Tax avoidance, household formation and inequality

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Dipl.-Vw. Salmai Qari
aus Düsseldorf

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Erstgutachter:
Prof. Dr. Kai A. Konrad, Freie Universität Berlin,
Max-Planck-Institut für Steuerrecht und Öffentliche Finanzen,
München

Zweitgutachter:
Prof. Dr. Viktor Steiner, Freie Universität Berlin

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Preface

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Chapter 1

Introduction

1.1 Motivation

Overview

Nonpecuniary factors like morale, home attachment or emotions play a role for economic decisions. For example, whether or not individuals donate to charities does not only depend on monetary factors like the deductibility of charitable contributions, but it is also driven by motives like prestige or social pressure.[1] That is, to some extent the payment as such influences the donator's payoff independently of how the contribution is finally spent.

Economic activity may also have negative side-effects on emotional payoffs that are difficult to observe. For example, the trend that an increasing share of time is spent for commuting between workplace and home may have a negative effect on "emotional well-being".[2] In line with this view, the "Stiglitz commission" recently published a report (Stiglitz et al. 2009) that suggests that statistical indicators like GDP do not provide enough information for policymakers, since such an indicator captures only pecuniary well-being. Consequently, the report suggests "that the time is ripe for our measurement system to *shift emphasis from measuring economic production to measuring people's well-being.*" [3]

[1] See Andreoni (1989) and in particular Andreoni (1990) for the analysis of charitable giving when individuals feel "warm glow". Glazer and Konrad (1996) study the motive of signaling wealth or status for charitable giving.

[2] See, for example, Roberts et al. (2011).

[3] See Stiglitz et al. (2009, p. 12, italics in original). See also Oswald (2010) who supports the

This thesis analyzes the role of different nonpecuniary factors that affect economic decisions by using standard rational choice methods. The first part of this thesis studies tax avoidance and tax compliance. Specifically, chapter 2 examines the link between the nonpecuniary factors "patriotism" or "home attachment" and individual tax compliance. The basic assumption is inspired by Andreoni (1990) and essentially means that individuals feel "a warm glow of giving" when they voluntarily pay their taxes and that this warm glow is higher for more patriotic citizens. Building on these results, chapter 3 moves to a cross-country setting and analyzes the consequences of patriotism on tax rates in a framework where individuals may migrate to a foreign country in order to avoid high tax liabilities.

The second part of this thesis (starting with chapter 4) deals with the economics of household formation. The pattern of how single individuals are matched and may subsequently enter a marital union seems to be a prime example for the presence of emotional payoffs. Yet, the literature on household formation and family economics in general has for a long time put only emphasis on outcome measures like labor supply or inequality. As a result emotional payoffs are an underresearched topic.

Chapter 4 analyzes a marriage market in a dynamic model with search frictions, where agents are not only characterized by a vertical trait like productivity, but also derive utility from emotional congruence or consumption complementarities. Chapter 5 checks the dynamics of life satisfaction of individuals who enter a marital union. In particular it is tested if being married is associated with a long-lasting increase in happiness. Chapter 6 considers the dynamics of inequality and presents a model to decompose cross-sectional inequality into permanent and transitory inequality.

The remainder of this section sequentially motivates the two research topics more thoroughly and sketches the relevant literature. The contribution and main findings of this thesis are summarized in section 1.2.

Tax avoidance and tax evasion

The analysis of tax avoidance and tax evasion in this thesis is carried out from two interrelated perspectives: the public finance perspective and the law enforcement perspective. The problem of tax law enforcement starts with the conceptual distinc-

arguments of the Stiglitz report and discusses some measures for quality of life or well-being.

tion between tax avoidance and tax evasion. A narrow definition of tax avoidance comprises all activities of a taxpayer targeted at reducing the individual tax liability by means that meet legal requirements. Examples are exploiting existing loopholes or converting labor income into capital income if this is subject to a lower tax rate (Sandmo 2005). A broader definition of tax avoidance encompasses migration or the transfer of capital to different jurisdictions or countries in order to escape high tax rates. This aspect illustrates a certain overlap between questions of tax competition and tax avoidance. Tax evasion as opposed to tax avoidance encompasses illegal actions of taxpayers aimed at reducing their respective tax liability. If, for example, a taxpayer deliberately underreports the amount of income she has earned, she might face sanctions like fines if this illegal activity is detected. Especially in recent years, policy makers are concerned that increasing levels of tax avoidance and tax evasion may erode the financial basis of governmental policy.

The public finance literature usually focuses on efficiency and equity issues. For example, income from employment is usually more visible than income from self-employment activities. If individuals with the same income engage in tax evasion depending on their employment conditions, or more generally depending on the observability of their respective income, then this gives rise to horizontal inequity. If high income earners have a better access to tax evasion possibilities, then the effective tax system has features of vertical inequity.

As noted by Andreoni (1989, p. 1), "the problem of tax compliance is as old as taxes themselves", and it is conceivable that a similar statement holds with respect to almost any law. According to Polinsky and Shavell (2000) the economically oriented literature dates back to the works by Montesquieu, Beccarie and Bentham in the eighteenth century. However, the seminal work that is perceived as the starting point of the recent literature is attributed to Gary S. Becker's (1968) economic analysis of "crime and punishment". Drawing on Becker's analysis, the seminal contribution in the theoretical public finance literature is provided by Allingham and Sandmo (1972). In their main model, the individual's labor supply and therefore earnings and the tax and penalty rates are exogenously given. Assuming that the tax authority does not know the taxpayer's income and audits occur randomly with a fixed probability, the amount of underreporting by the taxpayer is essentially a decision similar to consuming a risky asset.

The seminal paper by Allingham and Sandmo is the starting point for a huge theoretical and empirical literature. Many extensions link tax enforcement and the question of optimal taxation (e.g. Cremer et al. 1990) or derive the optimal cut-off rule where agents are audited when they report an income below a certain threshold (Reinganum and Wilde 1985). A major criticism is the amount of tax evasion predicted by the Allingham-Sandmo-model. For example, in the Sandmo (2005) reformulation of the model, a penalty rate equal to twice of the tax rate implies that tax evasion is deterred if the audit probability exceeds 0.5, a number that by far exceeds empirical estimates (Sandmo 2005, p. 649).

The lack of predictive power has also generated a large empirical literature focusing on the individual heterogeneity of taxpayers. One aspect of heterogeneity is the source of income. As noted above, income from employment is usually subject to third-party reporting and therefore more visible than income from self-employment. According to Slemrod (2007, p. 28, Table 1), a tax gap study conducted by the Internal Revenue Service in 2006 shows that only 1 percent of wages and salaries are underreported, while 57 percent of nonfarm proprietor income is underreported. The crucial difference between the two income types is the fact that while the taxpayer is required to report both types, only wage and salaries are subject to employer withholding. Slemrod (2007, p. 29) further notes that the 57 percent underreporting gap of nonfarm proprietor income accounts for one third of income tax underreporting in the 2006 study. These differences in opportunities for tax evasion imply that the subjective audit probability for individuals who are not subject to employer withholding must exceed a larger threshold to deter tax evasion compared to employed taxpayers.

Another avenue to resolve the prediction of high levels of tax evasion are nonpecuniary factors like social norms or morale.[4] The idea that there are differences concerning the attitude toward tax evasion is not new. For example, Schmölders and Strümpel (1968) note that the way how tax laws are interpreted and enforced in countries like Spain, Italy or Greece implies that the legislated income tax is just

[4]Note that one section of the seminal article by Allingham and Sandmo (1972) considered the "social stigma" of getting caught, but the main focus of the article was deliberately on pecuniary factors. The avenue of nonpecuniary factors was picked up by Gordon (1989), who introduces "individual morality" to explain why some individuals never evade taxes even if a low audit probability suggests to engage in tax evasion.

a "farce".[5] They also formulate the idea that an increase in measures of deterrence does not necessarily lead to a higher degree of tax compliance. The argument is that deterrence has two effects. The first direct effect reduces tax evasion, for example by increasing the audit probability. However, there is an indirect effect that reduces the individual's willingness to cooperate voluntarily with the tax authorities, because the individual dislikes the increase of "confrontation".[6] This idea was popularized by Frey (1997) who argues that taxpayers have an intrinsic motivation to comply with tax liabilities due to "civic virtue". According to Frey (1997), an increase in deterrence policies translates into higher "extrinsic motivation", but may at the same time crowd out intrinsic motivation.[7]

The argument that factors like morale or social norms affect the willingness to engage in tax evasion has triggered a large empirical literature based on cross-country surveys and laboratory experiments. For example, Torgler (2006) documents a link between religiosity and tax morale, while Frey and Torgler (2007) highlight a correlation between perceived levels of tax evasion and individual tax morale.

If such perceptions matter for tax compliance, it seems likely that governments try to manipulate perceptions of voters or taxpayers for their own purposes. As Slemrod (2007) documents, the U.S. appealed to citizens' patriotism to convince them to pay their taxes voluntarily, and the "U.S Secretary of Treasury during World War I, William Gibbs McAdoo, referred to these campaigns as 'capitalizing patriotism'" (Slemrod 2007, p. 40). Patriotism might also be used to ease tax competition. This idea is formulated by Konrad (2008) who analyzes a model where governments can invest into loyalty of taxpayers in order to make them less mobile. In light of these ideas, the first part of this thesis will provide the first study in the economics literature that systematically analyzes the link between patriotic sentiments, tax evasion and tax avoidance.

[5] Schmölders and Strümpel (1968, p. 5) state: "In den südeuropäischen Ländern (Spanien, Italien, Griechenland und bereichsweise Frankreich) läßt die Wirklichkeit des steuerlichen Alltags viele der geltenden gesetzlichen Normen zu nicht viel weniger als einer bloßen Farce werden."

[6] See Schmölders and Strümpel (1968, p. 145).

[7] See also Slemrod (2007) for a discussion on what he terms "behavioral models".

Household formation and inequality

In most developed countries, there is a tendency that cohabitation replaces marriage, but there is huge heterogeneity depending on the individuals' socioeconomic background. According to Lundberg and Pollak (2007, p. 12), highly educated Americans have increasingly delayed marriage and childbearing in recent years, while couples with a low education background delay marriage but not childbearing. There is also a tendency in legislation to grant unmarried couples the same rights and benefits as married couples (Cigno 2011). If cohabitation and marriage become increasingly similar, but divorce for married couples remains costly, one might ask why the option of marriage is still so popular (Cigno 2011).

From an economic view, whether or not an individual would like to enter a marital union depends on the gains to marriage compared to being single. Resembling the development of the aforementioned literature on the economics of law enforcement, the seminal work in the field of family economics is due to Gary Becker. Building on a series of articles (e.g. Becker 1973, 1974) he published the *Treatise on the Family* first in 1981 and an enlarged edition in 1991 (Becker 1991). The preface of the *Treatise* states that the intent is "to analyze marriage, births, divorce, division of labor in the household, prestige and other nonmaterial behavior with the tools and framework developed for material behavior" (Becker 1991, p. ix).

An important source of gains to marriage in Becker's household production model is the specialization of the two partners in household work and market sector work. If gains to specialization are important, then the "traditional" division of labor where women are responsible for rearing children and men work in the market sector might emerge. The basic idea is that there might be small initial biological differences related to childbirth that make women slightly more productive in the household sector or market discrimination, but these small differences are reinforced by the couples' subsequent investment into their respective sector-specific skills.

But the gains to marriage depend not only on the marital surplus, but also on how the surplus is shared. The *Treatise* mostly focuses on a unitary approach, i.e. the two spouses maximize a joint household production function and reach efficient outcomes. This setup essentially neglects that the marital union consists of two different persons who may have competing interests. In response to this, a literature has emerged that

models intra-family bargaining over the marital surplus. The early approaches are "divorce-threat" models where the two spouses employ Nash-bargaining to split the surplus using utility outside marriage as the threat-point.[8]

The pattern of who marries whom for actual unions depends not only on the potential gains, but also on the market conditions. In the simple model by Becker (1991), there are no frictions in the market. Since utility is transferable between the spouses, the problem is equivalent to an assignment problem (Koopmans and Beckmann 1957) and the equilibrium solution maximizes total output (Ermisch 2003, chapter 7, Becker 1991, chapter 4). It follows that the equilibrium exhibits positive assortative matching for all traits that are complementary with respect to household production.

Building on this simple model, a literature has emerged that analyzes how the form of the utility function and the presence of search frictions is related to the observation of assortative matching. As argued by Burdett and Coles (1999) and Ermisch (2003), even in the case of transferable utility the presence of search frictions may induce negative assortative matching. For example, there may be only two types, productive and unproductive ones. If unproductive types outnumber productive ones and search frictions are sufficiently high, there is an equilibrium in which unproductive types reject to marry within their own type, because they can extract more surplus when marrying productive types. On the other hand, productive types agree to marrying unproductive types, because the share of the surplus they get from these mixed marriages is high enough.

However, the mere presence of search frictions cannot answer Cigno's (2011) question why marriage remains so popular. His own suggestion is that marriage is still able to provide a commitment device for the partners, thereby allowing them to implement "efficiency-enhancing investments". Although this argument may be plausible, there is an apparent divide between the empirically oriented and the theoretical literature. In particular the search-theoretic literature has almost exclusively analyzed the case of "vertical traits", e.g. the aforementioned case of unproductive and productive types. On the other hand, the empirical literature emphasizes that especially

[8]The seminal articles using this bargaining setup are Manser and Brown (1980) and McElroy and Horney (1981). See also Lundberg and Pollak (1994) and Lundberg and Pollak (2007) for a discussion of these models.

for younger cohorts complementarities in consumption like joint sports activities are more important inputs for the marital surplus than the production of household commodities. For example, Lundberg (2010) uses data from the German Socio-Economic Panel Study (SOEP) and investigates the association between personality traits and the probability of being married. She provides evidence that the effect of personality traits like "openness to experience" on being married and divorced is gender-specific for older cohorts, while there are no gender differences for younger cohorts. Such a pattern is consistent with the idea that for older cohorts efficiency gains driven by gender-specific production of household goods are an important source of marital surplus, while for younger cohorts emotional congruence or the joint consumption of goods are more relevant.[9] This thesis will contribute to this literature on household formation in two aspects. First, it will develop a theoretical framework to analyze the matching patterns in a dynamic model market where search frictions and consumption complementarities matter. Second, it will add to the empirical literature concerned with measuring the marital surplus and inequality. The following section briefly explains the contribution of this thesis.

1.2 Contribution and main findings

This thesis mainly focuses on the decision problem of the individual and the resulting equilibrium patterns. The microeconomic models that are either working in the background or explicitly stated are standard rational choice models. The analysis is positive and does not intend to give explicit policy recommendations. However, a thorough positive analysis is a necessary condition for making informed decisions. Most chapters start with a theory model or provide some theoretical background and then move to an empirical test of the hypotheses. The employed empirical methods are mostly standard microeconometric methods. Just like the theoretical parts, the empirical analysis is purely positive. Moreover, although a number of specifications try to address some endogeneity issues, the econometric analysis focuses on exploring and describing patterns in the data rather than estimating causal effects. The reasons are twofold: First, most of the available datasets are cross-sectional and offer only

[9] See also Lundberg (2011) for a broad overview on "Psychology and Family Economics".

a limited number of controls. Second, the nature of the topic often prevents the application of a standard treatment-evaluation framework. For example, whether or not individuals are patriotic depends on the definition and is not comparable to, for instance, evaluating the effect of participation in education programs on wages. The thesis therefore focuses on the robustness of empirical patterns with respect to different measurement methods.

Tax avoidance and tax evasion

Chapters 2 and 3 analyze the link between patriotic sentiments and tax policy. The idea is that governments could also in non-war times be tempted to instill patriotism to exploit it for their own agenda. The English writer Samuel Johnson referred to such a misuse of patriotism by governments when he made his famous statement that "patriotism is the last refuge of a scoundrel."[10] Chapter 2 starts with an analysis of the relationship between patriotic sentiments and attitudes toward tax compliance. The theoretical background of the chapter is the basic idea that taxpayers feel a patriotic warm glow of voluntarily paying their taxes. It follows that the taxpayers exhibit an inclination against tax evasion despite low levels of expected punishment. Although the idea might appear simple at first glance, it is not obvious that such a relationships holds empirically. As noted by Lavoie (2011), in the United States there is a strong historical link between patriotism and resistance against paying taxes.

The empirical analysis of chapter 2 is based on cross-country survey data. The chapter contributes to the existing survey based literature in a number of ways. First, the concept of patriotism developed in the chapter builds on an extensive literature in political science on social identity and patriotism. One aspect of this measure is that it differs from nationalism. A key difference between the two concepts is that only nationalism is associated with rejection of "out-groups" like immigrants. The chapter is the first study in the economics literature that systematically investigates the link between individual patriotism and tax compliance by a number of specifications. The main findings are twofold. First, the association between the two variables is quite robust. Second, there is substantial heterogeneity of this relationship across

[10] According to the Johnson biography by Boswell (edited and amended by Croker), Johnson made this statement on April 7, 1775 (Boswell and Croker 1848, p. 446).

countries.

Chapter 3 moves from tax compliance to tax competition. It starts with a theoretical analysis of individual migration in a two-country setup. High income earners consider moving to the foreign country in order to enjoy lower taxation in the foreign country. Individuals in both countries enjoy a patriotic rent from residing in their home country. The patriotic component consists of two factors, one on the country level and the second on the individual level. As will be shown, the country with higher average patriotism will be able to choose higher tax rates.

The empirical part checks if such patterns are visible in cross-country data. To this end, it links the survey data with OECD data on tax rates and analyzes the association between tax rates and patriotism on two levels of aggregation. First, it explores the country level and second the level of income groups. As noted above, the analysis focuses on the joint distribution of patriotism and the tax scheme across countries rather than causal effects. The main result is a positive relationship between tax rates and patriotism.

Household formation and inequality

Chapter 4 moves to household formation. As before, the focus is on the decision problem of the individual. The problem is casted as the question of how a single individual searches for a partner in the "marriage market" characterized by search frictions. The main contribution of the chapter is the development of a theoretical framework that models the agent's decision when the agent takes both a "vertical" trait like productivity and a horizontal trait into account. The horizontal characteristic is not ordered and represents the idea that consumption complementarities like joint leisure activities are an important source of the marital surplus. As explained in the previous section, the search-theoretic literature almost exclusively focuses on vertical traits.

The framework developed in chapter 4 yields important results that are not visible in a static model like the one by Konrad and Lommerud (2010). For example, when search frictions change, all agents adjust their respective set of acceptable partners in a continuous way. The chapter also presents a small example showing that individuals' expected lifetime utility is not necessarily monotonically increasing

in the extent of the market. In particular, agents who are "low-types" measured along the vertical dimension, may benefit from a higher degree of search frictions. Although the chapter is most closely related to the literature on family economics, it may also prove useful for labor market applications.

Motivated by this theory, chapter 5 empirically investigates the nexus between marriage and life satisfaction. The amount of pleasure caused by the consumption complementarities like joint leisure activities is difficult to measure. Survey data on life satisfaction is the only data available that spans several years and is supposed to capture such non-monetary inputs. The personality measures used by Lundberg (2010) have been included in the SOEP data only recently and it is therefore not possible to include these variable if variation over several years is important. However, such personality traits (Lundberg 2010) are known to be very stable for adults and will therefore be picked up by fixed effects.

An important question to investigate is therefore the profile of life satisfaction over time for those individuals who marry. A number of recent longitudinal studies (e.g. Lucas and Clark 2006, Clark et al. 2008) pick up the famous idea by Brickman and Campbell (1971) that individuals have a fixed set-point of life satisfaction and will inevitably return to this set-point, and they present evidence that individuals after a few years adapt to the positive effect of marriage and return to their baseline level. Chapter 5 of this thesis argues that these results are very sensitive with respect to the baseline period. The chapter suggests an improved method to compare life satisfaction while married to life satisfaction while single. Using this improved method, a positive long-run association between marriage and life satisfaction is established.

Chapter 6 also tackles issues of measurement. There is a large literature documenting increasing wage inequality in recent years for different countries. In Germany, the increase is notably steep since the 2000's (Gernandt and Pfeiffer 2007, Müller and Steiner 2008). But it is important to take the time dimension into account. Two very distinct scenarios are compatible with an increase in cross-sectional inequality. First, imagine there is no wage mobility over time, i.e. each individual gets the same wage every period. In such a world, growing cross-sectional inequality implies a larger permanent inequality, because individuals maintain their rank in the wage distribution while the variance of the wage distribution is larger. On the other hand, imagine that wages are drawn randomly every period. If this is the case, individuals

face lucky periods with high wages and unlucky periods with low wages but they may get the same average wage over time.

Chapter 6 develops a model to decompose inequality into permanent and transitory inequality using the German Socio-Economic Panel Study. Because female wages exhibit more instability over time, the chapter focuses on male wages. The main finding is that while permanent inequality increases over time, there is a substantial slowdown of this evolution in the early 2000s. The preferred specification indicates that the fraction of permanent inequality is slightly above 0.6 in 2001, around 0.4 in 2003 and roughly 0.5 in 2006.

Chapter 2

The last refuge of a soundrel? Patriotism and tax compliance*

2.1 Introduction

This chapter considers the relationship between citizens' patriotism and their willingness to pay taxes. We test the hypothesis that more patriotic citizens are more likely to comply with their tax obligations using survey data from several countries. The analysis is motivated by casual observations about the nexus between war, patriotism and tax policy. In times of war, politicians appeal strongly to citizens' national pride trying to increase their tax compliance or to implement tax reform.[1]

As documented by Jones (1996), the US Treasury used mass media such as radio, magazines and movies, and hired professional advertisers, entertainers and movie directors during World War II. Even Walt Disney was hired by the US Secretary of the Treasury, Henry Morgenthau Jr., to produce the movie *The New Spirit*, with Donald Duck starring as the average citizen. Donald Duck learns on the radio that it

*This chapter is based on the article *The last refuge of a soundrel? Patriotism and tax compliance*, published in *Economica* (forthcoming). The paper is joint work with Kai A. Konrad, see Konrad and Qari (2011).

[1]Related to this, there is an old discussion about the role of patriotism during war for implementing long-lasting tax reforms. Adams (1911, p. 318) discusses the role of patriotism for overcoming the deadlock of tax reform that emerges from the rivalry of interest groups. More recently, Bank et al. (2008) analyze the instrumental role of wars and the patriotism generated by such events for tax reform. Their key argument is that wars may cause feelings of solidarity and shared sacrifice, and this may create a window of opportunity for revenue increasing tax reform. Levi (1997) develops a theory of compliance based on contingent consent.

is his privilege as a citizen to make his tax contributions. Reluctant first and afraid of the intricate aspects of tax filing, he then finds out that tax filing is easy and his resulting tax burden very small. Patriotic feelings are instrumental for convincing Donald that his taxes serve a good purpose: pay taxes to beat the Axis.[2] Tax compliance, hence, gives him a patriotic warm glow. Jones (1996, p. 126 f.) reports that this movie had been seen by over 32 million people, and, according to a Gallup poll, affected the willingness to pay taxes of 37 percent of the viewers.

The role of patriotism for the government's ability to tax was recognized in the economic literature long before World War II. One example in the context of the American civil war is provided by Hill (1894, p. 451):

> An income tax has the considerable advantage of being responsive to the influences of patriotism, which are certain to be strong whenever a serious war is undertaken by a democratic country. [...] But the productiveness of an income tax depends, in large measures, upon the readiness of men to reveal their incomes and meet the tax. To this extent it assumes the nature of a voluntary contribution, to which men will respond more freely when they realize that the hour is one of the sore need and perhaps, of peril to the country.

These arguments focus on the effects of a general increase in patriotism on tax compliance in times of war, compared to a lower level of patriotism during peace.[3] But a similar relationship should hold across citizens who are heterogeneous with respect to their patriotic feelings. Tax compliance is –to some extent– a matter of choice and it therefore exhibits features of a voluntary contribution to public goods. We may expect that more patriotic individuals derive a "warm glow of giving" (Andreoni 1990) from their tax payments, and that therefore they are more likely to file their taxes honestly.

[2] See also Jones (1988, pp. 716f.) and Watts (1995, pp. 103 ff.).

[3] A more indirect reasoning uses essentially the same rationale: Anderson (1917) suggests financing war by taxes rather than by debt. He argues that the increased patriotism during wartime makes tax payment during wartime more feasible, whereas debt needs to be financed by taxes once the war has ended. In a similar vein, Durand (1917, p. 902) explains: "The patriotism which during the war itself might induce the rich willingly to pay taxes according to the full measure of their ability is bound to wane considerably when the war is over."

To test this hypothesis empirically, we draw on two modules of the International Social Survey Programme (ISSP). The first module is on "National Identity" which allows us to derive a measure of individuals' patriotism. In a subset of eight countries, several hundred respondents completed as well the ISSP module on "Citizenship". This permits us to link an individual's patriotic sentiments to this person's attitude toward tax evasion. While controlling for several other potentially confounding factors, we show a robust positive association between patriotism and tax compliance.

Patriotism is not necessarily the most important reason for why tax compliance is so high or –paraphrasing Andreoni et al. (1998, p. 821)– why there are so many honest households and why cheaters do not cheat by more. Many other issues relating to social norms and psychology have been suggested and been shown to be empirically relevant.[4] However, the evidence documented by Jones (1996) shows that governments have appealed consciously to patriotism and instrumentalized its existence, and that the quantitative effect of patriotism is substantial.

We think that the study of the role of patriotism in the context of collecting revenue is particularly important for another reason: patriotism itself is potentially the result of governmental policy, leading to normative questions regarding patriotism. Indeed, Feldman and Slemrod (2006) discuss the possible role of propaganda for generating a mentality of solidarity and for overcoming free riding incentives, and anecdotal evidence from many countries suggests that governments are engaged in instilling patriotism, using their regulatory influence on the education system.[5] The logic

[4]These include intrinsic motivation potentially being crowed out by extrinsic incentives (Frey 1997), mental suffering from evading taxes (Gordon 1989, Coricelli et al. 2007), tax morale, moral sentiments, and an inclination for pro-social behavior (see Frey and Torgler 2007, for a survey), fairness considerations (Hartner et al. 2008), religiosity (Torgler 2006) and cultural background (Alm and Torgler 2006).

[5]There are many examples, across different times and political regimes. Li (1990) describes that instilling patriotism was an important aspect of education policy in imperial, Maoist and more recent China. *The Economist* (19/12/06, page 92) reports about legislation in Japan that requires schools to instill "a love of one's country" in children. The East German government prior to 1989 made "loving the German Democratic Republic" the first law for their (essentially mandatory) youth organizations. The government in Poland discussed about introducing *patriotism* as an independent subject in 2006 (*Neue Züricher Zeitung*, 11/6/2006). In the United States, education theorist Sigal Ben-Porath (2007) seriously argues that patriotism is a virtue that should be taught at school, and youth organizations such as the Boy Scouts subscribe in their charter (chapter 3) "...to teach them patriotism, courage, self-reliance and kindred virtues, using the methods which are now in common use by Boy Scouts".

behind this behavior is similar to that of firms which invest in building up customer relations and later exploit their bases of loyal customers when charging higher prices. In parallel to this logic, the government may instill patriotic preferences in its citizens, planning to draw on these loyalties for various purposes, including military draft, the collection of fiscal revenues and other voluntary activities that 'citizens can do for their country'. The effect of patriotism on tax compliance makes more patriotism a desirable aim for a revenue-oriented government. What may cause uneasiness with this compelling logic is the fact that patriotism may have a number of highly undesirable side effects, particularly if it turns into nationalism.

Although, to the best of our knowledge, we provide the first study which explicitly focuses on the relationship between patriotism and tax compliance, there are a number of related studies. For example, Slemrod (2007) discusses the existing evidence for the link between patriotism and tax compliance in times of war. He mentions the idea that this association could as well hold in non-war times. Furthermore there are a few papers that analyze the correlates of tax morale and enter in some specifications a single question on *nationalism*[6] (Torgler and Schneider 2007b, Alm et al. 2006, Torgler 2003a,b). They report a positive, but sometimes insignificant (Torgler and Schneider 2007b) association between tax morale and the nationalism question. The results are not easily comparable, for two main reasons. First, the set of control variables varies across the studies. Second, the issue of nationalism is not the main focus of these studies and hence it is not systematically analyzed. In particular the nationalism question is not considered in all regressions. Martinez-Vazquez and Torgler (2009) analyze tax morale in Spain and find in all specifications a correlation between the nationalism question and tax morale, while Torgler (2005) provides this evidence for Austria. Heinemann (2008) employs data from the World Values Survey and analyzes "benefit morale" instead of tax morale. He finds a positive association between the nationalism question and benefit morale.

We focus on the relationship between *patriotism* and tax compliance and depart from these studies in various ways. First, we integrate a large body of research from political science and distinguish between nationalism and patriotism. A key difference between patriotism and unquestioning nationalism is that only the latter is associated

[6]The question reads, e.g. in case of the US, "How proud are you to be an American?".

with rejection of "out-groups" like immigrants (de Figueiredo and Elkins 2003). We check this notion by means of an auxiliary regression, which clearly shows that the strong patriots in our sample hold positive views of immigrants. This is in contrast to the aforementioned empirical studies, which enter a single *nationalism* question, that is associated with higher levels of prejudice against immigrants (de Figueiredo and Elkins 2003).

Second, we do not rely solely on pooled specifications, but consider as well interaction terms for the eight countries in our main sample. This exercise reveals that the association between patriotism and tax compliance is robust, but also demonstrates some dispersion in the size of the effect across countries. Third, we attempt to resolve the possible simultaneity of patriotism and tax compliance by an instrumental variables approach.

More generally, we speak to a large positive literature in public economics studying various attitudes or preferences. Presumably, one of the most extensively studied area within this literature is attitudes toward redistribution.[7] Although the analysis of preference determinants seems to be highly interesting in itself, there is considerable evidence that policy outcomes reflect preferences obtained from surveys. This applies as well to the area of tax compliance (Slemrod 2007) and as such yields an additional reason to study the preferences toward tax compliance.

We proceed as follows. In the following section we describe the data sources and key variables. Section 2.3 provides the baseline OLS and ordered probit results. Section 2.4 discusses a number of robustness checks including the IV estimation. Finally, section 2.5 concludes.

2.2 Data

As individualized data on participation in the shadow economy do not exist, we proxy individuals' tax compliance with their judgments on whether tax evasion is a legitimate activity. More precisely, we draw on a question in the "Citizenship 2004" module of the International Social Survey Programme (ISSP). The central question is:

[7] Recent examples of this large literature are Alesina and Giuliano (2009), Keely and Tan (2008), Alesina and Fuchs-Schuendeln (2007), Alesina and La Ferrara (2005), Corneo and Grüner (2002).

> There are different opinions as to what it takes to be a good citizen. As far as you are concerned personally on a scale of 1 to 7, where 1 is not at all important and 7 is very important, how important is it: Never to try to evade taxes.

This variable closely resembles a corresponding question in the World Values Survey that is across countries associated with measures of the size of the shadow economy (see Torgler and Schneider 2007a, 2008, Slemrod 2007, and references therein). Moreover, Torgler (2004) reports a high correlation between such a question and tax compliance in lab experiments. Note that these self-reported attitudes on tax evasion are often called "tax morale" in the literature. For our purposes it is not important if tax morale is a separate entity explaining tax compliance or "just" a reasonable proxy of actual behavior. We argue that patriotism has an impact on tax compliance, either directly or indirectly via "tax morale". We therefore use "tax compliance" as a label for this variable in the following.

The main explanatory variable is *patriotism*, which is generated from a set of questions in the "National Identity 2003" module regarding the respondent's pride, "How proud are you of [country] in each of the following?", where [country] is the respondent's country of residence.[8] Although this module provides information for more than 20 countries we can use only a subset of the data. In the majority of countries participating in the ISSP the two modules on national identity and citizenship are separate studies. However, eight countries conducted the two studies jointly[9] and asked the same persons both sets of questions. Our individual-level-dataset comprises those persons' answers who took part in both surveys. The sample size varies between 911 and 1,704 observations per country resulting in 9,973 observations for the whole dataset.[10]

The pride question is asked for ten different economic, historical and political characteristics of the country (see Table 2.1). They are asked as a set of questions in

[8] Since some of the questions ask the respondent about the opinion on "her" country, it is not clear to which country the non-national respondent actually refers. Therefore, we exclude the small number of non-nationals from our sample.

[9] The eight countries are USA, Austria, Ireland, Netherlands, Poland, Canada, Portugal, Uruguay.

[10] The total number of persons in the dataset is 9,973. Due to missing values the number of observations in the following regressions is roughly between 5,400 and 7,800, depending on the set of control variables.

Table 2.1: Factor analysis

	Factor loadings
the way democracy works	.60333416
country's economic achievements	.69783102
its scientific and technological achievements	.68078557
its fair and equal treatment of all groups	.60224421
its achievements in the arts and literature	.53333066
its history	.48520555
its political influence in the world	.59697437
its achievements in sports	.45590345
country's armed forces	.5618465
Number of observations: 7210	

one subsection of the questionnaire, thereby indicating that they refer to the same topic. For all ten questions the respondents are asked to answer on the same four-point scale ranging from "very proud" to "not proud at all". We drop the question on pride in the social security system, since it may be closely linked to tax compliance. A factor analysis of the remaining nine questions reveals that they are indeed linked to a single underlying concept. There is only one factor with an eigenvalue larger than unity and hence we employ the predicted score of this factor as our measure of patriotism. A second standard approach to aggregate a number of correlated variables is principal component analysis. In our special case the two approaches are virtually identical, since patriotism constitutes the only underlying factor which explains most of the variation. The correlation coefficient between the first principal component and the first factor score is 0.9987 and confirms that the two approaches yield the same results. As a robustness check we calculate the average across these questions for each individual as an alternative measure of patriotism. This yields the same results.

The rationale to use these questions to measure patriotism is in line with previous research. For example, Huddy and Khatib (2007) analyze a similar set of questions of the General Social Survey. In their sample the questions on "democracy", "economic achievements", "fair and equal treatment" and "social security system" are highly correlated with latent "National Pride". The question on "political influence in the world", that turns out to be strongly correlated with patriotism in our sample, was

not part of their analysis. De Figueiredo and Elkins (2003) analyze the ISSP "National Identity 1995" study and find the same five questions to be highly correlated with patriotism.

Another important implication of Huddy and Khatib (2007) is the distinction between patriotism and nationalism, which is captured by questions like "America is a better country than most others".[11] In their factor analysis on a larger set of questions, patriotism and nationalism emerge as two clearly distinct but weakly correlated underlying concepts.[12] To check if our patriotism variable picks up nationalism, we have regressed a question capturing attitudes toward immigrants on our patriotism measure and a number of individual controls. This test clearly shows that more patriotic individuals hold positive views about immigrants.[13]

2.3 Patriotism and individual tax compliance

The core of the empirical analysis is the following baseline regression model:

$$Compliance_{i,j} = \alpha_j + \beta_1 Proud_{i,j} + \mathbf{x'_{i,j}}\beta_{\mathbf{2}} + \epsilon_{i,j} \tag{2.1}$$

It models tax compliance of individual i in country j ($Compliance_{i,j}$) as a function of the individual's pride in country j and other explanatory variables that capture, inter alia, opportunities of tax evasion. The variable $Proud_{i,j}$ denotes individual i's level of patriotism and $\mathbf{x'_{i,j}}$ is a vector of individual-specific control variables which we will describe below. An important feature is the inclusion of country fixed effects, denoted by α_j. These control for the different auditing technologies, quality of institutions and levels of enforcement and other differences across countries.

We firstly estimate equation (2.1) by OLS –thereby treating the response variable as interval data– and secondly by an ordered probit model.[14] As the results from

[11] For recent studies on the relationship between nationalism and immigration see O'Rourke and Sinnott (2006) and Mayda (2006). Mayda and Rodrik (2005) show that nationalism is associated with protectionist tendencies. All three articles use the ISSP "National Identity 1995" module. The set of questions in the 1995 module is largely congruent with the 2003 module.

[12] See the references in Huddy and Khatib (2007) for the broad literature on the distinction between patriotism and nationalism.

[13] See Table 2.13 in the appendix for the auxiliary regression.

[14] Estimation of fixed effects in nonlinear models can lead to biased and inconsistent estimates

both models are qualitatively similar, we mainly discuss the OLS results for ease of interpretation.

Opportunities for tax evasion clearly differ across the population. For example, employed individuals usually are subject to a withholding tax, while self-employed are not. In our baseline regression we have entered income, employment status (full-time, part-time etc.), marital status and "type of work" into $\mathbf{x}'_{\mathbf{i,j}}$ to control for these differences. "Type of work" asks if the respondent works for the government, a publicly owned firm, a private firm or whether she is self-employed. Surprisingly, income has no explanatory power and hence we have dropped it from the baseline model. We briefly discuss the results including income in a later section. We also control for age, sex, education and religious denomination, as these variables are known from the empirical tax compliance literature (e.g. Slemrod 2007) to be important. Except for age, all controls are entered as dummy variables. Our dataset provides ten categories for employment status and eleven categories for religious groups. We recode these variables because some of these categories are sparsely populated. For employment status we keep "full-time", "part-time" and "retired", all others are coded into "other". For religion we keep the main groups "no religion", "roman catholic" and "protestant". Everything else is collapsed into "other".

Table 2.2 provides summary statistics for the baseline estimation sample. The patriotism variable approximately has zero mean and a standard deviation of one. Hence, a positive value of β_1 (as hypothesized) is roughly equal to the absolute increase of tax compliance associated with a one-standard deviation increase of patriotism, if the model is fitted by OLS. For the ordered probit model β_1 is proportional to the change in probability of reporting the highest tax compliance category associated with such an increase in patriotism. We first compare the OLS and ordered probit coefficients in light of this proportionality and then calculate the absolute (marginal) effects for all categories.

Table 2.3 shows the results of the baseline specification. The first three and the remaining three columns respectively show the OLS and ordered probit results. Consider the main variable of interest for our hypothesis. The patriotism coefficient is fairly large and precisely estimated, and this holds for both model specifications.

(incidental parameters problem). This is not an issue for our sample, since there are several hundred observations in each country.

Table 2.2: Summary statistics (baseline sample)

	Mean	SD	Min	Max
Tax Compliance	6.044608	1.368534	1	7
Proud	-.007268	.9162638	-3.095159	1.933743
Female	.4786181	.4995845	0	1
Age	47.00151	15.7705	16	93
Marital Status:				
Married	.6156297	.4864869	0	1
Widowed	.0700989	.2553351	0	1
Divorced	.0774778	.2673705	0	1
Separated	.0204595	.1415778	0	1
Single	.2163341	.4117792	0	1
Education:				
No formal education	.0305215	.1720318	0	1
Lowest educ.	.1844709	.3879003	0	1
Above lowest educ.	.2609425	.4391854	0	1
Higher secondary educ.	.178266	.3827686	0	1
Above higher secondary educ.	.1715579	.3770274	0	1
University degree	.1742412	.3793485	0	1
Employment Status:				
Full-time	.5393258	.4984929	0	1
Part-time	.1016267	.3021821	0	1
Retired	.1963777	.3972908	0	1
Other	.1626698	.3690951	0	1
Type of work:				
Works for government	.2168372	.4121253	0	1
Public firm	.0858628	.2801849	0	1
Private firm	.541506	.4983161	0	1
Self-employed	.1557941	.3626904	0	1
Religion:				
No religious denomination	.1905081	.3927348	0	1
Catholic	.6060708	.4886605	0	1
Protestant	.1614959	.3680186	0	1
Other	.0419252	.2004351	0	1
Countries:				
USA	.1534463	.3604473	0	1
AUT	.0855274	.2796884	0	1
IRL	.1085024	.31104	0	1
NLD	.1697132	.3754122	0	1
POL	.1163844	.3207122	0	1
CAN	.0744592	.2625387	0	1
PRT	.1682039	.3740786	0	1
URY	.1237632	.3293388	0	1
Observations	5963			

Table 2.3: Baseline regression results, OLS and ordered probit

	OLS			Ordered probit		
Proud	0.241***	(10.02)	[0.161]	0.219***	(10.58)	[0.147]
Female	0.193***	(5.35)	[0.070]	0.180***	(5.53)	[0.066]
Age	0.00475**	(2.90)	[0.055]	0.00528***	(3.52)	[0.061]
Marital Status:						
Married	0.102*	(2.04)	[0.036]	0.0655	(1.58)	[0.023]
Widowed	−0.0757	(−0.89)	[−0.014]	−0.0800	(−1.02)	[−0.015]
Divorced	0.0864	(1.13)	[0.017]	0.0556	(0.83)	[0.011]
Separated	0.0417	(0.33)	[0.004]	0.0284	(0.24)	[0.003]
Education:						
Lowest educ.	0.256*	(1.97)	[0.073]	0.209*	(2.05)	[0.059]
Above lowest educ.	0.266*	(2.02)	[0.085]	0.214*	(2.07)	[0.069]
Higher secondary educ.	0.267*	(1.97)	[0.075]	0.231*	(2.12)	[0.065]
Above higher secondary educ.	0.254+	(1.88)	[0.070]	0.162	(1.53)	[0.045]
University degree	0.220	(1.62)	[0.061]	0.179+	(1.66)	[0.050]
Employment Status:						
Part-time	0.0346	(0.59)	[0.008]	−0.00417	(−0.08)	[−0.001]
Retired	0.0973+	(1.68)	[0.028]	0.0616	(1.12)	[0.018]
Other	−0.0131	(−0.25)	[−0.004]	−0.00917	(−0.20)	[−0.002]
Type of work:						
Public firm	−0.0203	(−0.30)	[−0.004]	−0.0366	(−0.60)	[−0.007]
Private firm	−0.137**	(−3.12)	[−0.050]	−0.131**	(−3.17)	[−0.048]
Self-employed	−0.249***	(−4.30)	[−0.066]	−0.230***	(−4.48)	[−0.061]
Religion:						
Catholic	0.152**	(2.69)	[0.054]	0.112*	(2.52)	[0.040]
Protestant	0.272***	(4.20)	[0.073]	0.249***	(4.39)	[0.067]
Other	0.00867	(0.08)	[0.001]	0.00267	(0.03)	[0.000]
Country fixed effects		Yes			Yes	
Observations		5963			5963	

coefficients for standardized variables (Mean=0, SD=1) in brackets
t and z statistics in parentheses, respectively
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table presents OLS and ordered probit regression results (robust standard errors). The explained variable is individual tax compliance. The main explanatory variable is individual patriotism (*Proud*), which is the score for the first principal factor derived from a set of 9 pride questions. The regressions control for sex, age, marital status (reference category: singles), education (reference category: no formal education), employment status (reference category: full-time), work type (reference category: working for the government) and religious denomination (reference category: no religion). The table omits country-fixed effects, intercept and cut-off parameters.

