

The propagation of the Internet and the consequent enrichment of the means of communication bring one of the biggest changes ever to social interaction. Therefore, it is no surprise that a growing number of academic studies aims to describe and understand this phenomenon, presenting it under various aspects and from different points of view.

One of the many facets of this issue is the impact of increasing Internet usage on the interaction between potential marital partners, at the beginning as well as in the course of their relationship. Thus, we can find many papers, both in sociological and economic fields, that concentrate on the effect of the Internet on the market for romantic partners.

The first issue to be addressed here is the impact of the Internet on social interaction in general. Putnam (2000) argues that the expansion of modern communication technologies, like TV consumption or Internet usage, results in the decline of social capital. In other words, the author claims that the use of modern technologies crowds out social participation. Therefore, put into the marriage market perspective, one could argue that the decline in social participation would result in fewer marriages over time. However, the empirical study by Bauernschuster, Falck, and Woessmann (2011) found no evidence that use of the Internet reduces social capital. On the contrary, the authors found a positive effect when the Internet is used to purchase or reserve tickets for cultural events. These findings thus support the view of the Internet as an influential communication tool with a potential to influence our personal lives and our romantic relationships, too.

Various studies in sociology (Merkle and Richardson (2000), Underwood and Findlay (2004), Young et al. (2000)) compare what are called computer mediated relationships with face-to-face relationships. All authors agree that as access to the Internet service increases, the number of computer mediated relationships grows as well. For what concerns the nature of these "online" relationships, in their study conducted on a sample of 75 adults, Underwood and Findlay (2004) stress especially the intimacy and the importance of the relationship perceived by the subjects of the study. Similar to these authors, Merkle and Richardson (2000) conclude that individuals often describe their online relationships as intimate and as authentic as face-to-face relationships. Further parallels between online and face-to-face relationships were confirmed by Hitsch, Hortacsu, and Ariely (2010), who compared the distributions of partners' characteristics under both arrangements and found no difference. Hence, the computer-mediated relationships can be considered as substitutes for face-to-face relationships, and moreover, as Merkle and Richardson (2000) point out, there is an increasing trend to use the Internet as a medium for finding a romantic partner. This is why both researchers and policy makers should acknowledge and prepare for the increasing role of the Internet in the personal lives of individuals.

While sociologists concentrate mainly on the individuals' perception of online relationships and their comparison with face-to-face relationships to find what the effect of the Internet is on the marriage market, economists regard the growing Internet access mainly as a shock to the matching function. Stevenson and Wolfers (2007) see the Internet as a shock, expanding the pool of potential partners on the one hand, but increasing anonymity on the other hand. While the first effect may be of great importance for those looking for a partner, and it may foster the number and the quality of created matches, the increased anonymity may encourage those engaging in infidelity, and thereby contribute to increased match separation. Indeed, as the authors point out, the data reveal that a significant number of online dating site users are currently married. The authors themselves acknowledge that the Internet may have various effects on the marriage market, and that it is unclear whether the decline in the search costs would result in matches with higher quality and what the final effect on marriage and divorce rates would be.

The contradictory effects the Internet may have on the marriage market are extensively summarized in Kendall (2010), whose hypotheses follow closely from Becker (1973). Kendall tried to estimate the effect of Internet usage on the divorce rate. He did not find its usage to have a significant effect here, but he discussed several reasons explaining the obtained results. While there is no doubt that the expansion of the Internet lowers search costs, it is not clear whether it reduces or increases the time people spend searching for a marital partner. As Becker (1973) argues in his seminal paper, the decline in search costs should lead to longer searches and better quality of matches since it is more affordable to wait until a good match is found. On the other hand, Kendall claims that forward-looking individuals may enter even a potentially less satisfying marriage because they are unafraid of the negative effect of divorce since they believe that the chances of finding a good match later on are higher. This would result in individuals lowering their acceptance threshold and continuing to search for a better partner while matched.

The very recent study by Bellou (2013) illustrates the Internet's potential to influence individuals' marital decisions. The author focused her attention on assessing the effect of broadband Internet diffusion on the probability of marriage in the US. Her findings show that Internet expansions resulted in an increase in marriage rates among the studied population of 21-30 years old. In addition, Bellou claims that Internet has crowded out other traditional means of finding a partner. However, the role of Internet in finding a romantic partner is not limited to the online dating sites, but includes other opportunities like email communication or social networking. Nonetheless, even Bellou states that while Internet has a clear potential to influence family formation, its long-run effects, especially on the stability of realised matches, is still unknown and potentially ambiguous.

To sum up, the potential of the Internet to transform the market for romantic partners is indisputably acknowledged by the majority of authors working in this field. However, these authors also agree that it may be too early to assess the definite result of this transformation. I share this point of view especially with respect to the effect of Internet on the stability of matches. Marital stability is not only threatened by the broadened scope of outside options available to Internet users in the case of divorce. Intuitively, marital stability also depends on the quality of the match. If Internet usage influences the quality of the match as well, it may take some time until we will be able to evaluate fully the effect of Internet usage on issues such as marital stability and divorce rate.

However, this also shows why it is important to understand how the initial match formation is influenced by the growing usage of the Internet, which is a question that has been somehow overlooked in the existing empirical literature. My paper aims to fill this gap.

3.3 The Model

My empirical work is inspired by the approach of Kendall (2010), who analyzed the effect of the Internet on the divorce rate in the US. For reasons explained in the previous section, I explore the relationship between the Internet and match formation, and I study the impact of growing Internet usage on the marriage hazard rate.

I suspect *a priori* Internet usage to have two opposite effects. This is because while Becker argues that the decline in the search costs caused by growing Internet usage should lead to longer searches and better quality matches, one can also come up with an alternative hypothesis. As it is cheaper and especially easier to search for a suitable match, young potential marital partners in particular may become less afraid of the difficulties of finding a new partner should their marriage end in divorce. This may, contrary to Becker's prediction, lead to shorter searches and potentially a worse quality of matches. Taking into consideration both theories, one can argue that the effect of the Internet may shift the marriage hazard rate either way, upwards and downwards, and this shift may depend on the age of those looking for a marital partner. My analysis should show in which direction the overall influence goes and how it depends on the potential partners' age.

To identify the effect of Internet usage on match formation, I focus on gender and age-specific marriage hazard rate of those marrying for the first time. I estimate the effect of the growing Internet usage on the marriage hazard rate for every age at first marriage independently. Thus, my basic specification, conditional on gender and age at first marriage is

$$
\begin{aligned}
ln\left(marriage\, hazard_{i,t}^{age,gender}\right) \;&=\; \alpha^{age,gender}\ln\left(Internet\, access_{i,t}\right) + \beta X_{i,t}^{age,gender} + \\
&+ \gamma_i^{age,gender} + \mu_t^{age,gender} + \varepsilon_{i,t}^{age,gender},
\end{aligned}
$$

where i is the country index, and t is the time index. Further, $X_{i,t}$ denotes the vector of other controls, and γ_i and μ_t denote country- and year- fixed effects, respectively. I use country fixed effects to control for potential cultural differences between countries that may influence both computer literacy and marriage patterns, and I add time fixed effects to remove a time trend, which I suspect drives many changes in modern society, and which I assume to be common to all countries.

Inspired by the work of Kendall (2010), I include among my controls the unemployment rate, the real GDP per capita, income inequality and also in some specifications the share of tertiary educated in the population with all covariates used in logs. The unemployment rate and real GDP per capita should clearly have an impact on marital decisions, as was demonstrated in the theoretical model of Bergstrom and Bagnoli (1993). The decision to control for the effect of income inequality is motivated by two studies. First, Gould and Paserman (2003) discussed the effect of income inequality on marriage rates as well as length of search. They found higher male income inequality results in lower females' marriage rate and a longer search for their first and second husband. In addition, the study "A Nation Online" by the U.S. Department of Commerce (2002), found that the Lorenz Curve measuring inequality in Internet usage at home against income has a similar shape as the traditional Lorenz Curve computed for income inequality. This suggests that differences between countries reflected by their Gini coefficients have the potential to explain the mechanism of Internet usage as a tool for searching for a future spouse. Since I suspect that this mechanism can also directly depend on the level of inequality, I control for the interaction between the Gini coefficient and Internet usage. Finally, accounting for the effect of tertiary education in all specifications except one enables me to control for the generational shift in the delayed age at first marriage.

3.4 Data Description

I use the country level data for European countries from 1990 to 2008. To identify the effect of growing Internet usage on first time marriages, I construct my dependent

Table 3.1: List of European countries used

Western	Northern	Southern	Central-Eastern
Belgium	Denmark	Italy	Bulgaria
Germany	Finland		Croatia
Luxembourg	Norway		Czech Republic
Netherlands	Sweden		Hungary
Switzerland			Latvia
United Kingdom			Lithuania
			Poland
			Romania
			Slovakia
			Slovenia

variable; the gender and age-specific marriage hazard rates using data from the Eurostat New Cronos database available through the Eurostat homepage. This data is based on the annual demographic collection carried out by Eurostat from national statistical institutes. For each country and each year, I have information on separate cohorts, mainly the number of people that were single (and never married before) as of the 1st of January, and also the number of people that married for the first time in the given year. I consider age at marriage from 20 to 49 years, and I compute the marriage hazard rates for each age at first marriage as the share of the number of first marriages relative to the number of singles. I construct these variables separately for men and for women, and so the corresponding formula can be written as

$$marriage\,hazard_t^{age,gender} = \frac{\#\,first\,time\,marriages_t^{age,gender}}{\#\,never\,married_t^{age,gender}}. \tag{3.1}$$

Due to constraints with data availability for the whole period of 1990 to 2008, the analysis relies on data from 21 European countries with 225 data observations in each age category above age 18. Following Kalmijn (2007), these countries can be divided into four regions based on their marriage patterns: Western, Southern, Northern, and Central-Eastern Europe. Individual countries belonging to each group are listed in Table 3.1.

At this point, it is important to address the question of different marriage patterns across European countries. Kalmijn (2007) claims that there are significant differences in some aspects between marriage patterns across European countries. He finds that age at first marriage, which is closely related to the age-specific marriage hazard rate, is the highest in Northern Europe with average age at first marriage being almost 28 years of age. On the contrary, it is the smallest in Central-Eastern Europe, averaging at only slightly more than 22 years of age. This difference is clear in Figures 3.1 and 3.2 in which I plot age-specific marriage hazard rates for representative countries from the four regions first in 1995 and then in 2007, and it justifies my decision to include in my model country fixed effects. Moreover, the two figures show that between the years 1995 and 2007 there was a significant shift in marriage hazard rates: in all countries, both men and women postponed their decision to enter marriage. More importantly, it should be noticed in the two figures that the character of differences between countries seems to be the same before and after the shift. To qualitatively support this claim I computed mean age at first marriage for these representative countries from four European regions, both in 1995 and 2007. Even in 2007 the differences in age at first marriage between central and eastern European countries and the rest of the Europe were much smaller, the ordering of countries with respect to the mean age at first marriage did not change. This allows me to assume that the time trend is common for all countries in my sample, and so, that country and common time fixed effects are sufficient to capture the general dynamic of the process[1].

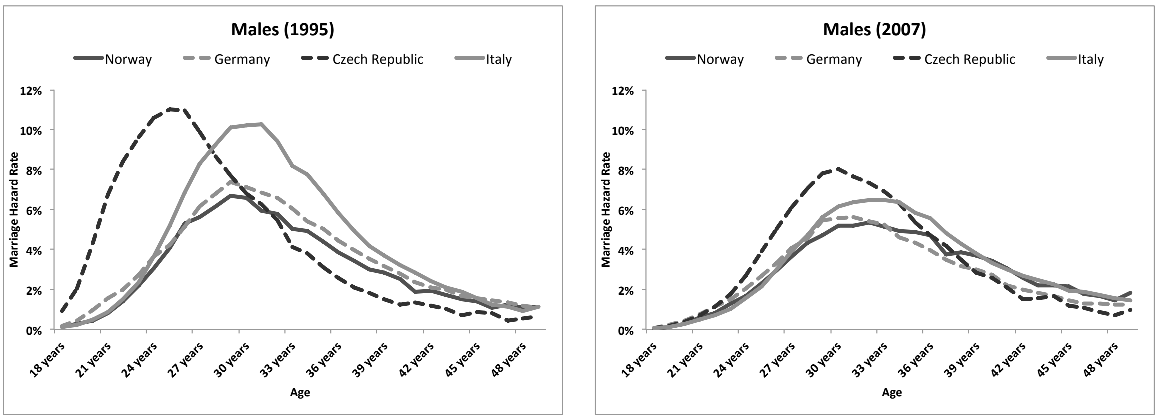


Figure 3.1: Hazard Functions for First-time Marriages (Males)

For what concerns the Internet usage, which is the variable of interest in my model, I obtain it from the macro level ICT Statistics Database constructed by the International Telecommunication Union, agency of United Nations. Since it is impossible to identify

[1]Note that this assumption is further verified by a robustness check presented in the results section.

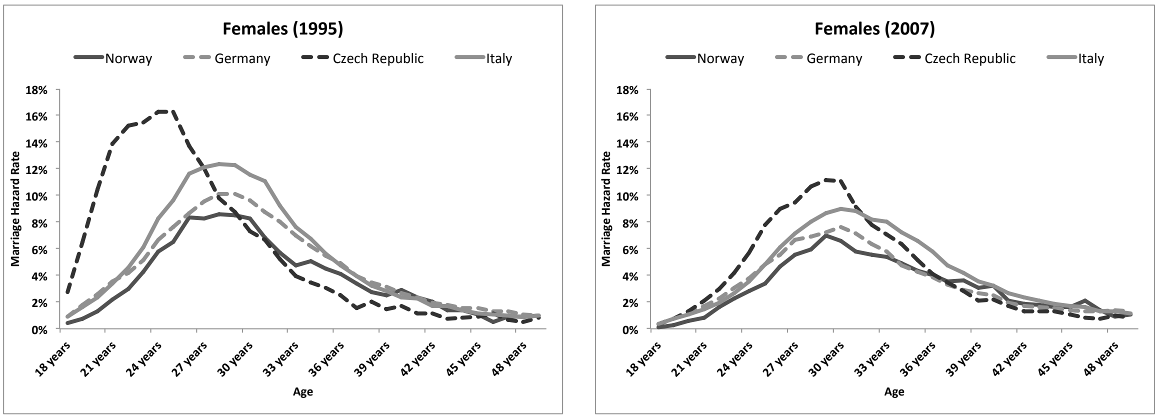


Figure 3.2: Hazard Functions for First-time Marriages (Females)

whether the Internet is used specifically as a tool for looking for a romantic partner or not, I have to rely on a variable describing the percentage of Internet users for a given country and year accessible through the UN database. However, I am positive that the assumption of a proportional relationship between the general usage of the Internet and usage of the Internet for romantic purposes is reasonable enough.

The list of control variables that completes the constructed dataset consists of male and female unemployment rates, real GDP per capita, the Gini coefficient index, and the share of population possessing tertiary education conditional on age. All these variables with the exception of the Gini coefficient index are also taken from the Eurostat New Cronos database available through the Eurostat homepage. The Gini coefficient index is a compound of the data available at Eurostat with a unique dataset constructed by the United Nations University, World Institute for Development Economics Research, which unifies data on income inequality from a vast number of studies and surveys (available at http://www.wider.unu.edu/research). The Gini coefficient for the analyzed countries can be found in Table 2.

The evolution of the percentage of Internet users is presented in Table 3. As expected, in all countries Internet usage grows from almost zero at the beginning of the 1990s to, in some cases, almost 90% at the end of the last decade. However, even at the end of the analyzed time period, Internet penetration differs significantly across countries, with the percentage of Internet users in Scandinavian countries representing almost double the percentage of Internet users in Southern Europe or in post-communist countries.

Summary statistics for the remaining explanatory variables can be found in Table 4 with mean and standard deviation computed over the analyzed time period.

3.5 Results

In this section, I discuss the estimation results obtained from the empirical model defined in section 3. I present two main specifications, referred to as Model 1 and Model 2. As a robustness check, I also use an additional specification labeled Model 3. The three specifications differ mostly in ways in which they address concerns about the estimated relationship between the Internet usage and the marriage hazard rate being driven purely by long-term time trends. All models are estimated separately for the two genders and for all cohorts starting with the age of 20 and ending with the age of 49. Standard errors are clustered at country level in all cases.

The first specification, presented as Model 1, includes the percentage of Internet users, a gender-specific unemployment rate, real GDP per capita, the Gini coefficient, and the interaction between the percentage of Internet users and the Gini coefficient as explanatory variables for the marriage hazard rate. Time and country fixed effects are included as well. The results are presented in Tables 6 and 7 for males and females respectively. We observe that the Internet usage has negative impact on the marriage hazard rate for younger cohorts, whereas some positive impact for older cohorts can be found in the case of males. The signs of the other controls are as predicted by the marriage market theory. The interaction term between Internet usage and the Gini coefficient is of the opposite sign as the coefficient for Internet usage only, signaling that the effect of the Internet is stronger in countries with lower inequality. This can be explained when we take into account the finding of Fuchs (2009), who claims that in countries with higher inequality, the actual usage of the Internet is less intensive even if the percentage of users might be relatively high. The author explains that the Internet, as opposed to other technologies, requires not only an initial investment but also entails recurring charges, which make it more difficult to benefit fully from Internet services for people from the lower tail of the income distribution.

In the second specification, presented as Model 2, I add to the controls the percentage of the tertiary educated in a given gender and age group that acts as a proxy for the generational change, which may influence marital behavior in a more complex way than the common time trend represented by time fixed effects (which are still used in this model, as well as the country fixed effects). The results are presented in Tables 8 and 9 for males and females respectively. They are very similar to those of Model 1 for what concerns the coefficients of Internet usage and other controls. The education coefficient is negative and significant for those in their late twenties, confirming the hypothesis that more educated people tend to postpone the marriage.

The third specification, presented as Model 3, serves as a robustness check. In terms of control variables, it is the same as Model 2, but it does not include country and time fixed effects as such. Rather, it accounts for the country-specific linear time trends. It is important to stress that country-specific trends in this specification capture most of the variation and thus leave very little explanatory power to the covariates. Despite this fact, the results presented in Tables 10 and 11 suggest that the effect of the Internet goes in the same direction as in Model 1 and Model 2, only the standard errors are too large for the coefficients to remain statistically significant, with the exception of a few age categories for males.

It has to be noted that aside from the three mentioned models, I tried even a non-linear specification for Internet usage with not only the interaction term between the Internet and the Gini coefficient but also with higher orders of these variables. This did not induce any major changes to the results, and so finally, I account only for the linear effect of Internet usage and for the interaction term.

Because this interaction term is statistically significant, it is clear that the influence of Internet usage on the marriage hazard rate is non-linear and cannot be expressed only by the coefficient corresponding to the Internet usage. This is why I report the marginal effect of Internet usage computed at the mean Gini (which equals 29.37) in Table 5. The results are presented for all three specifications and confirm the similarity of Model 1 and Model 2 as well as the loss of significance in Model 3.

I will consider Model 2 as my main specification for further discussion and more detailed presentation of the results. I believe it is parsimonious enough so that the explanatory power of my variable of interest is not diluted as in Model 3, but that it controls better than Model 1 for the generational change, which might possibly drive both Internet usage and marriage patterns. Hence, Model 2 probably offers the best identification of the effect for which I am looking for.

In Figure 3.3, I graphically represent the marginal effects of Internet usage estimated in Model 2 for both males and females with a 95% confidence interval included. We can see there that the Internet usage or rather the decrease in search costs caused by the increasing use of the Internet has a negative effect on the marriage hazard rate for certain age categories. This negative effect is largest at the age of 21 for both males and females and slowly decreases to zero in subsequent years. The effect of Internet usage is not distinguishable from zero at the 95 % confidence level for the age groups of 28 and older in the case of males and the age groups of 26 and older in the case of females. When comparing the two genders, we can say that the effect on the marriage hazard rate of males is only slightly larger in absolute value, which supports the claim that there is not much of a gender gap in the way the Internet is used for social communication.

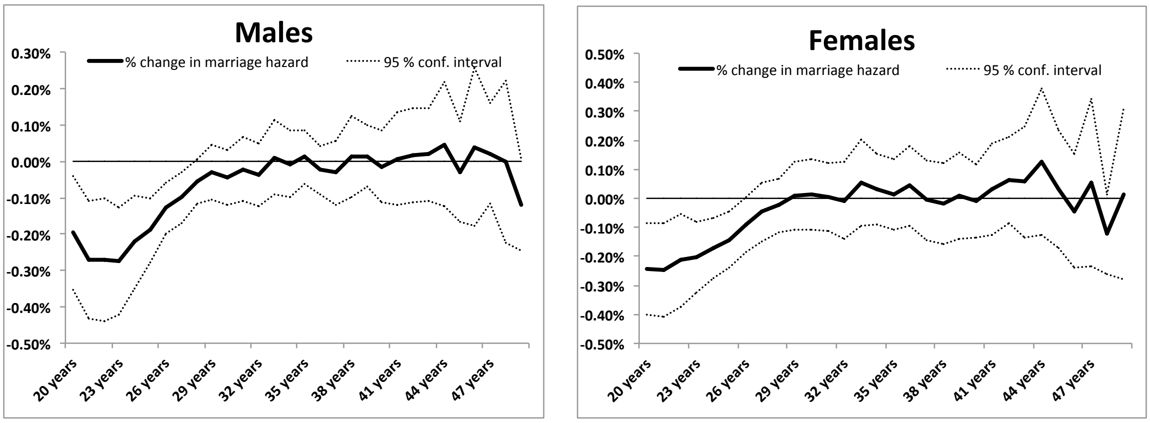


Figure 3.3: The percentage change in marriage hazard caused by an increase in Internet usage by 1 percent

To further illustrate the overall effect of the Internet on the marriage hazard rate over the analyzed time period, I present Figure 3.4. First, I construct the baseline marriage hazard curve as the average marriage hazard rate in year 1995 when the Internet usage started to grow (solid black line). Then, I construct the same for the year 2008 (solid grey line). Finally, I recompute the marriage hazard curve as it would be in 1995, but with the levels of Internet usage as in 2008 (dashed black line). The comparison of these curves helps me to contrast the overall shift in the marriage hazard rate and the part of the shift that we can attribute solely to Internet usage growth.