The t and z ratio respectively is at least equal to ten in both estimations. The OLS coefficient is equal to 0.241, suggesting that the increase in tax compliance associated with a one standard deviation increase in patriotism is roughly as large as the decrease in tax compliance when being self-employed. These results strongly support our hypothesis.

The estimation also confirms results that are known from previous analyses about the control variables. Females tend to report higher values of tax compliance, a finding in line with evidence from survey data (Torgler 2006) and experimental data (Alm and Jacobson 2007). Being married compared to being single increases tax compliance as well.[15] Age positively affects compliance, in line with Slemrod (2007) and Andreoni et al. (1998). Turning to education we find in both regressions some evidence for an inverse u-shape. Compliance is lowest for the reference group without any formal education and highest for the groups in the middle. The coefficient for university degree is imprecisely estimated and slightly smaller than the coefficients for the education levels in the middle. Indicated by small coefficients and large standard errors, employment status does not show up as an important factor for the degree of tax compliance. Workers in private firms and self-employed individuals have higher levels of non-compliance. Moreover, this negative impact is particularly strong for the self-employed. Catholics and protestants consider tax-compliance more important than the non-religious. The results indicate strong effects for both of these groups. The point estimate for protestants is larger than the coefficient for catholics.

The ordered probit model yields similar results in the sense that the relative coefficient sizes resemble the OLS results. Table 2.4 presents various partial effects to further assess the magnitude of the ordered probit coefficients. It calculates for each regressor the partial effect on the probability of reporting the highest tax compliance category, holding fixed the remaining variables at their mean. For example, being self-employed rather than working for the government decreases this probability by roughly 9 %, while there is a positive effect of 7 % for females. The partial effect on tax compliance of increasing patriotism by one standard deviation (calculated at the mean of patriotism - half its standard deviation) is of similar order: 8 %. Note that this is of very similar magnitude as the "marginal" effect for the patriotism variable

[15] Our results are in line with Torgler (2006). On the other hand, Slemrod (2007) and Andreoni et al. (1998) report that married persons have higher rates of non-compliance.

Table 2.4: Partial effects

	Marginal Effect	z statistic	Min→Max	-+ 0.5 SD
Proud	0.087	10.577	0.419	0.079
Female	0.071	5.552	0.071	0.036
Age	0.002	3.521	0.159	0.033
Marital Status:				
Married	0.026	1.580	0.026	0.013
Widowed	−0.032	−1.021	−0.032	−0.008
Divorced	0.022	0.834	0.022	0.006
Separated	0.011	0.238	0.011	0.002
Education:				
Lowest educ.	0.082	2.078	0.082	0.032
Above lowest educ.	0.084	2.096	0.084	0.037
Higher secondary educ.	0.090	2.164	0.090	0.035
Above higher secondary educ.	0.064	1.548	0.064	0.024
University degree	0.070	1.681	0.070	0.027
Employment Status:				
Part-time	−0.002	−0.081	−0.002	−0.000
Retired	0.024	1.126	0.024	0.010
Other	−0.004	−0.202	−0.004	−0.001
Type of work:				
Public firm	−0.015	−0.599	−0.015	−0.004
Private firm	−0.052	−3.175	−0.052	−0.026
Self-employed	−0.091	−4.484	−0.091	−0.033
Religion:				
Catholic	0.044	2.516	0.044	0.022
Protestant	0.097	4.479	0.097	0.036
Other	0.001	0.030	0.001	0.000
Observations	5963			

This table uses the ordered probit results (Table 2.3) and presents the effects on the probability of reporting the highest tax compliance category associated with changes of the respective variable, while holding the other regressors at the sample mean.

Column 1 presents marginal effects and column 2 the corresponding standard errors. Column 3 presents the effect of changing the variable from its minimum to its maximum. Column 4 shows the effect of changing the variable from its mean - 0.5 its standard deviation to its mean + 0.5 its standard deviation.

(8.7 %, see column 1), because its standard deviation is close to one.

Table 2.5 calculates the "marginal" effect on all tax compliance categories for the central patriotism variable. The 8.7 % increase in the probability of the highest tax

Table 2.5: Effects of increasing patriotism

	Prob(1)	Prob(2)	Prob(3)	
Proud	−0.00728	−0.00454	−0.00788	
	(−8.13)	(−6.88)	(−8.22)	
	Prob(4)	Prob(5)	Prob(6)	Prob(7)
Proud	−0.0234	−0.0245	−0.0193	0.0869
	(−9.65)	(−9.72)	(−9.47)	(10.58)
Observations	5963			

Marginal effects; z statistics in parentheses
This table uses the ordered probit results (Table 2.3) and presents the marginal effects of increasing patriotism, calculated for the seven tax compliance categories.

compliance category stems from a corresponding decrease in the probability mass of all other categories. This decrease is stronger for categories four, five and six, thereby reflecting the fact that only a small fraction of individuals report levels of tax compliance below four.

To summarize our results so far, we find a robust positive association between individual patriotism and tax compliance. This result emerges while controlling for a series of personal factors and unobserved country characteristics like the degree of law enforcement.

2.4 Robustness checks

2.4.1 Income

Empirical studies analyzing the relationship between income and noncompliance for the United States using IRS tax return data are inconclusive (Andreoni et al. 1998, Slemrod 2007). Nevertheless, we had initially entered a standardized measure of

income[16] into our baseline regression. Income has virtually no additional explanatory power (see Table 2.9 in the appendix) and its inclusion does not affect the results reported in the previous section. The income coefficient is small and insignificant. For these reasons we have dropped income from the baseline model. Note that some of the controls that are included, like education, age and employment status, are highly correlated with income and may sufficiently control for income, thereby causing the small income coefficient.

2.4.2 Instrumental variables estimation

The robust correlation of patriotism and tax compliance raises the question whether the coefficient reflects (to some extent) a causal relationship. The main obstacle for a causal interpretation is a possible simultaneity bias. For example, some individuals might face high psychological costs when trying to engage in tax fraud. If such individuals perceive their tax burden as high, they might be tempted to overreport their level of patriotism to "rationalize" their situation. As panel data is not available, we employ an instrumental variables approach to analyze this possibility.

Finding a suitable instrument for this setting is not straightforward. A literature in political psychology or political science in general (e.g. Huddy 2001, Huddy and Khatib 2007) suggests that patriotism or in-group (own country) identification is correlated with higher levels of political involvement and group membership. The basic idea is that individuals who participate in networks, for example sports clubs, are more likely to exhibit home attachment / patriotism. The link between patriotism and political involvement has been studied extensively. For example, Laband et al. (2009) show that homeowners, who flew an American flag on either Memorial Day or Independence Day 2006, were more likely to participate in the November 2006 elections.

Following these arguments we create two indicator variables. One dummy is equal to one if the respondent voted in the last election year and the second variable indicates if the respondent actively participates in a sports club. In an unreported

[16] As income is given in local currency in the ISSP data we standardize the variable to facilitate a meaningful comparison. We employ $\log(y_{ij}/\bar{y}_j)$ as normalized income, where y_{ij} denotes the income of individual i in country j and $\bar{y}_j$ is the average income in country j directly calculated from the sample.Corneo and Grüner (2002) also apply this transformation to ISSP data.

IV regression that employs both instruments the patriotism coefficient obtains a value of 1.64. In this regression the hypothesis of valid overidentifying restrictions is not rejected (Hansen J statistic $\chi^2(1) = 0.0295$, $p = 0.864$).

This test is admittedly weak and the election indicator might be directly linked to what is believed to be important for being a "good citizen". Hence, by this reasoning the exclusion restrictions might be violated for the election indicator. We therefore employ only the sports club indicator as an instrument in the following estimation. Table 2.6 shows the results. The coefficients for the control variables closely resemble the baseline OLS results. The coefficient for the central patriotism variable has the expected sign, but is considerably larger than the OLS coefficient. This estimate should be treated with caution as the first stage results indicate that the employed instrument is weak. The F-statistic for testing if the instruments enter the first stage obtains a value of 7.41. This value falls inside the rejection region of a Wald-test that accepts a worst-case actual size of 20 % for a nominal level of 5 % and it falls outside the rejection region of a corresponding test allowing a worst-case actual size of 15 % (Stock and Yogo 2005). To check the robustness of our findings with respect to the presence of weak instruments, we provide a confidence set obtained from inverting conditional likelihood ratio tests (e.g Moreira 2003). Due to the weak correlation between patriotism and the used instrument, this interval covers a large range of (positive) values. Note that the OLS coefficient is included in the interval, although the IV point estimate is much larger than the OLS point estimate. The results therefore corroborate the evidence obtained from the baseline estimation.

2.4.3 Extended set of controls

As a further robustness check, we enter additional variables into the baseline model. The OLS regression results are presented in Table 2.7. The first column includes subjectively assessed church attendance. The values for this variable are between one and eight, where one means that the individual attends church several times a week and eight means that she never goes to church. We derive three dummies from this variable: more than once a month (high), between once a month and once a year (middle), and less than once a year or never (low). High church attendance is the omitted reference group. The second column extends the model of the first

Table 2.6: IV estimation

Explained variable:	Proud		Compliance	
Proud			1.405^{+}	(1.79)
Female	−0.0242	(−1.12)	0.224^{***}	(4.53)
Age	0.00249^{**}	(2.58)	0.00185	(0.67)
Marital Status:				
Married	0.0753^{**}	(2.72)	0.0126	(0.15)
Widowed	0.105^{*}	(1.99)	−0.196	(−1.48)
Divorced	−0.0382	(−0.82)	0.133	(1.36)
Separated	−0.113	(−1.59)	0.174	(1.09)
Education:				
Lowest educ.	−0.0439	(−0.62)	0.305^{+}	(1.90)
Above lowest educ.	−0.0632	(−0.88)	0.332^{*}	(2.01)
Higher secondary educ.	−0.0908	(−1.24)	0.366^{*}	(2.06)
Above higher secondary educ.	−0.0527	(−0.72)	0.303^{+}	(1.82)
University degree	−0.104	(−1.40)	0.326^{+}	(1.81)
Employment Status:				
Part-time	−0.0326	(−0.93)	0.0719	(0.94)
Retired	−0.00748	(−0.21)	0.109	(1.50)
Other	-0.0500^{+}	(−1.68)	0.0474	(0.64)
Type of work:				
Public firm	−0.0628	(−1.47)	0.0535	(0.55)
Private firm	−0.0391	(−1.48)	−0.0891	(−1.40)
Self-employed	−0.0208	(−0.59)	-0.223^{**}	(−3.03)
Religion:				
Catholic	0.328^{***}	(10.74)	−0.233	(−0.87)
Protestant	0.261^{***}	(6.98)	−0.0340	(−0.15)
Other	0.125^{*}	(2.19)	−0.135	(−0.84)
participates in sports club	0.0651^{**}	(2.72)		
Constant	0.546^{***}	(5.68)	4.897^{***}	(9.94)
Weak identification test		$F = 7.41$		
Critical values (Stock and Yogo 2005):		15% maximal IV size:		8.96
		20% maximal IV size:		6.66
		25% maximal IV size:		5.53
Coverage-corrected confidence set and p-value for H_o: $Proud = 0$				
Confidence set		$[0.125, 5.760]$		
p-value		0.0328		
Observations		5963		

t and z statistics in parentheses, respectively

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table presents an IV version of the baseline estimation (Table 2.3).

column by introducing perceived corruption (*Corruption*). It is derived from the ISSP citizenship 2004 question on corruption, which reads "How widespread do you think corruption is in the public service in [country]?". It ranges from one, "hardly anyone is involved" to five, "almost everyone is involved". According to these groups five dummies are created, where lowest corruption acts as the reference category. Finally, the third column adds self-rated social class (*Class*) with possible answers ranging from one (lowest class) to ten. We create three groups: 1-4 (low), 5-7 (middle) and 8-10 (high). Low class is the reference category.

Table 2.7 shows that some of these controls are relevant, but including them does not change the results on the role of patriotism for tax compliance. We find large positive estimates for church attendance (column 1) in all three estimations.[17] We also find large estimates for corruption (column 2).[18] The results for the controls included in the baseline estimation are hardly affected. The only notable change is a drop in the religious denomination coefficients that are roughly halved (the catholics coefficient thereby becomes statistically insignificant). The three regressions strongly corroborate the baseline results regarding patriotism. The coefficient is about 2.4 in the three estimations and t-ratios larger than nine are obtained. The estimates suggest that a decrease in patriotism by about one-standard deviation has roughly the same effect as being self-employed. Thus, the strong effect of patriotism on tax compliance is robust with respect to inclusion of these controls.

2.4.4 Country-specific slopes

We now check if our results are driven by pooling the eight country-specific subsamples into one single model. Table 2.8 presents the results from introducing interaction terms between patriotism and the country dummies. The individual controls from the baseline estimation are included, but the coefficients are not shown to preserve space. The first two columns enter the country-specific slopes into the OLS and ordered probit model, respectively. The interaction terms show a positive effect of

[17] This finding is meaningful as individuals in our sample sort themselves roughly uniformly into the three groups (high, middle and low). The strong positive effect of church attendance on tax compliance is reported by Torgler (2006) as well.

[18] It is important to note that the coefficients for the different dummies are similar, and that only three percent of the individuals report that "hardly anyone" is involved in corruption.

Table 2.7: OLS regression with extended set of controls

	+Attendance		+Corruption		+Social class	
Proud	0.238***	(9.71)	0.238***	(9.46)	0.242***	(9.36)
Female	0.178***	(4.84)	0.167***	(4.46)	0.155***	(4.06)
Age	0.00432**	(2.61)	0.00434**	(2.60)	0.00447**	(2.63)
Married	0.0818	(1.62)	0.0812	(1.57)	0.0874+	(1.66)
Widowed	−0.0981	(−1.14)	−0.0859	(−0.99)	−0.100	(−1.13)
Divorced	0.0807	(1.04)	0.0855	(1.09)	0.0550	(0.68)
Separated	0.0350	(0.28)	−0.000800	(−0.01)	0.00153	(0.01)
Lowest educ.	0.246+	(1.87)	0.282*	(2.05)	0.266+	(1.91)
Above lowest educ.	0.273*	(2.05)	0.295*	(2.12)	0.267+	(1.88)
Higher secondary educ.	0.275*	(2.01)	0.293*	(2.06)	0.273+	(1.87)
Above higher secondary educ.	0.254+	(1.86)	0.278+	(1.95)	0.266+	(1.82)
University degree	0.223	(1.62)	0.235	(1.64)	0.224	(1.51)
Part-time	0.0479	(0.82)	0.0375	(0.62)	0.0355	(0.58)
Retired	0.103+	(1.75)	0.111+	(1.89)	0.103+	(1.72)
Other	0.00740	(0.14)	0.0156	(0.29)	0.0116	(0.21)
Public firm	−0.0379	(−0.56)	−0.0530	(−0.76)	−0.0537	(−0.76)
Private firm	−0.129**	(−2.92)	−0.131**	(−2.92)	−0.120**	(−2.61)
Self-employed	−0.246***	(−4.19)	−0.257***	(−4.30)	−0.246***	(−4.07)
Catholic	0.0686	(1.02)	0.0479	(0.71)	0.0444	(0.64)
Protestant	0.161*	(2.25)	0.156*	(2.16)	0.148*	(2.00)
Other	−0.0750	(−0.67)	−0.0745	(−0.65)	−0.0720	(−0.61)
Attendance: middle	−0.103*	(−2.44)	−0.0890*	(−2.09)	−0.0853*	(−1.96)
Attendance: less and never	−0.234***	(−4.62)	−0.242***	(−4.67)	−0.247***	(−4.64)
Corruption==2			−0.209*	(−2.00)	−0.194+	(−1.82)
Corruption==3			−0.202+	(−1.91)	−0.179+	(−1.65)
Corruption==4			−0.218*	(−1.99)	−0.202+	(−1.81)
Corruption==5			−0.189	(−1.46)	−0.170	(−1.30)
Class: middle					−0.0131	(−0.28)
Class: high					−0.108	(−1.60)
Constant	5.744***	(31.23)	5.951***	(27.89)	5.984***	(27.49)
Country fixed effects	Yes		Yes		Yes	
Observations	5809		5605		5447	

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table presents OLS regression regression results (robust standard errors). It extends the baseline OLS regression (Table 2.3). It sequentially adds church attendance (reference category: high), perceived corruption (reference category: lowest=1) and self-rated social class (reference category: low). See Table 2.3 for a description of the variables.

Table 2.8: Introducing interaction terms (and income)

	OLS	O. probit	OLS	O. probit
USA x Proud	0.106^{+}	0.141^{*}	0.114^{*}	0.165^{*}
	(1.94)	(2.17)	(2.02)	(2.45)
AUT x Proud	0.305^{**}	0.226^{***}	0.244^{*}	0.215^{**}
	(3.20)	(3.45)	(2.36)	(2.90)
IRL x Proud	0.433^{***}	0.391^{***}	0.489^{***}	0.436^{***}
	(4.94)	(5.37)	(5.05)	(5.49)
NLD x Proud	0.166^{*}	0.0943^{*}	0.161^{*}	0.0888^{+}
	(2.30)	(1.99)	(2.17)	(1.83)
POL x Proud	0.359^{***}	0.306^{***}	0.359^{***}	0.309^{***}
	(4.55)	(4.68)	(4.36)	(4.53)
CAN x Proud	0.190^{*}	0.249^{**}	0.229^{**}	0.279^{***}
	(2.47)	(3.20)	(3.08)	(3.62)
PRT x Proud	0.225^{***}	0.211^{***}	0.238^{***}	0.232^{***}
	(5.20)	(5.04)	(4.99)	(4.92)
URY x Proud	0.246^{***}	0.261^{***}	0.266^{***}	0.277^{***}
	(4.58)	(4.92)	(5.11)	(5.31)
AUT	-0.795^{***}	-0.732^{***}	-0.791^{***}	-0.731^{***}
	(-7.57)	(-7.98)	(-6.56)	(-7.05)
IRL	-0.482^{***}	-0.483^{***}	-0.520^{***}	-0.492^{***}
	(-4.53)	(-5.06)	(-4.38)	(-4.73)
NLD	-0.771^{***}	-0.757^{***}	-0.795^{***}	-0.768^{***}
	(-9.04)	(-9.33)	(-8.43)	(-8.56)
POL	-0.0355	-0.147	-0.0428	-0.139
	(-0.37)	(-1.50)	(-0.41)	(-1.31)
CAN	-0.128	-0.187^{*}	-0.149	-0.186^{+}
	(-1.41)	(-2.01)	(-1.53)	(-1.88)
PRT	-0.00732	-0.135	-0.0514	-0.158
	(-0.09)	(-1.54)	(-0.53)	(-1.60)
URY	0.0511	0.0305	0.0237	0.0161
	(0.59)	(0.33)	(0.25)	(0.16)
Income			0.0215	0.0132
			(0.83)	(0.53)
Control variables	Yes	Yes	Yes	Yes
Observations	5963	5963	5303	5303

t and z statistics in parentheses, respectively.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
The table presents OLS and ordered probit regression results (robust standard errors). It extends the baseline estimation (Table 2.3) and introduces income as well different patriotism slopes for each country. The table only shows the estimated country-specific slopes and the country fixed effects (reference category: USA); the coefficients for the control variables and cut-off parameters are omitted. Individual patriotism (*Proud*) is the score for the first principal factor derived from a set of 9 pride questions. Income is respondent's reported total income.

patriotism on tax compliance for each of the countries. The smallest slope is obtained for the United States. This may be explained by the fact that roughly 73 percent of the US citizens in our sample report the highest level of tax compliance. Since we include country fixed effects as well, there is not much variation left to exploit.

The main findings of this subsection are that all country-specific slopes are large and positive, in line with our hypothesis. Although there is some evidence for country-specific heterogeneity[19] –especially the United States are seemingly singled out–, the empirical evidence of the baseline model emerges in the country-specific model as well.[20]

2.4.5 Alternative patriotism measures and selection effects

The number of missing values for the nine pride questions is considerable and as a result a large amount of observations is lost. Note that the patriotism score is computed only for those individuals who reply to all nine questions. If individuals systematically refuse to answer, our results may be driven by this selection process.

In the following we briefly consider alternative measures that have different sample requirements. In this way we check the sensitivity of the results with respect to alternative definitions of patriotism and selectivity simultaneously. First, we use the average of all non-missing pride questions as an alternative patriotism measure. The resulting score is between one and four for all respondents who provide at least one answer.[21] Second, one could argue that the question on "fair and equal treatment of all groups" refers to similar moral sentiments as tax compliance. We therefore check whether excluding this question when calculating the average of non-missing

[19] Wald tests of the null hypothesis of equal country slopes yield the following: For column 1 this hypothesis is rejected on conventional levels ($F(7, 5927)$=2.14, $p = 0.0364$). Testing the same hypothesis for all slopes except the US slope (as well for column 1), we cannot reject the hypothesis ($F(6, 5927)$=1.48, $p = 0.1822$). This is in line with the fact that there is less variation within the United States compared to the other countries. When performing the same two tests for the ordered probit slopes (column 2), the null hypothesis has to be rejected in both cases ($\chi^2(7) = 16.50$, $p = 0.0210$ and $\chi^2(6) = 15.03$, $p = 0.0201$, respectively). The test patterns for columns 3 and 4 resemble the findings from columns 1 and 2.

[20] We have also entered normalized income into the present model with country-specific slopes. Columns 3 and 4 of Table 2.8 show the results. As in the baseline model, income has no additional explanatory power.

[21] Note that the scale of the alternative patriotism measure (see Table 2.10) is different.

answers affects the results (see Table 2.11 in the appendix.) Third, we conduct a series of additional regressions to analyze the relationship between tax compliance and each of the pride questions separately. All three setups produce coefficients that closely resemble our previous findings and serve as first evidence that neither sample selection nor the specific definition of patriotism affects the results.

As a further check with respect to selectivity, we estimate a number of Heckman-type selection models. The inverse Mills ratio enters significantly in some of the models thereby providing evidence that there is systematic selection. Crucially, the patriotism coefficient is unaffected in all models.[22]

2.4.6 Separate models for each country

As a final robustness check, we repeat the entire analysis separately for each country. We perform a series of principal component analyses on the eight subsamples to derive a country-specific measure of patriotism. We then estimate the baseline model for each subsample. Although there is variation across the models, the coefficient is positive for each of the samples. As before, the smallest effect is found for the United States. Thus, our results are not driven by pooling the eight subsamples.[23]

2.5 Conclusions

This chapter explores empirically the relationship between tax compliance and patriotism. While Hill (1894, p. 451) suggests that appeals to patriotism increase tax compliance in times of war, we use survey data to test this idea for non-war times. We find evidence for a strong and robust correlation of individuals' patriotism and tax compliance. We perform a variety of robustness checks to rule out spurious results. These checks include fitting country-specific patriotism slopes and using completely separated regressions for each country-subsample. Finally, an instrumental variable estimation provides evidence that the positive association reflects to some extent a causal relationship.

[22] See Tables 2.14 and 2.15 in the appendix for the results.
[23] Table 2.12 in the appendix shows the estimated effects for patriotism (not reporting the controls).

These results are important, particularly because patriotism itself is potentially subject to governmental policy. Countries might use their public education system in order to instill patriotism. In turn, such policies could simplify tax collection, because patriotic sentiments might function as a substitute for auditing. This positive effect of patriotism on tax compliance makes patriotism especially desirable for a revenue oriented government. The welfare implications of such policies are unclear and we do not intend to promote these. Patriotism has a number of undesirable side effects, particularly as it may turn into nationalism.

2.6 Appendix

Table 2.9: Introducing income

	OLS		Ordered probit	
Proud	0.247***	(9.84)	0.231***	(10.54)
Female	0.197***	(5.09)	0.187***	(5.35)
Age	0.00498**	(2.88)	0.00531***	(3.35)
Married	0.0920+	(1.69)	0.0598	(1.32)
Widowed	−0.0879	(−0.98)	−0.0807	(−0.98)
Divorced	0.0652	(0.81)	0.0429	(0.61)
Separated	−0.0219	(−0.17)	−0.0336	(−0.27)
Lowest educ.	0.254+	(1.84)	0.199+	(1.82)
Above lowest educ.	0.232+	(1.65)	0.182	(1.64)
Higher secondary educ.	0.239+	(1.66)	0.190	(1.63)
Above higher secondary educ.	0.231	(1.60)	0.133	(1.16)
University degree	0.185	(1.25)	0.134	(1.13)
Part-time	0.0250	(0.41)	−0.0116	(−0.21)
Retired	0.107+	(1.72)	0.0634	(1.07)
Other	−0.0146	(−0.26)	−0.0189	(−0.39)
Public firm	−0.00432	(−0.06)	−0.0185	(−0.29)
Private firm	−0.0940*	(−2.03)	−0.0929*	(−2.13)
Self-employed	−0.243***	(−3.91)	−0.222***	(−4.05)
Catholic	0.111+	(1.88)	0.0792+	(1.69)
Protestant	0.249***	(3.70)	0.231***	(3.92)
Other	0.0369	(0.34)	0.0192	(0.21)
Income	0.0165	(0.64)	0.00996	(0.40)
Country fixed effects	Yes		Yes	
Observations	5303		5303	

t and z statistics in parentheses, respectively
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
The table introduces (standardized) income into the baseline estimation. See the baseline estimation (Table 2.3) for a description of the variables. Country-fixed effects, intercept and cut-off parameters are not shown.

Table 2.10: Alternative patriotism measure: Average of non-missing answers

	+Attendance		+Corruption		+Social class	
Proud 2	0.378***	(10.56)	0.379***	(10.07)	0.383***	(9.95)
Female	0.195***	(5.98)	0.187***	(5.54)	0.172***	(5.01)
Age	0.00596***	(4.10)	0.00541***	(3.66)	0.00524***	(3.47)
Married	0.0894*	(2.00)	0.102*	(2.21)	0.0980*	(2.09)
Widowed	−0.0835	(−1.14)	−0.0645	(−0.85)	−0.0779	(−1.00)
Divorced	0.0757	(1.09)	0.0988	(1.41)	0.0745	(1.03)
Separated	−0.00527	(−0.05)	−0.0202	(−0.18)	−0.0241	(−0.21)
Lowest educ.	0.196*	(2.03)	0.213*	(2.01)	0.214+	(1.94)
Above lowest educ.	0.228*	(2.29)	0.227*	(2.09)	0.212+	(1.88)
Higher secondary educ.	0.270**	(2.60)	0.255*	(2.28)	0.243*	(2.07)
Above higher secondary educ.	0.204+	(1.95)	0.208+	(1.84)	0.205+	(1.73)
University degree	0.217*	(2.06)	0.206+	(1.82)	0.204+	(1.70)
Part-time	0.0671	(1.30)	0.0730	(1.38)	0.0715	(1.33)
Retired	0.0513	(1.00)	0.0645	(1.24)	0.0533	(1.00)
Other	−0.00318	(−0.07)	0.0168	(0.36)	0.0184	(0.39)
Public firm	−0.0608	(−1.00)	−0.0682	(−1.09)	−0.0740	(−1.16)
Private firm	−0.128**	(−3.29)	−0.135***	(−3.39)	−0.127**	(−3.12)
Self-employed	−0.240***	(−4.68)	−0.260***	(−4.92)	−0.260***	(−4.81)
Catholic	0.0348	(0.59)	0.0158	(0.27)	0.0130	(0.22)
Protestant	0.165**	(2.61)	0.166**	(2.60)	0.155*	(2.36)
Other	−0.00441	(−0.05)	−0.0180	(−0.19)	0.0125	(0.13)
Attendance: middle	−0.112**	(−3.01)	−0.0894*	(−2.34)	−0.0929*	(−2.39)
Attendance: less and never	−0.225***	(−5.03)	−0.223***	(−4.80)	−0.239***	(−5.02)
Corruption==2			−0.173+	(−1.83)	−0.162+	(−1.66)
Corruption==3			−0.188+	(−1.95)	−0.169+	(−1.70)
Corruption==4			−0.275**	(−2.75)	−0.259*	(−2.52)
Corruption==5			−0.269*	(−2.31)	−0.224+	(−1.89)
Class: middle					−0.0136	(−0.33)
Class: high					−0.0864	(−1.44)
Constant	4.612***	(24.34)	4.849***	(21.55)	4.881***	(21.05)
Country fixed effects	Yes		Yes		Yes	
Observations	7787		7336		7099	

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table presents OLS regression regression results (robust standard errors). Proud 2 is individual patriotism, calculated as the average of at most nine pride questions. See Table 2.3 and 2.7 for a description of the control variables.

Table 2.11: Alternative patriotism measure: Average of non-missing answers (set of eight questions)

	+Attendance		+Corruption		+Social class	
Proud 3	0.368***	(10.34)	0.365***	(9.75)	0.369***	(9.64)
Female	0.188***	(5.77)	0.180***	(5.35)	0.166***	(4.82)
Age	0.00581***	(4.00)	0.00528***	(3.57)	0.00511***	(3.39)
Married	0.0860+	(1.92)	0.0978*	(2.12)	0.0935*	(1.99)
Widowed	−0.0853	(−1.16)	−0.0673	(−0.88)	−0.0802	(−1.02)
Divorced	0.0704	(1.02)	0.0925	(1.32)	0.0683	(0.95)
Separated	−0.00819	(−0.08)	−0.0245	(−0.22)	−0.0286	(−0.25)
Lowest educ.	0.195*	(2.01)	0.213*	(2.01)	0.214+	(1.94)
Above lowest educ.	0.223*	(2.24)	0.223*	(2.05)	0.208+	(1.83)
Higher secondary educ.	0.266*	(2.56)	0.252*	(2.25)	0.238*	(2.03)
Above higher secondary educ.	0.201+	(1.92)	0.205+	(1.81)	0.201+	(1.69)
University degree	0.216*	(2.05)	0.205+	(1.81)	0.201+	(1.67)
Part-time	0.0690	(1.33)	0.0743	(1.40)	0.0727	(1.35)
Retired	0.0535	(1.04)	0.0662	(1.28)	0.0547	(1.03)
Other	−0.00234	(−0.05)	0.0185	(0.40)	0.0208	(0.44)
Public firm	−0.0543	(−0.89)	−0.0615	(−0.98)	−0.0668	(−1.05)
Private firm	−0.124**	(−3.18)	−0.130**	(−3.27)	−0.123**	(−3.01)
Self-employed	−0.237***	(−4.63)	−0.257***	(−4.86)	−0.257***	(−4.76)
Catholic	0.0376	(0.64)	0.0199	(0.34)	0.0178	(0.29)
Protestant	0.167**	(2.65)	0.170**	(2.65)	0.159*	(2.42)
Other	−0.00746	(−0.08)	−0.0207	(−0.21)	0.0108	(0.11)
Attendance: middle	−0.115**	(−3.09)	−0.0926*	(−2.42)	−0.0960*	(−2.47)
Attendance: less and never	−0.227***	(−5.08)	−0.225***	(−4.85)	−0.240***	(−5.05)
Corruption==2			−0.176+	(−1.85)	−0.164+	(−1.67)
Corruption==3			−0.199*	(−2.06)	−0.179+	(−1.81)
Corruption==4			−0.285**	(−2.85)	−0.269**	(−2.61)
Corruption==5			−0.284*	(−2.44)	−0.239*	(−2.02)
Class: middle					−0.00820	(−0.20)
Class: high					−0.0808	(−1.34)
Constant	4.639***	(24.49)	4.896***	(21.77)	4.925***	(21.24)
Country fixed effects	Yes		Yes		Yes	
Observations	7784		7333		7096	

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table presents OLS regression regression results (robust standard errors). Proud 3 is individual patriotism, calculated as the average of at most eight pride questions. See Table 2.3 and 2.7 for a description of the control variables.

Table 2.12: Separate models for each country

	USA	AUT	IRL	NLD	POL	CAN	PRT	URY
Proud 4	0.0422^{+}							
	(1.92)							
Proud 4		0.0959*						
		(2.21)						
Proud 4			0.184***					
			(5.25)					
Proud 4				0.0847**				
				(2.64)				
Proud 4					0.157***			
					(4.79)			
Proud 4						0.0783*		
						(2.33)		
Proud 4							0.106***	
							(5.46)	
Proud 4								0.129***
								(4.56)
Observations	915	510	647	1012	694	444	1003	738

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table presents OLS results (robust standard errors) for eight separate country-specific regressions. The explained variable is individual tax compliance. The main explanatory variable is individual patriotism (*Proud 4*), which is the score for the first principal component derived from a set of 9 pride questions. The principal component analysis is carried out separately for each country subsample. The control variables are the same as in the baseline estimation (see Table 2.3), but the coefficients are not shown.

Table 2.13: Auxiliary regression: Patriotism and view of immigrants

	(1)		(2)	
Proud	-0.167^{***}	(-9.76)	0.0111	(0.58)
Female	0.0403	(1.50)	0.0546^{+}	(1.82)
Age	-0.00638^{***}	(-5.18)	0.00287^{*}	(2.08)
Married	0.0951^{**}	(2.76)	0.0258	(0.67)
Widowed	0.208^{**}	(3.19)	-0.139^{*}	(-1.98)
Divorced	0.0982^{+}	(1.79)	-0.0271	(-0.44)
Separated	0.0680	(0.71)	-0.0756	(-0.70)
Lowest educ.	0.0358	(0.44)	-0.0432	(-0.47)
Above lowest educ.	-0.0494	(-0.61)	0.154^{+}	(1.67)
Higher secondary educ.	-0.201^{*}	(-2.37)	0.428^{***}	(4.45)
Above higher secondary educ.	-0.217^{**}	(-2.59)	0.574^{***}	(6.13)
University degree	-0.458^{***}	(-5.42)	0.856^{***}	(8.98)
Part-time	-0.0657	(-1.50)	0.0244	(0.50)
Retired	0.0254	(0.56)	-0.0721	(-1.42)
Other	-0.0891^{*}	(-2.41)	0.00103	(0.02)
Public firm	0.0862^{+}	(1.71)	0.0277	(0.52)
Private firm	0.0941^{**}	(2.86)	-0.0852^{*}	(-2.28)
Self-employed	0.0190	(0.44)	-0.0251	(-0.53)
Catholic	0.133^{***}	(3.72)	-0.155^{***}	(-3.75)
Protestant	0.119^{**}	(2.67)	-0.227^{***}	(-4.62)
Other	-0.0818	(-1.15)	0.100	(1.30)
Country fixed effects	Yes		Yes	
Observations	5810		5959	

t statistics in parentheses. Robust standard errors are used.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
The table presents OLS regression regression results (robust standard errors)
Dependent variable in Column(1): immigrants are generally good for [country's] economy (1=agree strongly, 5=disagree strongly)
Dependent variable in Column(2): immigrants take jobs away from people who were born in [country] (1=agree strongly, 5=disagree strongly)

Table 2.14: Heckman selection model (patriotism questions)

	(1)		(2)	
Tax Compliance				
Proud	0.247***	(10.63)	0.247***	(10.67)
Female	0.197***	(5.10)	0.197***	(5.10)
Age	0.00494**	(2.83)	0.00503**	(2.87)
Married	0.0855+	(1.65)	0.0849	(1.64)
Widowed	−0.0876	(−0.96)	−0.0891	(−0.99)
Divorced	0.0661	(0.84)	0.0632	(0.81)
Separated	−0.0205	(−0.16)	−0.0197	(−0.15)
Lowest educ.	0.251*	(2.24)	0.250*	(2.28)
Above lowest educ.	0.225*	(1.99)	0.223*	(2.01)
Higher secondary educ.	0.229+	(1.93)	0.223+	(1.91)
Above higher secondary educ.	0.219+	(1.85)	0.213+	(1.83)
University degree	0.170	(1.40)	0.175	(1.45)
Part-time	0.0276	(0.44)	0.0287	(0.46)
Retired	0.113+	(1.74)	0.113+	(1.73)
Other	−0.00648	(−0.12)	−0.00114	(−0.02)
Public firm	−0.00417	(−0.06)	−0.00181	(−0.03)
Private firm	−0.0941+	(−1.95)	−0.0920+	(−1.91)
Self-employed	−0.243***	(−3.94)	−0.239***	(−3.87)
Catholic	0.111*	(2.09)	0.110*	(2.09)
Protestant	0.249***	(3.87)	0.248***	(3.85)
Other	0.0374	(0.38)	0.0442	(0.45)
Income			−0.129	(−1.42)
Constant	5.650***	(30.33)	5.793***	(27.48)
Country fixed effects	Yes		Yes	
Pride-Indicator				
AUT	−1.063***	(−14.32)	−1.063***	(−14.32)
IRL	−0.654***	(−9.06)	−0.654***	(−9.06)
NLD	−0.872***	(−13.75)	−0.872***	(−13.75)
POL	−0.898***	(−13.40)	−0.898***	(−13.40)
CAN	−0.960***	(−12.91)	−0.960***	(−12.91)
PRT	−0.563***	(−8.22)	−0.563***	(−8.22)
URY	−0.624***	(−9.25)	−0.624***	(−9.25)
Income	0.297***	(14.74)	0.297***	(14.74)
Constant	1.331***	(23.81)	1.331***	(23.81)
mills				
lambda	−0.224	(−1.16)	−1.150+	(−1.71)
Observations	7598		7598	

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table presents a Heckman-Selection model, where the incidence of reporting to all pride questions is related to the set of country dummies and individual income.

Table 2.15: Heckman selection model (baseline sample)

	(1)		(2)	
Tax Compliance				
Proud	0.247***	(10.63)	0.247***	(10.66)
Female	0.197***	(5.10)	0.197***	(5.09)
Age	0.00495**	(2.83)	0.00505**	(2.88)
Married	0.0858+	(1.66)	0.0848	(1.64)
Widowed	−0.0876	(−0.96)	−0.0890	(−0.98)
Divorced	0.0660	(0.84)	0.0632	(0.81)
Separated	−0.0206	(−0.16)	−0.0197	(−0.15)
Lowest educ.	0.251*	(2.25)	0.251*	(2.27)
Above lowest educ.	0.226*	(2.00)	0.224*	(2.00)
Higher secondary educ.	0.229+	(1.94)	0.224+	(1.90)
Above higher secondary educ.	0.219+	(1.85)	0.213+	(1.82)
University degree	0.171	(1.40)	0.174	(1.44)
Part-time	0.0276	(0.44)	0.0291	(0.46)
Retired	0.113+	(1.73)	0.113+	(1.73)
Other	−0.00682	(−0.13)	−0.00145	(−0.03)
Public firm	−0.00406	(−0.06)	−0.00137	(−0.02)
Private firm	−0.0940+	(−1.95)	−0.0916+	(−1.90)
Self-employed	−0.243***	(−3.94)	−0.238***	(−3.86)
Catholic	0.111*	(2.09)	0.110*	(2.09)
Protestant	0.249***	(3.87)	0.248***	(3.84)
Other	0.0372	(0.38)	0.0433	(0.44)
Income			−0.125	(−1.37)
Constant	5.649***	(30.23)	5.794***	(27.08)
Country fixed effects	Yes		Yes	
Baseline-Indicator				
AUT	−1.071***	(−15.26)	−1.071***	(−15.26)
IRL	−0.809***	(−12.23)	−0.809***	(−12.23)
NLD	−0.937***	(−15.77)	−0.937***	(−15.77)
POL	−0.993***	(−15.89)	−0.993***	(−15.89)
CAN	−1.429***	(−22.03)	−1.429***	(−22.03)
PRT	−0.674***	(−10.56)	−0.674***	(−10.56)
URY	−0.637***	(−9.98)	−0.637***	(−9.98)
Income	0.303***	(16.43)	0.303***	(16.43)
Constant	1.234***	(23.57)	1.234***	(23.57)
mills				
lambda	−0.198	(−1.13)	−1.012+	(−1.66)
Observations	8619		8619	

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table presents a Heckman-Selection model, where the incidence of being in the baseline sample is related to the set of country dummies and individual income. In order to be in the baseline sample, the individual has to answer all nine pride questions and the control variables have to non-missing.

Chapter 3

Patriotism, taxation and international mobility*

3.1 Introduction

Henry Morgenthau Jr., US Secretary of the Treasury during World War II, instructed Walt Disney to work on an animated movie to make US citizens less reluctant to pay their income taxes. The result was entitled *The New Spirit* and features Donald Duck who is, initially, disinclined to pay income taxes. He then, however, becomes convinced that "Taxes to beat the Axis" is his patriotic duty and happily pays them. Although innovative and ground-breaking, the production of *The New Spirit* is not a unique episode in history. Indeed, the role of patriotism for fiscal policy during war had been acknowledged in the US and UK long before World War II.[1] Likewise, patriotism has recurrently been invoked to mobilize citizens for other contributions such as military service (Levi 1997).

Patriotic sentiments usually run strongest during times of war. Nonetheless, patriotism is unlikely to be important for governments' (fiscal) policy *only* in times of

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[1]On the role of patriotism for war financing in the UK during World War I, see Stamp (1932). Bank et al. (2008) provide more systematic evidence demonstrating that US tax reforms leading to heavier tax burdens have often been enacted during wartime. Durand (1917, p. 905) relates this association between war and taxes to patriotism: "One can hardly overestimate the effect of patriotic sentiment during war time as an aid to the fiscal policy of the government. Much heavier taxes can be successfully collected during war than during peace."

war. Indeed, moral appeals to "patriotic duty" – such as in *The New Spirit* and its sequel entitled *The Spirit of '43* – are likely to carry significant weight also in times of peace.[2] Moreover, as argued in the previous chapter, they relate to a warm glow from paying taxes,[3] which is only one manifestation of a possibly close link between patriotism and personal income taxation. A further potentially important link between patriotism and taxation – and the focus of the current chapter – emerges in an international context when taking into consideration fiscal competition between countries and taxpayer mobility. This was already acknowledged by Seligman (1892, p. 138):

> It is not always strictly true, as Adam Smith said, that "the proprietor of stock is properly a citizen of the world, and not attached to any particular country". Feelings of patriotism, of local pride, of desire of proximity to friends, of long custom and old usage sometimes play a considerable role.