It is clear from Figure 3.4 that the Internet usage contributes only a fraction of the overall shift towards a higher age at first marriage. Moreover, this figure helps to address potential concerns about the identified effect of the Internet usage being driven mostly by the overall shift in the marriage hazard rate over the years. If it was so, the effect of the Internet would simply shift the whole curve for all age cohorts because this is exactly how the overall pattern changed between the years 1995 and 2008. The marriage hazard rate as such decreases until the age of 30 and increases in subsequent years, whereas the effect of Internet usage was identified to be significant only until the age of 27 in the case of males and 25 in the case of females. This means that the modification of the curve given by the growth of Internet usage does not simply mirror the overall shift, but

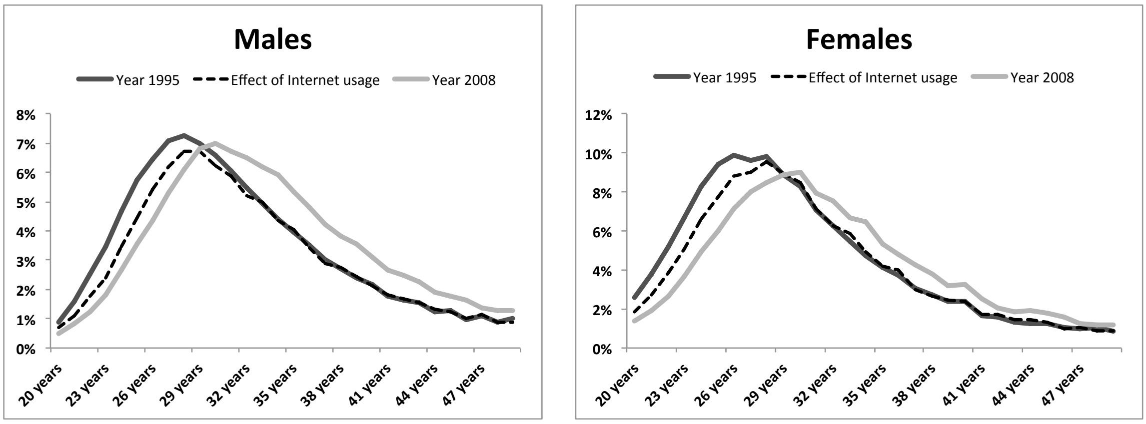


Figure 3.4: Marriage hazard shift attributable to the Internet usage change between the years 1995 and 2008

accounts for a part of what happens with younger cohorts.

This allows me to believe that Internet usage has an effect on marital decisions for those in their twenties. The negative sign of the effect suggests that the decrease in the search costs caused by the increasing role of the Internet in personal lives supports Becker's claim of consequently longer searches and hence potentially, better quality of matches.

3.6 Extensions

Although the analysis presented so far basically answers the research question of my paper, there are several ways how it can be extended and complemented by examining the issue from a different perspective. In this section, I will provide two such perspectives that will shed new light on the studied issue. First, I slightly transform my treatment variable (Internet penetration) in order to take into account that different cohorts may be exposed to the Internet in different ways, and second, I complement my analysis of marriage patterns by briefly also discussing the issue of divorce rate.

3.6.1 Cumulative Internet Usage

So far, I estimated my model using Internet usage at the time of marriage as the explanatory variable. As an alternative to this approach, inspired by Donohue and Levitt (2001), I calculate the cumulative Internet usage as the explanatory variable of interest. To do so, I first transform the data to the cohort level and thereafter for each cohort the cumulative exposure to the Internet is computed. However, since I am interested in the effect of Internet usage on the person's search for romantic partner, I computed the cumulative exposure as the sum of Internet usage only after the person in the given cohort reached age 17. The altered specification, conditional on gender and age at first marriage is

$$\begin{aligned} ln\left(marriage\, hazard^{age,gender}_{i,cohort}\right) &= \alpha\ ln\left(cum.\, Internet\, access_{i,cohort}\right) + \beta X^{age,gender}_{i,cohort} + \\ &+ \gamma^{age,gender}_{i} + \mu^{age,gender}_{cohort} + \varepsilon^{age,gender}_{i,cohort}, \end{aligned}$$

where i is the country index, and *cohort* is the cohort index. Further, $X_{i,cohort}$ denotes the vector of other controls, and γ_i and μ_{cohort}, state- and cohort- fixed effects, respectively. Again, I use country fixed effects to control for the potential cultural differences between countries that may influence both computer literacy and marriage patterns, and I add cohort fixed effects to remove a time trend, which I suspect drives many changes in modern society and which I assume to be common to all countries. These fixed effects operate in the same way as those in my previous specification.

Based on my conclusions from the previous section, I estimate the model using only the second specification. Thus, I control for the percentage of the tertiary educated in a given gender and age group to proxy for the generational change. The remaining explanatory variables remain the same as in the previous section (real GDP per capita, the unemployment level, the Gini index, and the interaction between the Gini index and cumulative Internet usage. I present the results in Tables 12 and 13 for males and females, respectively. The estimation results are both qualitatively and quantitatively similar to those of Model 2 for what concerns the coefficients of Internet usage and other controls.

Because of the interaction term between cumulative Internet usage and the Gini index, the influence of Internet usage on the marriage hazard rate is nonlinear and cannot be expressed only by the coefficient corresponding to the Internet usage. This is why I again present also the marginal effect of Internet usage computed at the mean Gini (which equals 29.37) in Table 14 . Again, the results are comparable to those obtained using the Model 2 specification in the previous section. I graphically represent marginal effects of Internet usage for both males and females with a 95% confidence interval included in Figure 3.5. It is clear that the corresponding graphs, representing the estimating effects, are almost the same in size and structure to those presented in Figure 3.3.

The results presented in this section strengthen my belief that Internet usage has an

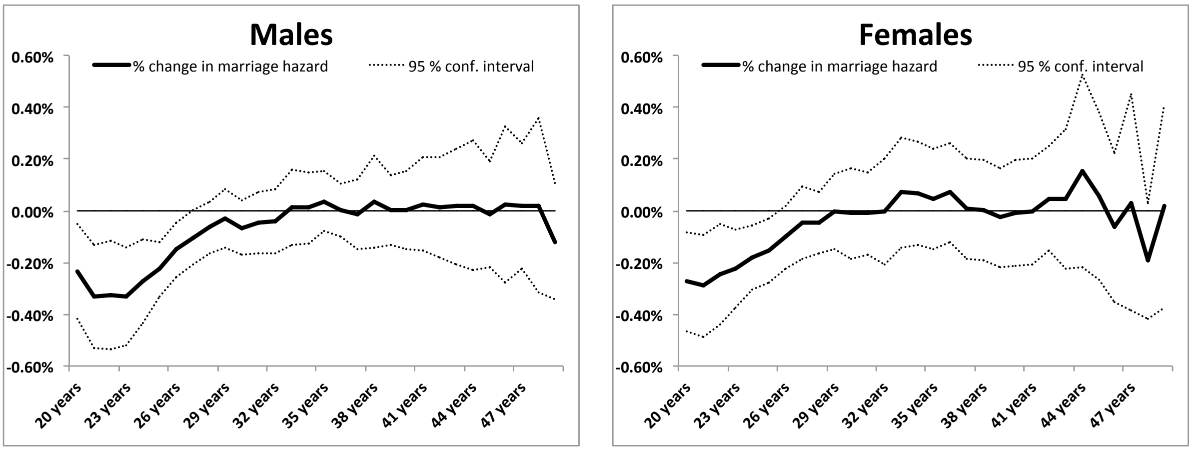


Figure 3.5: The percentage change in marriage hazard caused by an increase in Internet usage by 1 percent

effect on marital decisions for those in their early twenties. To reiterate my previous claim, the negative sign of this effect suggests that the decrease in the search costs caused by an increasing role of the Internet in personal lives supports Becker's claim of consequently longer searches and potentially better quality of matches.

3.6.2 Divorce Rate

The main aim of this paper has been to answer how the decrease in search costs caused by an increasing role of the Internet in personal lives influences marriage hazard. The results support Becker's theory which suggests longer searches and potentially better quality in realized marriages. In addition to the presented analysis, this result gives me an opportunity to shed some light on the direct effect of the Internet on the divorce rate. As I already argued, the estimated effect of Internet usage on the divorce rate is, in the long run, a composition of direct as well as indirect effects. Thus, it makes it very difficult to make any inference about the sign and size of the direct effect I am interested in. This issue was discussed by Kendall (2010), who estimated the effect of Internet penetration on the divorce rate. One of the potential reasons for Kendall's non-significant results is the fact that the direct and indirect effects influence the divorce rate in the opposite directions and thus they canceled out.

The analysis I performed with respect to the effect of Internet usage on the marriage hazard rate allows me to assess the direction of the indirect effect of Internet usage on the divorce rate. If Becker's theory is to be believed, a longer search time which I confirmed should eventually lead to a better quality of matches and thus result in a lower divorce rate. However, before making any inference about the direct effect of Internet usage on the divorce rate, the overall effect has to be estimated. Using the country level Eurostat data on divorce rates, I estimate the overall effect using the same set of explanatory and control variables as in the Model 2 specification.

The results are presented in Tables 15 and 16. The marginal effect of Internet usage on the divorce rate is found to be significant at the 1% significance level and most importantly has a positive sign. It means that overall Internet usage increases divorce rate. However, since the indirect effect of the Internet usage strengthens marital stability if Becker's theory is to be believed, the direct effect of the Internet usage on the divorce rate has to have a negative impact on marriage stability. The intuition behind this result may lie in the increased prospects the Internet brings to those looking for a new partner, for example in the form of specialized dating web sites or forums.

3.7 Conclusion

In this paper, I contributed to the still limited but already growing pool of literature, which seeks to describe and understand the effects of Internet usage on the marriage market. I concentrated on marriage formation since I believe that it is important to first understand how the Internet affects this particular aspect of the marriage market, which has a crucial impact on the overall quality and stability of the resulting matches. Only with this knowledge will we be able to fully assess the effect of the Internet usage on topics like the divorce rate and others in the future.

I conducted my econometric analysis on a panel of 21 European countries over the time period 1990 to 2008 with the gender and age-specific marriage hazard rate as the dependent variable using both with-in and between cohort approaches. The data allowed me to estimate the impact of Internet usage specific for every gender and age group. I found a negative effect for Internet usage on the marriage hazard rate for males as well as for females in their early twenties. This effect is only slightly stronger for males, but it remains significant until a higher age than in the case of females.

I discussed why the change in marital behavior caused by a decline of search costs attributed to Internet usage may have different explanations for individuals of different ages, and I showed that my results rather confirmed the validity of Becker's theory of longer search times as opposed to other conjectures debated in the literature. Further, following Becker's theory, I was able to estimate the sign of the direct effect of Internet usage on the divorce rate, which I find to have a positive sign. This suggests that the increased prospects from using the Internet for those looking for a new partner have a negative impact on marriage stability.

To conclude, my analysis showed that growing Internet usage has the potential to change the marital behavior of individuals. Even though right now it may be still too early to assess the long-term impact of these changes, future research may bring interesting insight into how they reshape whole marital patterns and especially what the consequences for marital stability in the long run would be.

3.A Appendix 2

Table 3.2: Gini Coefficient Index

country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Belgium			32.47	30.78	30.36	29.00	28.00	27.00	27.00	29.00	30.00	28.00		28.30	26.10	28.00	27.80	26.30	27.50
Bulgaria	23.70	26.20	30.90	31.60	35.30	36.80	34.50	34.40	32.10	30.90	30.80	30.60	34.20	32.20	35.80	33.80	31.20	35.30	35.90
Croatia	27.10	26.70	27.50	26.50				24.62	27.90			29.00		29.00	30.00	30.00	28.00	29.00	28.00
Czech Republic	20.10	22.20	20.71	25.80	23.00	28.20	26.15	23.90	25.80	25.70	27.00	25.00	27.30	27.30	26.80	26.00	25.30	25.30	24.70
Denmark	30.70		25.00			20.00		20.00		21.00		22.00		24.80	23.90	23.90	23.70	25.20	25.10
Finland	25.60	25.10	25.00	26.10	26.10	26.80	27.40	28.50	29.50	25.70	24.00	24.00	26.00	26.00	25.00	26.00	25.90	26.20	26.40
Germany	29.79	29.74	30.84	30.43	30.60	31.86	30.49	30.39	29.82	29.95	29.88	31.75	29.00	28.00	28.00	26.10	26.80	30.40	30.20
Hungary	29.30	29.68	30.40	31.50	33.45	24.30	24.40	25.80	24.30	23.70	26.00	25.00	24.00	27.00	27.40	27.60	33.30	25.60	25.20
Italy		31.73		35.21		33.00	32.00	31.00	31.00	30.00	29.00	29.00	33.30		33.20	32.80	32.10	32.30	31.00
Latvia	24.00	24.70	33.30	28.30	32.50	34.60	34.90	33.60	33.00	33.30	34.00	32.20	35.80	37.90	39.10	36.10	39.20	35.40	37.70
Lithuania	24.80		37.20		35.04	33.34	34.70	34.50	35.70	36.80	35.50	38.20	39.00	39.30	39.40	36.30	35.00	33.80	34.00
Luxembourg		26.77			27.03	29.00	28.00	25.00	26.00	27.00	26.00	27.00		27.60	26.50	26.50	27.80	27.40	27.70
Netherlands	25.80	25.60	25.50	25.70	25.50	29.00	29.00	26.00	25.00	26.00	29.00	27.00	27.00	27.00		26.90	26.40	27.60	27.60
Norway	25.20	25.23	26.00	24.50	25.50	25.84	27.80	28.10	27.20	27.30	28.90	26.70	29.60	26.60	25.20	28.20	30.00	24.20	25.10
Poland	31.00	31.40	32.40	31.70	32.30	32.20	32.90	34.00	32.60	33.40	34.50	34.10	35.30	35.60	36.60	35.60	33.30	32.20	32.00
Romania		24.30	25.20	26.20	26.20	28.70	30.50	30.20	29.40	28.70	30.30	35.30	34.90	35.20	35.90	36.10	36.40	37.80	36.00
Slovakia	21.60	23.30	24.50	23.00			23.70	24.90	26.20	24.90	26.40	26.30	26.70	29.90	25.40	26.20	28.10	24.50	23.70
Slovenia	23.20	26.50	25.90	25.10	24.60	26.40	25.20	24.00	24.30	24.80	24.60	24.40	23.50	24.30	24.00	23.80	23.70	23.20	23.40
Sweden	24.60	23.00	25.20	25.70	28.80	25.60	23.80	25.40	24.20	26.10	29.50	26.30	25.80	25.40	23.00	23.40	24.00	23.40	24.00
Switzerland		33.83	35.96						31.90		31.00	29.70	30.90						
United Kingdom	33.63	33.72	33.86	33.77	32.90	32.00	32.00	30.00	32.00	32.00	32.00	35.00	35.00	34.00		34.60	32.50	32.80	33.90

Table 3.3: Internet Users (%)

country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Belgium	0.00	0.02	0.10	0.20	0.70	0.99	2.97	4.94	7.89	13.77	29.43	31.29	46.33	49.97	53.86	59.81	64.18	69.27	71.25
Bulgaria				0.00	0.02	0.12	0.73	1.22	1.84	2.91	5.37	7.61	9.08	12.04	18.13	19.97	27.09	33.64	39.67
Croatia				0.10	0.27	0.51	0.86	1.73	3.27	4.41	6.64	11.56	17.76	22.75	30.91	33.14	37.98	41.44	44.24
Czech Republic				0.58	1.26	1.45	1.94	2.92	3.90	6.83	9.78	14.70	23.93	34.30	35.50	35.27	47.93	51.93	62.97
Denmark	0.10	0.19	0.39	0.58	1.34	3.83	5.71	11.38	22.67	30.59	39.17	42.96	64.25	76.26	80.93	82.74	86.65	85.03	85.02
Finland	0.40	1.40	1.89	2.57	4.92	13.90	16.78	19.46	25.45	32.30	37.25	43.11	62.43	69.22	72.39	74.48	79.66	80.78	83.67
Germany	0.13	0.25	0.44	0.46	0.92	1.84	3.05	6.71	9.88	20.85	30.22	31.65	48.82	55.90	64.73	68.71	72.16	75.16	77.91
Hungary		0.00	0.05	0.19	0.48	0.68	0.97	1.94	3.89	5.86	7.00	14.53	16.67	21.63	27.74	38.97	47.06	53.30	61.04
Italy	0.02	0.04	0.07	0.12	0.19	0.52	1.02	2.28	4.56	14.38	23.11	27.22	28.04	29.04	33.24	35.36	37.99	40.79	44.53
Latvia							0.81	2.05	3.32	4.39	6.32	7.22	21.94	26.98	38.58	46.26	53.63	59.17	63.41
Lithuania							0.28	0.98	1.97	2.92	6.43	7.18	17.69	25.91	31.23	36.22	43.90	49.90	55.22
Luxembourg	0.00		0.15	0.30	0.50	1.59	5.55	7.14	11.75	17.39	33.89	36.16	39.84	54.55	65.88	70.43	72.51	78.92	82.23
Netherlands	0.33	0.53	1.32	1.97	3.26	6.47	9.65	14.07	22.24	39.18	43.98	49.37	61.29	65.63	69.89	80.79	82.61	85.82	87.42
Norway	0.71	1.41	2.22	2.78	4.15	6.42	18.25	20.42	22.56	24.68	26.76	29.25	72.84	78.13	77.69	81.99	82.55	86.93	90.57
Poland		0.01	0.05	0.13	0.39	0.65	1.30	2.07	4.10	5.46	7.29	9.90	21.15	24.87	32.53	38.81	44.58	48.60	53.13
Romania				0.00	0.03	0.07	0.22	0.45	2.24	2.70	3.61	4.54	6.58	8.90	12.44	16.56	24.66	28.30	32.42
Slovakia				0.13	0.32	0.52	0.78	1.17	2.69	5.44	9.43	12.53	40.14	43.04	52.89	55.19	56.08	61.80	71.31
Slovenia				0.41	1.07	2.90	5.07	7.59	10.10	12.61	15.11	30.18	27.84	31.85	40.81	50.09	54.01	56.74	57.68
Sweden	0.58	1.16	1.50	1.72	3.41	5.10	9.04	23.73	33.47	41.43	45.69	51.77	70.57	79.13	83.89	84.83	87.76	82.01	89.12
Switzerland	0.60	1.18	1.75	2.17	2.72	3.55	4.55	15.93	24.93	33.95	47.89	54.71	61.39	64.00	66.59	68.23	70.86	66.83	69.84
United Kingdom	0.09	0.17	0.26	0.52	1.04	1.90	4.12	7.39	13.67	21.29	26.82	33.48	56.48	64.82	65.61	69.58	68.82	75.09	78.39

Table 3.4: Explanatory Variables - Summary Statistics

country	**unemployment (males, %)**	**unemployment (females, %)**	**tertiary educated (males, %)**	**tertiary educated (females, %)**	**real GDP per capita (Euro)**	**GINI coeficient (Index)**
Belgium	6.95 (0.8)	10.06 (1.77)	26.61 (2.74)	31.24 (4.46)	23341 (3298)	28.48 (1.72)
Bulgaria	12.61 (5.3)	12.11 (4.52)	15.06 (0.86)	24.8 (1.31)	2000 (472)	28.27 (4.63)
Croatia	10.74 (2.38)	13.73 (2.48)	10.98 (0.56)	14.16 (0.36)	5743 (1018)	27.95 (1.51)
Czech Republic	5.96 (1.26)	8.93 (1.54)	12.34 (0.9)	11.09 (1.89)	6536 (924)	25.07 (2.21)
Denmark	5.19 (1.72)	6.42 (1.81)	24.46 (2.73)	28.79 (3.89)	30974 (3125)	23.78 (2.92)
Finland	10.38 (3.99)	10.01 (3.43)	22.92 (3.65)	34.29 (7.88)	24516 (4104)	26.07 (1.34)
Germany	8.34 (1.51)	8.69 (0.89)	21.65 (0.65)	17.05 (1.76)	24472 (1822)	29.69 (1.51)
Hungary	7.46 (1.36)	6.9 (1.27)	12.21 (1.6)	16.3 (2.88)	5371 (859)	28.45 (3.12)
Italy	7.05 (1.26)	12.54 (2.46)	9.23 (1.59)	10.35 (3.41)	20042 (1351)	31.78 (1.68)
Latvia	11.23 (3.19)	10.05 (2.88)	14.62 (1.51)	23.05 (3.8)	4074 (1385)	35.16 (2.29)
Lithuania	11.75 (5.06)	10.25 (3.66)	25.05 (6.57)	35.23 (7.69)	4293 (1262)	36.11 (2.01)
Luxembourg	2.4 (0.88)	4.12 (1.35)	21.26 (3.8)	18.6 (5.08)	50829 (7298)	27.02 (0.97)
Netherlands	3.94 (1.1)	5.55 (1.62)	25.73 (2.91)	24.61 (4.45)	24779 (3008)	26.76 (1.27)
Norway	4.41 (1.28)	3.93 (0.91)	28.77 (1.7)	35.59 (3.13)	38679 (5162)	26.69 (1.72)
Poland	13.51 (4.52)	16.05 (4.39)	11.21 (2.86)	16.43 (4.86)	5107 (899)	33.32 (1.6)
Romania	7.88 (0.79)	6.27 (0.84)	10.1 (1.61)	9.95 (1.86)	2193 (453)	31.98 (3.03)
Slovakia	15.15 (3.86)	16.18 (2.88)	10.96 (1.56)	11.77 (2.11)	4450 (1018)	25.25 (2.01)
Slovenia	5.97 (1.1)	6.81 (0.73)	13.74 (2.72)	19.63 (4.63)	10553 (2289)	24.49 (1.02)
Sweden	7.23 (2.4)	6.46 (1.94)	24.17 (2.24)	31.08 (2.73)	29263 (4138)	25.12 (1.77)
Switzerland	3.04 (0.8)	4.02 (0.68)	31.6 (2.66)	17.32 (4.6)	37079 (2120)	32.22 (2.29)
United Kingdom	7.46 (2.33)	5.64 (1.21)	26.68 (2.98)	25.49 (5.08)	26211 (3557)	33.09 (1.3)