To better understand the underlying argument, it is important to define more precisely what we understand by patriotic sentiments. For many, patriotism has become a value-laden concept bearing a strong negative connotation; being linked to nationalism and hostility toward the out-group (e.g. Druckman 1994, Mummendey et al. 2001). This, however, pertains only to what has been termed "blind", "unquestioning" patriotism, which is to be distinguished from "constructive" patriotism (Schatz et al. 1999, p. 151). While 'patriotism' and 'nationalism' thus defined often become closely tied in reality, the previous chapter has argued that it is important to distinguish between the two concepts. The Oxford English Dictionary (OED 2003, p. 2122) defines patriotism as "devotion to one's country". In fact, this love and devotion can – pragmatically – be understood as being linked to an intrinsic preference for living in one's native country, compared to living in the diaspora (all else equal). Patriotism, in other words, is a state of mind that leads individuals to

[2]For instance, tax-paying as a patriotic duty was also an issue in the presidential campaign 2008 (see, e.g., Joe Biden on ABC News, September 22, 2008, and the discussion his statement induced). While the US is currently at war in Iraq and Afghanistan, Biden's appeal should mainly be seen against the background of the current financial crisis.

[3]See also Harbaugh et al. (2007) who provide evidence from brain scans suggesting that paying taxes in laboratory experiments causes physiological rewards

experience a non-monetary benefit (or "patriotic rent") from residing in their native country.[4] Patriotic citizens may then be willing to pay higher income taxes in their native land, not only because of patriotic duty (as Donald Duck in *The New Spirit*), but also because they have to pay these taxes in order to reside there. Intuitively, patriotism thus reduces individuals' propensity to move abroad in response to high marginal taxes and this reduction in the elasticity of the tax base allows governments to adopt higher levels of taxation.

This chapter has two main contributions. First, theoretically, we formalize Seligman's (1892) argument about the role of patriotism in the context of fiscal competition, using a simple median voter framework commonly employed in the public choice literature (Holcombe 1989). Specifically, we develop a model of redistributive taxation in the spirit of Meltzer and Richard (1981), enhanced by the possibility of international migration. This allows us to better characterize the exact effects of patriotic feelings in an international context, and derive empirically testable implications. The model shows that, for countries of equal size, an increase in patriotism in one country raises the equilibrium tax rate in that country. The intuition is that patriots' "patriotic rent" increases their cost of emigration. They might thus refrain from moving abroad under conditions where they would have done so in the absence of their patriotism. Countries can "exploit" this by implementing higher taxes in the equilibrium.[5]

Second, rather than rely on descriptive evidence (see above), we test this prediction using the *International Social Survey Programme National Identity* (2003) study from the previous chapter and matching this dataset with OECD data on tax burdens (across 21 countries in the year 2003). The empirical analysis indicates a strong and robust positive correlation between patriotism and fiscal burdens, even when controlling for other intervening factors and correcting for possible endogeneity. This suggests that the higher shadow cost for patriotic citizens relocating abroad does indeed, as hypothesized by the theory, allow countries to exploit the patriotic feelings of their population through the tax system.

[4] This rent can be one of the underpinnings for location preferences such as "home attachment", which has been analyzed, e.g., by Mansoorian and Myers (1993). They, however, focus on countries' incentives for interregional transfers.

[5] Complementary theoretical analyses linking taxation and "home attachment" can be found in Ogura (2006) for capital income taxes, and Konrad (2008) for labor income taxes.

Our analysis contributes to several strands of research. First, a literature starting with Meltzer and Richard (1981) identifies determinants of the amount of redistribution. While Meltzer and Richard (1981) themselves highlight that the efficiency costs of taxation may limit redistribution, later studies in the public choice and political economics tradition illustrate that redistribution may be affected by the modes of redistribution available (Lizzeri and Persico 2001), uncertainty and perceptions about social mobility during individuals' lifetime or across generations (Glazer and Konrad 1994, Piketty 1995, Benabou and Ok 2001, Dorsch 2010), the role of redistribution as insurance (Sinn 1995, Moene and Wallerstein 2001), specificity and portability of skills (Iversen and Soskice 2001), demography (Razin et al. 2002), non-monotonicity (Epple and Romano 1996), the existence of power coalitions (Breyer and Ursprung 1998, Iversen and Soskice 2006), proportional representation in political decision making (Austen-Smith 2000, Aidt and Dallal 2008) or the amount of mobilization and political engagement (Solt 2008). Our analysis adds the role of patriotism to this list: i.e., patriotism may affect the ability of governments to extract tax revenue and to use that revenue for redistribution in a globalized world.

We also add a new aspect to the discussion about the future of the welfare state and redistribution in an international context. Rodrik (1998) argued that welfare state institutions may become more important as countries become more open in a globalizing world (for some recent evidence on the connection between globalization and social spending, see, e.g., Dreher et al. 2008). But, at the same time, policy makers and economists are concerned that migration and international tax competition may erode the financial basis for governmental policy (Weck-Hannemann 2001). That is, while from a welfare point of view mobility has upsides and downsides,[6] high mobility of highly skilled, high-income earners is likely to have detrimental effects

[6]Bhagwati and Dellalfar (1973) and Bhagwati and Hamada (1976) argued more than 30 years ago that "brain drain" endangers the countries from which this drain originates and argued for a coordinated corrective tax. Justman and Thisse (1997, 2000) maintain that mobility of skilled labor may deprive a country of the fruits of *public* educational investment (thus leading to underinvestment in public education). To the contrary, Andersson and Konrad (2003) point out that the outmigration threat may overcome the problem of time-consistent taxation of the returns to *private* investment in education. Wildasin (2000) – combining both views – claims that international migration can be good or bad for educational investment, depending on the public or private nature of education financing.

on the amount of fiscal revenue that is available for redistribution (e.g., Feld 2000).[7] In line with Seligman's (1892) pioneering conjecture, we argue that patriotism, and the attachment it generates to home, might help prevent a possible "race to the bottom". Intuitively, patriotism generates a base of loyal citizens that makes the tax base less elastic with respect to tax rate changes, and this leads to a tax competition equilibrium in which taxes may remain high.[8]

Thirdly, our analysis links closely to recent attention given to the impact of social identities on economic decision-making (e.g., Akerlof and Kranton 2000, Shayo 2009, Klor and Shayo 2010). While - in line with the approach taken in this literature - social identities enter additively to an individual's utility function in our theoretical model, we add a new dimension to this research field by regarding how specific social identities may affect individuals' migration decisions in an international setting - and how this, in turn, affects governments' taxation decisions.

Finally, while pointing out a potential fiscal benefit of patriotism, our analysis does *not* intend to promote a naïve theory of "patriotism is beautiful". This would clearly ignore all negative side-effects of patriotic sentiments. Rather, our analysis provides a word of caution: the Treasury's inherent interest in having patriotic subjects as taxpayers may well strengthen the political push for patriotism - certainly in a world of highly mobile taxpayers and the downward pressure that competition for these mobile taxpayers puts on government revenues. Hence, current increases in international mobility may presage further attempts by some countries to strengthen patriotism to levels higher than they would have been in the absence of this fiscal effect.

In the next section the formal framework is outlined. Then, in section 3.3, we turn to the empirical evaluation of the core predictions about the link between patriotism and taxation. Finally, section 3.4 brings together the main conclusions and discusses some implications of our findings.

[7] This concern has been raised first in the context of capital income taxation. For overviews of this vast literature, see Wilson (1999), Fuest et al. (2005) and Sørensen (2007).

[8] Apart from patriotism and the citizen loyalty it may generate, other elements that cause countervailing forces to the race to the bottom have been identified in theoretical work. Baldwin and Krugman (2004) focus on agglomeration advantages. Hohaus et al. (1994) and Zissimos and Wooders (2008) consider aspects of heterogeneity and product differentiation. Our empirical test is independent of these other factors.

3.2 The formal framework

We consider a static[9] game with migration followed by taxation and redistribution. Suppose there are two countries, A and B. Each country has two political parties denoted as D_K and R_K, for $K \in \{A, B\}$. The sets of individuals born in countries A and B are $I_A = [0, 1 + n_A]$ and $I_B = [0, 1 + n_B]$. In each country, a subset $[0, 1]$ of individuals has low productivity, implying that they earn an income equal to w_L. The remaining individuals are more productive, and earn a gross income equal to $w_H > w_L$. The sizes of the group of individuals with high productivity born in A and B are $n_A < 1/2$ and $n_B < 1/2$, respectively. The incomes w_L and w_H are exogenous and fixed, reflecting, for instance, individuals' marginal productivity in a competitive labor market with constant returns.[10] Individuals also differ in terms of their *patriotism*: each individual obtains a particular (non-monetary) pleasure from residing in his/her native country, compared to living in the respective other country.[11] For an individual i born in country K, this pleasure is denoted as $h_K + \eta_i$. It consists of a deterministic and a stochastic component. The deterministic component $h_K \geq 0$ measures the happiness individuals enjoy on average from residing

[9] Our framework could be embedded into a fully dynamic multi-period supergame with the two-stage game considered here being played in each period: i.e., migration choices followed by taxation choices in each of the periods, with individuals and parties who have an infinite life and maximize discounted present values (or an overlapping generations structure). In the absence of migration costs, the equilibrium we derive below for the static game is also an equilibrium in such a finitely or infinitely repeated game. If there was an infinite number of periods, equilibria other than the one we derive can be supported (e.g., by trigger strategies), and the uniqueness result we have would be lost.

[10] We could make w_L and w_H a function of relative scarcity of types, or of other factors of production (such as capital) in the two countries. We refrain from doing so, however, as this would significantly complicate the analysis without affecting our main conclusions.

[11] One might argue that non-natives may over time develop patriotism toward their new home-country. This is not captured here. This need not be problematic as the destination country moved into is less likely to "re-socialize" individuals into feeling patriotic about it when these individuals' identities and loyalties are firmly established in the native country (Hooghe 2005, Johnston 2005). Given that scholars studying identity formation and the internalization of norms and loyalties generally agree that "agents' first and most intensive period of socialization occurs inside the main institutions of state socialization (for example, education systems)" (Johnston 2005, p. 1026) the development of patriotic feelings may be more difficult for immigrants. This holds especially for those who have spent considerable time in their native country (as relative length of embeddedness within both structures is crucial; see Egeberg 2004). Our assumption might be inappropriate if the country of origin is authoritarian or a "failed state". Such countries are not included in the empirical analysis.

in their native country, and we refer to values h_A and h_B as the *average patriotism rent*. This rent does not need to be the same across both countries. The stochastic component, η_i, is an independent draw from the same distribution for all individuals. We assume that $E(\eta_i) = 0$, and that the distribution is characterized by a cumulative distribution function $G(\eta_i)$ that is continuous on its whole support - given by $[-(w_H + \max\{h_A, h_B\}), w_H]$ - and continuously differentiable on this interval.[12]

In STAGE 1, individuals choose whether to stay in their country of origin or to migrate to the other country. Simplifying, we assume that individuals with low income are immobile, and individuals with high income are perfectly mobile in this stage.[13] The sets J_A and J_B with measures $1 + \gamma_A$ and $1 + \gamma_B$ describe the post-migration distribution of individuals. Here, $\gamma_A \in [0, n_A + n_B]$ is the size of the population of high income earners who choose to reside in country A, and similarly for γ_B. As there is no other place to go to or to come from, it must be that $\gamma_A + \gamma_B = n_A + n_B$. These population sizes are observed at the end of STAGE 1. Moreover, individuals lose their mobility at the end of this stage.[14]

In STAGE 2, a political equilibrium determines taxes and redistribution. The timing with taxation following the migration choices maps the idea that migration decisions are "more long-term" than taxation, but is not essential for the qualitative predictions here. In each country ($K \in \{A, B\}$) both parties – D_K and R_K – choose policy platforms (t_K, S_K^H, S_K^L) consisting of a proportional tax rate $t_K \in [0, 1]$ that applies uniformly to all inhabitants, and non-negative subsidies $S_K^H \geq 0$ and $S_K^L \geq 0$, where S_K^H and S_K^L are the amounts paid to high and low productivity residents respectively. We allow for different per-capita subsidies for the two different types of

[12] The random element induces a smooth distribution of patriotism rents, similar to the distribution of home-attachment in Mansoorian and Myers (1993).

[13] The assumption that migration is an option only for high income earners is common in the literature – see, for example, Andersson and Konrad (2003) and Beine et al. (2008) – and builds on findings by, among others, Docquier and Marfouk (2006), that highly educated workers are five to ten times more likely to emigrate. Note also that "welfare tourism" – i.e., migration by the poor for welfare benefits – is probably of only minor concern in the international context analyzed here, as transfer entitlements can be tied to how long a person has resided in the country.

[14] Mobility is often higher in earlier stages of life (e.g., when deciding where to study or at the beginning of one's professional career) and, due to high set-up costs, is a more "long-term" decision compared to taxation (which is adjusted more frequently). Similar timing regarding migration and policy choices is adopted, for instance, in Mitsui and Sato (2001).

individuals, but require that all individuals with the same gross income receive the same per-capita subsidy. The proposed policy platform has to obey a government budget constraint. Given that gross tax revenue in country K is given by $(w_L + \gamma_K w_H)t_K$ and tax collection has a cost equal to $\frac{t_K^2}{2}(w_L + \gamma_K w_H)$, net tax revenue T_K that is available for redistribution is[15]

$$T_K = (t_K - \frac{t_K^2}{2})(w_L + \gamma_K w_H). \tag{3.1}$$

Hence, a balanced government budget requires

$$S_K^L + S_K^H \gamma_K = (t_K - \frac{t_K^2}{2})(w_L + \gamma_K w_H). \tag{3.2}$$

Voters observe the policy platform choices of the parties and vote for one or the other platform. We assume sincere voting. The platform that receives the most votes is implemented. In case of a draw, a random device decides on implementation. Once these decisions are made, income accrues, taxes are collected, tax revenue is redistributed according to the policy platform and the game ends.

We now turn to the payoffs of the players. Individuals care about the sum of net income and patriotic rents. The net income of an individual locating in country K is $(1 - t_K)w_L + S_K^L$ if the income of the individual is w_L, and $(1 - t_K)w_H + S_K^H$ if the individual's income is w_H. An individual i born in country A and staying in this country receives in addition a patriotic rent equal to the sum of the deterministic average patriotism rent h_A, and the idiosyncratic component η_i. Note that the overall patriotic rent for i can be negative in country A even though $h_A \geq 0$ if the idiosyncratic component η_i is sufficiently negative. If the individual i is born in A and moves to B, the patriotism rent received is zero. This is a normalization and adopted without loss of generality.[16] The intrinsic patriotic rent for an individual i

[15] The cost of taxation may have many possible microeconomic underpinnings. In the simplest case, the cost of taxation may be the physical transaction cost of tax collection or tax compliance. Still, it could also be seen as a shortcut that accounts for an excess burden of taxation. The convexity of this cost in the tax rate is a common and plausible assumption used to describe the excess burden of taxes (e.g. Bolton and Roland 1996, p. 100).

[16] For instance, the patriotic rents for living in countries A and B could be $h_A + \alpha_i$ and β_i, respectively, for an individual i born in country A, with stochastic α_i and β_i. In this case, η_i can simply be seen as $\eta_i = \alpha_i - \beta_i$. The absolute levels of α_i and β_i matter for happiness, but the

who is born in B and stays in B is defined analogously as $h_B + \eta_i$. Summarizing, the payoff of an individual i with high income w_H, born in country A ($i \in I_A$) is

$$\begin{aligned} u_i &= (1 - t_A)w_H + S_A^H + h_A + \eta_i \quad \text{if } i \text{ stays in } A \\ u_i &= (1 - t_B)w_H + S_B^H \qquad\quad \text{if } i \text{ moves to } B. \end{aligned} \tag{3.3}$$

The payoff for individuals born in country B is defined analogously. The payoff of individuals with low income in country K is

$$u_i = (1 - t_K)w_L + S_K^L + h_K + \eta_i. \tag{3.4}$$

As individuals with low productivity do not have a residence choice here, they always stay in the country where they were born. They may have a positive or negative patriotic rent from this.

Finally, we assume that all political parties are office motivated. Each party chooses the policy platform that, given the anticipated choice by the competing party in the same country, maximizes the probability of winning a majority of votes. As the median voter theorem will apply in our framework, it is well known that a large class of alternative party preferences would lead to the same voting equilibrium in STAGE 2. Solving for the subgame perfect equilibrium of this game, we find two main results.

Proposition 1 *A subgame perfect equilibrium exists and is unique.*

A proof is in the appendix. Intuitively, the groups with low productivity choose their optimal income tax rates in each of the two countries. They take into consideration that the share of highly productive individuals in their own country is decreasing in the tax rate in their own, and increasing in the tax rate of the other country. This causes a unique crossing of the reaction functions. Patriotism, and the home attachment (or "lock-in") it creates, typically leads to strictly positive taxes in the equilibrium. Patriotism weakens the "race to the bottom" in competitive tax setting between countries.

The comparative static properties of this equilibrium yield the main hypothesis of our empirical analysis:

difference is all that matters for the migration decision.

Proposition 2 *Greater patriotism in a country yields a higher equilibrium tax rate in this country and a lower equilibrium tax rate in the other country (i.e.,* $\frac{dt_A}{dh_A} > 0$, $\frac{dt_B}{dh_B} > 0, \frac{dt_A}{dh_B} < 0$ *and* $\frac{dt_B}{dh_A} < 0$*).*

A proof of Proposition 2 is also in the appendix. If country A initially has an indigenous population that is more patriotic on average than the population in country B (i.e., $h_A > h_B$), then, for identical tax rates (i.e., $t_A = t_B$), the mobile high income earners in A are less likely to emigrate than the mobile high income earners from country B. Country A thus ends up with a larger set of high income earners in the post-migration equilibrium than country B ($\gamma_A > \gamma_B$). For the median voter in A, this makes a higher tax rate more desirable than in B. This higher tax has general equilibrium repercussions. As shown in the proof of the proposition, these repercussions are weaker than the primary effect.

Proposition 2 yields our main empirical hypothesis: more patriotism triggers higher tax rates.

3.3 Empirical analysis

In this section, we link the 2003 ISSP "National Identity II" survey data from the previous chapter to the OECD "Benefits and Wages" database to test our main hypothesis (for a set of 21 countries in the year 2003).[17] The central dependent and independent variables (i.e., tax burden and patriotism respectively) are described in section 3.3.1, while the empirical approach (and the two levels of aggregation at which we evaluate our central hypothesis) is explained in section 3.3.2. The 'baseline' results are presented in section 3.3.3, while section 3.3.4 discusses a number of robustness checks.

[17] The countries are: Australia, Austria, Canada, Denmark, Finland, France, (West-)Germany, Hungary, Ireland, Japan, New Zealand, Norway, Poland, Portugal, Slovak Republic, South Korea, Spain, Sweden, Switzerland, the United Kingdom and the United States. The ISSP aims to provide a nationally representative sample of roughly 800 to 1500 respondents in each of these countries (thus providing about 22300 observations as a starting point). Note that the battery of patriotism questions employed in our analysis is available only in the ISSP National Identity surveys conducted in 1995 and 2003, as well as in the corresponding GSS (USA only) and ALLBUS (Germany only) studies. The 1995 income data in the ISSP and the OECD are, however, not sufficiently detailed to allow a reasonable number of observations for this year - leaving us with a single cross-section.

3.3.1 Data

The *dependent variable*, $Tax_{i,j}$, is defined as gross income minus net income, divided by gross income. As such, it quantifies the income tax burden as the share of gross income paid in income taxes and social security contributions. It is calculated by linking the income level each respondent in the 2003 ISSP survey claims to earn to the income tax rate data in the OECD "Benefits and Wages" study. The latter study provides information on workers' income tax payments as well as social security contributions levied on employees for several benchmark cases depending on household type and income level. More specifically, information regarding the overall income tax burden is provided for 200 levels of income (ranging from 0% to 200% of the average employee's income) for each of the countries surveyed.[18] This thus provides a relatively detailed description of the income tax burden along the income scale, allowing us to match each respondent closely to the tax burden calculated by the OECD for his/her income group and household type.

We restrict our sample to those 7427 respondents in the ISSP dataset who are single (note, though, that only 3090 of these provide sufficient information about income and patriotic sentiments), and this for two reasons. First, the ISSP data do not allow a clear portrait of how multi-individual households are constituted (e.g., whether adults in a given household are married, cohabiting, live with their (grand)parents or children is difficult to establish with certainty). This information, however, is crucial to accurately determine the appropriate tax rates in the OECD data, and thus to derive our central tax burden variable. Second, singles are likely to be more mobile and less attached to a country for personal reasons (e.g., married individuals, or individuals taking care of children and/or (grand)parents are more strongly bound to a given country and might 'grow' to love it because of that). Singles thus constitute a 'least-likely' category of individuals vulnerable to exploitation by

[18] One could argue that individuals earning the average worker's income (or even twice that amount) are not necessarily the "rich and mobile" for which our theoretical model (implicitly) predicts the strongest effects. Nevertheless, for most countries in our sample, the 90th-percentile of the income distribution corresponds to approximately 1.5 times the average worker's income (Atkinson 2008). Exceptions are Ireland and the US, where the 90th-percentile is at 200% of the average worker's income (Atkinson 2008). Hence, we feel confident that most of the income distribution which is of empirical interest to our model is de facto represented in our sample. We are grateful to Tom Cusack for extensive and fruitful discussions on this point.

a national government for patriotic reasons, providing a harsh test for structural effects.

We also - for the time being - exclude 1309 respondents claiming an income below 60% of the average worker's income in their country (bringing the final sample to about 1700 individuals). This, likewise, has two reasons. First, these citizens often have a net wage exceeding the gross wage (leading to a negative tax burden), making it difficult to interpret their tax "burden". This lack of tax payments also implies that this group cannot be exploited by the government through higher income taxation related to their (possible) patriotism. Second, net income exceeding gross income indicates that these respondents are likely to be recipients of social welfare benefits. They might prefer higher (income) tax rates to finance redistribution in their favor and become more attached to their country due to the receipt of welfare benefits. This, however, entails a reverse causality argument where high tax rates lead to more patriotism. To prevent this from artificially inflating support for our hypothesis, we exclude this income group in our 'baseline' estimations (although, importantly, we return to this exclusion below). We chose a cut-off at 60% to exclude all negative tax burdens from the sample. Still, as this choice is rather arbitrary, we illustrate that imposing a cut-off at 50% or 70% does not affect our main findings.

The *core explanatory variable* of our analysis is the respondent's patriotism ($Proud_{i,j}$). We follow chapter 2 and combine the pride indicators through a factor analysis into a single patriotism variable.[19] Note that articulated patriotism – as measured in surveys – is not necessarily a direct measure of h. Patriotism is sampled among the population that emerges in the post-migration equilibrium. As some individuals with sufficiently negative idiosyncratic patriotism $\eta_i < 0$ will have left the country in equilibrium, average articulated patriotism among the indigenous population in the post-migration equilibrium should be higher than the average patriotism among all individuals who are born and raised in a given country. Nevertheless, for the testable implications of the formal analysis, this is not a problem.[20]

[19] In chapter 2, the question on the social security system was excluded, although inclusion left the results unaffected. The patriotism indicator in this chapter uses the entire battery of pride questions.

[20] More formally, the average patriotism rent among the indigenous population in the post-migration

3.3.2 Empirical specifications

We evaluate our main hypothesis at two levels of aggregation.

First, and possibly most intuitive, we work at the country level. The idea here is that, to the extent that taxation decisions in a given country are influenced by the patriotic nature of its population, the average tax burden should be a reflection of the average level of patriotism. To assess this prediction, we aggregate the patriotism and income tax burden variables described in the previous section across all respondents for each of our 21 countries.[21] As such, we derive one patriotism-tax burden combination for each country. As standard regression analysis is unreliable using such a limited number of observations, we rely on a simple graphical representation. That is, we depict the average degree of patriotism (on the horizontal axis) against the tax burden (on the vertical axis) in a simple cross-plot, and expect a positive relation between both variables. Although this analysis admittedly does not allow controlling for possible confounding factors, it does present a general view of the relation between both variables.

Second, we exploit the idea that governments generally impose an overall tax schedule or tax structure, which affects groups of taxpayers differently depending on their income level (and socio-economic characteristics). Hence, an alternative test of our

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equilibrium is

$$[h_K + E(\eta_i \,|i \in I_K \cap J_K\,)] > h_K \text{ for } K \in \{A, B\}.$$

For instance, let $n_A = n_B$. Then, for $h_A > h_B$, we find that $t_A > t_B$ in the equilibrium. This means that, apart from the patriotism rent and in pure income terms, the fiscal conditions in country A for high income earners are less attractive than in country B. Hence, the cut-off $h_A + \eta_i$ of indigenous individuals who stay in A is higher than the cut-off $h_B + \eta_i$ for indigenous individuals in B. Accordingly, $t_A > t_B$ and the differential effects on outmigration in A and in B reinforces the pre-existing differences between the expected patriotism rents of non-migrants in the two countries from $h_A - h_B$ to

$$[h_A + E(\eta_i \,|I_A \cap J_A\,)] - [h_B + E(\eta_i \,|I_B \cap J_B\,)] > h_A - h_B$$

in the equilibrium. For our estimations, this implies that the coefficient measuring the effect of differences in actual patriotism will be biased downward. Hence, if actual migration changes the measured patriotism in the indigenous population of a country, then this effect biases the empirical test against our hypothesis.

[21] Other taxes might play a role as well. Still, income taxes might be particularly important (as illustrated by the choice in *The New Spirit* to focus on income tax payments). Moreover, we have no information on other taxes.

theory exploits aggregates for the 200 different income levels reported in the OECD Benefits and Wages database. Indeed, to the extent that the government defines (or adjusts) the overall tax structure, the observed average tax burden *of given income groups* will be a reflection of their average patriotic sentiment. Evidently, we do *not* imply here that governments deliberately impose higher taxes on certain income groups depending on their perceived level of patriotism. Such a link between the incidence of income taxes across the income distribution with the incidence of patriotism across the income distribution would be highly implausible. Nonetheless, when more patriotism among high-income earners reduces their international mobility - as argued above - more progressive forms of taxation introduced by the government to exploit this will show up in the distribution of tax burdens across income levels; this provides the cornerstone of our analysis here.

The level of observation in this analysis obviously is no longer the country, but a given income level within a country. That is, we calculate for all individuals in a given income category in a given country, the average level of patriotism. For example, we aggregate the information on all individuals claiming an income between, say, 103.00% and 103.99% of the average workers' income in a given country. The maximum number of observations in the analysis therefore equals the number of countries (21) times the number of income classes (200). However, our sample does not include respondents for all income levels in each country, and the final sample reduces to about 280 observations. As this allows for reliable inference from standard regression estimation techniques, we test our central hypothesis by estimating a regression equation of the following form:

$$Tax_{i,j} = \beta_0 + \beta_1 Proud_{i,j} + \mathbf{x'_{i,j}}\beta_{\mathbf{2}} + e_{i,j} \tag{3.5}$$

where $Tax_{i,j}$ represents the average income tax burden faced by income group i in country j, $Proud_{i,j}$ denotes income group i's average level of patriotism and $\mathbf{x'_{i,j}}$ is a vector of control variables. Essentially, this approach thus exploits the cross-country variation in patriotism for different income brackets (while, as discussed below, controlling for these income brackets in themselves).

Beside the central patriotism variable described in the previous section (aggregated

at the income group level), we add a number of control variables to capture the effect of potential mediating factors. First of all, we include each income group i's position in the income distribution of his/her country ($IncPos_{i,j}$). This designates the percentage of country j's average wage that this income group i represents. Hence, as the OECD provides detailed data for 200 income levels (see above), $IncPos_{i,j}$ ranges from 0% to 200%. The coefficient estimate is expected to be positive, as higher income leads to higher tax burdens. Further, we control for a number of country characteristics. First, the country's unemployment rate ($Unem_j$) is taken from the World Development Indicators. Unemployment increases the need for public spending on unemployment (and, potentially, other social welfare) benefits, and thus is likely to be associated with higher equilibrium tax rates. We include the level of GDP (per capita and in natural logarithms to account for the highly skewed distribution of this variable; GDP_j). Following Wagner's Law, we expect that the wealth of a country is associated with higher taxes. Inclusion of this variable is also important to account for the relative sizes of countries. We also account for the ideological persuasion of the government ($IDEO_j$) based on the oft-cited idea that left-wing parties favor more government intervention and redistribution than their right-wing counterparts, which is likely to lead to higher tax burdens (e.g., Hibbs 1977). The variable $IDEO_j$ is obtained from the Comparative Political Dataset (Armingeon et al. 2008) and takes on values between 1 and 5, with larger numbers representing more leftist governments. As governments are unable immediately to change fiscal policies to match their ideological preferences, we lag this variable by four years (due to the strong temporal dependence in the series; using slightly shorter or longer lags makes little difference to our findings). Given the coding scheme, we expect this variable to be positively related to the income tax burden. Fourth, we include an index of fiscal decentralization ($DECENTR_j$), measured as the share of total government revenues raised at the national level (likewise taken from the Comparative Political Dataset; Armingeon et al. 2008). The idea here is that if public good provision is decentralized and lower-level governments are fiscally autonomous, the central government itself is in less need of financial resources, allowing income tax rates to be lower.

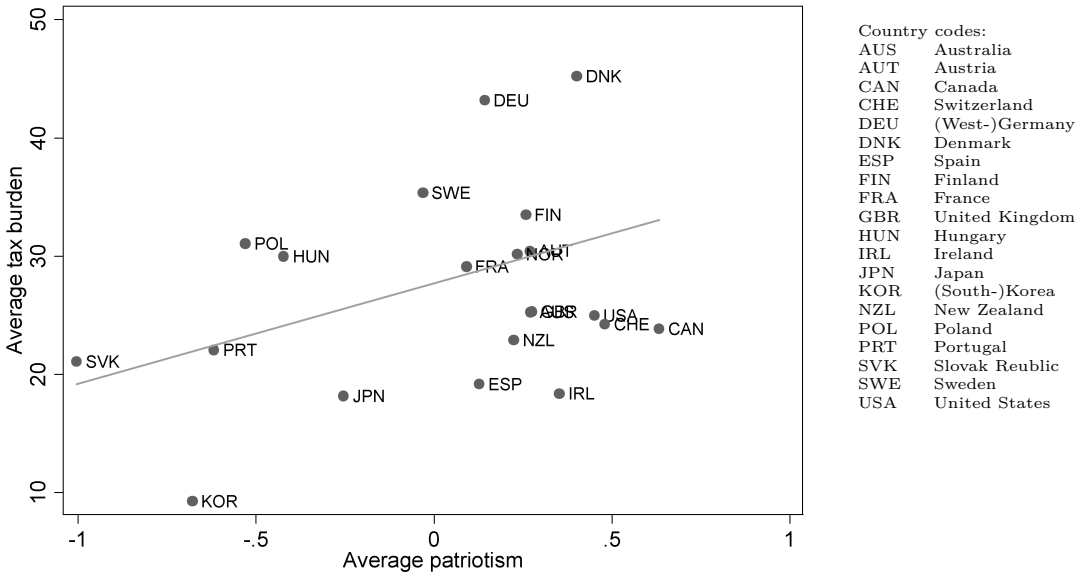
Before we turn to the results, it is important to note that, although our dataset pools cross-sections from different countries, we do not include country fixed ef-

fects in our estimations. To include country fixed effects would lead to a focus on within-country variation, whereas our model predicts that variation in patriotism is associated with between-country tax differentials (controlling for other factors). Since we use various country variables to control for obvious level differences in the country-specific tax schedules in our sample, one might consider clustering the standard errors at the country level to control for unobserved country characteristics. However, Hubert-White type standard-errors for country-level clusters are inappropriate in our setting, as that correction requires a large number of clusters with relatively few observations in each cluster.[22] Our sample is characterized by the opposite tendency: few clusters with numerous observations.

3.3.3 Results

The results of the country-level analysis are represented in Figure 1, where we show the average degree of patriotism in a given country on the horizontal axis and place the average tax burden of respondents from that country on the vertical axis. We also

Figure 3.1: Tax burden and patriotism across countries



[22]See Wooldridge (2003) and the references therein for studies showing that cluster-robust estimation may fail even when the number of clusters is as large as 40 or 50.

add a trend-line to the picture to clarify the overall relation between both variables. This simple cross-plot clearly confirms the expected positive relation between the level of patriotism and the level of taxation. Countries where respondents report more pride in their country (i.e., patriotic sentiment) are also those countries that, on average, tend to impose heavier tax burdens on their inhabitants.

Shifting the analysis to a lower level of aggregation and concentrating on the patriotism-taxation relation using data on 200 income-groups, we find the results presented in Table 3.1. The first column regresses income group i's tax burden on its patriotism score (Aver. Proud) controlling only for the relative income position (IncPos). The second column adds controls for various country characteristics. The remaining three columns have two purposes. First, by varying the cut-off point for dropping low-income earners, we evaluate the robustness of our findings to this particular choice. Hence, in columns (4) and (5), we report some results using a cut-off of 50% and 70% (rather than 60%, as in the main estimations). Second, varying this cut-off point also allows an empirical assessment of whether the patriotism effect in our dataset is particularly strong for high income groups and/or particularly weak for low income groups (see above). To this end, in column (3), we also add results using only those respondents to the ISSP survey who claim to earn less than 60% of the average worker's income. For these low income people, the theory predicts no relation between patriotism and the tax burden (though, as mentioned, there may be a reverse causality problem here leading to a spurious positive relationship between the two variables; see section 3.3.1). Hence, comparing columns (2), (3), (4) and (5), we can determine whether the positive association between patriotism and tax burden is stronger for the upper part of the income distribution.

Starting the discussion of our findings with a brief description of the control variables, we find that – as expected – income groups placed relatively higher in the country's income distribution face a significantly heavier tax burden. Also, in line with the proposition that left-wing governments favor intervention more highly, the tax burden is higher when the government's ideological position (four years ago) was further to the left. The extent of fiscal decentralization, on the other hand, is linked to a lower income tax burden (supporting the idea that central governments in such a setting need fewer resources from, among others, income taxation). GDP and unemployment show the expected positive relation to the tax burden, but remain

Table 3.1: Main results

	(1) ≥ 60%	(2) ≥ 60%	(3) ≤ 60%	(4) ≥ 50%	(5) ≥ 70%
IncPos	0.0849***	0.0862***	9.056***	0.0935***	0.0858***
	(7.62)	(9.75)	(4.80)	(11.30)	(8.59)
GDP		0.595	−93.63*	0.988	0.382
		(0.75)	(−2.17)	(1.39)	(0.38)
Unem		0.0952	0.0988	0.165	0.0621
		(0.73)	(0.01)	(1.41)	(0.39)
IDEO		3.182***	−6.628	3.153***	3.199***
		(9.86)	(−0.39)	(10.51)	(9.34)
Decentr		−0.0547*	2.172	−0.0631**	−0.0602*
		(−2.36)	(1.05)	(−2.92)	(−2.36)
Aver. Proud	3.568***	1.892**	151.8	1.569**	1.696*
	(5.35)	(3.00)	(1.17)	(2.60)	(2.36)
Constant	19.66***	8.179	421.0	3.316	10.89
	(16.85)	(0.93)	(1.64)	(0.42)	(0.96)
N	292	282	192	323	243

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

statistically insignificant at conventional levels.

Turning to our central patriotism variable, we find strong and consistent support for our main proposition. The estimations (columns (1)-(2) in Table 3.1) show that patriotism is positively associated with the income tax burden, even after controlling for relative income positions. The point estimates are very similar in both baseline estimations, indicating that this result is robust to adding additional country-level explanatory variables. This evidence is strongly in line with the theoretical hypothesis. It suggests that countries are able to exploit the patriotic feelings of their populations by levying higher taxes. Remember, moreover, that our findings are based only on individuals who are single (whose propensity to move arguably is greatest) and that actual migration biases the empirical test against our hypothesis (see above). Hence, our estimates could be seen as a conservative estimate of the true effect.

The remaining columns in Table 3.1 furthermore illustrate that our findings are robust to the cut-off we employ for including low-income earners in the dataset. Moreover, the patriotism variable has a positive sign, but fails to reach statistical

significance at conventional levels, in the model using only the low-income subsample of our population (i.e., 192 observations). This supports the theoretical prediction that for these low income people no relation between patriotism and the tax burden exists (despite a potential reverse causality problem that would inflate the positive relationship between the two variables).

3.3.4 Robustness checks

3.3.4.1 Alternative patriotism measure

The 2003-wave of the ISSP survey contains a number of further questions probing people's attachment to their country. Specifically, there are six such questions: "How close do you feel to [country]?", "I would rather be a citizen of [country] than of any other country in the world", "There are some things about [country] today that make me feel ashamed of [country]" , "The world would be a better place if people from other countries were more like [country nationality]" , "Generally speaking, [country] is a better country than most other countries" and "People should support their country even if the country is in the wrong". These were not included in the analysis thus far for two reasons. First, they constitute a more heterogeneous set of questions, and appear to generally invoke more interpretation on the part of the respondent (while "being proud" might be a sentiment that is more easily evaluated). Moreover, reference to a sense of superiority in some of these questions might better reflect nationalism, rather than patriotism (see, for example, Huddy and Khatib, 2007). Second, the potential reverse causality argument is likely to be stronger for these questions. As they do not refer to evaluation of proudness of certain, well-defined achievements, the answer is likely to be of a more general nature and might be "contaminated" by the country's fiscal policies.

Nonetheless, as a check on the robustness of our findings to the specific set of questions selected in the main analysis, we re-estimate the model including these additional questions in the factor analysis. Table 3.2 presents the results (with Proud II indicating the score of the first principal factor of the extended set of 16 questions).

The regression results are virtually unchanged. Patriotism is once again significantly positively related to the tax burden in all estimations, in line with theoretical predictions. This, however, appears mainly due to the fact that the additional ques-

Table 3.2: Alternative patriotism measure

	(1)	(2)
IncPos	0.0849***	0.0868***
	(7.60)	(9.76)
GDP		0.486
		(0.61)
Unem		0.111
		(0.87)
IDEO		3.103***
		(9.69)
Decentr		−0.0499*
		(−2.15)
Proud II	3.619***	1.980**
	(5.41)	(3.11)
Constant	19.60***	8.984
	(16.82)	(1.03)
N	288	278

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

tions do not load strongly on the first factor (note that this indicates that the six additional questions indeed refer to something else than patriotism; possibly nationalist sentiments). Hence, the resulting score of the first factor closely resembles the previous patriotism measure leading to similar regression results.

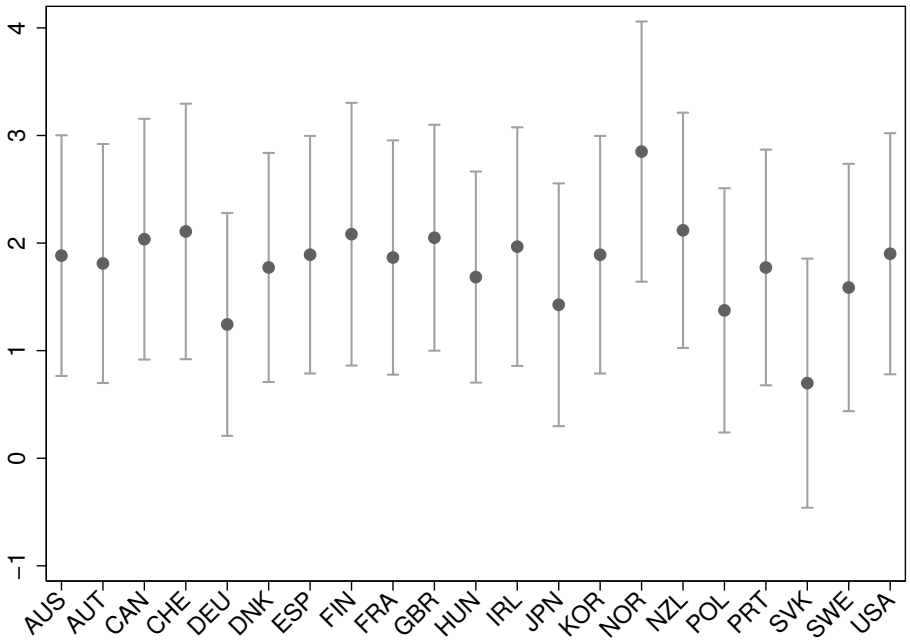
3.3.4.2 Country-by-country elimination

Moreover, we drop all countries one by one from the sample to assess whether our results are driven by the inclusion of any of these. The results of these 21 additional regressions are presented graphically in Figure 2. In each case, the value for the coefficient estimates in each estimation are given on the Y-axis, while the country excluded from a given run of the model is presented on the X-axis. The squares in the figure represent the point estimates for each regression, whereas the lines indicate the 90% confidence interval around each estimate. Note that in all cases we included the full set of control variables (though we do not report these to preserve space).

The results clearly indicate that in all subsamples (which have at least 175 observations) the effect of patriotism on the tax burden remains positive. The coefficient

estimates are, moreover, very stable across these additional estimations: i.e. the 10% confidence bands for nearly all estimates overlap. We should note, however, that excluding Slovakia causes the patriotism variable to lose statistical significance at the 90% confidence level (though it remains positive). Overall, therefore, we conclude that our main findings are quite robust to the sample employed.

Figure 3.2: Excluding each country one by one



3.3.4.3 Instrumental variables estimation

A high (income) tax burden may correspond to extensive (or high-quality) public goods provision, which might lead citizens to like their country better and, hence, to be more patriotic. While such a reverse-causality argument may hold regarding questions about pride in certain aspects of their country (such as the social security system or fair and equal treatment of individuals), it is much harder to maintain for other proudness questions (such as a country's economic achievements or political influence in the world). Nonetheless, this section takes this potential reverse causality argument seriously and employs an instrumental variables (IV) approach to evaluate

to what extent it might affect our results.