Table 3.5: The Marginal Effect of Internet Usage Evaluated at the Mean Gini

	MALES			FEMALES		
Age at first marriage	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
20 years	-0.222** (0.091)	-0.196** (0.09)	-0.003 (0.06)	-0.253** (0.097)	-0.243** (0.091)	0.002 (0.047)
21 years	-0.278** (0.086)	-0.271** (0.094)	-0.027 (0.055)	-0.268** (0.097)	-0.247** (0.092)	-0.029 (0.044)
22 years	-0.286** (0.084)	-0.271** (0.098)	-0.055 (0.049)	-0.24** (0.091)	-0.212** (0.091)	-0.044 (0.039)
23 years	-0.277*** (0.071)	-0.275** (0.085)	-0.049 (0.041)	-0.223** (0.071)	-0.201** (0.07)	-0.057 (0.043)
24 years	-0.24*** (0.062)	-0.221** (0.074)	-0.051 (0.038)	-0.189** (0.063)	-0.171** (0.06)	-0.056 (0.041)
25 years	-0.205*** (0.053)	-0.19** (0.052)	-0.053* (0.027)	-0.163** (0.059)	-0.143** (0.056)	-0.046 (0.03)
26 years	-0.144** (0.043)	-0.127** (0.041)	-0.043* (0.022)	-0.102* (0.056)	-0.088 (0.054)	-0.032 (0.028)
27 years	-0.116** (0.04)	-0.1** (0.04)	-0.042 (0.025)	-0.064 (0.056)	-0.047 (0.057)	-0.017 (0.036)
28 years	-0.071* (0.037)	-0.055 (0.035)	-0.025 (0.027)	-0.044 (0.047)	-0.023 (0.053)	-0.001 (0.038)
29 years	-0.048 (0.042)	-0.029 (0.043)	-0.008 (0.027)	-0.013 (0.056)	0.009 (0.066)	0.004 (0.039)
30 years	-0.033 (0.04)	-0.044 (0.044)	-0.02 (0.029)	0.008 (0.062)	0.014 (0.07)	-0.007 (0.035)
31 years	-0.005 (0.049)	-0.021 (0.051)	-0.021 (0.024)	0.001 (0.06)	0.006 (0.067)	-0.027 (0.029)
32 years	-0.017 (0.048)	-0.037 (0.051)	-0.038* (0.02)	-0.013 (0.069)	-0.007 (0.076)	-0.051 (0.033)
33 years	0.021 (0.056)	0.011 (0.059)	-0.018 (0.024)	0.034 (0.079)	0.055 (0.085)	-0.025 (0.026)
34 years	0.014 (0.052)	-0.007 (0.053)	-0.025 (0.025)	0.006 (0.067)	0.032 (0.071)	-0.037 (0.025)
35 years	0.012 (0.044)	0.012 (0.043)	-0.028 (0.02)	-0.005 (0.064)	0.013 (0.07)	-0.027 (0.032)
36 years	-0.029 (0.038)	-0.024 (0.038)	-0.032* (0.017)	0.027 (0.071)	0.044 (0.078)	-0.01 (0.038)
37 years	-0.03 (0.051)	-0.031 (0.051)	-0.035 (0.021)	-0.009 (0.073)	-0.006 (0.08)	-0.03 (0.037)
38 years	0.007 (0.06)	0.013 (0.064)	-0.019 (0.024)	-0.049 (0.077)	-0.016 (0.08)	-0.023 (0.037)
39 years	0.003 (0.048)	0.015 (0.049)	-0.015 (0.023)	-0.031 (0.079)	0.009 (0.085)	-0.013 (0.037)
40 years	-0.024 (0.053)	-0.014 (0.057)	-0.019 (0.033)	-0.042 (0.075)	-0.008 (0.072)	-0.037 (0.042)
41 years	0.006 (0.073)	0.007 (0.074)	-0.006 (0.034)	0 (0.093)	0.03 (0.091)	0.013 (0.058)
42 years	0.008 (0.074)	0.017 (0.074)	-0.014 (0.033)	0.054 (0.087)	0.064 (0.086)	0.031 (0.05)
43 years	0.005 (0.078)	0.02 (0.074)	-0.022 (0.046)	0.04 (0.11)	0.057 (0.11)	-0.019 (0.074)
44 years	0.034 (0.088)	0.047 (0.099)	0.031 (0.056)	0.103 (0.138)	0.126 (0.145)	-0.021 (0.087)
45 years	-0.039 (0.08)	-0.029 (0.079)	-0.044 (0.042)	0.018 (0.121)	0.031 (0.117)	-0.018 (0.055)
46 years	0.024 (0.107)	0.04 (0.126)	0.042 (0.068)	-0.089 (0.109)	-0.045 (0.112)	-0.043 (0.064)
47 years	0.029 (0.083)	0.022 (0.08)	0.019 (0.038)	0.013 (0.18)	0.053 (0.165)	-0.041 (0.046)
48 years	-0.001 (0.132)	-0.001 (0.128)	-0.013 (0.061)	-0.145 (0.1)	-0.123 (0.08)	-0.093 (0.082)
49 years	-0.119 (0.073)	-0.118 (0.073)	-0.045 (0.049)	0.008 (0.189)	0.016 (0.17)	-0.019 (0.099)

[a] Clustered standard errors at the country level in parentheses
[b] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.6: Model 1 (males)

Age at first marriage	Perc. Internet Users (Log)	Unemployment (Log)	Real GDP per capita (Log)	Gini Index (Log)	Gini (Log) * Internet (Log)
20 years	-0.74 (0.714)	-0.038 (0.122)	0.192 (0.623)	0.063 (0.633)	0.153 (0.19)
21 years	-1.164* (0.671)	-0.042 (0.099)	-0.407 (0.537)	-0.316 (0.544)	0.262 (0.177)
22 years	-1.325** (0.629)	0.01 (0.085)	-0.558 (0.46)	-0.652 (0.506)	0.308* (0.166)
23 years	-1.389** (0.633)	0.01 (0.085)	-0.373 (0.449)	-0.75 (0.53)	0.329* (0.172)
24 years	-1.402** (0.599)	0.019 (0.083)	-0.037 (0.445)	-0.865 (0.509)	0.344** (0.164)
25 years	-1.263** (0.549)	0.06 (0.078)	0.374 (0.407)	-0.854* (0.472)	0.313* (0.153)
26 years	-0.919* (0.463)	0.042 (0.071)	0.571 (0.363)	-0.64 (0.426)	0.229* (0.131)
27 years	-0.616 (0.428)	0.05 (0.06)	0.773** (0.297)	-0.34 (0.394)	0.148 (0.12)
28 years	-0.256 (0.352)	0.012 (0.058)	0.764** (0.245)	-0.052 (0.328)	0.055 (0.1)
29 years	-0.007 (0.323)	0.007 (0.057)	0.883** (0.247)	0.172 (0.317)	-0.012 (0.09)
30 years	0.258 (0.291)	0.011 (0.041)	0.883*** (0.202)	0.516* (0.266)	-0.086 (0.078)
31 years	0.385 (0.318)	-0.016 (0.053)	0.807*** (0.192)	0.599** (0.271)	-0.115 (0.085)
32 years	0.386 (0.304)	0.014 (0.05)	0.949*** (0.18)	0.551** (0.259)	-0.119 (0.081)
33 years	0.718* (0.349)	-0.049 (0.05)	0.555** (0.232)	0.685* (0.341)	-0.206** (0.091)
34 years	0.683* (0.352)	-0.052 (0.049)	0.598** (0.226)	0.567* (0.308)	-0.198** (0.094)
35 years	0.685* (0.355)	-0.072 (0.045)	0.592** (0.185)	0.614* (0.313)	-0.199* (0.098)
36 years	0.368 (0.36)	-0.031 (0.041)	0.702** (0.264)	0.408 (0.276)	-0.118 (0.1)
37 years	0.353 (0.382)	-0.043 (0.048)	0.791** (0.235)	0.38 (0.322)	-0.113 (0.102)
38 years	0.537 (0.447)	-0.044 (0.048)	0.691** (0.286)	0.425 (0.358)	-0.157 (0.12)
39 years	0.841** (0.393)	-0.027 (0.04)	0.821** (0.29)	0.706* (0.386)	-0.248** (0.109)
40 years	0.585 (0.447)	-0.018 (0.044)	1.02** (0.303)	0.469 (0.426)	-0.18 (0.122)
41 years	0.786 (0.557)	-0.008 (0.046)	0.882** (0.332)	0.793 (0.548)	-0.231 (0.149)
42 years	0.687 (0.523)	-0.081 (0.068)	0.665* (0.357)	0.577 (0.478)	-0.201 (0.138)
43 years	0.638 (0.598)	-0.099** (0.039)	0.457 (0.381)	0.686 (0.582)	-0.187 (0.16)
44 years	0.814 (0.691)	-0.179* (0.091)	0.376 (0.52)	0.699 (0.624)	-0.231 (0.184)
45 years	0.491 (0.578)	-0.122 (0.081)	0.474 (0.459)	0.452 (0.487)	-0.157 (0.154)
46 years	0.183 (0.799)	-0.124* (0.06)	0.666 (0.579)	0.186 (0.745)	-0.047 (0.209)
47 years	0.466 (0.692)	-0.118 (0.073)	0.441 (0.472)	0.3 (0.559)	-0.129 (0.182)
48 years	0.219 (0.834)	-0.221** (0.073)	-0.398 (0.605)	-0.035 (0.589)	-0.065 (0.215)
49 years	-0.148 (0.522)	-0.145** (0.068)	0.221 (0.38)	-0.183 (0.381)	0.008 (0.141)

[a] Country and time-fixed effects included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.7: Model 1 (females)

Age at first marriage	Perc. Internet Users (Log)	Unemployment (Log)	Real GDP per capita (Log)	Gini Index (Log)	Gini (Log) * Internet (Log)
20 years	-0.553 (0.641)	0.091 (0.171)	0.178 (0.405)	-0.014 (0.483)	0.089 (0.174)
21 years	-1.005* (0.557)	0.139 (0.164)	0.197 (0.435)	-0.188 (0.481)	0.218 (0.149)
22 years	-0.958 (0.594)	0.111 (0.133)	0.146 (0.449)	-0.187 (0.475)	0.212 (0.159)
23 years	-1.081** (0.492)	0.114 (0.112)	0.462 (0.384)	-0.307 (0.453)	0.254* (0.131)
24 years	-1.058** (0.462)	0.106 (0.103)	0.627 (0.4)	-0.375 (0.433)	0.257* (0.124)
25 years	-1.124** (0.387)	0.084 (0.086)	0.785** (0.344)	-0.558 (0.352)	0.284** (0.103)
26 years	-0.692* (0.365)	0.044 (0.082)	0.797** (0.29)	-0.411 (0.321)	0.174* (0.096)
27 years	-0.387 (0.42)	0.037 (0.075)	0.954** (0.262)	-0.119 (0.342)	0.095 (0.111)
28 years	-0.233 (0.334)	0.051 (0.073)	1.015*** (0.256)	0.036 (0.306)	0.056 (0.091)
29 years	0.238 (0.368)	0.021 (0.077)	1.107*** (0.221)	0.518 (0.332)	-0.074 (0.098)
30 years	0.499 (0.421)	0.051 (0.059)	1.219*** (0.209)	0.73 (0.428)	-0.145 (0.116)
31 years	0.405 (0.452)	0.095 (0.068)	1.315*** (0.237)	0.743 (0.43)	-0.119 (0.126)
32 years	0.406 (0.528)	0.086 (0.063)	1.219*** (0.25)	0.697 (0.486)	-0.124 (0.147)
33 years	0.751 (0.543)	0.017 (0.085)	0.825* (0.472)	0.731 (0.469)	-0.212 (0.148)
34 years	0.545 (0.53)	0.106 (0.105)	1.058** (0.493)	0.587 (0.509)	-0.159 (0.153)
35 years	0.412 (0.507)	0.071 (0.076)	0.829** (0.345)	0.3 (0.497)	-0.123 (0.146)
36 years	0.465 (0.583)	0.041 (0.08)	0.932** (0.404)	0.521 (0.549)	-0.13 (0.164)
37 years	0.446 (0.712)	0.15 (0.093)	1.331** (0.473)	0.377 (0.629)	-0.135 (0.198)
38 years	0.076 (0.607)	0.138* (0.074)	1.15** (0.423)	0.001 (0.501)	-0.037 (0.167)
39 years	0.388 (0.612)	0.187* (0.089)	1.038** (0.382)	0.536 (0.564)	-0.124 (0.168)
40 years	0.328 (0.642)	0.173* (0.089)	1.464** (0.481)	0.474 (0.645)	-0.109 (0.179)
41 years	0.327 (0.739)	0.145 (0.11)	1.085** (0.495)	0.361 (0.702)	-0.097 (0.197)
42 years	0.629 (0.581)	0.016 (0.092)	0.09 (0.431)	0.568 (0.52)	-0.17 (0.151)
43 years	0.541 (0.76)	0.021 (0.119)	1.132* (0.553)	0.85 (0.587)	-0.148 (0.198)
44 years	1.472 (1.098)	-0.038 (0.122)	0.783 (0.567)	1.095 (1.038)	-0.405 (0.288)
45 years	1.014 (0.988)	-0.033 (0.161)	0.369 (0.528)	0.943 (0.868)	-0.295 (0.261)
46 years	0.216 (0.935)	0.107 (0.167)	0.343 (0.689)	0.653 (0.816)	-0.09 (0.251)
47 years	0.959 (1.311)	0.082 (0.16)	-0.027 (0.777)	0.855 (0.986)	-0.28 (0.341)
48 years	-0.91 (0.751)	0.147 (0.188)	0.73 (0.641)	-0.558 (0.562)	0.226 (0.202)
49 years	0.995 (1.411)	-0.159 (0.204)	0.407 (0.883)	1.031 (1.14)	-0.292 (0.368)