Finding a suitable instrument for patriotism is not straightforward. One could think of medals won in Olympic Games or victories in wars, but while the former caters only to one very specific aspect of possible patriotic sentiment (and one that does not appear to matter very much in our data, cf. Table 2.1), the latter is hard to operationalize (especially as most countries in our sample have not experienced any major conflicts since WWII; and even in that global conflict winners and losers are sometimes hard to determine accurately). We instrument our measure of patriotism with the country's number of neighbors.[23] This builds on the idea that citizens of countries with fewer neighbors might be less susceptible to patriotic feelings (while there is, a priori, no reason to believe that the number of neighbors is related to tax burdens). This would follow from social identity and self-categorization theory's notion that social identification not only involves being part of a given social group (i.e., one's nation), but also that there is an "outgroup" one can differentiate or distance oneself from (e.g., Tajfel and Turner 1979, Turner et al. 1987, Shayo 2009). The presence of more different outgroups might therefore strengthen attachment or commitment to the own group. Column (1) of Table 3.3 shows the results from the second-stage regression, while column (2) shows the first stage. The results reveal that the relation between patriotism and tax burdens remains qualitatively similar. That is, the coefficient estimate retains its positive sign and statistical significance at conventional levels. While the estimated coefficient of patriotism becomes larger (suggesting there is some downward bias in the OLS estimations), the IV estimations confirm the results presented in the baseline estimation.

[23] Note that the instrument from the previous chapter is not available. The previous chapter included only those countries who conducted the ISSP studies on *National Identity* and *Citizenship* jointly. In the current chapter we use all countries who participated in the National Identity study. The instrument from the previous chapter is part of the Citizenship module.

Table 3.3: Instrumental variable regression results

	(1) Tax Burden	(2) Proud
IncPos	0.00730	0.00169*
	(0.13)	(2.41)
GDP	−18.22*	0.416***
	(−2.01)	(5.83)
Unem	1.517+	−0.0237*
	(1.74)	(−2.14)
IDEO	4.057**	−0.0325
	(2.95)	(−1.49)
Decentr	0.216	−0.00203
	(1.24)	(−0.80)
Proud	56.20*	
	(2.41)	
Number of borders		0.0379*
		(2.35)
Constant	170.8*	−4.002***
	(2.07)	(−4.59)
N	282	282

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.4 Conclusion

There is by now an extensive literature on nationalist movements and national identities. While, as argued above, nationalism and patriotism should be clearly distinguished, this literature is interesting nonetheless as it has brought forward a wide range of arguments as to why such identities develop (or are developed). These include cultivation of the identity for itself (e.g., Anderson 1991) or to delineate the boundaries of the nation as autonomous and distinguishable relative to others (Prizel 1998, e.g.,). Our analysis suggests one further reason to develop such identities, or, at least, an important side-effect of developing such identities: to provide a supportive base for the welfare state and intra-state redistribution. Piecemeal evidence on a number of countries suggests that countries indeed actively use their education system for teaching their young generations patriotism and for incubating emotions and values such as "loving your own country".[24] Of course, such policies may be pursued for many purposes. We have shown that, once these preferences exist, they can be, and seemingly are, instrumentalized for fiscal policy.

As argued in the previous chapter, it is important to note the (possibly numerous) negative side-effects of patriotic sentiments. We do not promote a naïve theory of "patriotism is beautiful". Hence, the policy implication of our findings is not to say: 'let's make our children good patriots'. Nonetheless, it is important to stress that the Treasury's inherent interest in having patriotic subjects as taxpayers may make the political push for patriotism in a country stronger than it would be without this fiscal effect. That is, there might exist an 'unholy alliance' between the "Chauvinists" in a country and those who would like to stabilize tax revenue in a world of growing mobility (and tax competition).[25] Whether or not patriotism is, overall, a rather undesirable and dangerous feeling, our findings help understand certain developments in various countries' national educational policies (both along the historical dimension and across different types of governance regimes; see above). Further, they

[24] See chapter 2, footnote 5 for a number of examples.

[25] Evidently, alternative strategies can be imagined through which governments can fight tax base flight and/or tax cheating. Krishna and Slemrod (2003), for example, point to the importance of tax system marketing in this respect. Moreover, from a long-run perspective, attracting highly qualified foreign workers may be as important for fiscal purposes as the ability to keep inhabitants as citizens at home by investing in patriotism. Though reasonably beyond the scope of this chapter, it would be interesting for future analyses to test such hypotheses.

suggest that current increases in international mobility, downward pressures on government revenues, and governments' greater needs for funding of the welfare state in a globalized world (or simply revenues needed to service increased government debt) make the fiscal motivation to invest in patriotism more relevant. This suggests that we might well observe a further strengthening of patriotism (and nationalism as a possible side-effect).

3.5 Appendix

We prove Propositions 1 and 2 in this Appendix.

Proof of Proposition 1. We turn to an analysis of the subgame perfect equilibrium and solve by backward induction. Consider STAGE 2. At this stage (γ_A, γ_B) is given. For given γ_K in country K, the voting game has a unique Condorcet winner with $S_K^H = 0$, $S_K^L = T_K(t_K^*)$ and

$$t_K^*(\gamma_K) = \gamma_K \frac{w_H}{w_L + \gamma_K w_H}. \tag{3.6}$$

To confirm this, first note that the individuals with low income constitute a majority and have the same preferences regarding combinations of (t_K, S_K^L, S_K^H).[26] For any given t_K, individuals with low productivity prefer the smallest possible transfer to individuals with high productivity. Hence, $S_k^H = 0$ and $S_K^L = T_K(t_K)$ describes their most preferred transfers for any given tax rate.[27] Moreover, it can be confirmed that (3.6) is the unique maximum of

$$u_i = (1 - t_K)w_L + (t_K - \frac{t_K^2}{2})(w_L + \gamma_K w_H) + h_K + \eta_i \tag{3.7}$$

and that $t_K^*(\gamma_K) \in (0, 1)$. Hence, $(t_K, S_K^L, S_K^H) = (t_K^*(\gamma_K), T_K(t_K^*), 0)$ constitutes the unique equilibrium in STAGE 2 in each country.

Turning to STAGE 1, now consider migration choices. Individuals anticipate the shares of highly productive individuals in the migration equilibrium and the tax rates (3.6) that are induced by these shares. The payoff to a highly productive individual

[26] Recall that we assume $n_A + n_B < 1$. If $n_A + n_B > 1$, self-sorting may occur in the equilibrium in the simple framework chosen here. Similarly, if the low income individuals can also migrate, the existence of a pure strategy equilibrium may become an issue. However, our assumptions match well with a more general, but more cumbersome, framework in which the migration costs of individuals are drawn from a random distribution. In such a setting, only a few high income earners will be fully mobile, while many have intermediate, high or even prohibitive costs of migration. If so, the median voter in both countries has low income, which is what is really needed for the qualitative results we find.

[27] We require uniform treatment of all individuals regarding the tax rate, and uniform redistribution among groups that are homogeneous regarding their productivities or skills. As is known from Epple and Romano (1996) and the work they inspired, assumptions about feasible redistribution are important for the types of redistribution policies that emerge in the equilibrium.

that chooses to reside in country K is

$$u_H = \begin{cases} (1-\gamma_K \frac{w_H}{w_L+\gamma_K w_H})w_H + h_K + \eta_i & \text{if} \quad i \in I_K \\ (1-\gamma_K \frac{w_H}{w_L+\gamma_K w_H})w_H & \text{if} \quad i \notin I_K \end{cases} . \tag{3.8}$$

The payoffs in the two lines of (3.8) refer to whether i was born in K or not. An individual i born in A will stay in A if $(1-\gamma_A \frac{w_H}{w_L+\gamma_A w_H})w_H + h_A + \eta_i > (1-\gamma_B \frac{w_H}{w_L+\gamma_B w_H})w_H$. This condition can be solved for the critical η_i that makes i indifferent between staying and moving, which is denoted as

$$\eta_A \equiv (\gamma_A \frac{w_H}{w_L+\gamma_A w_H} - \gamma_B \frac{w_H}{w_L+\gamma_B w_H})w_H - h_A. \tag{3.9}$$

Accordingly, assuming subgame perfect equilibrium play, the set of highly productive individuals who are born in A and migrate to B is

$$n_A G(\Delta_t w_H - h_A), \text{ with } \Delta_t \equiv \gamma_A \frac{w_H}{w_L+\gamma_A w_H} - \gamma_B \frac{w_H}{w_L+\gamma_B w_H}. \tag{3.10}$$

Recall that $G(\cdot)$ denotes the cumulative distribution function of the random component η of patriotism. Similarly, the size of the set of high income earners from B who migrate to A is

$$n_B G((-\Delta_t)w_H - h_B). \tag{3.11}$$

Migration choices based on anticipated taxes hence determine the sizes of the sets of (post-migration) high income earners in the two countries as

$$\begin{aligned} \gamma_A &= n_A\,(1-G(\Delta_t w_H - h_A)) + n_B G((-\Delta_t)w_H - h_B) \\ \gamma_B &= n_A G(\Delta_t w_H - h_A) + n_B\,(1-G((-\Delta_t)w_H - h_B)) \ . \end{aligned} \tag{3.12}$$

Each individual need not consider the change of γ_A or γ_B from her own migration choice here, because each individual has a measure of zero.

For existence of an equilibrium in Proposition 1 note that (3.6) establishes a one-to-one relationship between t_K and γ_K. Replacing Δ_t with the equilibrium value

$(t_A^*(\gamma_A) - t_B^*(\gamma_B))$ in the subgame perfect equilibrium for given γ_A and γ_B turns (3.12) into a system of two equations with two unknowns: γ_A and γ_B, viz.

$$\begin{array}{rcl} \gamma_A(\gamma_A,\gamma_B) & = & \left\{ \begin{array}{c} n_A\left(1-G(\frac{w_L w_H^2(\gamma_A-\gamma_B)}{(w_L+\gamma_A w_H)(w_L+\gamma_B w_H)}-h_A)\right) \\ +n_B G(\frac{w_L w_H^2(\gamma_B-\gamma_A)}{(w_L+\gamma_A w_H)(w_L+\gamma_B w_H)}-h_B) \end{array} \right. \\ \gamma_B(\gamma_A,\gamma_B) & = & \left\{ \begin{array}{c} n_A G(\frac{w_L w_H^2(\gamma_A-\gamma_B)}{(w_L+\gamma_A w_H)(w_L+\gamma_B w_H)}-h_A) \\ +n_B\left(1-G(\frac{w_L w_H^2(\gamma_B-\gamma_A)}{(w_L+\gamma_A w_H)(w_L+\gamma_B w_H)}-h_B)\right) \end{array} \right. \end{array} \tag{3.13}$$

The existence and uniqueness of a subgame perfect equilibrium is reduced to the question of whether this system has a unique solution. To consider this, note that (3.13) describes a self-mapping $g : \Gamma \to \Gamma$ for

$$\Gamma \equiv \{(x,y)\,|x \in [0, n_A+n_B], y \in [0, n_A+n_B], x+y = n_A+n_B\} \tag{3.14}$$

The pair $(\gamma_A, \gamma_B) \in \Gamma$ by definition. Moreover, $(\gamma_A(\gamma_A,\gamma_B), \gamma_B(\gamma_A,\gamma_B)) \in \Gamma$, as $\gamma_K(\gamma_A,\gamma_B) \in [0, n_A+n_B]$ and $\gamma_A(\gamma_A,\gamma_B) + \gamma_B(\gamma_A,\gamma_B) = n_A+n_B$ by (3.13). The mapping g is continuous (by using the continuity of G). Moreover, Γ as defined in (3.14) is a compact and convex set. Hence, Brouwer's fixed point theorem can be applied to confirm that this mapping has a fixed point (γ_A^*, γ_B^*). This fixed point characterizes the post-migration shares of highly productive individuals in the two countries in an equilibrium.

It remains to confirm that this solution is unique. Note that the functional relationship $\gamma_A(\gamma_B)$ in the first equation in (3.13) determines a slope

$$\frac{d\gamma_A}{d\gamma_B} = \frac{\left(n_A G'_A \frac{w_L w_H^2}{(w_L+\gamma_B w_H)^2} + n_B G'_B \frac{w_L w_H^2}{(w_L+\gamma_B w_H)^2}\right)}{\left(1 + n_A G'_A \frac{w_L w_H^2}{(w_L+\gamma_A w_H)^2} + n_B G'_B \frac{w_L w_H^2}{(w_L+\gamma_A w_H)^2}\right)}, \tag{3.15}$$

where

$$G'_A \equiv \frac{\partial G(\eta)}{\partial \eta} \text{ at } \eta = \eta_A \text{ and } G'_B \equiv \frac{\partial G(\eta)}{\partial \eta} \text{ at } \eta = \eta_B\,.$$

This slope is positive and smaller than 1. Similarly, the second equation reveals a slope $\frac{d\gamma_B}{d\gamma_A}$ that is positive throughout but smaller than 1. Accordingly, these two functions can intersect only once. ■

Proof of Proposition 2. Using (3.6) to replace γ_A and γ_B in (3.12) yields a system of equations that determines the equilibrium tax rates as functions of $n_A, n_B, w_H, w_L, h_A, h_B$ and $G(\eta)$:

$$\begin{array}{rcl} \frac{t_A w_L}{w_H(1-t_A)} & = & n_A\left(1-G((t_A-t_B)w_H-h_A)\right)+n_B G((t_B-t_A)w_H-h_B) \\ \frac{t_B w_L}{w_H(1-t_B)} & = & n_A G((t_A-t_B)w_H-h_A)+n_B\left(1-G((t_B-t_A)w_H-h_B)\right) \end{array} \tag{3.16}$$

The system of equations (3.16) determines the equilibrium tax rates in the unique subgame perfect equilibrium. Totally differentiating (3.16) with respect to t_A, t_B, h_A and h_B yields the following system of equations:

$$\begin{array}{rl} & \left[\begin{array}{cc} -X-\Omega_A & X \\ X & -X-\Omega_B \end{array}\right]\left(\begin{array}{c} dt_A \\ dt_B \end{array}\right) \\ = & -\left(\begin{array}{c} n_A G'_A \\ -n_A G'_A \end{array}\right)dh_A-\left(\begin{array}{c} -n_B G'_B \\ n_B G'_B \end{array}\right)dh_B, \end{array} \tag{3.17}$$

with

$$\begin{array}{rl} X \equiv & n_A G'_A w_H + n_B G'_B w_H > 0 \\ \Omega_A \equiv & \frac{\partial(\frac{t_A w_L}{w_H(1-t_A)})}{\partial t_A} = \frac{w_L}{w_H(1-t_A)^2} > 0 \\ \Omega_B \equiv & \frac{\partial(\frac{t_B w_L}{w_H(1-t_B)})}{\partial t_B} = \frac{w_L}{w_H(1-t_B)^2} > 0. \end{array} \tag{3.18}$$

From here, we can analyze the comparative statics. We find that

$$\begin{aligned}
\frac{dt_A}{dh_A} &= \frac{\begin{vmatrix} -(n_A G'_A) & X \\ n_A G'_A & -X-\Omega_B \end{vmatrix}}{\begin{vmatrix} -X-\Omega_A & X \\ X & -X-\Omega_B \end{vmatrix}} \\
&= \frac{[(n_A G'_A)(X+\Omega_B) - n_A G'_A X]}{(X+\Omega_A)(X+\Omega_B)-X^2} \\
&= \frac{n_A G'_A \Omega_B}{(X+\Omega_A)(X+\Omega_B)-X^2} > 0
\end{aligned} \tag{3.19}$$

The positive sign is obtained as follows. The denominator is positive, as both X and Ω_B are positive, and the numerator is also positive. Similarly,

$$\begin{aligned}
\frac{dt_B}{dh_A} &= \frac{\begin{vmatrix} -X-\Omega_A & (-n_A G'_A) \\ X & n_A G'_A \end{vmatrix}}{\begin{vmatrix} -X-\Omega_A & X \\ X & -X-\Omega_B \end{vmatrix}} \\
&= \frac{[(n_A G'_A)(-X-\Omega_A) - (-n_A G'_A)X]}{(X+\Omega_A)(X+\Omega_B)-X^2} \\
&= \frac{-n_A G'_A \Omega_A}{(X+\Omega_A)(X+\Omega_B)-X^2} < 0.
\end{aligned} \tag{3.20}$$

Again, the denominator is positive. The numerator is negative, explaining the negative sign. Given the signs of these expressions, it follows that

$$\frac{d(t_A - t_B)}{dh_A} > 0. \tag{3.21}$$

As $t_A = t_B$ in the equilibrium for $n_A = n_B$, this completes the proof of Proposition 2. ■

Chapter 4

The law of attraction* –gains to marriage in theory–

4.1 Introduction

Finding a suitable match marriage market is a complex task. Search frictions in the market force agents to trade off the chance of meeting a better partner in the future against the foregone utility due to staying single for a longer period of time. Quality is determined by a number of traits and agents usually agree on the ranking for a subset of the characteristics involved – the "vertical traits" – but disagree with respect to others – the "horizontal traits". In this chapter, we study the different roles of vertical and horizontal heterogeneity among agents in matching models. The first parameter captures a discrete vertical dimension, for example income. All agents agree on the ranking along this vertical dimension. The second parameter represents a horizontal non-ordered characteristic. This dimension will capture non-monetary benefits that are generated, for example, by emotional congruence of the two partners. We refer to this trait as "taste" to highlight that agents do not necessarily agree on the ranking of agents along this dimension. Agents take the implications of both dimensions for their individual utility into account when deciding on their search strategy. The central aim of this chapter is to employ a tractable model to analyze matching and sorting in this environment assuming that utility is nontransferable.

*This chapter is based on the discussion paper *The law of attraction – bilateral search and horizontal heterogeneity*. The discussion paper is joint work with Dirk Hofmann, see Hofmann and Qari (2011).

Our analysis is motivated by two distinct but closely related strands of literature. The first is the large empirical literature in economics and sociology documenting a positive association between traits of partners in existing unions. For example, the classic work by Becker (1973, 1974) finds a positive correlation between partners' education levels and partners' height. Kalmijn and van Tubergen (2006) provide empirical evidence for a correlation between ethnicity, while Kalmijn (2006) and Mare (1991) document assortative mating for religion and education. A more recent and important finding in this literature is that consumption complementarities with respect to horizontal traits, e.g, a shared interest in leisure activities, are becoming more and more important sources of the marital surplus (Lundberg and Pollak 2007, Lundberg 2011).

The second literature is the theoretical literature on two-sided search and matching. The seminal work by Becker (1973) analyzes in a static transferable-utility model how assortative mating arises in equilibrium. Starting from this basic model, a huge literature has emerged that discusses how different assumptions with respect to utility specifications, search frictions and heterogeneity change this outcome.[1] However, in contrast to the empirical literature the discussion of heterogeneity is centered on vertical traits.

If agents differ only with respect to a vertical dimension, all agents agree on the ranking of potential mates. Therefore, all individuals propose to the best available agent. Depending on the level of search frictions, this most desirable agent chooses the range of acceptable qualities. In this way, the boundary between the first and second class is derived. Similarly, the highest agent in the second class sets a range and hence creates the boundary between the third and second class (see, for example, Burdett and Coles 1997). The procedure continues until the equilibrium is derived for the whole range of the vertical trait. By contrast, since the agents in our model are additionally marked by a horizontal characteristic, there is no common most desirable agent. Although this complicates the analysis, our model and the corresponding equilibrium characterization remain tractable.

The interaction of horizontal and vertical preferences reveals some new insights in this strand of search and matching models. First, the model encompasses the

[1] See Burdett and Coles (1999) for a survey of this literature.

prediction of assortative mating from the classic vertical model. If the level of search frictions is sufficiently low, the costs of rejecting offers are low. Therefore, agents, especially the vertically "gifted", are selective and this leads high type agents to reject low types. This in turn generates positive assortativeness.

Second, all agents adjust continuously their optimal reservation utility strategies in response to changing search frictions. This result seems particularly appealing compared to the "classical" model involving only the vertical dimension. For example, in the model by Burdett and Coles (1997), a marginal increase of the level of search frictions may lead to a discrete loss in agents' expected utilities.

Third, depending on the model parameters, low type agents might benefit from increasing search frictions. If the level of search frictions happens to be in such a range, a higher level of search frictions has two effects. First, the frequency of meeting potential partners is lower and this effect harms the agents. Second, the probability that a high type accepts a low type increases, and this effect outweighs the first effect.

Fourth, our analysis shows that both kind of matching equilibria, complete segregation of types and integrating equilibria may emerge. Finally, we show that our approach is general in the sense that it allows to consider (i) different utility specifications concerning the two traits and (ii) to extend easily the number of vertical types.

Our framework builds on the existing literature that deals with bilateral search and matching. As mentioned above, the seminal static model by Becker (1973, 1974) assumes that utility is transferable and that no search frictions are present. Recent analyses in the area of vertical heterogeneity and transferable utility are Bloch and Ryder (2000), Shimer and Smith (2000) and Atakan (2006). The papers that are closer to our analysis are Burdett and Coles (1997), Eeckhout (1999) and Smith (2006) who analyze vertical heterogeneity in a nontransferable utility model including search frictions.

Clark (2007) studies bilateral sorting with horizontal heterogeneity in a frictionless assignment model. We depart from Clark (2007) as in his model agents prefer similar agents, but the trait considered for matching is ordinal, e.g. height. The taste parameter in our model can be interpreted as agents' location on a circle. This standard approach in the Industrial Economics literature (Schmalensee 1978, Salop 1979) avoids end-point-effects. This assumption is also employed by Konrad and

Lommerud (2010) who study the interplay of matching and redistributive taxation in a static model. In their model, agents are matched only for a single period in which they have to either accept a match or stay single forever.

We proceed as follows. In the following section we develop the marriage model. We then solve for the equilibria in the model for one or two income-levels and discuss the comparative statics of the approach. Section 4.4 provides an example for specific income and taste distance functions. These permit an explicit model solution. Section 4.5 discusses two extensions of the model. First, we introduce weights for the two parts of utility into the model. This allows us to analyze the full range between two polar cases: in the first polar case agents marry for love and in the second they marry for money. Second, we show that our framework can be easily modified to account for more than two income levels. Section 4.6 concludes. All proofs are relegated to the appendix.

4.2 The model

There is a unit mass of individuals. Each individual i is characterized by two parameters $(y_i, t_i) \in Y \times T$. The first parameter captures vertical ex-ante heterogeneity of agents. For concreteness, we refer to this trait as income y_i. We assume that there are two income levels such that $y_i \in Y = \{y_L, y_H\}$ with $y_H \geq y_L \geq 0$. The second parameter t_i captures horizontal heterogeneity and for concreteness we refer to it as taste t_i. We assume a continuum of taste parameters such that $t_i \in T = [0, 2]$. We follow the common approach from the Industrial Economics literature introduced by Schmalensee (1978) and Salop (1979), i.e. individuals are located around a circle of circumference 2.[2] This approach allows to avoid end point effects.[3] We assume that individuals are uniformly distributed on $Y \times T$; both income levels are equally likely and the location on the circle for each agent is drawn independently of her income.

Preferences of all agents are identical regarding the relative locations of potential

[2] In contrast to Schmalensee (1978) and Salop (1979) we re-scale the circumference of the individual's location to 2. Hence, we have a maximum distance of 1 between two individuals on the circle.

[3] This differs from the approach by Clark (2007) who analyzes a model in which agents prefer agents of similar height. In such a model agents with "extreme" (small or large) height behave differently compared to agents with more common realizations.

partners to their own position. All agents prefer to be matched with partners of higher income. With respect to the horizontal dimension, agents prefer to be matched with individuals of similar taste. If two agents i and j decide to marry each other, both enjoy a utility gain depending on a measure of the distance between their respective locations on the circle. Formally the distance in taste x between two agents i and j is given by

$$x := \begin{cases} \min\{t_i - t_j, 2 + t_j - t_i\}, & \text{if } t_i \geq t_j \\ \min\{t_j - t_i, 2 + t_i - t_j\}, & \text{if } t_i < t_j \end{cases}.$$

Hence, the taste difference of two randomly drawn agents x is the realization of a random variable X. Clearly, as both agents' taste parameters are drawn independently and are ex-ante uniformly distributed, the random variable X is uniformly distributed on $[0, 1]$.

Once a match is formed, individuals enjoy a utility flow depending on both partners' incomes and the taste difference x for all subsequent periods.[4] The utility function is additively separable. One part of an agent's utility is the gain induced by household income. A second source of utility is the intra-marital gain through the difference, or rather the similarity in taste. By this choice the two dimensions of utility generation become substitutes for the agents. If agent i marries agent j her per-period-utility equals

$$U(y_i, t_i, y_j, t_j) = f(y_i, y_j) + g(x),$$

where x is determined by the definition given above. Function f, which captures the part of agent i's utility induced by the vertical trait income, is assumed to be increasing in both arguments. Function g, which captures the (intra-marital) utility gain through the horizontal trait, is assumed to be differentiable in $(0, 1)$. Furthermore, we assume $g' < 0$, as agents prefer partners who are located closer to themselves. We normalize $g(1) = 0$.[5] As long as agent i stays single, her per-period-

[4] For simplification we assume that there is no divorce. This is a crucial assumption because agents stop searching in our model once they are married.

[5] This normalization implies that there are no negative utilities induced by the maximum taste difference. This assumption does not affect the results qualitatively.

utility depends only on her income y_i and is given by

$$U(y_i, t_i) = f(y_i, y_i).^6$$

This definition of a single agent's utility reflects the idea that the marital surplus is generated by consumption complementarities with respect to the horizontal dimension (see, for example, Lundberg 2011). Furthermore, agent i's utility derived from income within marriage is only affected if she marries a partner with a different income level. For ease of notation and reading, the utility of a single agent is sometimes written as $f(y_i, -) := f(y_i, y_i)$. We assume that the marital surplus is not transferable.

The matching institution is characterized by search frictions, i.e. individuals face difficulties finding a partner. As commonly used in the matching literature with search frictions (e.g. Burdett and Coles 1997), α denotes the arrival rate of potential partners where α is the parameter of a Poisson process. The type of a potential partner j an individual i meets is assumed to be independent of individual i's type. If two singles meet, they first observe each others' traits and then decide either to propose to the other or to continue searching. If both singles propose to each other, a match is formed and the two singles leave the market forever, otherwise the agents continue searching. Two individuals forming a match are replaced by (unmarried) clones. Hence, the distribution of single agents is stationary across time. Future per-period utility flows are discounted at rate r.[7] Both the discount rate and the arrival rate of singles determine the extent of the market, which we denote by $\theta := \alpha/r$.

A strategy of a (single) individual in this framework is a subset of all potential partners for any point in time. Such a subset can be interpreted in the following way: The subset contains all partners this particular individual would like to marry and hence she would propose to at a certain point in time.[8] Such a strategy of a particular agent depends on her belief about the distribution of singles who propose

[6] Note that individual utility U is defined as a function of 4 arguments for married agents and as a function of only 2 arguments when for single agents.

[7] The life-time-utility of an individual marrying someone with per-period-utility k at period 0 when using discount factor r is $\int_0^\infty k \cdot e^{-rt} dt = \frac{k}{r}$.

[8] Note that agents *end* their game when marrying another agent as there is no divorce and consequently there are no strategic considerations for married agents.

to her. In turn, her strategy determines the offer distribution which other singles face. In equilibrium, beliefs and offer strategies must be compatible with each other. For example, consider for a moment two types of agents, females and males. Females have beliefs about the offers they receive from males and calculate a list of acceptable males based on these beliefs. This determines the offer distribution of females proposing to male agents. In equilibrium, females must have correct beliefs about the offers they receive from males. Likewise, male singles must have correct beliefs about the offers received by females.

In order to keep the model as tractable as possible, we focus entirely on a stationary environment. To be more precise, we assume that individuals employ time-stationary reservation utility strategies. We already noted that the distribution of singles is stationary over time due to the cloning assumption. Since all other agents as well employ time-stationary reservation utility strategies, the search problem of any particular agent is in fact stationary. It is therefore optimal for an individual agent to employ a stationary reservation utility strategy (Adachi 2003).

4.3 Optimal search policies

In the following, we first establish some intermediate results assuming that there is no vertical heterogeneity. This step-wise presentation of the model allows to develop an intuitive understanding of the effects due to horizontal heterogeneity. We will then analyze to what extent these intermediate results generalize to the case of two distinct income classes. Finally, we discuss comparative statics of the model.

4.3.1 No vertical heterogeneity

In this section we analyze agents' strategies and the resulting equilibria assuming that there is no vertical heterogeneity. Hence, all agents in the marriage market have the same income $y_H = y_L \equiv y$. As introduced above, the taste parameter t is distributed uniformly on $T = [0, 2]$. The taste parameter can be interpreted as the location of the respective agent on a circle with circumference 2.

Since the income-specific part of agents' utility is unaffected by marriage, single agents effectively condition their proposals to other singles only on taste. Further-

more, when choosing their optimal strategies, agents take the search frictions of the matching institution into account. When agents have an offer at hand, they balance the possibility of receiving a better offer in future periods against the foregone utility due to staying single and continue searching.

The optimal strategy of an individual i is determined by using a dynamic programming approach. Agents maximize their expected lifetime utility V_i by choosing optimally the partners they would propose to.[9] For the next short time period Δ, lifetime utility V_i consists of three parts. First, for the duration of Δ the agent stays single and obtains $\Delta f(y,-)$. For the second term, let α_i denote the arrival rate of singles who are proposing to agent i. Moreover, let $H_{-i}(x)$ denote the probability that the difference in taste of a proposing agent is equal to x or less. Then, over this time interval of Δ she receives at least one proposal with probability $\Delta\alpha_i$. In this case the individual decides whether to accept or reject the proposal. Obviously, she will only accept proposals which yield a higher lifetime utility than V_i. Formally, utility resulting from a union with an agent of taste x exceeds V_i; $(f(y,y)+g(x))/r > V_i$. The third and last term of V_i captures the unlucky event that the agent did not meet anyone proposing to her in the time span of Δ and is stuck with her lifetime utility V_i. Collecting terms and discounting yields

$$\begin{aligned} V_i = &\frac{1}{1+\Delta r}\Bigg[\Delta f(y,-) + \Delta\alpha_i E_{-i}\left(\max\left\{V_i, \frac{f(y,y)+g(x)}{r}\right\}\right) \\ &+ (1-\Delta\alpha_i)V_i\Bigg] + o(\Delta) \end{aligned} \tag{4.1}$$

where agent i applies the expectation operator on the distribution of taste differences associated with the set of single agents proposing to her. Note that we follow the convention to subscript the expectations operator according to the respective random variable. Since agent i applies the expectation operator on the taste difference $x \sim H_{-i}(x)$, it is denoted as E_{-i}. The o-function captures the small probability events of meeting more than one individual in time span Δ. Rearranging equation (4.1) and

[9] Burdett and Coles (1999) provide an introduction to the dynamic programming approach and a survey of the literature on search and matching.

letting $\Delta \to 0$ yields

$$rV_i = f(y,-) + \frac{\alpha_i}{r} E_{-i}\left(\max\left\{0, f(y,y) + g(x) - rV_i\right\}\right). \tag{4.2}$$

As agents apply time-stationary reservation utility strategies and $g(\cdot)$ is decreasing in the taste difference x, equation (4.2) reveals that this corresponds to a cut-off strategy with respect to taste. Each individual i sets a certain minimal quality standard $\bar{x}_i$ on her future partner and accepts proposals if and only if $x \leq \bar{x}_i$. We will refer to such strategies as reservation quality strategies. By this observation we restrict the further analysis to strategies of this type. Rearranging equation (4.2) yields the following description of the agents' strategies:

Lemma 1 *Reservation utility strategies*

Given the expected distribution of offers by other agents $H_{-i}(x)$, agent i proposes to all singles with $x \leq \bar{x}_i$ where either

1. $rV_i = f(y,y) + g(\bar{x}_i)$ *and*

$$rV_i = f(y,-) + \frac{\alpha_i}{r} \int_0^{\bar{x}_i} \left(g(x) - g(\bar{x}_i)\right) dH_{-i}(x) \tag{4.3}$$

or

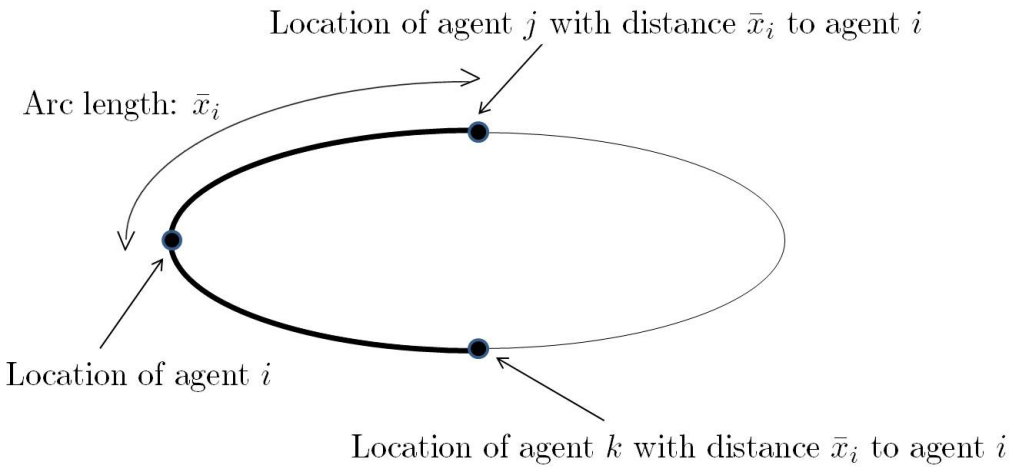
2. $rV_i < f(y,y) + g(\bar{x}_i)$, $H_{-i}(\bar{x}_i) = 1$ *and*

$$rV_i = f(y,-) + \frac{\alpha_i}{r} E_{-i}\left(f(y,y) + g(x) - rV_i\right). \tag{4.4}$$

Lemma 1 implicitly characterizes agent i's optimally chosen subset of acceptable agents, given her beliefs about the distribution of offers by other singles and about the search frictions in the market. In the first case agent i is decisive in the sense that she selects only a subset of all available offers. In the second case she is restricted by the offers made to her and is willing to accept all of them.

Figure 4.1 describes the type space and agent i's strategy. As there is only one income level, all agents are located on one circle. Agent i is located on the very left. The thick line in the figure represents agent i's cut-off-strategy. The partners she

Figure 4.1: Geometry of the one-circle-model



is willing to accept are symmetrically located around her own position. The offers agent i receives are not depicted in the figure. If agent i is decisive, it follows from Lemma 1 that she is indifferent between marrying and staying single when meeting the proposing agents j or k. If she is not decisive, agents j and i will not propose to agent i. In that case $H_{-i}(\bar{x}_i) = 1$ and agent i accepts all agents who propose to her.

Equilibrium

Lemma 1 states that the set of acceptable partners can be characterized as a uniform distribution with strictly positive support. That is, agent i accepts all individuals with $x \in [0, \bar{x}_i]$. Note that this formulation is silent about the offer distribution $H_{-i}(x)$. However, we will focus on symmetric equilibria in the sense that the offer distributions and acceptance sets are identical across agents. Hence, we rule out that the density h_{-i} is zero for some parameter range, while agent i's acceptance region is strictly positive on the full support. In the following μ_i denotes the fraction of singles who will propose to agent i on contact. The focus on symmetric equilibria is motivated by the fact that all agents are ex-ante symmetric in the sense that they have the same income level y and that they are distributed uniformly on the circle. Hence, there is ceteris paribus no agent who prefers moving to a different location.

The focus on symmetric equilibria implies that any agent i is decisive in the sense

of the first part of Lemma 1, which allows us to rewrite equation (4.2) as

$$rV_i = f(y,-) + \frac{\alpha\mu_{-i}}{r}\int_0^{\bar{x}_i}\left(g(x) - g(\bar{x}_i)\right)h_{-i}(x)dx. \tag{4.5}$$

The offer distribution is strictly positive on the full support and individuals are located uniformly on the circle. Therefore, the offer distribution is a uniform distribution with associated density $h_{-i}(x) = 1/\mu_{-i}$. Inserting this density into equation (4.5) yields[10]

$$rV_i = f(y,-) + \theta\left[\int_0^{\bar{x}_i} g(x)dx - \bar{x}g(\bar{x})\right]. \tag{4.6}$$

Furthermore, the first part of Lemma 1 yields

$$rV_i = f(y,y) + g(\bar{x}_i). \tag{4.7}$$

Equilibrium requires that equation (4.6) and equation (4.7) are satisfied for any agent i. By construction of the model, V_i is the maximum value of lifetime utility for each agent i. Hence, all agents face the same decision problem and will apply the same cut-off-value $\bar{x} = \bar{x}_i$ and receive the same lifetime utility $V_i = V$. Rewriting equations (4.6) and (4.7) yields the solution for the equilibrium that we summarize in the following proposition.

Proposition 1 *Equilibrium without vertical heterogeneity*

In equilibrium, all agents marry the first single who yields at least the reservation utility rV, where rV is characterized by:

$$\begin{aligned}
&(I) && rV = f(y,y) + g(\bar{x})\\
&(II) && rV = f(y,-) + \theta\left[\int_0^{\bar{x}} g(x)dx - \bar{x}g(\bar{x})\right]
\end{aligned}$$

Proposition 1 fully characterizes the two unknown parameters ($\bar{x}$ and V) for a

[10]Note that $\int_0^{\bar{x}} g(x) - g(\bar{x})dx = \int_0^{\bar{x}} g(x)dx - \bar{x}g(\bar{x})$.

given extent of the market θ.[11] For ease of exposition, we will mainly discuss the features of the model in terms of the quality $\bar{x}$. The following corollary summarizes the main properties.

Corollary 1 *Properties of the reservation quality*

1. *The reservation quality $\bar{x}$ is characterized by*

$$g(\bar{x}) = \theta \left[\int_0^{\bar{x}} g(x)dx - \bar{x}g(\bar{x}) \right]. \tag{4.10}$$

2. *The reservation quality $\bar{x}$ is decreasing in θ and we have*

$$\lim_{\theta \to 0} \bar{x} = 1 \text{ and } \lim_{\theta \to \infty} \bar{x} = 0.$$

As there is no intra-marital income redistribution, the reservation quality is unaffected by the income level y. In general, all agents prefer to be matched with singles of similar taste, as such matches yield the largest utility gain. An extent θ close to zero implies that there are maximum search frictions in the market. In this case all singles set $\bar{x}$ to the maximum and accept the first single they encounter.[12] On the

[11] We can easily rewrite the model to a setup with two sets of agents, say females and males. In this case let $i \in \{w, m\}$ denote women and men respectively. The reservation utility for females and males is given by

$$rV_w = f(y, -) + \frac{\alpha \mu_m}{r} \int_0^{\bar{x}_w} \left(g(x) - g(\bar{x}_w) \right) h_m(x)dx \tag{4.8}$$

and

$$rV_m = f(y, -) + \frac{\alpha \mu_w}{r} \int_0^{\bar{x}_m} \left(g(x) - g(\bar{x}_m) \right) h_w(x)dx \tag{4.9}$$

respectively. In equilibrium the arrival rate of offers μ_m and the conditional taste distribution $H_m(x)$ must be consistent with male agents' reservation strategy defined by equation (4.9). Likewise, $H_w(x)$ and μ_w must be consistent with females' strategy given by equation (4.8).

[12] This is due to the normalization $g(1) = 0$. Otherwise agents would accept only those partners who are associated with a non-negative marital surplus.

other hand, a large extent θ implies that singles can easily meet each other or that they are very patient. For $\theta \to \infty$ there are no search frictions, and every agent will "wait" (for a time span of zero) for her perfect match. This corresponds to the perfect assortative mating results in previous models without search frictions, e.g. Becker (1973). However, this "notion of assortative mating" differs from the usual definition of assortative mating, as the taste parameter is not an ordinal measure. Assortative mating can be defined with respect to correlation between spouses' location on the circle. If search frictions are absent, agents complete mating only with individuals of the same taste parameter. Hence, there is perfect correlation between partners' location. For maximum search frictions there is no correlation between spouses' taste parameters. For intermediate levels of search frictions, the correlation with respect to taste is decreasing in the level of search frictions.

4.3.2 Introducing vertical heterogeneity ("two circles")

In this section we introduce vertical heterogeneity into the model. Therefore we drop the assumption of a single income level and consider two income levels $y_H > y_L$. These two income levels are equally likely in the population. As before, the taste parameter t is distributed uniformly on $T = [0, 2]$ and is drawn independently of an agent's income. By this specification we have two different types of agents: High type agents with high income y_H and low type agents with low income y_L. Whenever it is necessary to distinguish between one particular agent and types of agents, we denote individuals by small letters and types by capital letters.

Contrary to the case of a single income level, agent i takes into account possible intra-marital income redistribution as $f(y_i, y_H) > f(y_i, y_L)$. As before, we solve for the symmetric equilibrium of the extended model. Once again, agents balance waiting costs and the foregone utility of marrying a mediocre partner. When evaluating possible partners, both characteristics are to some extent substitutes: Agents may be willing to accept lower income for a better match in taste and vice versa.

In principle, we derive lifetime utility of a particular agent analogously to equation (4.1). However, each agent now faces two different offer distributions: Offers received from high type agents and offers from low type agents. For high type agents who are willing to marry agent i who has income y_i, let $H^H_{-i}(x_H|y_i)$ denote the cumulative

probability that the difference in taste is equal to x_H or less. Analogously, we define $H^L_{-i}(x_L|y_i)$ and x_L for low types.[13] Let α_i^H denote the probability that agent i contacts a high type single who is willing to marry her. Likewise, let α_i^L denote the probability that she contacts a low type single who is willing to marry her. As in the case without vertical heterogeneity, agents employ reservation utility strategies. Using the definitions so far, we can extend equation (4.1) to account for the two types. Hence, expected discounted lifetime utility of agent i is given by

$$\begin{aligned} V_i = & \frac{1}{1+\Delta r}\Bigg[\Delta f(y_i,-) \\ & + \Delta(\alpha_i^H+\alpha_i^L)\left(\sum_K \frac{\alpha_i^K}{\alpha_i^H+\alpha_i^L} E^K_{-i}\left(\max\left\{V_i, \frac{f(y_i,y_K)+g(x_K)}{r}\right\}\right)\right) \\ & + (1-\Delta(\alpha_i^H+\alpha_i^L))V_i\Bigg] + o(\Delta) \end{aligned} \tag{4.11}$$

where $K \in \{H, L\}$.