[a] Country and time-fixed effects included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.8: Model 2 (males)

Age at first marriage	Perc. Internet Users (Log)	Education (Log)	Unempl. (Log)	Real GDP (Log)	Gini (Log)	Gini (Log) * Internet (Log)
20 years	-1.281 (0.953)	-0.092 (0.068)	-0.04 (0.168)	0.187 (0.7)	-0.41 (0.848)	0.321 (0.267)
21 years	-1.634* (0.877)	-0.088 (0.053)	-0.071 (0.133)	-0.403 (0.578)	-0.686 (0.746)	0.403 (0.242)
22 years	-1.795** (0.745)	-0.168** (0.061)	-0.029 (0.135)	-0.521 (0.492)	-0.988 (0.653)	0.451** (0.201)
23 years	-1.791** (0.729)	-0.153** (0.056)	-0.049 (0.136)	-0.366 (0.455)	-1.008 (0.682)	0.448** (0.199)
24 years	-1.728** (0.674)	-0.14** (0.049)	-0.019 (0.135)	-0.05 (0.456)	-1.103 (0.642)	0.446** (0.184)
25 years	-1.512** (0.548)	-0.362** (0.126)	0.062 (0.115)	0.602 (0.41)	-0.914 (0.546)	0.391** (0.154)
26 years	-1.203** (0.52)	-0.356** (0.12)	0.041 (0.102)	0.8** (0.347)	-0.751 (0.559)	0.318** (0.149)
27 years	-0.919* (0.483)	-0.355*** (0.084)	0.049 (0.081)	1.014** (0.284)	-0.483 (0.511)	0.242* (0.138)
28 years	-0.461 (0.418)	-0.371*** (0.079)	-0.025 (0.068)	0.977*** (0.232)	-0.048 (0.449)	0.12 (0.12)
29 years	-0.211 (0.381)	-0.344*** (0.082)	-0.031 (0.056)	1.075*** (0.223)	0.153 (0.393)	0.054 (0.109)
30 years	-0.076 (0.478)	-0.196 (0.141)	-0.051 (0.081)	0.945*** (0.229)	0.304 (0.467)	0.01 (0.134)
31 years	0.036 (0.516)	-0.261 (0.171)	-0.128 (0.086)	0.857*** (0.207)	0.414 (0.494)	-0.017 (0.146)
32 years	0.044 (0.522)	-0.252* (0.143)	-0.09 (0.083)	1.005*** (0.219)	0.388 (0.496)	-0.024 (0.145)
33 years	0.566 (0.552)	-0.183 (0.153)	-0.141* (0.073)	0.565* (0.287)	0.669 (0.544)	-0.164 (0.152)
34 years	0.527 (0.565)	-0.186 (0.165)	-0.156** (0.063)	0.614* (0.299)	0.602 (0.544)	-0.158 (0.156)
35 years	0.758* (0.398)	-0.211* (0.106)	-0.186** (0.061)	0.491** (0.173)	0.772* (0.398)	-0.221* (0.11)
36 years	0.407 (0.438)	-0.266 (0.18)	-0.127* (0.071)	0.605** (0.249)	0.523 (0.397)	-0.127 (0.123)
37 years	0.299 (0.489)	-0.208 (0.183)	-0.118 (0.082)	0.721** (0.202)	0.388 (0.45)	-0.097 (0.134)
38 years	0.571 (0.593)	-0.311 (0.283)	-0.094 (0.098)	0.649** (0.284)	0.499 (0.54)	-0.165 (0.162)
39 years	0.728 (0.476)	-0.32 (0.216)	-0.076 (0.075)	0.767** (0.259)	0.621 (0.448)	-0.211 (0.131)
40 years	0.576 (0.589)	-0.187 (0.194)	-0.076 (0.101)	0.943** (0.309)	0.469 (0.644)	-0.175 (0.161)
41 years	0.833 (0.69)	-0.016 (0.172)	-0.114 (0.097)	0.734* (0.369)	0.977 (0.717)	-0.244 (0.187)
42 years	0.769 (0.65)	0.034 (0.228)	-0.145 (0.141)	0.542 (0.378)	0.771 (0.632)	-0.223 (0.175)
43 years	0.707 (0.705)	-0.017 (0.239)	-0.221* (0.124)	0.254 (0.41)	0.876 (0.779)	-0.203 (0.193)
44 years	0.773 (0.827)	-0.151 (0.224)	-0.183 (0.16)	0.338 (0.538)	0.613 (0.796)	-0.215 (0.224)
45 years	0.59 (0.689)	0.09 (0.196)	-0.223 (0.174)	0.244 (0.505)	0.672 (0.647)	-0.183 (0.187)
46 years	-0.079 (0.849)	-0.14 (0.371)	-0.223 (0.14)	0.559 (0.6)	-0.039 (0.844)	0.035 (0.221)
47 years	0.644 (0.866)	-0.218 (0.255)	-0.199 (0.151)	0.404 (0.49)	0.638 (0.815)	-0.184 (0.236)
48 years	0.459 (1.053)	-0.274 (0.374)	-0.355* (0.177)	-0.616 (0.637)	0.476 (0.873)	-0.136 (0.283)
49 years	0.112 (0.677)	-0.28 (0.278)	-0.297* (0.159)	0.02 (0.441)	0.132 (0.58)	-0.068 (0.184)

[a] Country and time-fixed effects included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.9: Model 2 (females)

Age at first marriage	Perc. Internet Users (Log)	Education (Log)	Unempl. (Log)	Real GDP (Log)	Gini (Log)	Gini (Log) * Internet (Log)
20 years	-0.998 (0.836)	-0.136 (0.089)	-0.161 (0.233)	0.034 (0.395)	-0.194 (0.782)	0.223 (0.244)
21 years	-1.49* (0.786)	-0.153* (0.083)	-0.101 (0.233)	0.036 (0.42)	-0.43 (0.772)	0.368 (0.229)
22 years	-1.216 (0.931)	-0.132 (0.078)	-0.102 (0.222)	-0.055 (0.485)	-0.25 (0.875)	0.297 (0.27)
23 years	-1.264 (0.747)	-0.074 (0.07)	-0.082 (0.192)	0.259 (0.416)	-0.398 (0.81)	0.314 (0.215)
24 years	-1.17 (0.747)	-0.055 (0.069)	-0.091 (0.179)	0.433 (0.409)	-0.399 (0.824)	0.296 (0.214)
25 years	-1.317** (0.594)	-0.121 (0.094)	-0.064 (0.147)	0.699* (0.341)	-0.705 (0.661)	0.347* (0.169)
26 years	-0.922* (0.495)	-0.208** (0.09)	-0.076 (0.125)	0.829** (0.265)	-0.55 (0.523)	0.246* (0.14)
27 years	-0.645 (0.608)	-0.224** (0.092)	-0.054 (0.127)	1.005*** (0.256)	-0.297 (0.605)	0.177 (0.169)
28 years	-0.619 (0.48)	-0.232** (0.098)	-0.032 (0.114)	1.097*** (0.247)	-0.277 (0.485)	0.176 (0.135)
29 years	0.044 (0.56)	-0.209* (0.119)	-0.085 (0.117)	1.171*** (0.219)	0.402 (0.54)	-0.01 (0.155)
30 years	-0.002 (0.68)	-0.244* (0.129)	-0.032 (0.109)	1.252*** (0.219)	0.223 (0.635)	0.005 (0.188)
31 years	0.154 (0.641)	-0.185 (0.117)	-0.057 (0.108)	1.318*** (0.24)	0.532 (0.616)	-0.044 (0.177)
32 years	0.26 (0.803)	-0.144 (0.124)	-0.063 (0.128)	1.176*** (0.258)	0.615 (0.763)	-0.079 (0.224)
33 years	0.519 (0.876)	-0.064 (0.173)	-0.119 (0.158)	0.737 (0.513)	0.473 (0.797)	-0.137 (0.242)
34 years	0.101 (0.861)	-0.094 (0.196)	-0.12 (0.163)	0.93* (0.47)	0.093 (0.832)	-0.021 (0.241)
35 years	-0.115 (0.759)	-0.26 (0.16)	-0.082 (0.113)	0.735** (0.246)	-0.262 (0.688)	0.038 (0.211)
36 years	0.379 (0.873)	-0.07 (0.184)	-0.151 (0.123)	0.806** (0.315)	0.454 (0.84)	-0.099 (0.244)
37 years	0.175 (1.063)	-0.193 (0.201)	-0.083 (0.158)	1.249** (0.423)	0.146 (1.011)	-0.054 (0.297)
38 years	-0.227 (0.934)	0.109 (0.204)	-0.055 (0.144)	0.965** (0.37)	-0.367 (0.879)	0.062 (0.259)
39 years	0.214 (0.815)	0.289 (0.182)	0.004 (0.154)	0.843** (0.31)	0.316 (0.82)	-0.061 (0.225)
40 years	0.115 (0.933)	0.089 (0.21)	0.005 (0.159)	1.31** (0.407)	0.262 (1.019)	-0.036 (0.262)
41 years	0.464 (0.888)	0.218 (0.19)	-0.069 (0.2)	0.876* (0.464)	0.603 (0.914)	-0.128 (0.243)
42 years	1.061 (0.73)	-0.234 (0.229)	-0.169 (0.168)	-0.143 (0.442)	1.099 (0.812)	-0.295 (0.197)
43 years	0.892 (1.16)	-0.053 (0.229)	-0.224 (0.244)	0.783 (0.567)	1.338 (1.175)	-0.247 (0.323)
44 years	1.848 (1.535)	0.223 (0.298)	-0.26 (0.254)	0.536 (0.598)	1.664 (1.611)	-0.509 (0.417)
45 years	2.028 (1.353)	-0.2 (0.323)	-0.304 (0.289)	0.107 (0.526)	2.084 (1.465)	-0.591 (0.373)
46 years	0.822 (1.349)	0.129 (0.389)	-0.082 (0.253)	-0.067 (0.719)	1.394 (1.404)	-0.257 (0.377)
47 years	1.429 (1.657)	-0.21 (0.386)	-0.291 (0.282)	-0.505 (0.759)	1.434 (1.527)	-0.407 (0.449)
48 years	-1.171 (1.012)	-0.275 (0.425)	-0.341 (0.202)	0.349 (0.504)	-0.774 (1.016)	0.31 (0.286)
49 years	2.356 (1.737)	-0.034 (0.418)	-0.698* (0.342)	-0.212 (0.876)	2.726 (1.784)	-0.693 (0.476)

[a] Country and time-fixed effects included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.10: Model 3 (males)