Rearranging equation (4.11) and letting $\Delta \to 0$ yields

$$rV_i = f(y_i,-) + \sum_K \frac{\alpha_i^K}{r} E^K_{-i}\left(\max\left\{0, f(y_i,y_K)+g(x_K)-rV_i\right\}\right). \tag{4.12}$$

Equation (4.12) implies that agent i optimally chooses cut-off-values with respect to the difference in taste. In particular, agent i now calculates two reservation taste levels $\bar{x}_i(\cdot)$ depending on the income type of proposing agents. Analogously to Lemma 1, we characterize the reservation-utility strategies as follows:

Lemma 2 *Reservation utility strategies for two income levels*

Given the expected distribution of offers by other agents $H^K_{-i}(x_K|y_i)$ where $K \in \{H, L\}$, agent i uses a reservation taste strategy and accepts all agents with $x \leq \bar{x}_i(y_K)$ where either

[13] To stress that the offer distribution of agent i is fundamentally determined by her income type y_i, we write $H^K_{-i}(\cdot|y_i)$ instead of the (rather correct) $H^K_{-i}(\cdot)$ for $K \in \{H, L\}$.

1. $rV_i = f(y_i, y_K) + g(\bar{x}_i(y_K))$ *and*

$$rV_i = f(y_i, -) + \sum_K \frac{\alpha_i^K}{r} \int_0^{\bar{x}_i(y_K)} \left(g\left(x_K\right) - g(\bar{x}_i\left(y_K\right))\right) dH_{-i}^K\left(x_K|y_i\right) \tag{4.13}$$

or

2. $rV_i < f(y_i, y_K) + g(\bar{x}_i(y_K))$, $H_{-i}^K(\bar{x}_i(y_K)) = 1$ *and*

$$rV_i = f(y_i, -) + \sum_K \frac{\alpha_i^K}{r} E_{-i}^K \left(f(y_i, y_K) + g(x_K) - rV_i\right). \tag{4.14}$$

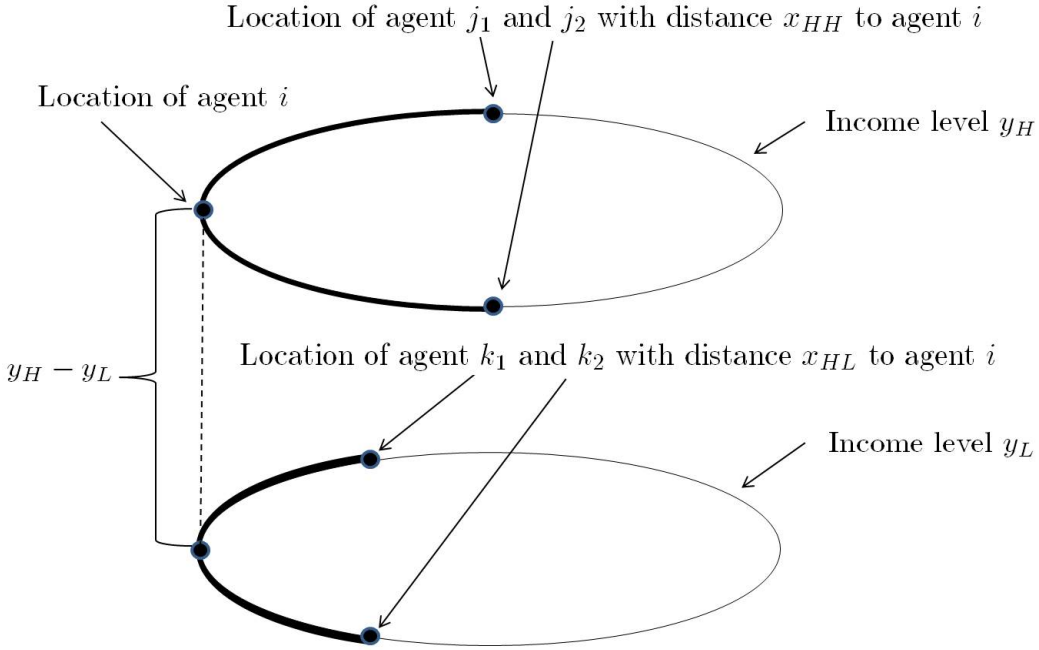
Equilibrium

As in the previous section we focus on symmetric equilibria. All agents with the same income are ex-ante identical due to our assumptions on the distributions of individuals' traits. But compared to the case without vertical heterogeneity, there are now two different types of agents, high types and low types. By imposing symmetry on the equilibrium outcome we require that agents of the same income type apply the same strategies.

While the solution for the model without vertical heterogeneity is characterized by two equations for the two endogenous variables V and $\bar{x}$, there are now in principle 6 endogenous variables. These are the expected discounted lifetime utilities for both high and low type agents (V_H and V_L) and the reservation qualities for type K_1 agents proposing to type K_2 agents. The reservation qualities are denoted by $x_{K_1K_2}$, where $K_1, K_2 \in \{H, L\}$. For example, the *least acceptable agent* for high types proposing to low types is denoted by x_{HL}.

Figure 4.2 shows the basic geometry of the model. There are two income levels $y_H > y_L$ and hence agents are located on two circles. Agents are distributed uniformly on the two circles, while the fraction of high and low type agents is equal. For example, agent i is assumed to have high income y_H and is located to the very left. For any given offer distributions from high and respectively low types, her best response is a cut-off-strategy. The figure depicts the two reservation qualities x_{HH} and x_{HL}. As partners with high income are more attractive compared to their low income counterparts (with identical taste), agent i is less selective among rich types,

Figure 4.2: Geometry of the two-circles-Model



i.e. we have $x_{HH} \geq x_{HL}$.

As a first step in solving the equilibrium, the set of initially six relevant unknown variables is reduced. A simple observation shows that in equilibrium high types will have a higher reservation utility than low types, that is we have $V_H > V_L$. To see this, suppose to the contrary that they would have a lower reservation utility than their low type counterparts. Then, a high type could deviate to the strategy of a low type. As she is even more attractive than the low type due to her income, she receives at least as many offers as the low type agents. Hence, her utility stemming from possible future marriages is at least as high as a low type's utility from marriage events (as all agents use reservation utility strategies). In addition, her utility associated with staying single is higher. This shows that in equilibrium we must have $V_H > V_L$ as $y_H > y_L$. Consequently, high types are more selective with respect to low types than low types are with respect to high types. Thus, we have $x_{HL} \leq x_{LH}$. This implies that x_{LH} does not matter for equilibrium considerations, as low type agents are not decisive for mixed marriages.

Depending on the level of search frictions two distinct types of equilibria emerge;

equilibria with and respectively without income segregation. To understand the mechanism that drives this result, assume that the extent of the market is very large ($\theta \to \infty$). Intuitively, in this case a high type agent would even reject a poor type who has the same taste as her. That is, an agent with characteristics (y_H, t_i) rejects the agent with characteristics (y_L, t_i) because of intra-marital income redistribution. Hence, high type agents generally reject low type agents and an income segregation equilibrium emerges. Only below a certain threshold $\tilde{\theta}$, high type agents will consider marrying low type agents. For all extents θ above this threshold the equilibrium solution exhibits $x_{HH} > 0$ and $x_{HL} = 0$. We will discuss the characteristics of $\tilde{\theta}$ after establishing the complete solution for the two types of equilibria.

We start the equilibrium analysis with the case $\theta < \tilde{\theta}$, where mixed marriages occur in equilibrium. First, we look at the equilibrium strategy of a high type agent i. As mentioned above, all agents apply reservation-utility strategies and we focus on symmetric equilibria. Hence, both acceptance and offer distributions are characterized by a non-degenerate density function with strictly positive support. Furthermore, as $x_{HL} \leq x_{LH}$, we know that a high type agent i is decisive. Let $H^K_{-i}(x_K|y_H)$ denote the offer distributions of agents of type $K \in \{H, L\}$, where μ^K_{-i} denotes the fraction of type K-singles who are willing to marry agent i on contact. As both high and low types are equally likely, this implies that agent i faces an arrival rate of $0.5\alpha\mu^H_{-i}$ from high types and respectively $0.5\alpha\mu^L_{-i}$ from low types. Exploiting the decisiveness of agent i, we apply the first part of Lemma 2 which yields

$$\begin{aligned} rV_i =& f(y_i, -) \\ &+ \sum_K \frac{0.5\alpha\mu^K_{-i}}{r} \int_0^{\bar{x}_i(y_K)} \left(g\left(x_K\right) - g(\bar{x}_i\left(y_K\right))\right) dH^K_{-i}\left(x_K|y_i\right). \end{aligned} \tag{4.15}$$

Similar to the derivation involving only a single income level, the relevant densities are $h^K_{-i}(x_K|y_i) = 1/\mu^K_{-i}$. Since agent i is a high type, we employ the type-based notation for high types and rewrite equation (4.15) as follows

$$\begin{aligned} rV_H =& f(y_H, -) \\ &+ \frac{1}{2}\theta \left[\int_0^{x_{HH}} g(x)dx + \int_0^{x_{HL}} g(x)dx - g(x_{HL})x_{HL} - g(x_{HL})x_{HL} \right]. \end{aligned} \tag{4.16}$$

Applying once more agent i's decisiveness, the first part of Lemma 2 yields:

$$rV_H = f(y_H, y_H) + g(x_{HH}) \tag{4.17}$$
$$rV_H = f(y_H, y_L) + g(x_{HL}) \tag{4.18}$$

The three equations (4.16), (4.17) and (4.18) provide a full characterization of the first three variables of the model V_H, x_{HH} and x_{HL}. Equations (4.17) and (4.18) provide a further intuitive insight as

$$g(x_{HL}) - g(x_{HH}) = f(y_H, y_H) - f(y_H, y_L).$$

This result shows that under any specification of search frictions a high type agent "requires" from low type agents a better match with respect to taste. The difference between the reservation qualities measured in terms of g equals the income loss due to redistribution.

We now turn to the solution for a low type agent j. Recall that $x_{LH} \geq x_{HL}$, as high types are decisive for mixed marriages. Hence, employing once again the symmetry argument, agent j is only decisive within other poor agents. Consequently, we employ both parts of Lemma 2 to calculate the reservation utility for agent j. For low types proposing to agent j, part (i) of Lemma 2 applies, while part (ii) is suitable for high types proposing to agent j. Collecting terms yields

$$\begin{aligned} rV_j =& f(y_j, -) + \frac{\alpha_j^H}{r} E_{-j}^H \left(f(y_j, y_H) + g(\bar{x}_j(y_H)) - rV_j \right) \\ &+ \frac{\alpha_j^L}{r} \int_0^{\bar{x}_j(y_L)} \left(g\left(x_L\right) - g(\bar{x}_j\left(y_L\right)) \right) dH_{-j}^L\left(x_L | y_j\right). \end{aligned} \tag{4.19}$$

The fact that high types are decisive for mixed marriages permits a step-wise equilibrium derivation. The reservation utility strategies for any high type agent i is already determined. This includes the threshold quality x_{HL}. Hence, the fraction of high type agents proposing to low type agents μ_{-j}^H is given and equal to x_{HL}. This simplifies the arrival rate of offers from high types to $\alpha_j^H = 0.5\alpha x_{HL}$. Furthermore, the density of $H_{-j}^L\left(x_L | y_j\right)$ is $h_{-j}^L = 1/\mu_{-j}^L$.

For a low type agent j, the reservation utility with respect to other low types is by Lemma 2

$$rV_L = \quad f(y_L, y_L) + g(x_{LL}). \tag{4.20}$$

Using these simplifications and exploiting the type-based notation, equation (4.19) simplifies to

$$\begin{aligned} rV_L =& f(y_L, -) \\ &+ \frac{1}{2}\frac{\alpha}{r} x_{HL} \left[f(y_L, y_H) + E\left(g(x) \mid x \leq x_{HL}\right) - f(y_L, y_L) - g(x_{LL}) \right] \\ &+ \frac{1}{2}\frac{\alpha}{r} \left[\int_0^{x_{LL}} g(x)dx - x_{LL} g(x_{LL}) \right]. \end{aligned} \tag{4.21}$$

This completes the equilibrium solution. The following proposition collects the relevant equations and summarizes the results for $\theta < \tilde{\theta}$.

Proposition 2 *Integration equilibrium*

The solution for the five unknown endogenous variables is characterized by the following system of equations:

$$\begin{aligned} (I)\, rV_H &= f(y_H, y_H) + g(x_{HH}) \\ (II)\, rV_H &= f(y_H, y_L) + g(x_{HL}) \\ (III)\, rV_H &= f(y_H, y_H) \\ &\quad + \frac{1}{2}\frac{\alpha}{r} \left[\int_0^{x_{HH}} g(x)dx + \int_0^{x_{HL}} g(x)dx - x_{HH} g(x_{HH}) - x_{HL} g(x_{HL}) \right] \\ (IV)\, rV_L &= f(y_L, y_L) + g(x_{LL}) \\ (V)\, rV_L &= f(y_L, y_L) \\ &\quad + \frac{1}{2}\frac{\alpha}{r} x_{HL} \left[f(y_L, y_H) + E\left(g(x) \mid x \leq x_{HL}\right) - f(y_L, y_L) - g(x_{LL}) \right] \\ &\quad + \frac{1}{2}\frac{\alpha}{r} \left[\int_0^{x_{LL}} g(x)dx - x_{LL} g(x_{LL}) \right] \end{aligned}$$

Equation (III) of the solution captures the standard reservation equation for high type agents. It implies that the flow value of search rV_H is equal to the current

payoff $f(y_H, -) = f(y_H, y_H)$ plus the expected surplus generated by the optimal search strategy. This optimal strategy is given by x_{HH} and x_{HL}. Equations (I) and (II) show another standard reservation strategy result: High agents must be indifferent between searching further and marrying the (optimally chosen) least acceptable partner among high types (in terms of the taste distance x_{HH}) and among low types (in terms of the taste distance x_{HL}). In addition the two equations capture the constraints for this strategy discussed above; that is high type agents require compensation along the horizontal dimension from low type agents.

Equation (V) describes the standard reservation equation for low type agents. Since low type agents are not decisive for mixed marriages, they treat x_{HL} essentially as given. Therefore, the first bracket of the right hand side can be interpreted as the current payoff including a stochastic component generated by possible mixed marriages. The second bracket equals the expected surplus from choosing the optimal reservation quality within their own types. Low types have only one decision variable and hence equation (IV) completes the solution. This equation describes the usual indifference condition and is comparable to equations (I) and (II).

As mentioned above, the fact that high types are decisive for mixed marriages permits a step-wise solution for the equilibrium. Low types take the high types' decisions in equilibrium as given and optimize only within their own types. This property has simplified the derivation of Proposition 2, and the extensions section of this chapter shows how this concept generalizes to any (discrete) number of agents.

We now turn to the case $\theta > \tilde{\theta}$. In this case search frictions are low such that high types are selective and reject offers from low types. As a result, the two types endogenously partition themselves into two classes and choose the threshold quality within their own class. Therefore, there are no mixed marriages and we can immediately apply the results from the case without vertical heterogeneity.

To solve for the symmetric equilibrium we use Proposition 1 for the two types of agents separately. Compared to the case without vertical heterogeneity in section 4.2, we have to adjust the arrival rate of offers. Since both types are equally likely and the assumptions with respect to random matching still hold, the adjusted arrival rate is now 0.5α. The following proposition summarizes the results for the segregation equilibrium:

Proposition 3 *Segregation equilibrium*

The solution for the three endogenous variables is characterized by the following system of equations:

$$\begin{aligned} g(\bar{x}) &= \frac{\theta}{2}\left[\int_0^{\bar{x}} g(x)dx - \bar{x}g(\bar{x})\right] \\ rV_H &= f(y_H, y_H) + g(\bar{x}) \\ rV_L &= f(y_L, y_L) + g(\bar{x}) \end{aligned}$$

The first equation characterizes the reservation quality $x_{LL} = x_{HH} = \bar{x}$. Both agents use the same reservation quality, because there are no mixed marriages and hence there is no intra-marital income redistribution. But clearly, the utilities of either type differ according to the different income levels. This can be seen in Proposition 3 as $f(y_H, y_H) > f(y_L, y_L)$.

Finally, we solve for the critical level of search frictions $\tilde{\theta}$ that separates the integration equilibria from the segregation equilibria. When the level of search frictions is equal to $\tilde{\theta}$, a high type agent is indifferent between accepting the best available low type agent and the optimally chosen high type agent. Hence, equations (I) and (II) from Proposition 2 yield

$$f(y_H, y_H) + g(x_{HH}) = f(y_H, y_L) + g(0). \tag{4.22}$$

As equation (4.22) shows, the threshold extent translates directly into a reservation quality among high types $\tilde{x}_{HH}$. Setting $x_{HL} = 0$ in equation (III) from Proposition 2 yields this threshold reservation quality $\tilde{x}_{HH}$. It is easy to show that this equation and the first equation from Proposition 3 coincide for $x_{HL} = 0$. Hence, the threshold extent is well-defined. This completes the solution.

Properties of the solution

In the following we discuss some properties with respect to the solution of the general model with vertical heterogeneity and provide some intuition for the results developed so far. The relevant exogenous parameter for equilibrium behavior is the extent θ. We therefore write particular endogenous variables of the model as functions of the

extent θ and discuss properties of the equilibrium solution with respect to changes in θ.

We start the discussion with some continuity properties of the solution:

Proposition 4 *Continuity Properties*
The reservation qualities $x_{HH}(\theta), x_{HL}(\theta)$ and $x_{LL}(\theta)$ are continuous in $\theta \in \mathbb{R}_+$.

The continuity for $\theta \neq \tilde{\theta}$ is straightforward as the optimal cut-off strategies are adjusted smoothly by the agents. When search frictions increase (θ decreases) starting from $\tilde{\theta}$, high type agents start sending offers to low types. The possible utility gains with respect to the horizontal dimension are distributed in a continuous way on the two circles. Therefore, there is continuity for the reservation utility strategies of high type agents with respect to changes in θ.

From the perspective of low types, the first proposals from high types slightly below $\tilde{\theta}$ start with probability zero. This probability increases continuously if θ decreases further. Hence, the reservation utility of low types is not affected in a discontinuous manner. It follows that there is no discontinuity in their offer behavior within their own types. Finally, for the reservation quality that high types require from low types we have already established that $x_{HL} = 0$ and hence continuity is obvious.

We proceed by analyzing the limiting behavior of the different reservation qualities:

Proposition 5 *Limiting Properties*
The limiting behavior of the reservation qualities is as follows:

a) $\lim_{\theta \to 0} x_{HH}(\theta) = 1, \lim_{\theta \to 0} x_{LL}(\theta) = 1$ *and* $\lim_{\theta \to 0} x_{HL}(\theta)$ *is given by* $g(x_{HL}) = f(y_H, y_H) - f(y_H, y_L)$.

b) $\lim_{\theta \to \infty} x_{HH}(\theta) = 0, \lim_{\theta \to \infty} x_{LL}(\theta) = 0$

The first part of Proposition 5 covers the case of maximum search frictions. The normalization $g(x) \geq 0$ implies that agents (weakly) prefer to marry any partner of their own class rather than staying single. Since $x \in [0, 1]$, the limiting threshold quality for maximum search friction is equal to one.

As a high type faces redistributional losses when marrying a low type, she is only willing to marry low type agents who compensate her for this loss. This holds as well for maximum search frictions and explains the limiting behavior of $x_{HL}(\theta)$.

The second part of Proposition 5 is straightforward. In a market without search frictions complete segregation emerges. Every agent sets her required minimum quality to the maximum as she meets all agents instantaneously.

We now discuss the differentiability properties that we summarize as follows:

Proposition 6 *Differentiability Properties*

a) Reservation quality $x_{LL}(\theta)$ is differentiable for all $\theta \in \mathbb{R}_+ \setminus \tilde{\theta}$ and is not differentiable in $\tilde{\theta}$.

b) Reservation quality $x_{HH}(\theta)$ is differentiable for all $\theta \in \mathbb{R}_+$ and is decreasing in θ.

c) Reservation quality $x_{HL}(\theta)$ is differentiable for all $\theta \in \mathbb{R}_+ \setminus \tilde{\theta}$ and is non-increasing in θ.

Once again, the properties for $\theta \neq \tilde{\theta}$ are straightforward. Agents smoothly adjust their reservation utility strategies in response to a small change in search frictions.

By contrast, around $\tilde{\theta}$ only x_{HH} is differentiable. When search frictions increase (θ decreases) beyond $\tilde{\theta}$, high types start proposing to low type agents. Contrary to low types, high types are decisive. As marriages with low types start out as a probability zero event, high types do not need to adjust the rate of their proposals to other high types when search frictions increase. Hence, the solution for x_{HH} exhibits differentiability in $\tilde{\theta}$.

In general, reservation qualities x_{HL} and x_{LL} are not differentiable in $\tilde{\theta}$. For an extent slightly below $\tilde{\theta}$, low types receive offers from high types with a positive probability. Low type agents receive a larger utility gain from these offers than from the least acceptable partner within their own class. Since the low types are not decisive for these mixed marriages, one can interpret the possibility of marrying a high type as a new opportunity which happens by chance. Since low types correct their reservation quality for these lucky events, their reservation quality is not differentiable in $\tilde{\theta}$. An example which illustrates this is discussed in section 4.4. The example also shows that low types may even benefit from higher search frictions because of these lucky events.

4.4 An example

We now illustrate the mechanics of the model by a particularly simple example that permits the derivation of an explicit solution. First, we assume that utility derived from the vertical dimension is equal to the average household income if agents are married. As before, single agents' utility equals their own income. Formally, we specify $f(\cdot,\cdot)$ as follows:

$$f(y_H, y_H) = f(y_H, -) = y_H \tag{4.23}$$

$$f(y_H, y_L) = f(y_L, y_H) = \frac{y_H + y_L}{2} \tag{4.24}$$

$$f(y_L, y_L) = f(y_L, -) = y_L \tag{4.25}$$

This assumption might be interpreted as full income pooling. Both spouses receive the same income share independently of their contributed shares to household income. With respect to the taste dimension, we assume that utility is decreasing in the simple linear distance. Formally, we have

$$g(x) = 1 - x.$$

Clearly, this specification is in line with the set of assumptions from the previous section. Inserting these functions into Propositions 2 and 3 yields the explicit solution as follows:

Corollary 2 *Explicit solution for the example*

a) For $\theta \leq \tilde{\theta}$ an integration equilibrium emerges, where the five unknown endogenous variables V_H, V_L, x_{HH}, x_{HL} and x_{LL} are characterized by the following

system of equations:

$$\begin{aligned}
(Ia) \quad rV_H &= y_H + 1 - x_{HH} \\
(IIa) \quad rV_H &= \frac{y_H + y_L}{2} + 1 - x_{HL} \\
(IIIa) \quad rV_H &= y_H + \frac{1}{4}\theta\left[x_{HH}^2 + x_{HL}^2\right] \\
(IVa) \quad rV_L &= y_L + 1 - x_{LL} \\
(Va) \quad rV_L &= y_L + \frac{1}{2}\theta x_{HL}\left[\frac{y_H - y_L}{2} + x_{LL} - \frac{x_{HL}}{2}\right] + \frac{1}{4}\theta x_{LL}^2
\end{aligned}$$

b) For $\theta > \tilde{\theta}$ a segregation equilibrium emerges, where the three unknown endogenous variables V_H, V_L and $\bar{x}$ are characterized by the following system of equations:

$$\begin{aligned}
(Ib) \quad \bar{x} &= \frac{2}{\theta} \cdot (\sqrt{1+\theta} - 1) \\
(IIb) \quad rV_H &= y_H + 1 - \bar{x} \\
(IIIb) \quad rV_L &= y_L + 1 - \bar{x}
\end{aligned}$$

c) The threshold extent $\tilde{\theta}$ is given by

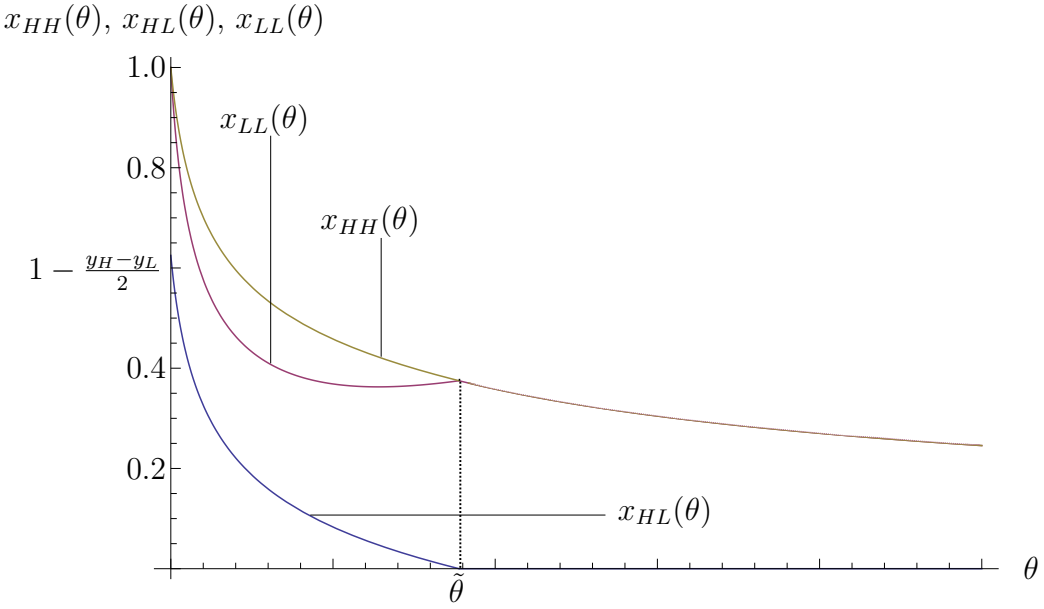
$$\tilde{\theta} = 8\frac{2 - (y_H - y_L)}{(y_H - y_L)^2}. \tag{4.26}$$

To simplify the discussion further, we choose explicit values for the two income levels and the discount rate and present the model solution graphically. In particular, we use $y_H = 1$ and $y_L = 0.25$. Agents discount future utility with $r = 0.05$.[14]

Figure 4.3 depicts the reservation qualities $x_{HH}(\theta), x_{HL}(\theta)$ and $x_{LL}(\theta)$ for the specification given above. For a market extent above $\tilde{\theta}$ the solution exhibits complete segregation. In this case there are no mixed couples and $x_{HL}(\theta) = 0$. The two reser-

[14] We set incomes and the discount rate r to specific values to simplify the example as much as possible. This implies that the figure shows the reservation qualities for different values of α. Since the qualitative findings are independent of specific values of r, we denote all functions as functions depending on θ.

Figure 4.3: Reservation qualities

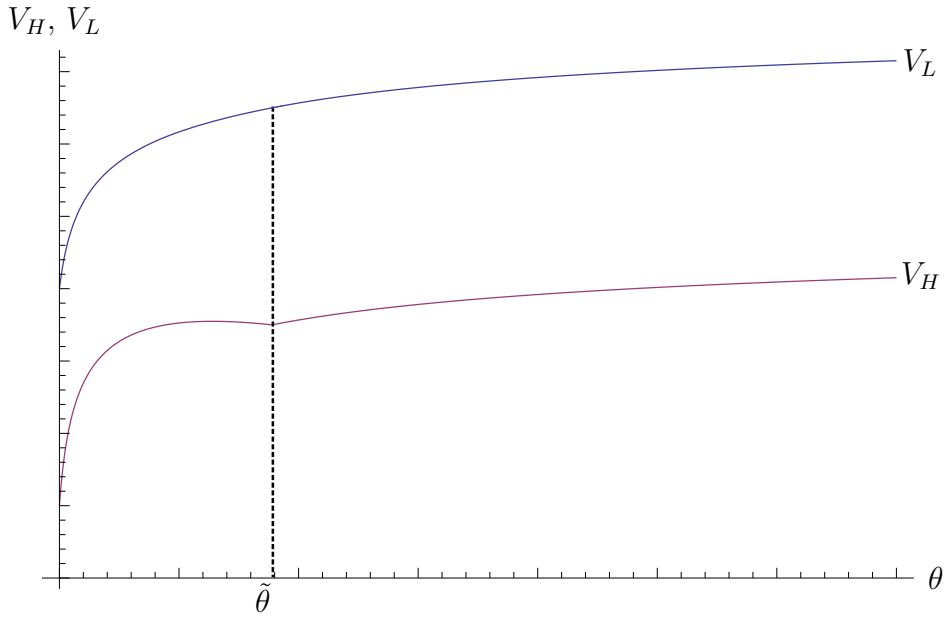


vation qualities for high types within themselves and for low types within themselves coincide as established by Proposition 3. As discussed, there are no mixed couples, and intra-marital redistribution does not play a role. Therefore, agents condition their proposals within their own type only on taste and $\bar{x}$ is identical for both types. In the limit ($\theta \to \infty$) the two reservation qualities $x_{HH}(\theta)$ and $x_{LL}(\theta)$ converge to zero. This is because an infinite market extent implies that all agents meet each other instantaneously.

For $\theta \leq \tilde{\theta}$ integration equilibria emerge. For values around $\tilde{\theta}$, the three reservation qualities clearly exhibit the continuity and differentiability properties discussed in the previous section. What happens if search frictions increase further such that θ approaches zero? First note that equations (IIa) and (IIIa) of Corollary 2 imply $x_{HH} - x_{HL} = \frac{y_H - y_L}{2}$. This distance is the "compensation" in taste required by high type agents from low type agents for the income loss due to redistribution. By the assumptions with respect to $g(\cdot)$, this distance is constant ($\frac{3}{8}$). Hence, in the figure $x_{HL}(\theta)$ and $x_{HH}(\theta)$ are parallel functions for $\theta \leq \tilde{\theta}$.

For maximum search frictions (θ close to zero) the reservation qualities x_{HH} and x_{LL} converge to one. In this case all agents propose to any agent within their own

Figure 4.4: Lifetime utilities



class. This result is driven by the normalization $g(1) = 0$ that states that agents weakly prefer marrying any agent from the same class rather that staying single forever. As discussed, an important feature of the model is that high type agents do not accept all low type agents. In general, the value for $x_{HL}(0)$ can be obtained from part a) of Proposition 5. In this specific example, we have $x_{HL}(0) = 1 - \frac{y_H - y_L}{2} = \frac{5}{8}$.

A notable feature is that for a certain range of θ the reservation quality within low type agents is *decreasing* in θ. That is, although the probability of meeting other low type agents increases, low agents are less selective within their own class. Intuitively, the decisive high type agents reduce the set of acceptable low type partners if the market extent increases. As a consequence low type agents realize that the *lucky* event of being matched to a high type becomes more unlikely. Hence, in this range they get less choosy regarding low types although market conditions improve.

Figure 4.4 highlights the consequences of this feature on agents' lifetime utilities. For the aforementioned range of $\theta < \tilde{\theta}$, low type agents would be better off if the extent of the market shrinks slightly. This is driven by the positive probability of being matched with a high type. Low type agents prefer these mixed matches,

because they marry a partner with similar taste and a high income. By contrast, high type agents dislike the income reduction through redistribution and would always prefer lower search frictions. The presence of the additional horizontal dimension allows high types to reduce continuously their offers to lower types when search frictions decrease. Low type agents adjust their reaction to this reduction in the offer distribution continuously, and the overall effect for low types' expected utility is the sum of two effects. The first, direct, effect of decreasing search frictions leads to meeting potential partners more often. The second, indirect, effect might cause agents to be more selective when deciding on whom to propose to. The example documents a case when the second effect is larger than the first. For values near $\tilde{\theta}$, the net effect of decreasing search frictions is a reduction of low types' lifetime utility.[15]

4.5 Extensions

4.5.1 Introducing weights

This section introduces weights that capture the idea that –for example– a population is more concerned about potential spouses' taste than spouses' income. In particular, let $\beta \in (0,1)$ denote the weight for the income-related payoff and let $1-\beta$ be the weight on taste-related utility. Agent i's utility if married to agent j is then defined as

$$U(y_i, t_i, y_j, t_j) = \beta f(y_i, y_j) + (1-\beta) g(x),$$

where x is the taste difference as before.[16] The limiting cases $\beta \to 0$ and $\beta \to 1$ describe agents who are "romantically minded" or "greedy for money" respectively.[17]

First note that these weights do not change the general analysis at all. As utility is ordinal, we can simply transform the utility function by dividing by weight β. This

[15] Clearly, only agents who are not decisive concerning potentially formed marriages may suffer from decreased search frictions.

[16] Hence, there is now only one additional normalization required; as before we assume $g(1) = 0$. Once again, this assumption is only for the sake of simplicity and could be replaced by constant.

[17] We stick to the assumption that all agents have the same utility function.

transformed utility function is

$$\tilde{U}(y_i, t_i, y_j, t_j) = f(y_i, y_j) + \tilde{g}(x) \text{ with } \tilde{g}(x) = \frac{(1-\beta)}{\beta} g(x).$$

As $\tilde{g}$ is decreasing and $\tilde{g}(1) = 0$, the transformed utility $\tilde{U}$ meets all requirements for the utility specification, that are discussed in section 4.2. Hence, the analysis does not change and replacing g by $\tilde{g}$ in Proposition 1 yields the solution for the case without vertical heterogeneity. Likewise, Proposition 2 and Proposition 3 implicitly characterize the solution for the integration and segregation equilibria respectively.

In the following, we discuss the comparative statics for the reservation qualities associated with the limiting cases $\beta \to 0$ and $\beta \to 1$. By equations (I) and (II) of Proposition 2, the critical market extent $\tilde{\theta}$, that divides the integration equilibrium from the segregation equilibrium (where $x_{HL} = 0$), is implicitly defined by

$$\beta(f(y_H, y_H) - f(y_H, y_L)) = (1-\beta)(g(0) - g(x_{HH})). \tag{4.27}$$

Note that the critical market extent is well defined by inserting the modified utility specification into equation (4.22). As before, equation (4.27) yields an expression for x_{HH} at the critical market extent $\tilde{\theta}$. Clearly, an increase of β requires a higher threshold x_{HH} at $\tilde{\theta}$ as g is decreasing in x. What are the implications for $\tilde{\theta}$? From the previous analysis we know that the high types' reservation qualities are increasing in θ, i.e. the lower the search frictions (increasing θ) the lower the taste difference for the least acceptable partners (i.e., $\bar{x}$ is decreasing). Hence, this shows that higher values of β are associated with smaller values of the critical market extent $\tilde{\theta}$.

Using this result, it is straightforward to show that the integration equilibrium does not exist for values of β beyond an upper bound $\tilde{\beta}$. Note that the right-hand-side of equation (4.27) captures the maximum possible gain along the horizontal dimension relative to the least acceptable high type partner. It is bounded by $(1-\beta)g(0)$ as $g(1) = 0$. Recall that the left-hand-side of this equation describes the income loss for the high type agent due to intra-marital redistribution when marrying a low type. If this loss exceeds the maximum possible gain with respect to the horizontal dimension, high type agents reject any low type agent. Since the maximum gain equals $g(0)$,

the upper bound for β is characterized by the following inequality

$$\beta(f(y_H, y_H) - f(y_H, y_L)) > (1 - \beta)g(0).$$

Rearranging shows that for

$$\beta > \tilde{\beta} := \frac{g(0)}{f(y_H, y_H) - f(y_H, y_L) + g(0)}$$

high types will reject low type agents for all values of θ.

It remains to discuss the optimal strategy of high and low types within their own class. Since there is no intra-marital redistribution for these marriages, the two types of agents apply the same cut-off-value with respect to taste. To summarize, for

$$\beta > \tilde{\beta}$$

low and high types optimize in separate spheres. The equilibrium is fully characterized by inserting $\tilde{g}(x)$ and $x_{HL} = 0$ into Proposition 3. Once again, since complete segregation emerges, the arrival rate of potential partners who have the same income equals $\alpha/2$. Finally, note that $0 < \tilde{\beta} < 1$.

Obviously, decreasing β is associated with larger values of $\tilde{\theta}$. In the limiting case, income becomes irrelevant for the agents' decision problem as in the case without vertical heterogeneity.

In sum, we have established two results. First, assigning weights to the two parts of the utility function does not change the analysis. The solution is obtained by a simple reformulation of the variables. More interestingly, for both limiting cases the resulting model solution can be derived by exploiting the available results for the case without vertical heterogeneity. However, the critical threshold $\tilde{\theta}$ differs across the two limiting cases.

The reasoning for the two limiting cases is also quite different. Intuitively, for large values of β only high types are acceptable for a high type. Hence, low types are stuck with each other and this leads to complete segregation. Since the markets of low and high type agents are divided into two separate parts, the arrival rate of offers is equal to 0.5α. Hence, the reservation qualities for this case can be obtained by inserting

this modified arrival rate into the one-circle-solution. By contrast, for low values of β, income is not very important and in the limiting case ($\beta \to 0$) income does not affect agents' decisions. In this case both low and high type agents are basically identical. Hence, the result converges to the one-circle solution with the original arrival rate α.

4.5.2 More than two types of income

In the previous sections we have analyzed the case of at most two discrete levels of income and horizontal heterogeneity. A central assumption regarding the horizontal dimension is symmetry in payoffs, that is both spouses receive exactly the same noneconomic gain when married (cf. Konrad and Lommerud 2010). This symmetry allows us to partially apply results known from the model involving only a vertical dimension (e.g. Burdett and Coles 1997). In particular, this symmetry implies that the high type agent is decisive for mixed marriages. Hence, in equilibrium all low-type agents who receive offers from a particular high type agent also propose to this agent. This observation is crucial, as it allows to use a step-wise approach to solve for the equilibrium. In the two-type model, low types take the high type's equilibrium behavior essentially as given and perform a conditional maximization. In the following, we will exploit this idea to establish an integration equilibrium for N discrete income levels $y_1 < y_2 < ... < y_N$. In this extended model each type except the lowest type will be decisive concerning agents with lower vertical traits. Once again, we denote individuals by small letters and income classes by capital letters if a distinction seems helpful. In the following, we term agents who have a income level y_J where $J \in \{1, 2, ..., N\}$ agents of "type J".

Let α_i^J denote the probability that agent i contacts a single of type J who is willing to marry her. Generally, we denote the cumulative probability that the distance of an agent of type J who is willing to marry individual i as $H_{-i}^J(x_J|y_i)$. In general, there are N different types of agents proposing to individual i and hence the lifetime utility is determined by

$$
\begin{aligned}
V_i = & \frac{1}{1+\Delta r}\Bigg[\Delta f(y_i,-) \\
& + \Delta\left(\sum_J \alpha_i^J\right)\left(\sum_K \frac{\alpha_i^K}{\sum_J \alpha_i^J} E_{-i}^K\left(\max\left\{V_i, \frac{f(y_i,y_K)+g(x_K)}{r}\right\}\right)\right) \\
& + (1-\Delta(\sum_J \alpha_i^J))V_i\Bigg] + o(\Delta).
\end{aligned} \tag{4.28}
$$

For given offer distributions, we could now reformulate Lemma 2 to describe the reservation utility strategies for the case of N different income levels. However, as the reasoning is identical, we proceed directly to equilibrium behavior.

For each agent of type J there is one reservation utility level V_J. Furthermore, each agent of type J has N different reservation qualities concerning partners from every potential type of agent. Hence, there are $N+1$ unknowns for each type of agent which sum up to $N \cdot (N+1)$ unknowns to describe individuals' equilibrium strategies completely.

As before, matches are formed only by mutual agreements. Exactly as in the two type model, higher types have higher reservation utilities. Hence, they are the decisive players when agents of different income levels propose to each other. It follows that the amount of unknowns capturing equilibrium behavior can be reduced to those relevant for the formation of matches. As Type N agents are the highest type in the market, they are always decisive. Therefore, there are N binding reservation quality equations associated with type N agents. We call these "decisiveness equations" in the following. An agent of type $N-1$ is decisive concerning all lower types and her own type which yields $N-1$ relevant decisiveness equations. In general, there are J decisiveness equations associated with an agent of type J. Additionally, there are N unknowns concerning the reservation utilities. Thus, the equilibrium is fully described by this set of collectively

$$
N + \sum_J J = N + \frac{N \cdot (N+1)}{2}
$$

unknowns.

As noted above, we want to proceed directly to the equilibrium solution. For the two-type model, exploiting Lemma 2 provides two equations describing the equilibrium values for the two reservation utilities. Modifying these computations to the present case yields N equations describing the N reservation utilities. Furthermore, each combination between two individuals of types K and respectively L where $K \geq L$ yields an additional equation of the form

$$rV_K - f(y_K, y_L) = g(\overline{x}_K(y_L)).$$

There are N equations concerning the reservation utilities. For each $K \geq L$ there are K additional equations. Adding up yields

$$N + \sum_J J = N + \frac{N \cdot (N+1)}{2}$$

equations in total which equals the number of unknowns. Hence, this system of equations characterizes the equilibrium solution. Once again, without specifying the distance and payoff functions, no explicit derivations can be offered.

Depending on the parametrization, the resulting equilibrium may exhibit segregation as well as integration outcomes with respect to the N types of agents. Let x_{KL} denote the least acceptable L-type-agent from the perspective of K-type-agents. Hence, whenever a K-type-agent meets an L-type agent of quality x_{KL}, she is indifferent between staying single or marrying this agent. The following proposition summarizes the system of equations for high search frictions in the sense that even the highest (N) type is willing to marry some agents of the lowest type[18]:

Proposition 7 *Complete integration equilibrium*

The solution for the $N + \frac{N \cdot (N+1)}{2}$ *unknown endogenous variables is characterized by a system of two types of equations.*

[18] Clearly, by the fact that reservation utility is increasing in type and all agents apply reservation utility strategies, this implies that all types of agents are possibly matched in equilibrium.

Decisiveness equations ($\frac{N(N+1)}{2}$ equations):

$$\begin{aligned} rV_K =& f(y_K, y_L) + g(x_{KL}) \text{ for all } K \geq L \\ & (\text{where } K \in \{1, 2, ..., N\},\ L \in \{1, 2, ..., N\}) \end{aligned}$$

Reservation utility equations (N equations):

$$\begin{aligned} rV_K =& f(y_K, -) \\ & + \frac{1}{N}\frac{\alpha}{r}\Bigg[\sum_{L=K+1}^{N} x_{LK}[f(y_K, y_L) + E\left(g(x) \mid x \leq x_{LK}\right) \\ & - f(y_K, y_K) - g(x_{KK})\Bigg] \\ & + \frac{1}{N}\frac{\alpha}{r}\sum_{L=1}^{K}\left[\int_0^{x_{KL}} g(x) - g(x_{KL})dx)\right] \\ & (\text{where } K \in \{1, 2, ..., N\}) \end{aligned}$$

In general, depending on the extent of the market, all intermediate equilibria between the perfect integration equilibria discussed in Proposition 7 and the perfect segregation equilibria can emerge. We do not provide solutions for all these intermediate cases. The method to construct these cases is clear from the discussion above, while writing down all possible cases is lengthy and involves bulky notation.

4.6 Conclusion

This chapter analyzes how matching and sorting takes place when individuals are characterized by both vertical and horizontal ex-ante heterogeneity. Our dynamic model assumes that search frictions are present in the market and that utility is nontransferable. Along the vertical dimension all individuals agree on the ranking of agents and prefer to be matched with the highest agent. This vertical trait can therefore be interpreted as income, wealth or even beauty. Unlike in most of the search-theoretic literature, the horizontal dimension considered here is not ordered.

It captures inputs which are not equally ranked across agents. Possible examples are joint leisure activities of couples or spouses' emotional congruence. The analysis for our definition of horizontal heterogeneity[19] is quite different from the more common assumption of preferring similar characteristics along an ordered trait like height (e.g. Clark 2007).[20]

One appealing result is that the reservation-utility strategies are continuous in the market extent. By contrast, in the classic vertical model (e.g. Burdett and Coles 1997) the strategies and the corresponding expected lifetime utilities are not continuous. Our result is driven by the fact that agents are able to condition their offers on both dimensions. If the search frictions are large enough, high-type agents start sending offers to low-type agents. When the extent of the market is exactly at this threshold, high-type agents propose only to the low-type agent who yields the largest horizontal payoff. When search frictions increase further, high-type agents expand continuously the set of acceptable low-type agents. Low-type agents are decisive only within low-types and choose optimally the range of acceptable payoff with respect to the horizontal trait.

We also show that –depending on the model parameters– low type agents might prefer a higher degree of search frictions. If the level of search frictions happens to be in such a range, a higher level of search frictions has two effects. First, the frequency of meeting potential partners is lower and this effect harms the agents. Second, the probability that a high type accepts a low type increases, and this effect outweighs the first effect.

Finally, we present two important extensions. First, the weights assigned to the utilities from the two traits are not a restrictive as long as utility remains additively separable. Second, the number of types in the vertical dimension can be increased to an arbitrary natural number.

There are several routes for future research. For simplicity, it is assumed that individuals who leave the market are immediately replaced by clones. Introducing different inflow and outflow specifications should lead to multiple equilibria for a

[19] Konrad and Lommerud (2010) employ such a definition of horizontal heterogeneity and analyze the implications of redistributive taxation in a static one-period model.

[20] In these models the probability of being matched is usually not independent of the location. For example, if agents prefer partners of similar height, individuals in the middle of the distribution have higher chances of meeting an appropriate partner.

given extent of the market. Another important assumption is the symmetry of the horizontal dimension. This ensures that both agents in a match always receive the same gain along the horizontal dimension. This in turn implies that high-type agents are decisive for mixed matches and considerably simplifies the extension to N discrete income levels.

4.7 Appendix

Proof of Lemma 1. From equation (4.2) we know that an agent accepts all proposals which yield a higher utility than staying single, i.e. agent i accepts if and only if

$$rV_i \leq f(y,y) + g(x). \tag{4.29}$$

In general, there are two cases to distinguish: In the first case agent i does not accept all proposals which she faces. Thereby, she accepts all proposals up to the taste difference where she is indifferent between marriage and staying single. This determines her reservation quality $\bar{x}_i$ which is then given by

$$rV_i = f(y,y) + g(\bar{x}_i). \tag{4.30}$$

Using equation (4.30) we can reformulate the right-hand-side of equation (4.2). This yields

$$rV_i = f(y,-) + \frac{\alpha_i}{r} \int_0^{\bar{x}_i} \left(g\left(x\right) - g\left(\bar{x}_i\right)\right) dH_{-i}(x).$$

In the second case the agent accepts every proposal she faces. The agent would be even willing to accept agents whose location is beyond the taste difference of $\bar{x}_i$, but these individuals do not propose to her. Formally, we have

$$rV_i < f(y,y) + g(\bar{x}_i) \text{ and } H_{-i}(\bar{x}_i) = 1$$

as every offer is accepted. Furthermore, as the agent always marries when she faces a proposal, the maximum operator from equation (4.2) simplifies and we get

$$rV_i = f(y,-) + \frac{\alpha_i}{r} E_{-i}\left(f(y,y) + g(x) - rV_i\right).$$

■

Proof of Proposition 1. The proof follows directly from the text. ■

Proof of Corollary 1. The first part simply follows by equations (I) and (II) from Proposition 1 and recalling the utility definition $f(y,-) = f(y,y)$. For the second

part let

$$F(\theta, x(\theta)) := \theta \left[\int_0^{\bar{x}} g(x)dx - \bar{x}g(\bar{x}) \right] - g(\bar{x}).$$

Using the implicit function theorem we establish that $\bar{x}$ is decreasing in extent θ as

$$\begin{aligned} \frac{d\bar{x}}{d\theta} &= -\left(\frac{dF}{d\bar{x}}\right)^{-1} \cdot \frac{dF}{d\theta} \\ &= -\frac{\int_0^{\bar{x}} g(x)dx - \bar{x}g(\bar{x})}{\theta(g(\bar{x}) - g(\bar{x}) - \bar{x}g'(\bar{x})) - g'(x)} \\ &= \frac{\int_0^{\bar{x}} g(x)dx - \bar{x}g(\bar{x})}{g'(x)(1 + \theta\bar{x})} < 0. \end{aligned}$$

The last sign holds as the numerator is positive due to $g' < 0$ and the denominator is negative for the same reason. Hence, we get $d\bar{x}/d\theta < 0$, i.e. the reservation quality required by the agents is increasing in the extent of the market.

It remains to show the limiting behavior of $\bar{x}$. Letting $\theta \to 0$ and finding a solution to equation (4.10) is equivalent to solving $g(\bar{x}) = 0$ which yields $\bar{x} = 1$. The considerations for $\theta \to \infty$ are similar. We have to find $\bar{x}$ which fulfills

$$g(\bar{x}) = \theta \left[\int_0^{\bar{x}} g(x)dx - \bar{x}g(\bar{x}) \right].$$

For given θ, we can choose $\bar{x}$ arbitrarily close to 0 such that the right-hand-side is arbitrarily close to zero, whereas the left-hand-side still yields a finite value. Hence, this equation has always a solution. Furthermore, as the right-hand-side is increasing in θ, we have $\lim_{\theta \to \infty} \bar{x}(\theta) = 0$. ■

Proof of Lemma 2. This is a direct generalization of the proof from Lemma 1. The rest follows directly from the text. ■

Proof of Proposition 2. The proof follows directly from the text. ■

Proof of Proposition 3. The proof follows directly from the text and from Proposition 1. ■

Proof of Proposition 4. First note that $x_{HL}(\tilde{\theta}) = 0$, which we will use at some points throughout the proof.

First, we consider the continuity of $x_{HH}(\theta)$. The continuity for $\theta \in \mathbb{R}_+ \setminus \{\tilde{\theta}\}$ can be seen directly from the equation system (I)-(V) of the integration equilibrium given in Proposition 2 and the expression $g(\bar{x})$ from the income segregation equilibrium given in Proposition 3. For the case of $\theta = \tilde{\theta}$, by equating (I) and (III) and taking $x_{HL}(\tilde{\theta}) = 0$ into account we get

$$g(x_{HH}) = \frac{\theta}{2}\left[\int_0^{x_{HH}} g(x)dx - x_{HH}g(x_{HH})\right].$$

Hence, this solution for x_{HH} at $\tilde{\theta}$ coincides with the solution of $g(\bar{x})$ of the segregation equilibrium. Since the solution is the same on both sides of $\tilde{\theta}$ we have continuity for x_{HH} for all $\theta \in \mathbb{R}_+$.

Now we analyze $x_{LL}(\theta)$. The continuity for $\theta \in \mathbb{R}_+ \setminus \{\tilde{\theta}\}$ can be seen directly from the equation system (I)-(V) of the integration equilibrium given in Proposition 2 and the expression $g(\bar{x})$ from the income segregation equilibrium given in Proposition 3. For the case of $\theta = \tilde{\theta}$ equating (IV) and (V) together with $x_{HL}(\tilde{\theta}) = 0$ yields

$$g(x_{LL}) = \frac{\theta}{2}\left[\int_0^{x_{LL}} g(x)dx - x_{LL}g(x_{LL})\right].$$

Hence, this solution for x_{HL} at $\tilde{\theta}$ coincides with the solution of $g(\bar{x})$ of the segregation equilibrium. Since the solution is the same on both sides of $\tilde{\theta}$ we have continuity for x_{LL} for all $\theta \in \mathbb{R}_+$.
Finally, we analyze $x_{HL}(\theta)$. The continuity of x_{HL} for all $\theta \in (0, \tilde{\theta})$ follows directly from the equation system (I)-(V). For $\theta > \tilde{\theta}$ we have $x_{HL} \equiv 0$. Hence, as x_{HL} is zero per definition at $\tilde{\theta}$ we have continuity for all $\theta \in \mathbb{R}_+$. ■

Proof of Proposition 5. a) Let $\theta = 0$. By equations (I) and (III) from Proposition 2 we get $g(x_{HH}) = 0$. By the definition of g this yields $\lim_{\theta\to 0} x_{HH}(\theta) = 1$. The same argument for equations (IV) and (V) from Proposition 2 shows $\lim_{\theta\to 0} x_{LL}(\theta) = 1$. Furthermore, by equating (I) and (II) from Proposition 2 one gets that the difference between least acceptable partners (measured in g) is a constant:

$$g(x_{HL}) - g(x_{HH}) = f(y_H, y_H) - f(y_H, y_L) \tag{4.31}$$

We already know for $\theta \to 0$ we have $g(x_{HH}) = 0$. Using this in equation (4.31) shows the last claim from part (a).

b) For $\theta \to \infty$ we have complete segregation and hence Corollary 1 applies. This completes the proof. ■

Proof of Proposition 6. By Proposition 2 and Proposition 3 the differentiability of reservation qualities x_{LL}, x_{HH} and x_{HL} for all $\theta \in \mathbb{R}_+ \setminus \tilde{\theta}$ is obvious. It remains to show the differentiability of x_{HH} in $\tilde{\theta}$.

For reasons of simplicity we analyze the system of equations given in Proposition 2 and Proposition 3 as functions of the market extent α instead of θ; the latter definition of market extent is just a transformation by the constant discount factor r. By the implicit functions theorem the left- and the right-hand-side derivatives of the reservation quality of the high type among her own class are

$$\lim_{\Theta \nearrow \tilde{\Theta}} \frac{\partial x_{HH}}{\partial \alpha} = \lim_{\Theta \searrow \tilde{\Theta}} \frac{\partial x_{HH}}{\partial \alpha} = \frac{\int_0^{x_{HH}} g(x)dx - x_{HH} g(x_{HH})}{g'(x_{HH})(2r + x_{HH}\alpha)}.$$

Hence, x_{HH} is differentiable in $\mathbb{R}_+$. Furthermore, the analysis of the derivatives shows easily that the reservation qualities x_{HH} and x_{HL} are decreasing and respectively non-increasing everywhere. ■

Proof of Corollary 2. All stated equations are the results of calculations using the formula given in Proposition 2 for part a) and Proposition 3 for part b).

It remains to calculate the threshold extent $\tilde{\theta}$. From equation (4.22) it is clear that at $\tilde{\theta}$ we have

$$y_H + 1 - x_{HH} = \frac{y_H + y_L}{2} + 1 \Leftrightarrow x_{HH} = \frac{y_H - y_L}{2}.$$

By Proposition 4 we know that $x_{HH}(\theta)$ is continuous at $\tilde{\theta}$ and hence, using equation (Ib) at $\tilde{\theta}$, it must hold that

$$\frac{y_H - y_L}{2} = \frac{2}{\tilde{\theta}}(\sqrt{1 + \tilde{\theta}} - 1).$$

Solving this for $\tilde{\theta}$ yields

$$\tilde{\theta} = 8\frac{2 - (y_H - y_L)}{(y_H - y_L)^2}.$$

This completes the proof. ■

Proof of Proposition 7. The proof follows directly from the text. ■

Chapter 5

Are there long-lasting gains to marriage?

5.1 Introduction

A simple revealed preference argument –as in the previous chapter– suggests that persons who marry are better off than in their previous situation while single. An important question is whether this utility gain is reflected in individuals' happiness. Of course there are counterarguments, for example that the true quality of the partner may only gradually be revealed. Given that some non-zero divorce costs exist (e.g. monetary, psychological or social), some individuals may end up worse off than while single. But for the vast majority of existing unions one should expect that utility while married is larger than the previous utility while single.

The early literature based on cross-sectional data consistently found a positive impact of marriage on individuals' life satisfaction (for a review, see Diener et al. 1999). One obvious shortcoming of these studies is that they are unable to distinguish whether or not this correlation just reflects preexisting differences between the two groups. Stutzer and Frey (2006) provide evidence for this argument by comparing several groups of singles over time. They find that those who are on average happier than other singles have a higher propensity to marry than the less happy ones. They conclude that a large part of the cross-sectional correlation is due to selection of the happier individuals into marriage.

A second objection regarding the results of the cross-sectional literature is the idea

of hedonic adaptation (e.g. Loewenstein et al. 2003, Loewenstein and Ubel 2008). In this context the theory implies that individuals quickly get used to the positive effects of having a partner which in turn suggests that their utility bounces back to the level before marriage. A number of recent longitudinal studies test this hypothesis and provide inconsistent evidence. For example, Lucas et al. (2003), Lucas and Clark (2006) and Clark et al. (2008) conclude that individuals on average fully adapt to marriage within 1-2 years after marriage. Frijters et al. (2008) analyze quarterly data from the Household, Income and Labor Dynamics in Australia survey (HILDA) and argue that individuals fully adapt to marriage within a quarter. By contrast, Zimmermann and Easterlin (2006) report that individuals' happiness two years after marriage is higher than the baseline level. The divergent conclusions are difficult to resolve due the different samples, methodologies and control variables used in these studies.

Our aim is to reconsider the effects of marriage on individuals' happiness using a different empirical strategy. We use 23 years of German panel data and follow the same individuals over several years. All individuals included in the sample marry in the course of time. Instead of entering a single marriage dummy we use a series of duration dummies. In this way we can identify an individual's happiness profile over time, starting five years before to five years after marriage. The reference period for our calculations is five years prior to marriage. In this way we are able to pick up the value of being single as the reference utility level more accurately. We include individual fixed effects into our analysis. The reasons are twofold. First, the fixed effects model implies the weakest assumptions in order to capture the idea of hedonic adaptation. If individuals over time return to some genetically determined level of happiness, this will be picked up by the fixed effects. Second, the coefficient estimates are solely driven by variation within the same person thereby ruling out selection effects.

As in the previous literature we find the strongest positive impact on happiness in the years around marriage and a huge drop one year after marriage.[1] However, after

[1]There are several explanations for this drop, e.g. partial adaptation or rising aspiration levels. The focus of this chapter is not to distinguish between these factors. Our results suggest that individuals enjoy long-lasting happiness gains from marriage and as such are compatible with Easterlin (2005), who argues that individuals' aspirations in the income domain change strongly whereas aspirations with regard to marriage tend to be stable.

this honeymoon period effect reported happiness stabilizes. Since we use pre-marital singlehood as the reference period our estimates readily allow us to gauge the value of marriage in terms of money. The gains are large. For example, the happiness boost for males in a union lasting five years roughly equals 85,000 Euros a year. Thus, our results are more in line with recent cross-sectional studies (e.g. Blanchflower and Oswald 2004) than recent longitudinal studies.

This chapter has two main contributions. First, we obtain a more reliable estimate of the marriage benefits by using a longer time span. Second, we demonstrate that estimates of adaptation are very sensitive with respect to the chosen reference period. The findings are important from a policy perspective. Although we focus on the gains to marriage, the sensitivity of adaptation estimates is likely to occur in other areas that rely on the life satisfaction approach, e.g. the calculation of loss compensation (Adler and Posner 2008, Dolan and Kahneman 2008, Oswald and Powdthavee 2008b) or the valuation of public goods (Luechinger and Raschky 2009, Luechinger 2009, 2010).

Our results also contribute to the broader positive literature on individual well-being. For example, Stevenson and Wolfers (2008) employ data from the General Social Survey for the years 1972-2006 and show that in the United States income inequality increased while at the same time happiness inequality decreased. They conjecture that over time non-monetary factors have become an increasingly important input for individual well-being. Our estimates suggest that the gains to marriage are rather large compared to other life events and income. Hence, the returns to marital unions may be one of the important non-monetary inputs.

5.2 Background

As explained thoroughly in the previous chapter, the theory of search and matching clearly predicts that a single individual chooses to marry only if the (expected) utility from the partnership exceeds the value of being single. In order to investigate the marriage gains empirically, we build on previous papers which convincingly argue that self-reported well-being is a reasonable approximation to individual utility (e.g. Oswald and Wu 2010, Blanchflower and Oswald 2008, Di Tella et al. 2003, Di Tella

and MacCulloch 2006, Frey and Stutzer 2002 and Luttmer 2005). In particular, we follow Blanchflower and Oswald (2004) and assume that reported individual well-being is equal to

$$r = h\left(u\left(y, x, m, t\right)\right) + e. \tag{5.1}$$

In equation (5.1), r is reported well-being, $u\left(\cdot\right)$ is individual utility depending on income y, a set of personal characteristics x, time t and marital status m, and $h\left(\cdot\right)$ is a non-differentiable function linking actual to reported well-being. The error term e captures all unobserved effects including the individuals' inability to report perfectly their true utility. Although not always stated, previous longitudinal studies which use life satisfaction as the explained variable implicitly adopt such a framework.

Our empirical approach differs from previous analyses in two important dimensions. The first is the treatment of unobserved heterogeneity. Lucas et al. (2003), Lucas and Clark (2006) and Zimmermann and Easterlin (2006) compare different groups of individuals, for example individuals who cohabit prior to marriage and those who marry without providing an observable cohabitation period. Consequently, models that exploit between-individual-variation are needed and the authors rely on linear mixed effects models (hierarchical / multilevel models). However, it is difficult to rule out selection effects in such models. Moreover, they require that the random parameters are orthogonal to other fixed regressors. However, it seems reasonable that unobserved personality traits are correlated with regressors such as employment status and age, which renders the assumption invalid and suggests to employ a fixed effects framework.[2]

The second important factor is the choice of the reference period. In their recent longitudinal study of anticipation and adaption to various life events, Clark et al. (2008) use the average of the years before the event as the baseline period. For example, to trace individual's adaptation to unemployment, they enter dummy variables indicating the years in which the individuals became unemployed and subsequent years. Using this approach, they convincingly show for their primary life event –unemployment– that compared to the years of employment there is not much recovery from the drop in happiness. Unemployment starts bad and stays bad and

[2]Ferrer-i-Carbonell and Frijters (2004) provide a discussion on this matter.

this effect is more strongly pronounced for men. However, while it is perfectly valid to employ the years right before the transition as the reference period in the case of unemployment, we think that it is not a good choice for the analysis of marriage. Most individuals enjoy having a partner some years before they marry and move in together. Therefore, using the average of all years that are at least one year (Clark et al. 2008) or two years (Lucas and Clark 2006) prior to marriage as the reference, leads to overestimation of the "baseline" utility.[3]

Our results are particularly interesting in light of Stutzer and Frey (2006), who show that those singles who are generically happier than other singles are also more likely to marry. Since we restrict the sample to those who marry in the course of time, our results indicate that they become even happier while married.

5.3 Data and empirical strategy

We employ data from 23 waves of the German Socio-Economic Panel (SOEP), covering the years 1984-2006. The SOEP is a representative panel study for Germany, which started in 1984 as a longitudinal survey of private households and individuals in West Germany and was expanded in 1990 to cover the population of the former East Germany. One particular advantage of the SOEP design is that all adult (16 years or older) household members are asked to complete separate questionnaires. While the initial 1984 sample comprised approximately 6,000 households, this number grew to roughly 12,000 in 2006. A detailed description of the SOEP is provided by Wagner et al. (2007).

Our main goal is to estimate the gains of marriage among those who decide to marry for the first time. Hence, we keep in our main sample only those individuals who change their reported marital status over time from "single" to "married" and are present in the sample at least five years before and at least five years after marriage. Moreover, we restrict the sample to those who experience only one transition of marital status during this time span. There are two reasons for these restrictions. First, as discussed in the introduction, happiness probably spikes during the adjoining years before and after marriage (see also Clark et al. 2008). The long time

[3] As mentioned above, Zimmermann and Easterlin (2006) provide evidence in favor of long-lasting marriage gains despite using this reference period.

span enables us to obtain a clean estimate of utility while single and the benefits of marriage after this honeymoon period. Second, both economic theory and the psychology literature on "adaptation" suggest to exclude observations on persons who –for example– divorce during the time span. If no partner is available, it is impossible to receive marriage benefits. Likewise, "participants cannot continue to adapt to the event of marriage if the marriage is no longer intact" (Lucas et al. 2003). After this 5-years span individuals may stay married, divorce or become widowed.

Our main subsample created by these restrictions comprises 1,662 females and 1,614 males who marry in one of the years, resulting in 18,277 and 19,137 person-year observations for females and males, respectively. As discussed in the previous section, we employ reported life satisfaction as a proxy for individual utility. The respective question in the SOEP reads "How satisfied are you with your life, all things considered?". The survey respondents are asked to answer this question on an eleven-point scale ranging from zero to ten, where zero means "fully dissatisfied" and ten "fully satisfied".

We assess the impact of marriage on individuals' utility with the following empirical counterpart to equation (5.1):

$$LS_{i,t} = \alpha_i + \mathbf{x}'_{\mathbf{it}}\beta + \gamma y_{i,t} + \sum_{j=\underline{j}}^{\bar{j}} \theta_j MD^j_{i,t} + \epsilon_{i,t} \tag{5.2}$$

where $LS_{i,t}$ denotes self-reported life satisfaction, $\mathbf{x}'_{\mathbf{it}}$ is a vector of individual controls and $y_{i,t}$ is real income. Unobserved individual heterogeneity (e.g. personality traits) is captured by a fixed effect α_i. A common finding in the literature dealing with well-being equations is that ordered and cardinal estimators produce the same qualitative results (see, for example, Ferrer-i-Carbonell and Frijters 2004 for a discussion). Hence, for ease of interpretation we focus on OLS models including individual fixed effects.

The main explanatory variables are a series of dummy variables indicating the number of years before or after marriage. If, e.g. person $i = a$ marries in the year 1994, then the dummy indicating 0 years after marriage is set to one in 1994 for this individual ($MD^0_{a,1994} = 1$). The remaining person-year observations are defined relative to the year of marriage, e.g. for person $i = a$ the dummy indicating one year

before marriage is set equal to one in 1993 ($MD^{-1}_{a,1993} = 1$) and the dummy indicating one year after marriage equals one in 1995 ($MD^{1}_{a,1995} = 1$). We enter eleven dummies into our baseline estimation, indicating the time span from five or more years before marriage ($\underline{j} = -5$) up to five or more years after marriage ($\overline{j} = 5$). The omitted reference category is five or more years before marriage ($j = -5$).

This approach is similar to Frijters et al. (2008) and the graphical approach by Gardner and Oswald (2006), who analyze individuals' levels of mental strain before and after divorce in a five-year span (ranging from two years before to two years after divorce). It differs from the setup by Clark et al. (2008), who analyze adaptations to major life events employing the average of the years before the event as the reference. In the terminology of equation (5.2) they enter the dummies for $j = 0, \ldots, 5$, but omit the dummies for $j = 5, \ldots, -1$.

While this makes perfect sense for the major topic of their paper, adaptation to unemployment, it is less convincing for the analysis of marriage adaptation. Before individuals decide to marry, they usually have a permanent relationship for some time, although they are single and may live in different households. It seems therefore likely that individuals (at least partially) enjoy the benefits of having a partner one or two years before marriage. This holds in particular for the non-monetary gains. By analyzing the life satisfaction movements relative to five years before marriage, we are able to capture the benefits of having a partner compared to being single more accurately.

Previous research based on cross-sectional data has identified a number of individual characteristics, which are associated with different levels of life satisfaction, in particular race, sex, education, health, employment status and age (e.g. Frey and Stutzer 2002, Blanchflower and Oswald 2004). Effects of time-invariant personal characteristics like race and sex will be picked up by the individual fixed effects. From the list of remaining controls, we further are unable to include health as it is not available before 1992. Hence, $\mathbf{x}'_{\mathbf{it}}$ contains age, age squared, a dummy indicating if the individual is employed, years of schooling and a region dummy indicating East Germany. There is also growing evidence that institutional changes over time affect females and males asymmetrically (e.g. Stevenson and Wolfers 2009). Instead of interacting all variables with a sex dummy, we conduct all estimations separately for females and males to account for the possible sex differences.

Table 5.1 provides means and standard deviations for the life satisfaction scores and the control variables.For most of the variables the two summary statistics are similar for both sexes. The notable exception is employment status. While among the 18,277 female observations the employment indicator is set to one in 73% of the cases, the corresponding number for males is 90%.

Table 5.1: Summary statistics (pooled)

(a) females

	Mean	SD
Life satisfaction	7.353778	1.632699
Age	28.61925	7.381942
$Age^2/100$	8.735515	4.96222
Employed	.7354052	.4411293
HH income	31.99215	16.45593
East	.1202057	.3252108
Education	11.78946	2.550592
Number of Observations	18277	
Number of Individuals	1662	

(b) males

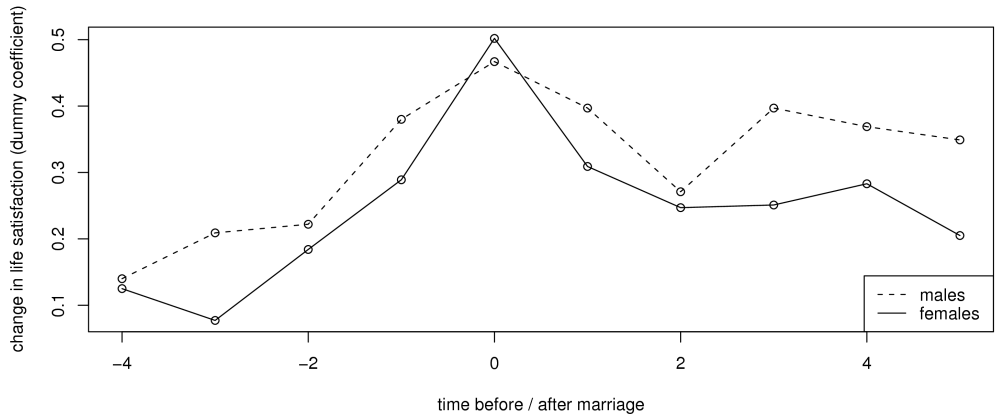
	Mean	SD
Life satisfaction	7.336939	1.556043
Age	30.41239	7.69778
$Age^2/100$	9.841665	5.175599
Employed	.8936092	.3083452
HH income	33.63773	15.73546
East	.1053979	.3070735
Education	11.94048	2.758223
Number of Observations	19137	
Number of Individuals	1614	

5.4 Life satisfaction regressions

Table 5.2 presents the main results. Column (1) shows the estimates for the sample of females, while column (2) provides the results for males. The estimates of central importance in this table are the dummy coefficients picking up the change in life

satisfaction several years before and after marriage. For ease of discussion, we present these graphically as well (Figure 5.1).

Figure 5.1: Change in life satisfaction before and after marriage



During the years prior to marriage the results differ across both sexes. Compared to the baseline category of five years (or more) prior to marriage, both females and males seemingly enjoy the benefits of having a partner already two years prior to marriage. This is consistent with the idea that they are in a permanent relationship with their partner, but live in different households. Interestingly, males also report higher levels of life satisfaction four and three years before they marry, while this pattern is absent for females. Clark et al. (2008) provide a similar finding and report that males are happier 2-3 years before they marry while this "anticipation" effect for females is present only one year prior to marriage.

The figure clearly shows that life satisfaction for both females and males starts to increase steeply two years prior to marriage. After a honeymoon period around the years of transition, happiness drops, but 2-5 years after marriage it is still substantially larger than in the pre-marital baseline stage. Recall that these results are obtained from a fixed effects regression and as such are driven by changes within the same person over time and not by selection.

Figure 5.1 also suggests that the honeymoon period starts one year before and lasts until one or two years after the transition. This pattern may explain why the recent longitudinal literature is often unable to find long-lasting boosts of life satisfaction

Table 5.2: Baseline life satisfaction regression

	(1) female	(2) male
Age	-0.0471^{**}	-0.0410^{**}
	(-3.22)	(-3.10)
$\text{Age}^2/100$	0.0126	-0.00248
	(0.62)	(-0.14)
Employed	0.0505^{+}	0.134^{***}
	(1.74)	(3.36)
HH income	0.00556^{***}	0.00414^{***}
	(6.61)	(5.11)
East	-0.0452	-0.233
	(-0.35)	(-1.63)
Education	0.0245^{*}	-0.0134
	(2.35)	(-1.47)
θ_{-4}	0.125^{*}	0.140^{**}
	(2.27)	(2.74)
θ_{-3}	0.0771	0.209^{***}
	(1.42)	(4.12)
θ_{-2}	0.184^{***}	0.222^{***}
	(3.35)	(4.36)
θ_{-1}	0.289^{***}	0.380^{***}
	(5.12)	(7.35)
θ_0	0.502^{***}	0.467^{***}
	(8.31)	(8.50)
θ_1	0.309^{***}	0.397^{***}
	(4.59)	(6.50)
θ_2	0.247^{***}	0.271^{***}
	(3.39)	(4.14)
θ_3	0.251^{**}	0.397^{***}
	(3.21)	(5.70)
θ_4	0.283^{***}	0.369^{***}
	(3.38)	(4.98)
θ_5	0.205^{*}	0.349^{***}
	(2.22)	(4.38)
Constant	7.892^{***}	8.272^{***}
	(36.04)	(41.46)
Number of observations	18277	19137
Number of individuals	1662	1614
R^2 within	0.0203	0.0187

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

associated with marriage. Individuals in our sample enjoy higher levels of happiness already two years before they marry. Hence, fitting only a single intercept for the years before the transition leads to an inflated estimate for happiness while single.

We further inquire this conjecture in two ways. First, we use exactly the same sample as before but we omit the dummies for $j = -5, \ldots, -1$ when fitting equation (5.2). This is in line with Clark et al. (2008) and implicitly treats the average of the years before marriage as the reference category. Table 5.3(a) clearly shows that this

Table 5.3: Evidence for adaptation due to inflated reference utility

(a) baseline sample

	(1) female	(2) male
Age	−0.0162	0.00105
	(−1.24)	(0.09)
Age^2/100	−0.0137	−0.0394*
	(−0.70)	(−2.26)
Employed	0.0457	0.138***
	(1.57)	(3.45)
HH income	0.00546***	0.00417***
	(6.49)	(5.13)
East	−0.0631	−0.226
	(−0.49)	(−1.59)
Education	0.0282**	−0.0141
	(2.72)	(−1.54)
θ_0	0.303***	0.207***
	(7.47)	(5.31)
θ_1	0.0938*	0.118**
	(2.00)	(2.63)
θ_2	0.0159	−0.0259
	(0.31)	(−0.54)
θ_3	0.00471	0.0817
	(0.08)	(1.58)
θ_4	0.0211	0.0362
	(0.35)	(0.65)
θ_5	−0.119*	−0.0627
	(−2.02)	(−1.21)
Constant	7.401***	7.611***
	(38.26)	(43.35)
Number of observations	18277	19137
Number of individuals	1662	1614
R^2 within	0.0186	0.0157

t statistics in parentheses
$^+$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) reduced sample (see text)

	(1) female	(2) male
Age	0.00726	−0.0401$^+$
	(0.33)	(−1.87)
Age^2/100	−0.0657*	−0.0103
	(−2.19)	(−0.38)
Employed	0.0588$^+$	0.327***
	(1.73)	(4.66)
HH income	0.00732***	0.00395**
	(6.28)	(3.28)
East	0.00739	0.0000721
	(0.04)	(0.00)
Education	0.00809	−0.00733
	(0.42)	(−0.47)
θ_0	0.204***	0.0823*
	(4.65)	(1.97)
θ_1	−0.0250	−0.00670
	(−0.50)	(−0.14)
θ_2	−0.112*	−0.142**
	(−2.03)	(−2.74)
θ_3	−0.121*	−0.00716
	(−2.00)	(−0.13)
θ_4	−0.0962	−0.0329
	(−1.46)	(−0.54)
θ_5	−0.195**	−0.0331
	(−2.63)	(−0.50)
Constant	7.522***	8.458***
	(17.93)	(20.77)
Number of observations	11684	11748
Number of individuals	1650	1603
R^2 within	0.0365	0.0337

t statistics in parentheses
$^+$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

reverses the conclusions. The estimates would now suggest full adaptation, i.e. that both females and males get used to the hedonic gains of marriages and bounce back to their baseline levels two years after marriage. For the second test we estimate the same set of dummies, but we delete all observations which date back two or more years

before marriage. Thus, in this estimation the baseline value now comprises not an average, but only a single period: one year before marriage. Table 5.3(b) presents the results. As one could expect from Figure 5.1, this approach further exaggerates the adaptation conclusion. Moreover, it generates coefficients which suggest a negative impact of marriage after a short honeymoon period.

Our main conclusion therefore is that the utility gains from marriage (as suggested by simple revealed preference arguments) are reflected in changes of individuals' happiness. For both females and males life satisfaction five years after marriage is sizeably larger than while single. The baseline specification suggests that females on average enjoy five years after marriage a gain of 0.21 life satisfaction points compared to their own life satisfaction while single. The corresponding point estimate for males is 0.35.[4] These estimates are economically significant. For both sexes the benefits of having a partner are 2-3 times as large as the increase in happiness associated with employment rather than non-employment. A further (unreported) regression enters a dummy for unemployment compared to employment and shows that the positive effect of marriage is roughly half of the negative effect of unemployment. Both approaches therefore indicate economically large long-lasting gains to marriage.[5] After briefly discussing some robustness checks in the following section, we convert the coefficient estimates into Euro values in section 5.6.

5.5 Robustness checks

The previous section has established that individuals on average enjoy economically large gains to marriage, even five years after marriage. We next investigate how inclusion of additional controls affects our findings. A particular interesting variable in the context of marital unions is the presence of children. We thus extend the baseline estimation (Table 5.2) by introducing a dummy indicating if children are

[4] Although some studies report that females tend to be happier than males, this result is not robust, see Dolan et al. (2008) for a review. Our findings are not at odds with this, since the coefficients pick up the change rather than the level of well-being.

[5] For studies focusing on the relationship between unemployment status and happiness, see for example Kassenboehmer and Haisken-DeNew (2009) and Winkelmann and Winkelmann (1998). Booth and van Ours (2009, 2008) analyze the effects of working hours rather than working status on well-being.

present in the household. Di Tella et al. (2003) provide evidence for a correlation between individual life satisfaction and macroeconomic variables like gross domestic product. If for example an economic upturn simultaneously increases individual happiness and the propensity to marry, then our marital status dummies may pick up these macroeconomic shocks rather than the benefits of having a partner. We enter a set of time fixed effects into the baseline model to check this possibility.[6]

Table 5.4 compiles the results. The children coefficient is positive in all regressions. However, the associated standard errors are quite large and as a result the estimates are statistically insignificant for females. More importantly, both estimations corroborate the previous baseline results. Although the estimates are slightly smaller, the main conclusions remain unaffected: for both females and males reported life satisfaction while married is significantly larger than while single.

We next investigate if the union dummies just trace out nonlinearities in the relationship between age and well-being. Table 5.5 shows the results of the baseline model augmented with higher order terms for age. The estimated gains to marriage in this augmented model are slightly smaller compared to the baseline model, especially for males. One implication of this model is that the gap between the coefficients for females and males is now smaller. For example, the estimates suggest that both females and males on average enjoy four years after marriage a benefit of 0.31 life satisfaction points. On the whole, the results closely resemble the findings obtained from the baseline estimation.

Finally, we check if our results are sensitive to subtle changes in the sample design. Up to now we require all respondents to stay married at least for five years. After this time frame they may divorce, stay married or do not report their current marital status at all. We now force the individuals to stay married and delete the observations, if they do not meet this requirement. Note that the panel is still unbalanced. Based on this sample we repeat the entire analysis. As these estimations generate the same evidence as before we relegate the tables to the appendix.

Our main conclusions are therefore twofold. First, marriage works. Both females and males enjoy economically (and statistically) significant gains to marriage, even

[6]Note that such specifications are common (e.g. Luttmer 2005, Clark et al. 2008) to inquire the robustness of the results, although the year dummies and the duration dummies are presumably highly collinear, thereby complicating the interpretation of the coefficients.

Table 5.4: Life satisfaction regressions (controlling for time fixed effects)

	(1) female	(2) male
Age^2	0.0225	0.00415
	(1.09)	(0.22)
Employed	0.0542^{+}	0.125**
	(1.82)	(3.14)
HH income	0.00560***	0.00424***
	(6.62)	(5.19)
East	−0.0624	−0.251^{+}
	(−0.48)	(−1.76)
Education	0.0262*	−0.0121
	(2.51)	(−1.32)
Children	0.0302	0.0554^{+}
	(0.96)	(1.92)
θ_{-4}	0.113*	0.131*
	(2.06)	(2.56)
θ_{-3}	0.0704	0.205***
	(1.29)	(4.05)
θ_{-2}	0.186***	0.225***
	(3.38)	(4.43)
θ_{-1}	0.288***	0.380***
	(5.11)	(7.36)
θ_0	0.510***	0.461***
	(8.31)	(8.23)
θ_1	0.307***	0.381***
	(4.53)	(6.13)
θ_2	0.248***	0.252***
	(3.36)	(3.75)
θ_3	0.244**	0.374***
	(3.06)	(5.19)
θ_4	0.258**	0.332***
	(3.03)	(4.32)
θ_5	0.177^{+}	0.304***
	(1.87)	(3.67)
Constant	7.065***	7.474***
	(50.37)	(55.91)
Time fixed effecs	Yes	Yes
Number of observations	18277	19137
Number of individuals	1662	1614
R^2 within	0.0256	0.0243

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.5: Life satisfaction regressions with a quartic in age

	(1) female	(2) male
Age	-0.372^{***}	-0.736^{***}
	(-3.90)	(-5.65)
Age^2	1.286^{***}	2.889^{***}
	(3.36)	(5.12)
Age^3	-0.0203^{**}	-0.0500^{***}
	(-3.17)	(-4.82)
Age^4	0.000108^{**}	0.000304^{***}
	(2.92)	(4.43)
Employed	0.0541^{+}	0.154^{***}
	(1.82)	(3.83)
HH income	0.00526^{***}	0.00375^{***}
	(6.20)	(4.59)
East	-0.0486	-0.245^{+}
	(-0.38)	(-1.72)
Education	0.0299^{**}	-0.00803
	(2.83)	(-0.87)
Children	-0.00725	0.00565
	(-0.22)	(0.19)
θ_{-4}	0.140^{*}	0.144^{**}
	(2.54)	(2.81)
θ_{-3}	0.0951^{+}	0.211^{***}
	(1.74)	(4.13)
θ_{-2}	0.206^{***}	0.219^{***}
	(3.70)	(4.28)
θ_{-1}	0.313^{***}	0.371^{***}
	(5.47)	(7.12)
θ_0	0.529^{***}	0.450^{***}
	(8.59)	(8.05)
θ_1	0.337^{***}	0.368^{***}
	(4.88)	(5.86)
θ_2	0.274^{***}	0.230^{***}
	(3.64)	(3.39)
θ_3	0.277^{***}	0.344^{***}
	(3.42)	(4.73)
θ_4	0.305^{***}	0.305^{***}
	(3.52)	(3.92)
θ_5	0.209^{*}	0.251^{**}
	(2.18)	(3.00)
Constant	10.70^{***}	14.07^{***}
	(12.79)	(13.06)
Number of observations	18277	19137
Number of individuals	1662	1614
R^2 within	0.0211	0.0209

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5 (or more) years after marriage. All regressions include individual fixed effects and hence are not driven by selection. Including more controls, in particular time fixed effects, leaves the evidence unaffected.

Second, the key factor for our results is the choice of the reference period. Using five years prior to marriage as the relevant baseline year allows us to calculate utility while single more accurately. If we –instead of this– use 1-2 years prior to marriage as the reference category, the same sample generates evidence of complete "adaptation" as in previous longitudinal studies.

5.6 Quantifying the benefits of marriage

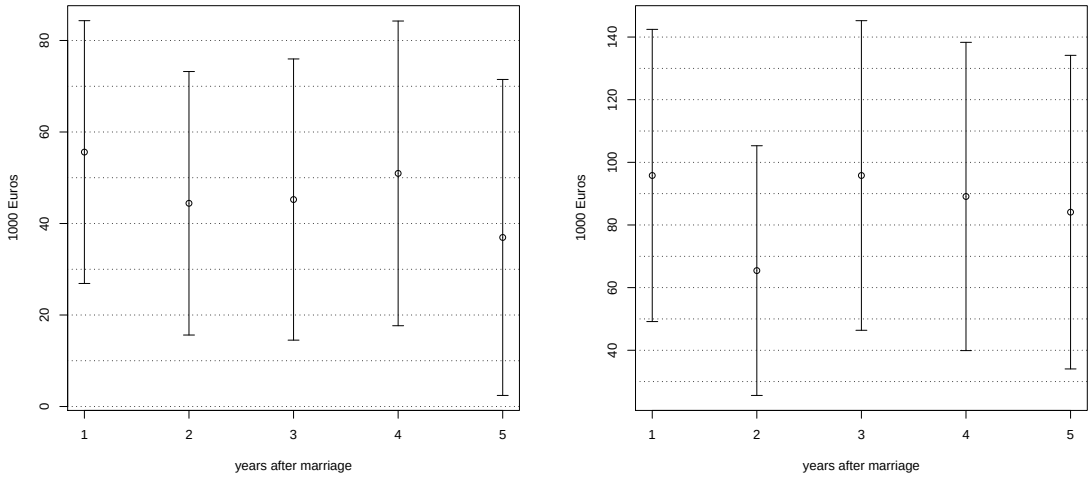
We now use the regression results to derive euro values of the gains to marriage (see, for example, Clark and Oswald 2002, Blanchflower and Oswald 2004, Oswald and Powdthavee 2008a). Recall that the coefficient θ_j picks up the change in life satisfaction j years after marriage. Hence, using the implicit function theorem and imposing $\Delta LS = 0$ we obtain from equation (5.2) the following shadow value for having a partner j years after marriage:

$$\frac{\frac{\partial LS}{\partial MD^j}}{\frac{\partial LS}{\partial y}} = \frac{\theta_j}{\gamma} \equiv \lambda_j \tag{5.3}$$

While the average estimate of the shadow value λ_j is simply given by $\frac{\hat{\theta}_j}{\hat{\gamma}}$, we use the delta method to construct confidence intervals for λ_j. Household income after taxes and transfers y is measured in units of 1000 Euros (normalized to the year 2000). Hence, the shadow value λ_j equals the amount of additional annual net income an individual would need to receive in order to report the same level of life satisfaction if the positive impact of marriage was removed.