Age at first marriage	Perc. Internet Users (Log)	Education (Log)	Unempl. (Log)	Real GDP (Log)	Gini (Log)	Gini (Log) * Internet (Log)
20 years	1.008 (0.651)	-0.089 (0.078)	-0.147 (0.088)	0.351 (0.825)	0.893 (0.663)	-0.299 (0.19)
21 years	0.185 (0.382)	0.019 (0.051)	-0.271*** (0.056)	-0.421 (0.675)	0.225 (0.399)	-0.063 (0.11)
22 years	-0.126 (0.375)	-0.069 (0.061)	-0.135* (0.075)	0.033 (0.571)	-0.104 (0.354)	0.021 (0.104)
23 years	-0.261 (0.433)	-0.009 (0.036)	-0.129** (0.044)	0.01 (0.366)	-0.259 (0.38)	0.063 (0.119)
24 years	-0.38 (0.457)	0.006 (0.039)	-0.084* (0.042)	0.023 (0.382)	-0.407 (0.46)	0.097 (0.126)
25 years	-0.327 (0.353)	-0.012 (0.09)	0.001 (0.043)	0.378 (0.297)	-0.352 (0.339)	0.081 (0.098)
26 years	-0.163 (0.374)	-0.051 (0.092)	-0.013 (0.036)	0.629* (0.34)	-0.182 (0.331)	0.035 (0.106)
27 years	-0.007 (0.326)	-0.082 (0.078)	0.009 (0.033)	0.62* (0.34)	0.045 (0.324)	-0.01 (0.092)
28 years	-0.005 (0.382)	-0.138 (0.084)	0.002 (0.043)	0.69* (0.348)	0.18 (0.333)	-0.006 (0.109)
29 years	0.151 (0.322)	-0.132** (0.047)	-0.05 (0.053)	0.211 (0.367)	0.307 (0.281)	-0.047 (0.091)
30 years	0.203 (0.276)	-0.097 (0.071)	-0.005 (0.048)	0.324 (0.414)	0.456 (0.309)	-0.066 (0.082)
31 years	-0.056 (0.3)	-0.188* (0.102)	-0.054 (0.068)	0.254 (0.448)	0.172 (0.288)	0.01 (0.089)
32 years	-0.213 (0.298)	-0.119 (0.125)	-0.011 (0.076)	0.446 (0.424)	0.075 (0.287)	0.052 (0.089)
33 years	0.029 (0.383)	0.01 (0.167)	-0.047 (0.096)	-0.217 (0.54)	0.132 (0.325)	-0.014 (0.113)
34 years	-0.054 (0.333)	-0.042 (0.178)	-0.055 (0.078)	-0.003 (0.638)	-0.015 (0.308)	0.009 (0.096)
35 years	-0.229 (0.283)	-0.042 (0.102)	-0.083* (0.046)	0.003 (0.542)	-0.118 (0.288)	0.059 (0.082)
36 years	-0.071 (0.299)	-0.146 (0.161)	-0.117** (0.051)	-0.105 (0.469)	0.037 (0.226)	0.011 (0.086)
37 years	-0.148 (0.329)	-0.05 (0.169)	-0.028 (0.043)	-0.002 (0.433)	-0.088 (0.328)	0.033 (0.093)
38 years	0.365 (0.431)	-0.142 (0.235)	-0.03 (0.064)	-0.282 (0.463)	0.287 (0.397)	-0.113 (0.124)
39 years	0.454 (0.417)	-0.234 (0.25)	-0.07 (0.057)	-0.702* (0.388)	0.33 (0.336)	-0.139 (0.119)
40 years	0.618 (0.472)	0.049 (0.151)	-0.052 (0.061)	0.434 (0.808)	0.506 (0.564)	-0.189 (0.137)
41 years	0.388 (0.318)	0.147 (0.219)	-0.047 (0.073)	-1.036* (0.564)	0.49 (0.377)	-0.116 (0.089)
42 years	0.552 (0.521)	0.437 (0.286)	0.005 (0.103)	-0.231 (0.743)	0.733 (0.478)	-0.167 (0.151)
43 years	-0.194 (0.355)	0.129 (0.282)	-0.09 (0.114)	-1.124 (0.846)	0.044 (0.481)	0.051 (0.099)
44 years	0.691 (0.662)	-0.217 (0.306)	-0.094 (0.107)	-1.418 (0.967)	0.411 (0.683)	-0.195 (0.182)
45 years	0.562 (0.394)	0.048 (0.296)	-0.167 (0.108)	0.122 (0.837)	0.721* (0.387)	-0.179 (0.118)
46 years	0.827 (0.795)	-0.331 (0.429)	-0.001 (0.123)	-0.524 (1.426)	1.01 (0.872)	-0.232 (0.223)
47 years	1.92** (0.787)	-0.198 (0.259)	0.019 (0.099)	0.062 (1.152)	2.019** (0.798)	-0.562** (0.229)
48 years	1.162* (0.653)	-0.273 (0.38)	-0.164 (0.098)	-0.126 (1.066)	1.322 (0.768)	-0.348* (0.192)
49 years	0.767 (0.651)	-0.3 (0.287)	0.011 (0.135)	1.323 (0.818)	1.012* (0.527)	-0.24 (0.191)

[a] Country-specific time trends included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.11: Model 3 (females)

Age at first marriage	Perc. Internet Users (Log)	Education (Log)	Unempl. (Log)	Real GDP (Log)	Gini (Log)	Gini (Log) * Internet (Log)
20 years	0.803 (0.735)	-0.021 (0.096)	-0.155 (0.091)	0.242 (0.494)	0.76 (0.743)	-0.245 (0.212)
21 years	0.282 (0.494)	-0.092 (0.057)	-0.067 (0.067)	0.656 (0.496)	0.494 (0.479)	-0.103 (0.14)
22 years	0.165 (0.45)	-0.081** (0.032)	-0.073 (0.053)	0.665* (0.359)	0.301 (0.389)	-0.07 (0.126)
23 years	-0.358 (0.512)	-0.016 (0.049)	-0.129 (0.079)	0.557 (0.401)	-0.292 (0.472)	0.083 (0.14)
24 years	-0.547 (0.601)	0.014 (0.053)	-0.103 (0.069)	0.509 (0.419)	-0.486 (0.608)	0.141 (0.164)
25 years	-0.531 (0.336)	0.089 (0.063)	0.005 (0.075)	0.323 (0.27)	-0.494 (0.389)	0.142 (0.09)
26 years	-0.272 (0.354)	-0.062 (0.09)	0.002 (0.048)	0.428 (0.354)	-0.261 (0.34)	0.073 (0.096)
27 years	-0.09 (0.322)	-0.15 (0.095)	-0.013 (0.054)	0.313 (0.531)	-0.089 (0.284)	0.028 (0.09)
28 years	0.097 (0.395)	-0.137 (0.091)	-0.011 (0.054)	0.29 (0.334)	0.227 (0.412)	-0.022 (0.109)
29 years	0.285 (0.512)	-0.206** (0.092)	-0.054 (0.072)	0.148 (0.377)	0.598 (0.41)	-0.076 (0.143)
30 years	0.339 (0.408)	-0.229** (0.085)	-0.017 (0.063)	-0.069 (0.355)	0.572 (0.381)	-0.094 (0.113)
31 years	-0.105 (0.47)	-0.205 (0.137)	-0.053 (0.077)	-0.097 (0.437)	0.26 (0.413)	0.03 (0.134)
32 years	-0.432 (0.388)	-0.204 (0.125)	-0.042 (0.113)	0.034 (0.488)	0.003 (0.315)	0.119 (0.112)
33 years	-0.682 (0.721)	-0.003 (0.244)	-0.118 (0.172)	-0.584 (0.662)	-0.358 (0.528)	0.194 (0.212)
34 years	-0.758 (0.496)	0.043 (0.284)	-0.169 (0.167)	-0.637 (0.836)	-0.569 (0.365)	0.209 (0.149)
35 years	-0.368 (0.374)	-0.158 (0.124)	0.021 (0.071)	-0.221 (0.507)	-0.255 (0.465)	0.093 (0.104)
36 years	-0.142 (0.502)	0.024 (0.147)	-0.088 (0.097)	-0.442 (0.514)	0.1 (0.471)	0.033 (0.14)
37 years	0.245 (0.612)	-0.116 (0.256)	-0.102 (0.087)	0.249 (0.775)	0.226 (0.655)	-0.089 (0.174)
38 years	-0.254 (0.435)	0.218 (0.259)	-0.12 (0.086)	-0.574 (0.678)	-0.483 (0.43)	0.062 (0.126)
39 years	0.53 (0.46)	0.262 (0.174)	-0.047 (0.091)	-0.772 (0.475)	0.464 (0.388)	-0.165 (0.13)
40 years	1.034 (0.621)	0.109 (0.225)	0.046 (0.105)	0.296 (0.818)	1.078* (0.613)	-0.326* (0.179)
41 years	0.347 (1.123)	0.251 (0.243)	-0.182 (0.167)	-1.177 (0.954)	0.243 (0.962)	-0.102 (0.319)
42 years	0.561 (0.731)	-0.445** (0.182)	0.064 (0.139)	-1.049 (0.921)	0.831 (0.586)	-0.163 (0.21)
43 years	0.793 (1.074)	-0.324 (0.211)	-0.046 (0.171)	0 (0.985)	1.424 (1.004)	-0.246 (0.3)
44 years	1.476 (1.285)	0.127 (0.298)	-0.137 (0.203)	-1.477 (1.376)	1.365 (1.323)	-0.444 (0.357)
45 years	1.282 (1.028)	-0.083 (0.176)	-0.258 (0.151)	-0.06 (0.87)	1.501 (1.061)	-0.391 (0.296)
46 years	0.584 (1.076)	0.056 (0.474)	-0.158 (0.163)	-1.218 (1.029)	1.157 (0.839)	-0.19 (0.312)
47 years	1.734* (0.923)	-0.103 (0.328)	-0.109 (0.13)	-0.513 (1.152)	1.688* (0.883)	-0.531* (0.271)
48 years	1.041 (1.132)	0.013 (0.281)	0.002 (0.166)	0.773 (1.129)	1.457 (1.047)	-0.354 (0.324)
49 years	2.466* (1.406)	0.133 (0.32)	-0.222 (0.214)	0.978 (1.206)	3.233** (1.204)	-0.749* (0.39)

[a] Country-specific time trends included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.12: Model 2 - Within Cohort Estimation (males)