Figure 5.2 plots 95% confidence intervals for λ_j where j ranges from married for one year to five years. The point estimate for females equals roughly 55,000 Euros after the first year of marriage and 36,000 in the fifth year. The associated uncertainty for these shadow values is quite large. The lower and upper bound for the first year is approximately 28,000 and 85,000 Euros respectively, while the corresponding bounds in the fifth year are around 3,000 and 72,000 Euros.

Figure 5.2: Shadow values for the gains of marriage (1000 Euros)



(a) females (b) males

In the regressions of the previous section the income coefficient is higher for females while the marriage dummy coefficients are higher for males.[7] As a result the estimated shadow value of marriage is higher for males. The point estimate is equal to 95,000 in the first year, while it equals 84,000 in the fifth year after marriage. The confidence interval bounds are 49,000 and 142,000 in the first year, while they equal 34,000 and 134,000 after five years.

Although it is important to include individual fixed effects to estimate correctly the marriage dummy coefficients, this raises a potential problem for the quantification approach, since the amount of within-person variation in income is typically small. However, other studies which do not include individual fixed effects and enter a single marital status dummy report comparable average estimates.[8] Furthermore, we do not solely rely on the average shadow value. The interval estimates take into account that λ_j is a ratio of two estimated coefficients and show that the data are compatible with a large range of shadow values.

[7]The only exception is the year of marriage ($t = 0$).

[8]For example, Carroll et al. (2009) obtain a shadow value of A$67,000 (in May 2001 dollars) and Blanchflower and Oswald (2004) report an estimate of $100,000 (in 1990 US dollars).

5.7 Conclusions

This chapter uses 23 waves of annual individual panel data to revisit the nexus between marriage and self-reported life satisfaction. Our results support the conclusion that having a partner is associated with a permanent boost in life satisfaction. In particular we show that individuals who are married for five or more years report significantly higher levels of happiness than while they are single. This evidence runs counter to the idea that individuals' happiness is centered around some baseline level determined by personality and genetics and that individuals who marry quickly return to this baseline after a short honeymoon period. Our data supports the view that individuals' happiness drops after the first year of marriage to a new post-marital level which is higher than while single. The drop after the first year may be interpreted as partial adaptation.

We show that these findings strongly depend on the choice of the reference period. We compare the movements of self-reported life satisfaction relative to five years prior to marriage. If we instead –as in the previous longitudinal literature– employ one year prior to marriage as the baseline level of happiness, the permanent impact of marriage vanishes. In this case the evidence suggests complete adaptation to marriage after two years. We believe that previous studies chose this point of reference due to a lack of suitable data and argue that this choice is not appropriate in this setting. It seems reasonable that individuals enjoy having a partner one or two years before they marry and move into a joint household. This in turn suggests that individuals' reported life satisfaction 1-2 years prior to marriage is considerably larger than in the state of singlehood. Our sample also suggests that the honeymoon period starts one year before marriage and lasts for two years. Comparing the life satisfaction movement of individuals who are married for 3 or more years relative to this inflated level of life satisfaction leads to the conclusion of quick adaptation to marriage.

Although this chapter focuses on marital unions, we think that our results are equally important for other areas of public policy. An innovative and growing literature highlights the consequences of adaptation to events like disease or bereavement in the context of resource allocation or loss compensation.[9] Our findings suggest to carefully check the robustness of these results with respect to the reference period.

[9] Cf. Adler and Posner (2008), Layard (2006), Oswald and Powdthavee (2008a,b)

5.8 Appendix

The appendix replicates the same set of regressions as the main text for a different sample. In this sample, all respondents are required to stay married after the five-year-span. In the baseline sample individuals can divorce, stay married or become widowed after a five-year-span of marriage.

Table 5.6: Life satisfaction regressions

	(1) female	(2) male
Age	-0.0506^{***}	-0.0443^{***}
	(-3.44)	(-3.33)
$\text{Age}^2/100$	0.0183	0.00212
	(0.89)	(0.12)
Employed	0.0555^{+}	0.135^{***}
	(1.90)	(3.35)
HH income	0.00557^{***}	0.00425^{***}
	(6.56)	(5.19)
East	-0.0196	-0.248^{+}
	(-0.15)	(-1.73)
Education	0.0220^{*}	-0.0143
	(2.09)	(-1.55)
θ_{-4}	0.129^{*}	0.142^{**}
	(2.34)	(2.78)
θ_{-3}	0.0810	0.210^{***}
	(1.49)	(4.15)
θ_{-2}	0.191^{***}	0.220^{***}
	(3.46)	(4.32)
θ_{-1}	0.297^{***}	0.379^{***}
	(5.25)	(7.32)
θ_0	0.533^{***}	0.487^{***}
	(8.53)	(8.52)
θ_1	0.321^{***}	0.403^{***}
	(4.76)	(6.59)
θ_2	0.259^{***}	0.278^{***}
	(3.54)	(4.24)
θ_3	0.264^{***}	0.405^{***}
	(3.36)	(5.80)
θ_4	0.296^{***}	0.376^{***}
	(3.52)	(5.07)
θ_5	0.215^{*}	0.354^{***}
	(2.32)	(4.45)
Constant	7.957^{***}	8.334^{***}
	(36.11)	(41.56)
Number of observations	18041	18893
Number of individuals	1660	1614
R^2 within	0.0208	0.0193

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.7: Life satisfaction regressions (controlling for time fixed effects)

	(1) female	(2) female
Age^2	0.0281	0.00912
	(1.35)	(0.48)
Employed	0.0595*	0.126**
	(1.99)	(3.12)
HH income	0.00562***	0.00435***
	(6.58)	(5.28)
East	−0.0372	−0.268+
	(−0.29)	(−1.86)
Education	0.0236*	−0.0130
	(2.24)	(−1.41)
Children	0.0307	0.0552+
	(0.97)	(1.90)
θ_{-4}	0.118*	0.133**
	(2.14)	(2.61)
θ_{-3}	0.0745	0.207***
	(1.37)	(4.08)
θ_{-2}	0.193***	0.224***
	(3.50)	(4.40)
θ_{-1}	0.296***	0.381***
	(5.24)	(7.35)
θ_0	0.532***	0.478***
	(8.51)	(8.33)
θ_1	0.317***	0.387***
	(4.66)	(6.22)
θ_2	0.258***	0.259***
	(3.49)	(3.85)
θ_3	0.254**	0.382***
	(3.18)	(5.29)
θ_4	0.268**	0.339***
	(3.14)	(4.41)
θ_5	0.184+	0.310***
	(1.95)	(3.74)
Constant	7.076***	7.468***
	(49.97)	(55.42)
Year dummies	Yes	Yes
Number of observations	18041	18893
Number of individuals	1660	1614
R^2 within	0.0261	0.0249

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.8: Life satisfaction regressions with a quartic in age

	(1) female	(2) female
Age	-0.355^{***}	-0.740^{***}
	(-3.69)	(-5.51)
Age^2	1.216^{**}	2.910^{***}
	(3.16)	(4.99)
Age^3	-0.0192^{**}	-0.0505^{***}
	(-2.98)	(-4.69)
Age^4	0.000103^{**}	0.000309^{***}
	(2.77)	(4.32)
Employed	0.0594^{*}	0.154^{***}
	(1.99)	(3.81)
HH income	0.00530^{***}	0.00387^{***}
	(6.17)	(4.69)
East	-0.0228	-0.260^{+}
	(-0.18)	(-1.81)
Education	0.0270^{*}	-0.00902
	(2.53)	(-0.97)
Children	-0.00393	0.00613
	(-0.12)	(0.20)
θ_{-4}	0.143^{**}	0.146^{**}
	(2.58)	(2.85)
θ_{-3}	0.0971^{+}	0.212^{***}
	(1.77)	(4.15)
θ_{-2}	0.210^{***}	0.217^{***}
	(3.78)	(4.24)
θ_{-1}	0.319^{***}	0.370^{***}
	(5.55)	(7.08)
θ_0	0.556^{***}	0.467^{***}
	(8.74)	(8.05)
θ_1	0.344^{***}	0.373^{***}
	(4.98)	(5.93)
θ_2	0.281^{***}	0.236^{***}
	(3.73)	(3.46)
θ_3	0.284^{***}	0.350^{***}
	(3.50)	(4.80)
θ_4	0.313^{***}	0.310^{***}
	(3.60)	(3.98)
θ_5	0.214^{*}	0.256^{**}
	(2.23)	(3.05)
Constant	10.57^{***}	14.12^{***}
	(12.57)	(12.76)
Number of observations	18041	18893
Number of individuals	1660	1614
R^2 within	0.0215	0.0213

t statistics in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 6

Dynamics of inequality*

6.1 Introduction

There is substantial empirical evidence for growing cross-sectional wage inequality across many countries in recent decades. Increasing wage variation could reflect a rise in either the permanent or the transitory component of inequality, or both. Understanding their respective contributions to increasing cross-sectional wage variation is important for determining the welfare implications of rising inequality as well as for appropriate policy reaction. For example, an increase in the returns to (unobserved) skills is consistent with increasing permanent inequality, implying that individuals' rank order in the wage distribution is maintained while the dispersion of the wage distribution across individuals increases. By contrast, rising transitory variation implies a growing year-to-year wage volatility, potentially with an increase in wage mobility (Katz and Autor 1999).

Exploiting the SOEP data from the previous chapter, we decompose the cross-sectional variance of male wages in Germany over a period between 1994-2006 into permanent and transitory components. Our analysis uses covariance structure models (e.g. Dickens 2000, Moffitt and Gottschalk 2002, Gustavsson 2007) and builds on a number of papers focusing on the 1990s and the early 2000s that document the increasing role of permanent inequality in Germany (Daly and Valletta 2008, Sologon and O'Donoghue 2009). By covering years beyond 2001, we analyze a time

*This chapter is based on the article *Dynamics in transitory and permanent variation of wages in Germany*, published in *Economics Letters*, 2011, 113(2), 143-146. The paper is joint work with Michał Myck and Richard Ochmann, see Myck et al. (2011).

period when the rise in cross-sectional inequality was notably steep (e.g. Gernandt and Pfeiffer 2007). Interestingly, our results suggest that for the years 2001-2003 –while cross-sectional inequality steeply increases– the role of permanent inequality becomes less important. After 2003, the fraction of permanent inequality increases again continuously up to roughly its 2001 level. Summarizing, both permanent and transitory factors are important drivers for the growth of cross-sectional inequality. While permanent inequality increases over the whole time-period, there is a substantial setback of this evolution in the early 2000s. This evidence can support the argument that changes in the labor market institutions in Germany over the last decade may have importantly contributed to increases in wage inequality in the early 2000s but at the same time could have increased wage mobility (Dustmann et al. 2009).

In the following section we present the method for separating the permanent and temporary components of the variance, some details on data and estimation. We present our main results in section 6.3 and conclude in section 6.4.

6.2 Dynamics of wages - modeling and estimation

We assume that real log-wages can be modeled as:

$$Y_{it} = x'_{it}\beta_t + u_{it} \tag{6.1}$$

for individuals $i = 1, ...N$ and periods $t = 1, ...T$, with x_{it} denoting a $K \times 1$-vector of individual-specific characteristics including a time-varying constant, β_t denoting a $K \times 1$ time-varying parameter vector, and u_{it} the residual. The latter can be decomposed into a permanent (μ_i) and a transitory (v_{it}) part which are assumed to be uncorrelated. Additionally we allow year-specific factor loadings p_t and λ_t on the two components, so that the expression for u_{it} takes the following form:

$$u_{it} = p_t\mu_i + \lambda_t v_{it} \tag{6.2}$$

Intuitively, $x'_{it}\beta_t$ defines the population's mean profile and the term μ_i introduces individual heterogeneity, which allows the individuals to deviate from the mean pro-

file. Our specification allows for a flexible form of the dynamics of the transitory component v_{it}, which is modeled as an ARMA(1,1) process, implying the following specification:

$$v_{it} = \rho v_{it-1} + \gamma \varepsilon_{it-1} + \varepsilon_{it} \tag{6.3}$$

Under the assumptions that $E[\mu_i] = E[v_{it}] = E[\varepsilon_{it}] = 0$ and $E[\mu_i \varepsilon_{it}] = E[\varepsilon_{it}\varepsilon_{js}] = 0$ for all i and j and for all $t \neq s$, the covariance matrix of residuals is given by:

$$cov(u_{it}, u_{it-s}) = p_t p_{t-s} \sigma_\mu^2 + \lambda_t \lambda_{t-s} E[v_{it} v_{it-s}] \tag{6.4}$$

where p_t, p_{t-s}, λ_t, and λ_{t-s} are time specific factor loadings and $E[v_{it}v_{it-s}]$ is equal to:

$$E[v_{it}v_{it-s}] = \begin{cases} \sigma_{v0}^2 & , t = 0, s = 0 \\ \rho^2 \sigma_{v0}^2 + \sigma_\epsilon^2 & , t = 1, s = 0 \\ \rho^2 E[v_{it-1}v_{it-1}] + (1 + \gamma^2 + 2\rho\gamma)\sigma_\epsilon^2 & , 2 \leq t, s = 0 \\ \rho^{s-1}(\rho E[v_{it-s}v_{it-s}] + \gamma\sigma_\epsilon^2) & , s+1 \leq t, 1 \leq s \leq T-1 \end{cases} \tag{6.5}$$

In equation (6.5), $\sigma_\mu^2 = var(\mu_i)$ and $\sigma_\varepsilon^2 = var(\varepsilon_{it})$. $\sigma_{v_0}^2 = var(v_{i0})$ is the initial condition for the ARMA-process.[1]

The estimation requires a two-step procedure. In the first step, we obtain estimates of u_{it}, the vector of residuals from the linear regression (6.1). These are used to construct an empirical covariance matrix. In the second step, we estimate the parameters of our theoretical covariance matrix by fitting the implications of specification (6.4) to the empirical matrix. The model's parameters are estimated by nonlinear least squares.[2]

The analysis uses the SOEP panel dataset from the previous chapter covering

[1] The initial condition is needed for an unbiased estimation of the parameters of the ARMA-process, c.f. MaCurdy (1982).

[2] Tables 6.3 and 6.4 in the appendix (section 6.5) provide the covariance matrices for the primary unbalanced sample.

the years 1994-2006. Our main sample is a fully balanced subsample of full-time working men aged 20-60; see the appendix (section 6.5) for details. A balanced panel approach ensures consistency with the underlying theoretical model and that any changes in the distribution of wages do not result from compositional changes. In parallel we conduct the analysis also on an unbalanced panel to assess the potential role of the changing composition. The balanced sample consists of 9,464 individual-year observations (728 individuals, 13 years), while there are 39,753 individual-year observations (in total on 6,048 men) in the unbalanced panel.

For each sample we estimate two specifications of equation (6.1). In the first, log wages are regressed only on a time-varying constant, while in the second x_{it} contains several individual-specific covariates (age, age-squared, east dummy, and education groups).

6.3 Results

The estimation results for the balanced and the unbalanced samples are presented in Table 6.1. There are advantages and disadvantages of using either of the sampling approaches. Taking the balanced panel seems more appropriate given the underlying model being estimated, as the empirical variances and covariances are then computed on a stable sample. On the other hand, the compositional changes imply that the balanced sample approach disregards individuals leaving and entering the labor market in the examined period. This excludes those whose labor market position (and thus wages) is less stable. By definition it also omits retiring and school-leaving cohorts and imposes collinearity between age and time effects. However, by inclusion of individuals with unstable employment histories, using the unbalanced panel may overestimate the role of transitory inequality. Thus there is a trade-off between the compositional difference of the two samples on the one hand and the time over which we perform the analysis on the other.

Since in the case of the unbalanced panel variances and covariances are estimated on different samples (with covariances estimated on more stable samples), our preferred specifications are those based on the balanced panel. As we shall see, the pattern of estimated changes is similar in the two samples, although the level and

Table 6.1: Parameter estimates - ARMA(1,1) specification

	Balanced		Unbalanced	
	constant	covariates	constant	covariates
$\sigma^2_{v_0}$	0.055	0.032	0.028	0.055
	(0.007)	(0.005)	(0.018)	(0.010)
σ^2_{μ}	0.087	0.030	0.111	0.032
	(0.004)	(0.003)	(0.008)	(0.005)
σ^2_{ε}	0.040	0.038	0.076	0.056
	(0.003)	(0.003)	(0.005)	(0.004)
ρ	0.857	0.884	0.857	0.872
	(0.027)	(0.020)	(0.035)	(0.022)
γ	-0.489	-0.488	-0.475	-0.479
	(0.028)	(0.021)	(0.028)	(0.022)
p_{2000}	1.203	1.372	1.084	1.195
	(0.026)	(0.079)	(0.083)	(0.166)
p_{2001}	1.225	1.481	1.084	1.286
	(0.029)	(0.077)	(0.076)	(0.141)
p_{2002}	1.162	1.368	1.038	1.277
	(0.026)	(0.076)	(0.081)	(0.157)
p_{2003}	1.150	1.282	1.034	1.267
	(0.027)	(0.078)	(0.086)	(0.169)
p_{2004}	1.199	1.477	1.040	1.371
	(0.027)	(0.080)	(0.080)	(0.167)
p_{2005}	1.239	1.588	1.057	1.416
	(0.030)	(0.087)	(0.080)	(0.167)
p_{2006}	1.296	1.574	1.056	1.397
	(0.030)	(0.082)	(0.080)	(0.160)
N	91	91	91	91
Wald-Tests (p-values):				
$p_{2001} = p_{2002}$	0.013	0.087	0.158	0.921
$p_{2001} = p_{2003}$	0.004	0.005	0.134	0.842
$p_{2001} = p_{2004}$	0.257	0.957	0.166	0.382
$p_{2001} = p_{2005}$	0.534	0.126	0.392	0.186
$p_{2001} = p_{2006}$	0.002	0.148	0.368	0.230

Notes: Standard errors in parentheses. See Section 6.2 for the full list of covariates.

Source: Own calculations using the SOEP data (1994-2006).

the statistical precision of the estimated changes depend on which of the samples we use. Table 6.1 shows estimated values of the parameters of the ARMA process and of selected factor loadings from the early 2000s. We also report p-values of significance tests of the difference between the factor loadings, which are most important from the point of view of our conclusions; the full list of coefficients is relegated to Table 6.5 in the appendix (Section 6.5).

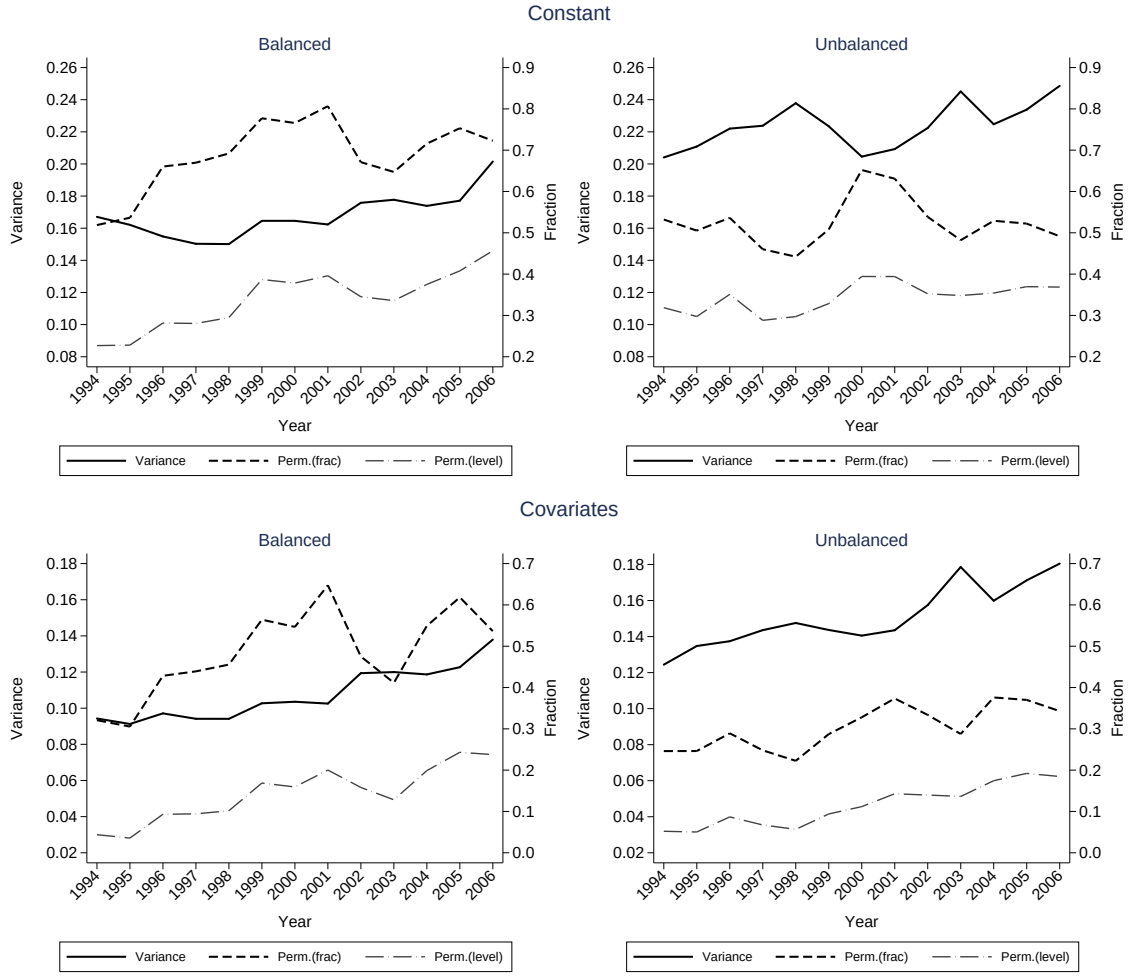
Implications of the two approaches are evident in the results. For example, comparing the estimated temporary variances (σ_ε^2) relatively to permanent variances (σ_μ^2) for the constant-only specifications, we see that the temporary variance is much more important than permanent variance in the unbalanced panel. Once additional covariates are introduced (columns 2 and 4 in Table 6.1), the ratio of permanent to temporary variance is very similar, at least in the balanced panel. Interestingly, the estimated transmission of temporary shocks is very similar for the two samples. An estimate for ρ of 0.88, together with an estimate for γ of about -0.49, implies that about 70% of a shock disappears after two periods.

To summarize the estimated results, we calculate the fraction of the permanent variance from our parameter estimates as $(\hat{p}_t^2 \cdot \hat{\sigma}_\mu^2) \,/\, var(\hat{u}_{it})$, where $var(\hat{u}_{it})$ denotes the variance of residuals in period t. Figure 6.1 shows the development of this fraction for the two specifications for both samples, together with the evolution of the cross-sectional variance of $\hat{u}_{it}$, and the level of the permanent variance.

Except for the constant model on the unbalanced sample, which is most strongly affected by compositional changes, from 1994 to 2001 the cross-sectional variance is more or less unchanged. It then rises sharply with a slowdown or drop around 2004 for the balanced and unbalanced samples respectively.

With respect to the role of permanent and transitory inequality, the results suggest that the fraction of permanent inequality increases continuously until 2001. Our preferred specification on the balanced panel including covariates indicates that permanent inequality has roughly doubled from 1994 to 2001. After this peak, from 2001-2003 the fraction of permanent inequality steeply drops. The fraction of permanent inequality in the preferred specifications obtains a value of roughly 0.4 in 2003. The difference in the permanent component, as picked up by the estimated factor loadings, is statistically significant for both specifications based on the balanced sample (p-values of 0.004 and 0.005, see Table 6.1). Estimates of the time

Figure 6.1: Cross-sectional variance and permanent component (fraction or level)



Source: Own calculations using the SOEP data (1994–2006).

variation in the early 2000s based on the unbalanced panel are not significant. After 2003, the fraction of permanent inequality increases again and obtains values comparable to 2001 levels.

The pattern of initial growth of the permanent component of variance, followed by a drop in 2003 and a subsequent recovery to close to 2001 level is evident in all but the constant model run on the unbalanced panel. Evidently, the relevance of the permanent variance component strongly depends on both the underlying model and on the applied sample. On the one hand, controlling for individual characteristics

reduces the role of the estimated permanent variance in both samples. On the other hand, as already mentioned, compositional differences over time in the unbalanced sample are likely to affect the estimate of the transitory component, while the balanced panel may overestimate the importance of permanent factors. It is therefore particularly interesting that the results from the balanced panel suggest an economically important setback of permanent inequality for the years 2001-2003, and that the overall pattern of this evolution is also observed in the unbalanced panel.

6.4 Conclusion

The cross-sectional variance of wages in Germany increased since the late 1990s with a particularly rapid growth after 2000. Employing covariance structure models on a sample of full-time employed male workers, we decompose the cross-sectional wage variance into its permanent and transitory parts. Permanent inequality as a fraction of total variance increased from 1994 to 2001, then declined substantially in 2002 and 2003 to recover to close to its 2001 level by 2006. Our findings suggest that both transitory and permanent inequality are important drivers for the growth of inequality during the 2000s. Unobservable permanent factors became more important as determinants of inequality over the entire sample period. However, for the years 2001-2003 there is an important setback of this evolution, potentially with a higher degree of wage mobility helping to offset the implications of growing cross-sectional variance.

6.5 Appendix

The analysis uses the SOEP data introduced in the previous chapter. Our main sample is a fully balanced panel of males working full-time, i.e. males who report at least 19 hours per week, for the years 1994-2006. We apply usual age restrictions and include individuals aged 20-60. Hourly wages are generated from reported weekly hours actually worked (including hours of paid overtime) and monthly earnings (including overtime pay), and computed as $wage = monthly\ earnings/(4.35 * weekly\ hours\ worked)$. The employed measure of earnings is gross individual labor income as reported for the month prior to the interview. Earnings are deflated by Consumer Price Index to the base of year 2000. We apply common restrictions to outliers in the data and truncate the distribution of monthly earnings in our balanced sample at the 0.5th percentile from below and at the 99.5th percentile from above. We do not apply sampling weights as any existing weights do not account for our sampling conditions.

Table 6.2 compiles summary statistics for the primary sample. The table clearly

Table 6.2: Summary statistics

Year	Mean	SD	CV
1994	13.09	5.61	0.43
1995	13.69	5.69	0.42
1996	14.36	5.87	0.41
1997	14.42	5.71	0.40
1998	14.70	5.88	0.40
1999	14.90	6.03	0.41
2000	15.49	6.61	0.43
2001	15.63	6.55	0.42
2002	16.03	6.73	0.42
2003	16.78	7.43	0.43
2004	16.73	7.07	0.42
2005	16.70	7.33	0.44
2006	16.55	7.71	0.47
Total	15.31	6.62	0.43

Notes: The table compiles mean, standard deviation and the coefficient of variation for hourly wages.

Source: Own calculations using the GSOEP data (1994-2006).

shows the tendency of increasing cross-sectional inequality over time. From 1994 to 1998 the coefficient of variation falls. In 2006 the coefficient of variation is equal to 0.47 which is roughly 12 % larger than in 2001.

Table 6.3 shows the covariance matrix for the specification including only a time-varying intercept. The covariance matrix for the specification entering the full set of covariates is given in Table 6.4. Table 6.5 shows the complete estimation results.

Table 6.3: Covariance matrix - balanced panel, constant

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1994	.1694												
1995	.1465	.1678											
1996	.1303	.1381	.1621										
1997	.1303	.1384	.139	.1605									
1998	.1257	.1311	.1331	.1373	.1544								
1999	.1263	.1287	.1313	.135	.1352	.1556							
2000	.124	.1274	.1346	.1395	.1373	.145	.1633						
2001	.128	.1323	.1369	.1387	.1362	.1415	.1497	.1664					
2002	.1198	.1243	.1297	.1302	.1306	.1375	.1442	.1479	.1706				
2003	.1234	.1291	.1279	.1339	.1317	.1382	.1446	.148	.15	.1816			
2004	.1203	.1247	.1268	.1292	.1292	.1377	.1434	.1468	.1465	.1576	.1742		
2005	.1199	.1246	.1285	.1325	.1307	.1379	.1423	.1471	.1505	.155	.1562	.18	
2006	.1219	.1256	.1299	.1351	.1344	.1434	.147	.1492	.1513	.1582	.1599	.1639	.202

Notes: Number of observations for computing covariances is 952.

Source: Own calculations using the GSOEP data (1994-2006).

Table 6.4: Covariance matrix - balanced panel, covariates

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1994	.0972												
1995	.0774	.1002											
1996	.0684	.0772	.1058										
1997	.0688	.0778	.0831	.1049									
1998	.0652	.0716	.0781	.0826	.1005								
1999	.0671	.07	.0761	.0799	.0811	.1007							
2000	.0624	.0666	.0771	.0819	.0808	.0873	.1083						
2001	.0649	.0697	.0781	.0798	.0783	.0827	.0933	.1083					
2002	.0622	.0667	.0744	.0747	.0759	.0816	.091	.0933	.1187				
2003	.0635	.0695	.071	.0767	.0754	.0813	.09	.0921	.0971	.127			
2004	.0634	.0676	.0721	.0741	.0749	.0821	.0905	.0926	.0952	.1047	.1231		
2005	.0627	.0672	.0738	.0775	.0764	.0822	.0898	.0931	.0993	.1024	.1056	.1298	
2006	.0615	.0647	.0707	.0758	.0759	.0838	.0897	.0907	.0962	.1013	.1051	.1096	.1444

Notes: Number of observations for computing covariances is 952. See Section 6.2 for the full list of covariates.

Source: Own calculations using the GSOEP data (1994-2006).

Table 6.5: Estimates for factor loadings - ARMA(1,1) Specification

	Balanced		Unbalanced	
	constant	covariates	constant	covariates
p_{1995}	1.002	0.969	0.975	0.994
	(0.011)	(0.027)	(0.023)	(0.048)
p_{1996}	1.078	1.173	1.037	1.118
	(0.016)	(0.038)	(0.034)	(0.069)
p_{1997}	1.076	1.177	0.964	1.053
	(0.017)	(0.043)	(0.047)	(0.085)
p_{1998}	1.095	1.201	0.975	1.017
	(0.019)	(0.049)	(0.059)	(0.105)
p_{1999}	1.214	1.398	1.011	1.141
	(0.024)	(0.059)	(0.063)	(0.113)
p_{2000}	1.203	1.372	1.084	1.195
	(0.026)	(0.079)	(0.083)	(0.166)
p_{2001}	1.225	1.481	1.084	1.286
	(0.029)	(0.077)	(0.076)	(0.141)
p_{2002}	1.162	1.368	1.038	1.277
	(0.026)	(0.076)	(0.081)	(0.157)
p_{2003}	1.150	1.282	1.034	1.267
	(0.027)	(0.078)	(0.086)	(0.169)
p_{2004}	1.199	1.477	1.040	1.371
	(0.027)	(0.080)	(0.080)	(0.167)
p_{2005}	1.239	1.588	1.057	1.416
	(0.030)	(0.087)	(0.080)	(0.167)
p_{2006}	1.296	1.574	1.056	1.397
	(0.030)	(0.082)	(0.080)	(0.160)
λ_{1996}	0.853	0.925	0.981	1.014
	(0.033)	(0.033)	(0.042)	(0.037)
λ_{1997}	0.851	0.905	1.047	1.065
	(0.038)	(0.037)	(0.042)	(0.040)
λ_{1998}	0.836	0.892	1.087	1.106
	(0.043)	(0.040)	(0.045)	(0.042)
λ_{1999}	0.752	0.833	0.981	1.049
	(0.055)	(0.050)	(0.048)	(0.048)
λ_{2000}	0.777	0.846	0.777	1.000
	(0.060)	(0.055)	(0.065)	(0.056)
λ_{2001}	0.705	0.740	0.810	0.975
	(0.063)	(0.063)	(0.054)	(0.054)
λ_{2002}	0.961	0.973	0.936	1.057
	(0.046)	(0.045)	(0.047)	(0.051)
λ_{2003}	1.006	1.037	1.042	1.170
	(0.046)	(0.045)	(0.046)	(0.049)
λ_{2004}	0.898	0.905	0.953	1.036
	(0.046)	(0.046)	(0.045)	(0.049)
λ_{2005}	0.845	0.843	0.981	1.085
	(0.048)	(0.050)	(0.046)	(0.049)
λ_{2006}	0.957	0.988	1.041	1.136
	(0.049)	(0.046)	(0.048)	(0.050)
N	91	91	91	91

Notes: Standard errors in parentheses. See Section 6.2 for the full list of covariates.

Source: Own calculations using the SOEP data (1994-2006).

Chapter 7

Conclusion

This thesis analyzes the role of different nonpecuniary factors for economic decisions. Chapter 2 picks up an idea formulated by Hill (1894) who argues that appeals to patriotic sentiments may be used in times of war to foster tax compliance. The chapter provides the first study in the economics literature that analyzes the association between individual patriotism and tax compliance in non-war times. Exploiting two modules from the International Social Survey Programme, the chapter makes two important contributions. First, building on extensive work in Political Science, it suggests a method to measure patriotism. Second, it shows a robust positive association between patriotism and tax compliance for eight countries. On average, an increase of one standard deviation in patriotism increases the probability of reporting the highest tax compliance category by 8 %. This is a large effect and comparable to the (negative) effect of being self-employed on tax compliance.

Chapter 3 moves to a higher level of aggregation and analyzes theoretically the interplay of taxation, patriotism and migration in a two-country model. The citizens obtain a patriotic rent from residing in their respective home countries. Individuals can migrate to a foreign country in order to avoid high taxes, but as a side-effect they forgo this patriotic rent. The equilibrium analysis shows that the country with higher expected patriotism can choose higher tax rates. The empirical analysis links the survey data from chapter 2 to OECD data on tax rates and provides evidence that the theoretical prediction is visible in the data.

The analysis in both chapters is purely positive and does not intend to suggest that governments should use patriotism to ease tax collection. The results provide

a word of warning: in view of increasing levels of tax competition, the Treasury's interest may lead to a push for patriotism.

Chapter 4 examines theoretically a two-sided "marriage market". Frictions in the market force agents to balance between accepting offers of "lower quality" and staying single to wait for a better offer. The main contribution of the chapter is the introduction of "horizontal heterogeneity" into the search-theoretic literature. The distinguishing feature of this horizontal dimension is that it is not ordered, i.e. agents do not agree on the ranking with respect to this dimension. The horizontal factor captures nonpecuniary payoffs due to emotional congruence or joint leisure activities. The analysis provides a number of important insights, for example that agents' expected lifetime utility is smoothly affected by marginal changes in the level of search frictions. The chapter also presents an example that shows that agents' expected lifetime utility does not necessarily satisfy monotonicity with respect to the level of search frictions.

While chapter 4 suggests an improved theory for modeling the gains to marriage, chapter 5 is concerned with measurement. The difficulty of observing nonpecuniary payoffs poses problems with respect to suitable data. To this end, the chapter resorts to survey data on life satisfaction available in the German Socio-Economic Panel (SOEP).[1] The empirical analysis shows that individuals' who are married for five years report substantially larger values of well-being compared to their well-being while single. The results, therefore, cast doubt on the increasingly prevailing view that individuals quickly adapt to various negative or positive life-events including marriage, an idea known as the "hedonic treadmill". The term "hedonic treadmill" was coined by Brickman and Campbell (1971) who hypothesized that individuals' well-being is dictated by personality traits and genetic predispositions and therefore any deviations from this "set-point" are only temporary. The recent literature in psychology acknowledges that this theory does not hold for all life events (see, for example, Diener et al. 2006). Yet, there are a number of longitudinal studies who argue that individuals fully adapt to certain events including marriage, divorce and widowhood. For example, Clark et al. (2008) find full adaptation to marriage, while

[1] While there is still some skepticism in the economics literature toward the use of such data, there is recent literature documenting a robust and high correlation between subjective life satisfaction data and objective measures (e.g. Urry et al. 2004, Oswald and Wu 2010).

rejecting full adaptation to unemployment.[2]

Chapter 5 provides an explanation for the inconclusive evidence in the recent longitudinal literature with respect to adaptation: it hinges on the reference period whether or not full adaptation is supported by the same data. The study by Clark et al. (2008) uses one year prior to the life-event as the baseline period for all considered life-events like unemployment or marriage. While this choice of the baseline period may be appropriate for examining adaptation to unemployment, it seems problematic for the analysis of marriage. It is likely that individuals enjoy the non-pecuniary gains to having a partner already one year before they decide to marry. Although the empirical exercise focuses on partnerships, the conclusions are potentially important for other areas where adaptation is investigated by the use of life satisfaction data.[3]

Chapter 6 moves to the measurement of inequality. In particular, it develops a model to decompose cross-sectional wage dispersion into permanent and transitory inequality. The analysis also exploits the SOEP panel data and selects a sample of males working full-time in the years 1994-2006. Permanent inequality increases from 1994 to 2001 and then declines substantially in 2002 and 2003. From 2004 to 2006 permanent inequality increases roughly by the same rate as before 2001. In 2006, the level of permanent inequality reaches approximately the 2001 level. Summarizing, while permanent inequality is increasing since the mid 1990s, there is a substantial setback of this evolution for the years 2001 to 2003.

There are several avenues for future research. Regarding the analysis of the interplay of intrinsic factors like patriotism and tax evasion, the principal difficulty is that of limited data. For example, the available survey data from the International Social Survey Programme (ISSP) is a cross-sectional dataset. It is therefore not possible to assess changes or the stability of variables like patriotism within the same individual over time. In 2006, the General Social Survey (GSS), which provides the ISSP data for the United States, changed to a rolling-panel-design. Every two years, a new

[2]For other studies who claim that complete adaptation takes place in marriage see, for example, Lucas et al. (2003) and Lucas and Clark (2006). Zimmermann and Easterlin (2006) reject complete adaptation to marriage.

[3]For example, Oswald and Powdthavee (2008b) provide evidence for adaptation to disability and note that the degree of adaptation may be important for the derivation of compensation payments.

sample of individuals enters the dataset, while a large number of persons is reinterviewed. At the time of writing this thesis, the current panel data release covers three waves (2006, 2008, 2010). However, the GSS questionnaire covers in each wave only a certain set of core questions, e.g. questions about residence and workplace. Once within-person variation for variables related to tax evasion or patriotism is available, the within-subject stability should be assessed.

Another interesting extension might become possible due to more detailed cross-country data on tax liabilities. For example, a recent discussion paper by Doerrenberg et al. (2011) follows the idea of chapter 3 of this thesis and examines the link between the intrinsic factor tax morale and tax rates. The authors exploit recent panel data from the World Tax Indicators database (that is not publicly available) and link the data to several waves of the World Values Survey (WVS). They regress tax rates on a number of variables and establish a positive association between tax morale and tax rates on the income-group-level. This result is in line with the evidence in chapter 3 to the extent that their measure of tax morale is presumably highly correlated with patriotism (as established in chapter 2 of this thesis). The limitation of their approach is the pseudo-panel-nature of the linked dataset. The implicit assumption is that the composition of income-groups in each country remains similar over time. This allows to match several cross-sections of the WVS data to the World Tax Indicators panel. Once the aforementioned GSS panel has a sufficient number of periods, a match of this GSS panel to the World Tax Indicators panel on the level of individuals rather than income-groups seems to be very promising.

Regarding the relevance of emotional payoffs for the formation of households and unions, there are a number of further questions. With respect to the theoretical model, chapter 4 assumes for simplicity that individuals leaving the market are immediately replaced by clones. This implies that the steady-state distribution of singles in the market is independent of the marriage decisions. A possible extension for future studies is therefore a combination of an exogenous inflow of singles in the market (e.g. Burdett and Coles 1997) and the horizontal dimension of chapter 4. A second possible extension is to allow asymmetry with respect to the emotional payoff. In the current formulation both partners obtain the same payoff generated by emotional congruence. If individuals with different vertical realization, e.g. different income, are matched, this asymmetry implies that the higher agent is decisive for

the marriage decision.

While chapter 5 supports the view that there are gains to marriage in the long-run, it is unable to pin down the different sources contributing to this gain. As mentioned in the introduction of this thesis, Lundberg (2010) analyzes whether an individual's personality is linked to this person's marital status at age 35. She finds gender-differences for older cohorts, while for younger cohorts the same personality traits are predictive of marital status. She argues that these results indicate a change in the sources for marital surplus: while for older cohorts production complementarities matter, joint consumption is a more important factor for younger cohorts. Building on this idea, the emotional congruence of partners could be related to some measure of the "distance" between the personality of the two spouses. This distance might be considered as the empirical counterpart of the horizontal distance (see chapter 4 of this thesis) and could be useful in regressions explaining well-being or an outcome measure like divorce. However, more time-variation is needed to follow this approach.

A further measure of well-being that has recently been included in the SOEP is an indicator of mental health. Oswald (2010) discusses a number of different indicators for "emotional prosperity", including mental health. Drawing on the recent research in that area, he argues that there is evidence for a decline of emotional prosperity in several developed countries. But this evidence stems from pooled cross-section data. Observing individuals' mental health over several years in the SOEP panel would allow to link this variable to a wide range of individual and household characteristics. A natural step is to apply the methodology of chapter 6 to that future panel data in order to derive the permanent and transitory dispersion of the mental health indicator.