Age at first marriage	Perc. Internet Users (Log)	Education (Log)	Unempl. (Log)	Real GDP (Log)	Gini (Log)	Gini (Log) * Internet (Log)
20 years	-2.275* (1.17)	-0.134** (0.062)	0.041 (0.185)	0.266 (0.755)	-1.627 (1.062)	0.604* (0.333)
21 years	-2.42** (0.98)	-0.115** (0.048)	-0.03 (0.128)	-0.316 (0.573)	-1.999* (1.047)	0.618** (0.271)
22 years	-2.24** (0.783)	-0.18** (0.057)	-0.034 (0.108)	-0.507 (0.463)	-2.104** (0.982)	0.566** (0.209)
23 years	-2.067** (0.76)	-0.162** (0.054)	-0.068 (0.11)	-0.351 (0.457)	-1.908* (1.035)	0.513** (0.204)
24 years	-1.849** (0.649)	-0.139** (0.044)	-0.043 (0.113)	-0.034 (0.436)	-1.807* (0.93)	0.466** (0.174)
25 years	-1.481** (0.505)	-0.32** (0.121)	0.031 (0.1)	0.528 (0.399)	-1.434* (0.739)	0.372** (0.14)
26 years	-1.141** (0.48)	-0.32** (0.121)	0.025 (0.096)	0.747** (0.356)	-1.141 (0.73)	0.293** (0.135)
27 years	-0.761* (0.387)	-0.347*** (0.089)	0.015 (0.074)	0.881** (0.283)	-0.697 (0.592)	0.195* (0.109)
28 years	-0.451 (0.368)	-0.348*** (0.086)	-0.021 (0.068)	0.956*** (0.244)	-0.269 (0.552)	0.115 (0.103)
29 years	-0.199 (0.297)	-0.339** (0.092)	-0.034 (0.052)	1.056*** (0.206)	0.064 (0.421)	0.05 (0.083)
30 years	-0.252 (0.389)	-0.197 (0.137)	-0.049 (0.074)	0.938*** (0.235)	-0.072 (0.537)	0.055 (0.108)
31 years	-0.094 (0.403)	-0.259 (0.166)	-0.135* (0.077)	0.812** (0.219)	0.116 (0.54)	0.014 (0.112)
32 years	0.02 (0.362)	-0.236* (0.134)	-0.124 (0.072)	0.846** (0.253)	0.116 (0.512)	-0.018 (0.099)
33 years	0.373 (0.369)	-0.186 (0.14)	-0.116* (0.062)	0.604** (0.219)	0.447 (0.433)	-0.106 (0.097)
34 years	0.554 (0.404)	-0.176 (0.164)	-0.146** (0.05)	0.619** (0.252)	0.736 (0.46)	-0.161 (0.106)
35 years	0.784** (0.303)	-0.213** (0.09)	-0.18** (0.052)	0.511** (0.154)	1.044** (0.357)	-0.221** (0.078)
36 years	0.47 (0.333)	-0.255 (0.171)	-0.133** (0.06)	0.598** (0.219)	0.742* (0.402)	-0.138 (0.089)
37 years	0.381 (0.346)	-0.201 (0.179)	-0.133* (0.075)	0.693*** (0.184)	0.644 (0.398)	-0.117 (0.088)
38 years	0.472 (0.426)	-0.305 (0.247)	-0.085 (0.081)	0.635** (0.252)	0.53 (0.487)	-0.129 (0.108)
39 years	0.41 (0.383)	-0.31 (0.191)	-0.071 (0.066)	0.771** (0.228)	0.393 (0.452)	-0.12 (0.1)
40 years	0.463 (0.428)	-0.2 (0.185)	-0.07 (0.092)	0.93** (0.282)	0.434 (0.55)	-0.137 (0.111)
41 years	0.546 (0.519)	-0.035 (0.159)	-0.101 (0.088)	0.713** (0.307)	0.661 (0.665)	-0.154 (0.135)
42 years	0.334 (0.543)	0.022 (0.231)	-0.126 (0.127)	0.514 (0.311)	0.204 (0.648)	-0.095 (0.139)
43 years	0.344 (0.629)	-0.044 (0.237)	-0.217* (0.11)	0.151 (0.345)	0.307 (0.799)	-0.096 (0.16)
44 years	0.188 (0.666)	-0.182 (0.225)	-0.148 (0.149)	0.295 (0.45)	-0.192 (0.863)	-0.049 (0.17)
45 years	0.298 (0.56)	0.102 (0.202)	-0.214 (0.154)	0.153 (0.417)	0.221 (0.644)	-0.092 (0.145)
46 years	-0.278 (0.619)	-0.122 (0.368)	-0.222* (0.12)	0.462 (0.52)	-0.627 (0.751)	0.089 (0.149)
47 years	0.102 (0.705)	-0.214 (0.264)	-0.172 (0.121)	0.326 (0.41)	-0.21 (0.845)	-0.024 (0.181)
48 years	0.185 (0.859)	-0.275 (0.375)	-0.325** (0.15)	-0.64 (0.571)	-0.008 (0.896)	-0.049 (0.218)
49 years	-0.11 (0.542)	-0.262 (0.281)	-0.295** (0.14)	-0.087 (0.334)	-0.43 (0.525)	-0.003 (0.137)

[a] Country and time-fixed effects included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.13: Model 2 - Within Cohort Estimation (females)

Age at first marriage	Perc. Internet Users (Log)	Education (Log)	Unempl. (Log)	Real GDP (Log)	Gini (Log)	Gini (Log) * Internet (Log)
20 years	-1.29 (0.956)	-0.151* (0.076)	-0.168 (0.203)	-0.009 (0.503)	-0.59 (0.919)	0.3 (0.277)
21 years	-1.569* (0.806)	-0.151** (0.067)	-0.123 (0.19)	-0.024 (0.48)	-0.818 (0.918)	0.378 (0.231)
22 years	-1.166 (0.779)	-0.129* (0.065)	-0.135 (0.185)	-0.165 (0.516)	-0.536 (0.898)	0.273 (0.221)
23 years	-1.118* (0.639)	-0.081 (0.063)	-0.116 (0.168)	0.066 (0.454)	-0.638 (0.858)	0.264 (0.179)
24 years	-1.02 (0.592)	-0.061 (0.063)	-0.108 (0.157)	0.231 (0.429)	-0.678 (0.854)	0.248 (0.166)
25 years	-1.14** (0.462)	-0.124 (0.096)	-0.08 (0.116)	0.481 (0.334)	-1.068 (0.683)	0.292** (0.128)
26 years	-0.804* (0.388)	-0.188** (0.086)	-0.077 (0.104)	0.686** (0.264)	-0.829 (0.536)	0.208* (0.108)
27 years	-0.487 (0.413)	-0.215** (0.085)	-0.052 (0.105)	0.873** (0.254)	-0.44 (0.549)	0.13 (0.111)
28 years	-0.405 (0.353)	-0.189** (0.087)	-0.047 (0.1)	0.988*** (0.248)	-0.234 (0.435)	0.107 (0.098)
29 years	0.122 (0.373)	-0.176 (0.109)	-0.108 (0.096)	1.042*** (0.209)	0.434 (0.449)	-0.038 (0.1)
30 years	0.047 (0.46)	-0.222* (0.113)	-0.06 (0.081)	1.143*** (0.185)	0.225 (0.52)	-0.016 (0.122)
31 years	0.13 (0.393)	-0.155 (0.106)	-0.087 (0.071)	1.155*** (0.199)	0.425 (0.455)	-0.041 (0.103)
32 years	0.33 (0.531)	-0.106 (0.106)	-0.153 (0.109)	0.839** (0.259)	0.4 (0.739)	-0.098 (0.138)
33 years	0.616 (0.509)	-0.059 (0.128)	-0.141 (0.107)	0.706* (0.367)	0.646 (0.614)	-0.161 (0.133)
34 years	0.76 (0.628)	-0.04 (0.183)	-0.2 (0.131)	0.779* (0.424)	0.998 (0.779)	-0.205 (0.169)
35 years	0.583 (0.561)	-0.185 (0.151)	-0.159 (0.098)	0.701** (0.245)	0.691 (0.69)	-0.158 (0.153)
36 years	0.686 (0.582)	-0.015 (0.163)	-0.204* (0.101)	0.762** (0.262)	0.953 (0.732)	-0.182 (0.158)
37 years	0.442 (0.687)	-0.142 (0.179)	-0.143 (0.136)	1.116** (0.366)	0.593 (0.841)	-0.129 (0.186)
38 years	0.306 (0.616)	0.143 (0.181)	-0.139 (0.111)	0.875** (0.307)	0.386 (0.766)	-0.09 (0.167)
39 years	0.102 (0.596)	0.219 (0.157)	-0.042 (0.112)	0.784** (0.286)	0.165 (0.777)	-0.038 (0.163)
40 years	0.319 (0.642)	0.126 (0.21)	-0.073 (0.14)	1.184** (0.37)	0.421 (0.832)	-0.096 (0.176)
41 years	0.062 (0.713)	0.203 (0.2)	-0.075 (0.168)	0.931** (0.426)	-0.046 (0.931)	-0.019 (0.195)
42 years	0.538 (0.546)	-0.198 (0.214)	-0.158 (0.143)	0.12 (0.401)	0.66 (0.707)	-0.145 (0.146)
43 years	0.459 (0.725)	-0.084 (0.22)	-0.236 (0.212)	0.809* (0.456)	0.713 (0.889)	-0.122 (0.188)
44 years	1 (0.975)	0.191 (0.315)	-0.275 (0.198)	0.389 (0.498)	0.664 (1.241)	-0.25 (0.246)
45 years	1.199 (0.892)	-0.144 (0.328)	-0.299 (0.273)	0.195 (0.533)	1.413 (1.107)	-0.338 (0.23)
46 years	0.225 (0.961)	0.121 (0.375)	-0.126 (0.234)	0.026 (0.584)	0.352 (1.198)	-0.085 (0.256)
47 years	0.963 (1.155)	-0.2 (0.368)	-0.313 (0.224)	-0.399 (0.678)	1.332 (1.294)	-0.276 (0.293)
48 years	-1.28 (0.874)	-0.324 (0.364)	-0.352* (0.183)	0.23 (0.364)	-1.704* (0.979)	0.322 (0.235)
49 years	0.983 (1.069)	-0.087 (0.35)	-0.606** (0.25)	-0.185 (0.664)	1.149 (1.268)	-0.286 (0.274)

[a] Country and time-fixed effects included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.14: The Marginal Effect of Internet Usage Evaluated at the Mean Gini for Model 2 Using Within Cohort Estimation

Age at first marriage	Males	Females
20 years	-0.234** (0.087)	-0.275** (0.092)
21 years	-0.332** (0.095)	-0.291** (0.094)
22 years	-0.326** (0.1)	-0.245** (0.092)
23 years	-0.332** (0.091)	-0.224** (0.071)
24 years	-0.273** (0.078)	-0.181** (0.06)
25 years	-0.225*** (0.05)	-0.154** (0.059)
26 years	-0.149** (0.051)	-0.101* (0.058)
27 years	-0.103* (0.05)	-0.047 (0.067)
28 years	-0.063 (0.047)	-0.045 (0.057)
29 years	-0.032 (0.054)	-0.005 (0.069)
30 years	-0.065 (0.05)	-0.009 (0.083)
31 years	-0.046 (0.057)	-0.01 (0.076)
32 years	-0.041 (0.058)	-0.002 (0.096)
33 years	0.013 (0.07)	0.071 (0.1)
34 years	0.011 (0.065)	0.068 (0.095)
35 years	0.038 (0.055)	0.047 (0.092)
36 years	0.003 (0.05)	0.071 (0.09)
37 years	-0.013 (0.065)	0.007 (0.092)
38 years	0.036 (0.085)	0.002 (0.092)
39 years	0.003 (0.064)	-0.025 (0.091)
40 years	0 (0.072)	-0.006 (0.097)
41 years	0.026 (0.086)	-0.003 (0.098)
42 years	0.013 (0.093)	0.049 (0.096)
43 years	0.018 (0.106)	0.047 (0.128)
44 years	0.021 (0.118)	0.154 (0.176)
45 years	-0.015 (0.097)	0.057 (0.154)
46 years	0.024 (0.142)	-0.064 (0.137)
47 years	0.021 (0.116)	0.032 (0.199)
48 years	0.021 (0.16)	-0.192* (0.107)
49 years	-0.121 (0.106)	0.017 (0.187)

Table 3.15: The Effect of Internet Usage on the Divorce rate

Divorce rate (Log)	Perc. Internet Users (Log)	Education (Log)	Unempl. (Log)	Real GDP (Log)	Gini (Log)	Gini (Log) * Internet (Log)
Males	0.039 (0.354)	0.197** (0.078)	-0.019 (0.063)	-0.065 (0.258)	-0.137 (0.312)	0.022 (0.102)
Females	0.102 (0.344)	0.216** (0.077)	-0.09 (0.055)	-0.09 (0.189)	-0.102 (0.293)	0.005 (0.098)

Table 3.16: The Marginal Effect of Internet Usage Evaluated at the Mean Gini

Divorce rate	Marginal effect of Internet usage
Males	0.113*** (0.031)
Females	0.119*** (0.031)

[a] Country and time-fixed effects included
[b] Clustered standard errors at the country level in parentheses
[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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