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Bibliography

Adachi, H. (2003). A Search Model of Two-sided Matching Under Nontransferable Utility, *Journal of Economic Theory* 113(2): 182–198.

Adams, T. S. (1911). The Place of the Income Tax in the Reform of State Taxation, *The American Economic Review* 1(2): 302–321.

Adler, M. and Posner, E. A. (2008). Happiness Research and Cost-Benefit Analysis, *Journal of Legal Studies* 37(S2): S253–S292.

Aidt, T. and Dallal, B. (2008). Female Voting Power: The Contribution of Women's Suffrage to the Growth of Social Spending in Western Europe (1869–1960), *Public Choice* 134(3): 391–417.

Akerlof, G. and Kranton, R. (2000). Economics and Identity*, *Quarterly Journal of Economics* 115(3): 715–753.

Alesina, A. and Fuchs-Schuendeln, N. (2007). Good-bye Lenin (Or Not?): The Effect of Communism on People's Preferences, *American Economic Review* 97(4): 1507–1528.

Alesina, A. and Giuliano, P. (2009). Preferences for Redistribution, IZA Discussion Papers 4056, Institute for the Study of Labor (IZA).

Alesina, A. and La Ferrara, E. (2005). Preferences for Redistribution in the Land of Opportunities, *Journal of Public Economics* 89(5-6): 897–931.

Allingham, M. G. and Sandmo, A. (1972). Income Tax Evasion: A Theoretical Perspective, *Journal of Public Economics* 1: 323–338.

Alm, J. and Jacobson, S. (2007). Using Laboratory Experiments in Public Economics, *National Tax Journal* 60(1): 129–152.

Alm, J., Martinez-Vazquez, J. and Torgler, B. (2006). Russian Attitudes Toward Paying Taxes–before, During, and After the Transition, *Economics* 33(12): 832–857.

Alm, J. and Torgler, B. (2006). Culture Differences and Tax Morale in the United States and in Europe, *Journal of Economic Psychology* 27(2): 224–246.

Anderson, B. (1991). *Imagined Communities: Reflections on the Origin and Spread of Nationalism. Rev. Edition*, London and New York: Verso.

Anderson, F. (1917). Fundamental Factors in War Finance, *The Journal of Political Economy* 25(9): 857–887.

Andersson, F. and Konrad, K. (2003). Human Capital Investment and Globalization in Extortionary States, *Journal of Public Economics* 87(7-8): 1539–1555.

Andreoni, J. (1989). Giving With Impure Altruism: Applications to Charity and Ricardian Equivalence, *The Journal of Political Economy* 6(6): 1447–1458.

Andreoni, J. (1990). Impure Altruism and Donations to Public Goods: A Theory of Warm-glow Giving, *The Economic Journal* 100(401): 464–477.

Andreoni, J., Erard, B. and Feinstein, J. (1998). Tax Compliance, *Journal of Economic Literature* 36(2): 818–860.

Armingeon, K., Careja, R., Potolidis, P., Gerber, M. and Leimgruber, P. (2008). Comparative Political Data Set III 1990–2006, Institute of Political Science, University of Berne.

Atakan, A. E. (2006). Assortative Matching With Explicit Search Costs, *Econometrica* 74(3): 667–680.

Atkinson, A. (2008). *The Changing Distribution of Earnings in OECD Countries*, Oxford University Press, USA.

Austen-Smith, D. (2000). Redistributing Income Under Proportional Representation, *Journal of Political Economy* 108(6): 1235–1269.

Baldwin, R. and Krugman, P. (2004). Agglomeration, Integration and Tax Harmonisation, *European Economic Review* 48(1): 1–23.

Bank, S. A., Stark, K. J. and Thorndike, J. J. (2008). War and Taxes, *UCLA School of Law, Research Paper No. 08-10* .

Becker, G. S. (1968). Crime and Punishment: An Economic Approach, *Journal of Political Economy* 76(2): 169.

Becker, G. S. (1973). A Theory of Marriage: Part I, *Journal of Political Economy* 81(4): 813–846.

Becker, G. S. (1974). A Theory of Marriage: Part II, *Journal of Political Economy* 82(2): 11–26.

Becker, G. S. (1991). *A Treatise on the Family*, Harvard University Press.

Beine, M., Docquier, F. and Rapoport, H. (2008). Brain Drain and Human Capital Formation in Developing Countries: Winners and Losers, *Economic Journal* 118(528): 631–652.

Ben-Porath, S. (2007). Civic Virtue Out of Necessity: Patriotism and Democratic Education, *Theory and Research in Education* 5(1): 41.

Benabou, R. and Ok, E. (2001). Social Mobility and the Demand for Redistribution: The Poum Hypothesis, *Quarterly Journal of Economics* 116(2): 447–487.

Bhagwati, J. and Dellalfar, W. (1973). The Brain Drain and Income Taxation, *World Development* 1(1-2): 94–101.

Bhagwati, J. and Hamada, K. (1976). The Brain Drain, *International Social Science Journal* 28(4): 691–729.

Blanchflower, D. G. and Oswald, A. J. (2004). Well-being Over Time in Britain and the USA, *Journal of Public Economics* 88(7-8): 1359–1386.

Blanchflower, D. G. and Oswald, A. J. (2008). Hypertension and Happiness Across Nations, *Journal of Health Economics* 27(2): 218–233.

Bloch, F. and Ryder, H. (2000). Two-sided Search, Marriages, and Matchmakers, *International Economic Review* 41(1): 93–115.

Bolton, P. and Roland, G. (1996). Distributional Conflicts, Factor Mobility, and Political Integration, *The American Economic Review* 86(2): 99–104.

Booth, A. L. and van Ours, J. C. (2008). Job Satisfaction and Family Happiness: The Part-time Work Puzzle, *Economic Journal* 118(526): F77–F99.

Booth, A. L. and van Ours, J. C. (2009). Hours of Work and Gender Identity: Does Part-time Work Make the Family Happier?, *Economica* 76(301): 176–196.

Boswell, J. and Croker, J. (1848). *Boswell's Life of Johnson: Including Their Tour to the Hebrides*, J. Murray.

Breyer, F. and Ursprung, H. (1998). Are the Rich Too Rich to Be Expropriated?: Economic Power and the Feasibility of Constitutional Limits to Redistribution, *Public Choice* 94(1): 135–156.

Brickman, P. and Campbell, D. (1971). Hedonic Relativism and Planning the Good Society, *Adaptation Level Theory: A Symposium*, Academic Press, pp. 287–302.

Burdett, K. and Coles, M. G. (1997). Marriage and Class, *Quarterly Journal of Economics* 112(1): 141–168.

Burdett, K. and Coles, M. G. (1999). Long-term Partnership Formation: Marriage and Employment, *Economic Journal* 109(456): F307–F334.

Carroll, N., Frijters, P. and Shields, M. A. (2009). Quantifying the Costs of Drought: New Evidence From Life Satisfaction Data, *Journal of Population Economics* 22(2): 445–461.

Cigno, A. (2011). The Economics of Marriage, *Perspektiven der Wirtschaftspolitik* 12: 28–41.

Clark, A. E., Diener, E., Georgellis, Y. and Lucas, R. E. (2008). Lags and Leads in Life Satisfaction: A Test of the Baseline Hypothesis, *Economic Journal* 118(529): F222–F243.

Clark, A. E. and Oswald, A. J. (2002). A Simple Statistical Method for Measuring How Life Events Affect Happiness, *International Journal of Epidemiology* 31(6): 1139–1144.

Clark, S. (2007). Matching and Sorting When Like Attracts Like, ESE Discussion Papers 171, Edinburgh School of Economics, University of Edinburgh.

Coricelli, G., Joffily, M., Montmarquette, C. and Villeval, M.-C. (2007). Tax Evasion: Cheating Rationally or Deciding Emotionally?, IZA Discussion Papers 3103, Institute for the Study of Labor (IZA).

Corneo, G. and Grüner, H. (2002). Individual Preferences for Political Redistribution, *Journal of Public Economics* 83(1): 83–107.

Cremer, H., Marchand, M. and Pestieau, P. (1990). Evading, Auditing and Taxing: The Equity-compliance Tradeoff, *Journal of Public Economics* 43(1): 67–92.

Daly, M. C. and Valletta, R. G. (2008). Cross-national Trends in Earnings Inequality and Instability, *Economics Letters* 99(2): 215–219.

de Figueiredo, R. and Elkins, Z. (2003). Are Patriots Bigots? An Inquiry Into the Vices of In-Group Pride, *American Journal of Political Science* 47(1): 171–188.

Di Tella, R. and MacCulloch, R. (2006). Some Uses of Happiness Data in Economics, *Journal of Economic Perspectives* 20(1): 25–46.

Di Tella, R., MacCulloch, R. J. and Oswald, A. J. (2003). The Macroeconomics of Happiness, *Review of Economics and Statistics* 85(4): 809–827.

Dickens, R. (2000). The Evolution of Individual Male Earnings in Great Britain: 1979-95, *The Economic Journal* 110: 27–49.

Diener, E., Lucas, R. E. and Scollon, C. N. (2006). Beyond the Hedonic Treadmill - Revising the Adaptation Theory of Well-being, *American Psychologist* 61(4): 305–314.

Diener, E., Suh, E. M., Lucas, R. E. and Smith, H. L. (1999). Subjective Well-being: Three Decades of Progress, *Psychological Bulletin* 125(2): 276–302.

Docquier, F. and Marfouk, A. (2006). International Migration by Education Attainment in 1990-2000, *in* Ç. Özden and M. Schiff (eds), *International Migration, Remittances, and the Brain Drain*, World Bank Publications.

Doerrenberg, P., Duncan, D., Fuest, C. and Peichl, A. (2011). Nice Guys Finish Last: Are People With Higher Tax Morale Taxed More Heavily?, Paper presented at the 67th Congress of the International Institute of Public Finance (IIPF), Ann Arbor, Michigan, USA.

Dolan, P. and Kahneman, D. (2008). Interpretations of Utility and Their Implications for the Valuation of Health, *Economic Journal* 118(525): 215–234.

Dolan, P., Peasgood, T. and White, M. (2008). Do We Really Know What Makes Us Happy? A Review of the Economic Literature on the Factors Associated With Subjective Well-being, *Journal of Economic Psychology* 29(1): 94–122.

Dorsch, M. (2010). Social Mobility and the Demand for Public Consumption Expenditures, *Public Choice* 142(1): 25–39.

Dreher, A., Sturm, J. and Ursprung, H. (2008). The Impact of Globalization on the Composition of Government Expenditures: Evidence From Panel Data, *Public Choice* 134(3): 263–292.

Druckman, D. (1994). Nationalism, Patriotism, and Group Loyalty: A Social Psychological Perspective, *Mershon International Studies Review* 38(1): 43–68.

Durand, E. (1917). Taxation Versus Bond Issues for Financing the War, *The Journal of Political Economy* 25(9): 888–916.

Dustmann, C., Ludsteck, J. and Schönberg, U. (2009). Revisiting the German Wage Structure, *Quarterly Journal of Economics* 124(2): 843–881.

Easterlin, R. A. (2005). A Puzzle for Adaptive Theory, *Journal of Economic Behavior & Organization* 56(4): 513–521.

Eeckhout, J. (1999). Bilateral Search and Vertical Heterogeneity, *International Economic Review* 40(4): 869–887.

Egeberg, M. (2004). An Organisational Approach to European Integration: Outline of a Complementary Perspective, *European Journal of Political Research* 43(2): 199–219.

Epple, D. and Romano, R. (1996). Ends Against the Middle: Determining Public Service Provision When There Are Private Alternatives, *Journal of Public Economics* 62(3): 297–325.

Ermisch, J. (2003). *An Economic Analysis of the Family*, Princeton University Press.

Feld, L. (2000). Tax Competition and Income Redistribution: An Empirical Analysis for Switzerland, *Public Choice* 105(1): 125–164.

Feldman, N. and Slemrod, J. (2006). War, Social Identity, and Taxation: Capitalizing Patriotism Through Voluntary Tax Compliance. mimeo.

Ferrer-i-Carbonell, A. and Frijters, P. (2004). How Important Is Methodology for the Estimates of the Determinants of Happiness?, *Economic Journal* 114(497): 641–659.

Frey, B. (1997). A Constitution for Knaves Crowds Out Civic Virtues, *The Economic Journal* 107(443): 1043–1053.

Frey, B. S. and Stutzer, A. (2002). What Can Economists Learn From Happiness Research?, *Journal of Economic Literature* 40(2): 402–435.

Frey, B. S. and Torgler, B. (2007). Tax Morale and Conditional Cooperation, *Journal of Comparative Economics* 35(1): 136–159.

Frijters, P., Johnston, D. W. and Shields, M. A. (2008). Happiness Dynamics With Quarterly Life Event Data, IZA Discussion Papers 3604, Institute for the Study of Labor (IZA).

Fuest, C., Huber, B. and Mintz, J. (2005). *Capital Mobility and Tax Competition*, Vol. 1, Now Publishers Inc.

Gardner, J. and Oswald, A. (2006). Do Divorcing Couples Become Happier by Splitting Up, *Journal of the Royal Statistical Society: Series A* 169(2): 319–36.

Gernandt, J. and Pfeiffer, F. (2007). Rising Wage Inequality in Germany, *SOEPpapers on Multidisciplinary Panel Data Research* 14.

Glazer, A. and Konrad, K. (1994). Intertemporal Commitment Problems and Voting on Redistributive Taxation, *Journal of Urban Economics* 36(3): 278–291.

Glazer, A. and Konrad, K. A. (1996). A Signaling Explanation for Charity, *American Economic Review* 86(4): 1019–28.

Gordon, J. (1989). Individual Morality and Reputation Costs as Deterrents to Tax Evasion, *European Economic Review* 33(4): 797–805.

Gustavsson, M. (2007). The 1990s Rise in Swedish Earnings Inequality - Persistent or Transitory?, *Applied Economics* 39(1): 25–30.

Harbaugh, W., Mayr, U. and Burghart, D. (2007). Neural Responses to Taxation and Voluntary Giving Reveal Motives for Charitable Donations, *Science* 316(5831): 1622.

Hartner, M., Rechberger, S., Kirchler, E. and Schabmann, A. (2008). Procedural Fairness and Tax Compliance, *Economic Analysis & Policy* 38(1).

Heinemann, F. (2008). Is the Welfare State Self-Destructive? A Study of Government Benefit Morale, *Kyklos* 61(2): 237–257.

Hibbs, D. (1977). Political Parties and Macroeconomic Policy, *The American Political Science Review* 71(4): 1467–1487.

Hill, J. (1894). The Civil War Income Tax, *The Quarterly Journal of Economics* pp. 416–452.

Hofmann, D. and Qari, S. (2011). The Law of Attraction: Bilateral Search and Horizontal Heterogeneity, SFB 649 Discussion Papers 2011-017, Sonderforschungsbereich 649, Humboldt University, Berlin, Germany.

Hohaus, B., Konrad, K. and Thum, M. (1994). Too Much Conformity?: A Hotelling Model of Local Public Goods Supply, *Economics Letters* 44(3): 295–299.

Holcombe, R. (1989). The Median Voter Model in Public Choice Theory, *Public Choice* 61(2): 115–125.

Hooghe, L. (2005). Several Roads Lead to International Norms, but Few via International Socialization: A Case Study of the European Commission, *International Organization* 59(04): 861–898.

Huddy, L. and Khatib, N. (2007). American Patriotism, National Identity, and Political Involvement, *American Journal of Political Science* pp. 63–77.

Iversen, T. and Soskice, D. (2001). An Asset Theory of Social Policy Preferences, *American Political Science Review* 95(4): 875–894.

Iversen, T. and Soskice, D. (2006). Electoral Institutions and the Politics of Coalitions: Why Some Democracies Redistribute More Than Others, *American Political Science Review* 100(02): 165–181.

Johnston, A. (2005). Conclusions and Extensions: Toward Mid-range Theorizing and Beyond Europe, *International Organization* 59(4): 1013.

Jones, C. (1988). Class Tax to Mass Tax: The Role of Propaganda in the Expansion of the Income Tax During World War II, *Buffalo Law Review* 37: 685.

Jones, C. (1996). Mass-based Income Taxation: Creating a Taxpaying Culture, 1940–1952, *in* W. E. Brownlee (ed.), *Funding the Modern American State, 1941-1995: The Rise and Fall of the Era of Easy Finance*, Cambridge University Press, pp. 107–147.

Justman, M. and Thisse, J. (1997). Implications of the Mobility of Skilled Labor for Local Public Funding of Higher Education, *Economics Letters* 55(3): 409–412.

Justman, M. and Thisse, J. (2000). Local Public Funding of Higher Education When Skilled Labor Is Imperfectly Mobile, *International Tax and Public Finance* 7(3): 247–258.

Kalmijn, M. (2006). Educational Inequality and Family Relationships: Influences on Contact and Proximity, *European Sociological Review* 22(1): 1–16.

Kalmijn, M. and van Tubergen, F. (2006). Ethnic Intermarriage in the Netherlands: Confirmations and Refutations of Accepted Insights, *European Journal of Population-Revue Europeenne De Demographie* 22(4): 371–397.

Kassenboehmer, S. C. and Haisken-DeNew, J. P. (2009). You're Fired! The Causal Negative Effect of Entry Unemployment on Life Satisfaction, *Economic Journal* 119(536): 448–462.

Katz, L. F. and Autor, D. H. (1999). Changes in the Wage Structure and Earnings Inequality, *in* O. Ashenfelter and D. Card (eds), *Handbook of Labor Economics*, Vol. 3 of *Handbook of Labor Economics*, Elsevier, chapter 26, pp. 1463–1555.

Keely, L. C. and Tan, C. M. (2008). Understanding Preferences for Income Redistribution, *Journal of Public Economics* 92(5-6): 944–961.

Klor, E. and Shayo, M. (2010). Social Identity and Preferences Over Redistribution, *Journal of Public Economics* 94(3-4): 269–278.

Konrad, K. (2008). Mobile Tax Base as a Global Common, *International Tax and Public Finance* 15(4): 395–414.

Konrad, K. A. and Lommerud, K. E. (2010). Love and Taxes - and Matching Institutions, *Canadian Journal of Economics* 43(3): 919–940.

Konrad, K. A. and Qari, S. (2011). The Last Refuge of a Scoundrel? Patriotism and tax compliance, *Economica* (forthcoming).

Koopmans, T. and Beckmann, M. (1957). Assignment Problems and the Location of Economic Activities, *Econometrica* 25(1): 53–76.

Krishna, A. and Slemrod, J. (2003). Behavioral Public Finance: Tax Design as Price Presentation, *International Tax and Public Finance* 10(2): 189–203.

Laband, D., Pandit, R., Sophocleus, J. and Laband, A. (2009). Patriotism, Pigskins, and Politics: An Empirical Examination of Expressive Behavior and Voting, *Public Choice* 138(1): 97–108.

Lavoie, R. (2011). Patriotism and Taxation: The Tax Compliance Implications of the Tea Party Movement. mimeo.

Layard, R. (2006). Happiness and Public Policy: A Challenge to the Profession, *Economic Journal* 116(510): C24–C33.

Levi, M. (1997). *Consent, Dissent, and Patriotism*, Cambridge University Press.

Li, M. (1990). Moral Education in the People's Republic of China, *Journal of Moral Education* 19(3): 159–171.

Lizzeri, A. and Persico, N. (2001). The Provision of Public Goods Under Alternative Electoral Incentives, *American Economic Review* 91(1): 225–239.

Loewenstein, G., O'Donoghue, T. and Rabin, M. (2003). Projection Bias in Predicting Future Utility, *Quarterly Journal of Economics* 118(4): 1209–1248.

Loewenstein, G. and Ubel, P. A. (2008). Hedonic Adaptation and the Role of Decision and Experience Utility in Public Policy, *Journal of Public Economics* 92(8-9): 1795–1810.

Lucas, R. E. and Clark, A. E. (2006). Do People Really Adapt to Marriage?, *Journal of Happiness Studies* 7(4): 405–426.

Lucas, R. E., Clark, A. E., Georgellis, Y. and Diener, E. (2003). Reexamining Adaptation and the Set Point Model of Happiness: Reactions to Changes in Marital Status, *Journal of Personality and Social Psychology* 84(3): 527–539.

Luechinger, S. (2009). Valuing Air Quality Using the Life Satisfaction Approach, *Economic Journal* 119(536): 482–515.

Luechinger, S. (2010). Life Satisfaction and Transboundary Air Pollution, *Economics Letters* 107(1): 4 – 6.

Luechinger, S. and Raschky, P. A. (2009). Valuing Flood Disasters Using the Life Satisfaction Approach, *Journal of Public Economics* 93(3-4): 620–633.

Lundberg, S. (2010). Personality and Marital Surplus, IZA Discussion Papers 4945, Institute for the Study of Labor (IZA).

Lundberg, S. (2011). Psychology and Family Economics, *Perspektiven der Wirtschaftspolitik* 12: 66–81.

Lundberg, S. and Pollak, R. A. (1994). Noncooperative Bargaining Models of Marriage, *American Economic Review* 84(2): 132–37.

Lundberg, S. and Pollak, R. A. (2007). The American Family and Family Economics, *Journal of Economic Perspectives* 21(2): 3–26.

Luttmer, E. F. P. (2005). Neighbors as Negatives: Relative Earnings and Well-being, *Quarterly Journal of Economics* 120(3): 963–1002.

MaCurdy, T. E. (1982). The Use of Time-Series Processes to Model the Error Structure of Earnings in a Longitudinal Data-Analysis, *Journal of Econometrics* 18(1): 83–114.

Manser, M. and Brown, M. (1980). Marriage and Household Decision-Making: A Bargaining Analysis, *International Economic Review* 21(1): 31–44.

Mansoorian, A. and Myers, G. (1993). Attachment to Home and Efficient Purchases of Population in a Fiscal Externality Economy, *Journal of Public Economics* 52(1): 117–132.

Mare, R. D. (1991). Five Decades of Educational Assortative Mating, *American Sociological Review* 56(1): 15–32.

Martinez-Vazquez, J. and Torgler, B. (2009). The Evolution of Tax Morale in Modern Spain, *Journal of Economic Issues* (1): 1–28.

Mayda, A. (2006). Who Is Against Immigration? A Cross-country Investigation of Individual Attitudes Toward Immigrants, *The Review of Economics and Statistics* 88(3): 510–530.

Mayda, A. and Rodrik, D. (2005). Why Are Some People (And Countries) More Protectionist Than Others?, *European Economic Review* 49(6): 1393–1430.

McElroy, M. B. and Horney, M. J. (1981). Nash-Bargained Household Decisions: Toward a Generalization of the Theory of Demand, *International Economic Review* 22(2): 333–49.

Meltzer, A. and Richard, S. (1981). A Rational Theory of the Size of Government, *The Journal of Political Economy* 89(5): 914–927.

Mitsui, K. and Sato, M. (2001). Ex Ante Free Mobility, Ex Post Immobility, and Time Consistency in a Federal System, *Journal of Public Economics* 82(3): 445–460.

Müller, K.-U. and Steiner, V. (2008). Would a Legal Minimum Wage Reduce Poverty?: A Microsimulation Study for Germany, Discussion Papers of DIW Berlin 791, DIW Berlin, German Institute for Economic Research.

Moene, K. and Wallerstein, M. (2001). Inequality, Social Insurance, and Redistribution, *American Political Science Review* 95(4): 859–874.

Moffitt, R. A. and Gottschalk, P. (2002). Trends in the Transitory Variance of Earnings in the United States, *The Economic Journal* 112(478): 68–73.

Moreira, M. J. (2003). A Conditional Likelihood Ratio Test for Structural Models, *Econometrica* 71(4): 1027–1048.

Mummendey, A., Klink, A. and Brown, R. (2001). Nationalism and Patriotism: National Identification and Out-group Rejection, *British Journal of Social Psychology* 40(2): 159–172.

Myck, M., Ochmann, R. and Qari, S. (2011). Dynamics in Transitory and Permanent Variation of Wages in Germany, *Economics Letters* 113(2): 143 – 146.

OED (2003). *Oxford English Dictionary*, Oxford English Dictionary, Oxford University Press, USA.

Ogura, L. (2006). A Note on Tax Competition, Attachment to Home, and Underprovision of Public Goods, *Journal of Urban Economics* 59(2): 252–258.

O'Rourke, K. and Sinnott, R. (2006). The Determinants of Individual Attitudes Towards Immigration, *European Journal of Political Economy* 22(4): 838–861.

Oswald, A. J. (2010). Emotional Prosperity and the Stiglitz Commission, *British Journal of Industrial Relations* 48(4): 651–669.

Oswald, A. J. and Powdthavee, N. (2008a). Death, Happiness, and the Calculation of Compensatory Damages, *Journal of Legal Studies* 37: S217–S251.

Oswald, A. J. and Powdthavee, N. (2008b). Does Happiness Adapt? A longitudinal study of disability with implications for economists and judges, *Journal of Public Economics* 92(5-6): 1061–1077.

Oswald, A. J. and Wu, S. (2010). Objective Confirmation of Subjective Measures of Human Well-Being: Evidence From the U.S.A., *Science* 327(5965): 576–579.

Piketty, T. (1995). Social Mobility and Redistributive Politics, *The Quarterly Journal of Economics* 110(3): 551.

Polinsky, A. M. and Shavell, S. (2000). The Economic Theory of Public Enforcement of Law, *Journal of Economic Literature* 38(1): 45–76.

Prizel, I. (1998). *National Identity and Foreign Policy: Nationalism and Leadership in Poland, Russia and Ukraine*, Vol. 103, Cambridge Univ Pr.

Qari, S., Konrad, K. and Geys, B. (2012). Patriotism,Taxation and International mobility, *Public Choice* 151(3): 695–717.

Razin, A., Sadka, E. and Swagel, P. (2002). The Aging Population and the Size of the Welfare State, *Journal of Political Economy* 110(4): 900–918.

Reinganum, J. and Wilde, L. (1985). Income Tax Compliance in a Principal-Agent Framework, *Journal of Public Economics* 26(1): 1–18.

Roberts, J., Hodgson, R. and Dolan, P. (2011). "It's Driving her Mad": Gender differences in the effects of commuting on psychological health, *Journal of Health Economics* 30(5): 1064 – 1076.

Rodrik, D. (1998). Why Do More Open Economies Have Bigger Governments?, *Journal of Political Economy* 106(5): 997–1032.

Salop, S. C. (1979). Monopolistic Competition With Outside Goods, *The Bell Journal of Economics* 10(1): 141–156.

Sandmo, A. (2005). The Theory of Tax Evasion: A Retrospective View, *National Tax Journal* 58(4): 643–663.

Schatz, R., Staub, E. and Lavine, H. (1999). On the Varieties of National Attachment: Blind Versus Constructive Patriotism, *Political Psychology* 20(1): 151–174.

Schmalensee, R. (1978). Entry Deterrence in the Ready-to-Eat Breakfast Cereal Industry, *The Bell Journal of Economics* 9(2): 305–327.

Schmölders, G. and Strümpel, B. (1968). Vergleichende Finanzpsychologie. Besteuerung und Steuermentalität in einigen Europäischen Ländern., Abhandlungen der Geistes- und Sozialwissenschaftlichen Klasse 4, Akadamie der Wissenschaften und der Literatur.

Seligman, E. (1892). On the Shifting and Incidence of Taxation, *Publications of the American Economic Association* 7(2): 7–191.

Shayo, M. (2009). A Model of Social Identity With an Application to Political Economy: Nation, Class, and Redistribution, *American Political Science Review* 103(2): 147–174.

Shimer, R. and Smith, L. (2000). Assortative Matching and Search, *Econometrica* 68(2): 343–369.

Sinn, H. (1995). A Theory of the Welfare State, *The Scandinavian Journal of Economics* 97(4): 495–526.

Slemrod, J. (2007). Cheating Ourselves: The Economics of Tax Evasion, *Journal of Economic Perspectives* 21(1): 25–48.

Smith, L. (2006). The Marriage Model With Search Frictions, *Journal of Political Economy* 114(6): 1124–1144.

Sologon, D. M. and O'Donoghue, C. (2009). Earnings Dynamics and Inequality in EU, 1994-2001, SOEPpapers 184, DIW Berlin, The German Socio-Economic Panel (SOEP).

Solt, F. (2008). Economic Inequality and Democratic Political Engagement, *American Journal of Political Science* 52(1): 48–60.

Sørensen, P. (2007). The Theory of Optimal Taxation: What Is the Policy Relevance?, *International Tax and Public Finance* 14(4): 383–406.

Stamp, S. (1932). *Taxation During the War*, H. Milford, Oxford University Press.

Stevenson, B. and Wolfers, J. (2008). Happiness Inequality in the United States, *The Journal of Legal Studies* 37(s2): S33–S79.

Stevenson, B. and Wolfers, J. (2009). The Paradox of Declining Female Happiness, *American Economic Journal: Economic Policy* 1(2): 190–225.

Stiglitz, J., Sen, A., Fitoussi, J. et al. (2009). Report by the Commission on the Measurement of Economic Performance and Social Progress, Commission on the Measurement of Economic Performance and Social Progress, Paris.

Stock, J. H. and Yogo, M. (2005). Testing for Weak Instruments in Linear IV Regression, *in* D. W. K. Andrews and J. H. Stock (eds), *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, Cambridge University Press, chapter 5.

Stutzer, A. and Frey, B. (2006). Does Marriage Make People Happy, or Do Happy People Get Married?, *Journal of Socio-Economics* 35(2): 326–347.

Tajfel, H. and Turner, J. (1979). An Integrative Theory of Intergroup Conflict, *The Social Psychology of Intergroup Relations* 33: 47.

Torgler, B. (2003a). Tax Morale in Transition Countries, *Post-Communist Economies* 15(3): 357–381.

Torgler, B. (2003b). To Evade Taxes or Not to Evade: That Is the Question, *The Journal of Socio-Economics* 32(3): 283–302.

Torgler, B. (2004). Cross-culture Comparison of Tax Morale and Tax Compliance: Evidence From Costa Rica and Switzerland, *International Journal of Comparative Sociology* 45(1-2): 17.

Torgler, B. (2005). Tax Morale in Latin America, *Public Choice* 122(1-2): 133–157.

Torgler, B. (2006). The Importance of Faith: Tax Morale and Religiosity, *Journal of Economic Behavior & Organization* 61(1): 81–109.

Torgler, B. and Schneider, F. (2007a). Shadow Economy, Tax Morale, Governance and Institutional Quality: a Panel Analysis, IZA Discussion Papers 2563, Institute for the Study of Labor (IZA).

Torgler, B. and Schneider, F. (2007b). What Shapes Attitudes Toward Paying Taxes? Evidence From Multicultural European Countries, *Social Science Quarterly* 88(2): 443–470.

Torgler, B. and Schneider, F. (2008). The Impact of Tax Morale and Institutional Quality on the Shadow Economy, *Journal of Economic Psychology* .

Turner, J., Hogg, M., Oakes, P., Reicher, S. and Wetherell, M. (1987). *Rediscovering the Social Group: A Self-categorization Theory*, Blackwell.

Urry, H. L., Nitschke, J. B., Dolski, I., Jackson, D. C., Dalton, K. M., Mueller, C. J., Rosenkranz, M. A., Ryff, C. D., Singer, B. H. and Davidson, R. J. (2004). Making a Life Worth Living: Neural Correlates of Well-Being, *Psychological Science* 15(6): pp. 367–372.

Wagner, G. G., Frick, J. R. and Schupp, J. (2007). The German Socio-Economic Panel Study (SOEP) - Scope, Evolution and Enhancements, *Schmollers Jahrbuch* 127: 139–170.

Watts, S. (1995). Walt Disney: Art and Politics in the American Century, *The Journal of American History* 82(1): 84–110.

Weck-Hannemann, H. (2001). Globalization as a Challenge for Public Choice Theory, *Public Choice* 106(1): 77–92.

Wildasin, D. (2000). Labor-market Integration, Investment in Risky Human Capital, and Fiscal Competition, *American Economic Review* pp. 73–95.

Wilson, J. (1999). Theories of Tax Competition, *National Tax Journal* 52: 269–304.

Winkelmann, L. and Winkelmann, R. (1998). Why Are the Unemployed So Unhappy? Evidence From Panel Data, *Economica* 65(257): 1–15.

Wooldridge, J. (2003). Cluster-sample Methods in Applied Econometrics, *American Economic Review* pp. 133–138.

Zimmermann, A. C. and Easterlin, R. A. (2006). Happily Ever After? Cohabitation, Marriage, Divorce, and Happiness in Germany, *Population and Development Review* 32(3): 511–528.

Zissimos, B. and Wooders, M. (2008). Public Good Differentiation and the Intensity of Tax Competition, *Journal of Public Economics* 92(5-6): 1105–1121.

English summary

This thesis analyzes the impact of nonpecuniary factors like morale, home attachment or emotions on economic decisions. For example, whether or not individuals donate to charities does not only depend on monetary factors like the deductibility of charitable contributions, but it is also driven by motives like prestige or social pressure.[1] That is, to some extent the payment as such influences the donator's payoff independently of how the contribution is finally spent.

Economic activity may also have negative side-effects on emotional payoffs that are difficult to observe. For example, the trend that an increasing share of time is spent for commuting between workplace and home may have a negative effect on "emotional well-being".[2] In line with this view, the "Stiglitz commission" recently published a report (Stiglitz et al. 2009) that suggests that statistical indicators like GDP do not provide enough information for policymakers, since such an indicator captures only pecuniary well-being. Consequently, the report suggests "that the time is ripe for our measurement system to *shift emphasis from measuring economic production to measuring people's well-being.*"[3]

The first part of this thesis studies tax avoidance and tax compliance. Specifically, chapter 2 examines the link between the nonpecuniary factors "patriotism" or "home attachment" and individual tax compliance. The basic assumption is inspired by Andreoni (1990) and essentially means that individuals feel "a warm glow of giving" when they voluntarily pay their taxes and that this warm glow is higher for more patriotic citizens. Building on these results, chapter 3 moves to a cross-country

[1] See Andreoni (1989) and in particular Andreoni (1990) for the analysis of charitable giving when individuals feel "warm glow". Glazer and Konrad (1996) study the motive of signaling wealth or status for charitable giving.

[2] See, for example, Roberts et al. (2011).

[3] See Stiglitz et al. (2009, p. 12, italics in original). See also Oswald (2010) who supports the arguments of the Stiglitz report and discusses some measures for quality of life or well-being.

setting and analyzes the consequences of patriotism on tax rates in a framework where individuals may migrate to a foreign country in order to avoid high tax liabilities.

The second part of this thesis (starting with chapter 4) deals with the economics of household formation. The pattern of how single individuals are matched and may subsequently enter a marital union seems to be a prime example for the presence of emotional payoffs. Yet, the literature on household formation and family economics in general has for a long time put its emphasis only on outcome measures like labor supply or inequality. Consequently, emotional payoffs are an underresearched topic.

Chapter 4 analyzes a marriage market in a dynamic model with search frictions, where agents are not only characterized by a vertical trait like productivity, but also derive utility from emotional congruence or consumption complementarities. Chapter 5 checks the dynamics of life satisfaction of individuals who enter a marital union. In particular it is tested if being married is associated with a long-lasting increase in happiness. Chapter 6 considers the dynamics of inequality and presents a model to decompose cross-sectional inequality into permanent and transitory inequality.

This thesis mainly focuses on the decision problem of the individual and the resulting equilibrium patterns. The microeconomic models that are either working in the background or explicitly stated are standard rational choice models. The analysis is positive and does not intend to give explicit policy recommendations. However, a thorough positive analysis is a necessary condition for making informed decisions. Most chapters start with a theory model or provide some theoretical background and then move to an empirical test of the hypotheses. The employed empirical methods are mostly standard microeconometric methods. As in the theoretical segments of the thesis, the empirical analysis is purely positive. Moreover, although a number of specifications try to address some endogeneity issues, the econometric analysis focuses on exploring and describing patterns in the data rather than estimating causal effects. The reasons for this are twofold: First, most of the available datasets are cross-sectional and offer only a limited number of controls. Second, the nature of the topic often prevents the application of a standard treatment-evaluation framework. For example, whether or not individuals are patriotic depends on the definition and is not comparable to, for instance, evaluating the effect of participation in education programs on wages. The thesis therefore focuses on the robustness of empirical patterns with respect to different measurement methods. In the following, the results of

each chapter are briefly summarized.

Chapter 1 extensively motivates the research question of the thesis and sketches the relevant literature. Chapters 2 and 3 analyze the link between patriotic sentiments and tax policy. The idea is that governments could also in non-war times be tempted to instill patriotism in order to exploit it for their own agenda. The English writer Samuel Johnson referred to such a misuse of patriotism by governments when he made his famous statement that "patriotism is the last refuge of a scoundrel."[4] Chapter 2 starts with an analysis of the relationship between patriotic sentiments and attitudes toward tax compliance. The theoretical background of the chapter is the basic idea that taxpayers feel a patriotic warm glow of voluntarily paying their taxes. It follows that the taxpayers exhibit an inclination against tax evasion despite low levels of expected punishment. Although the idea might appear simple at first glance, it is not obvious that such a relationships holds empirically. As noted by Lavoie (2011), in the United States there is a strong historical link between patriotism and resistance against paying taxes.

The empirical analysis of chapter 2 is based on cross-country survey data. The chapter contributes to the existing survey based literature in a number of ways. First, the concept of patriotism developed in the chapter builds on an extensive literature in political science on social identity and patriotism. One aspect of this measure is that it differs from nationalism. A key difference between the two concepts is that only nationalism is associated with rejection of "out-groups" like immigrants. The chapter is the first study in the economics literature that systematically investigates the link between individual patriotism and tax compliance by a number of specifications. The main findings are twofold. First, the association between the two variables is quite robust. Second, there is substantial heterogeneity of this relationship across countries.

Chapter 3 moves from tax compliance to tax competition. It starts with a theoretical analysis of individual migration in a two-country setup. High income earners consider moving to the foreign country in order to enjoy lower taxation in the foreign country. Individuals in both countries enjoy a patriotic rent from residing in their home country. The patriotic component consists of two factors, one on the country

[4] According to the Johnson biography by Boswell (edited and amended by Croker), Johnson made this statement on April 7, 1775 (Boswell and Croker 1848, p. 446).

level and the second on the individual level. It is shown that the country with higher average patriotism is able to choose higher tax rates.

The empirical part checks if such patterns are visible in cross-country data. To this end, it links the survey data with OECD data on tax rates and analyzes the association between tax rates and patriotism on two levels of aggregation. First, it explores the country level and second the level of income groups. As noted above, the focus of the thesis is a positive analysis. In particular, chapters 2 and 3 do not suggest to use home attachment as a policy instrument. The chapters rather provide a word of warning that governments might have an incentive to use such policies in order to reduce tax competition.

Chapter 4 moves to household formation. As before, the focus is on the decision problem of the individual. The problem is casted as the question of how a single individual searches for a partner in the "marriage market" characterized by search frictions. The main contribution of the chapter is the development of a theoretical framework that models the agent's decision when the agent takes both a "vertical" trait like productivity and a horizontal trait into account. The horizontal characteristic is not ordered and represents the idea that consumption complementarities like joint leisure activities are an important source of the marital surplus.

The framework developed in chapter 4 yields important results that are not visible in a static model like the one by Konrad and Lommerud (2010). For example, when search frictions change, all agents adjust their respective set of acceptable partners in a continuous way. The chapter also presents a small example showing that individuals' expected lifetime utility is not necessarily monotonically increasing in the extent of the market. In particular, agents who are "low-types" measured along the vertical dimension, may benefit from a higher degree of search frictions. Although the chapter is most closely related to the literature on family economics, it may also prove useful for labor market applications.

Motivated by this theory, chapter 5 empirically investigates the nexus between marriage and life satisfaction. The amount of pleasure caused by the consumption complementarities like joint leisure activities is difficult to measure. Survey data on life satisfaction is the only available data that spans several years and is supposed to capture such non-monetary inputs. The chapter therefore relies on survey data from the German Socio-Economic Panel Study (SOEP) and investigates the profile

of life satisfaction over time for those individuals who marry. The chapter provides evidence that individuals report substantially higher values of life satisfaction, even several years after the change of their marital status. The results of the chapter contradict the findings of several recent panel studies that argue that life satisfaction is only temporarily affected by marriage. The idea that individuals have a fixed set-point of life satisfaction and will inevitably return to this set-point was termed "hedonic treadmill" by Brickman and Campbell (1971).

Although the recent empirical psychology literature highlights the limitations of a narrow interpretation of the set-point theory (see, for example, Diener et al. 2006), there are a number articles providing evidence in favor of it. For example, Clark et al. (2008) argue that individuals on average fully adapt to various life events like marriage or divorce, while there is only partial adaptation to unemployment. On the other hand, Zimmermann and Easterlin (2006) conclude that marriage is associated with a permanent increase in life satisfaction.

Chapter 5 shows that the different conclusions are to some extent driven by the different econometric models. For example, the study by Zimmermann and Easterlin (2006) relies on multi-level-models, while individual heterogeneity in the study by Clark et al. (2008) is captured by a fixed effect. Moreover, the chapter shows that the choice of the baseline period is a crucial factor for calculating the extent of adaptation.

Chapter 6 also tackles issues of measurement. There is a large literature documenting increasing wage inequality in recent years for different countries. In Germany, the increase is notably steep since the 2000's (Gernandt and Pfeiffer 2007, Müller and Steiner 2008). However, two very distinct scenarios are compatible with an increase in cross-sectional inequality. In the first scenario there is no wage mobility over time, i.e. each individual gets the same wage every period. In such a world, growing cross-sectional inequality implies a larger permanent inequality, because individuals maintain their rank in the wage distribution while the variance of the wage distribution is larger. In the second scenario wages are drawn randomly every period. If this is the case, individuals face lucky periods with high wages and unlucky periods with low wages but they may get the same average wage over time.

Chapter 6 develops a model to decompose inequality into permanent and transitory inequality using the SOEP panel data from chapter 5. Because female wages exhibit

more instability over time, the chapter focuses on male wages. The main finding is that while permanent inequality increases over time, there is a substantial slowdown of this evolution in the early 2000s. The preferred specification indicates that the fraction of permanent inequality is slightly above 0.6 in 2001, around 0.4 in 2003 and roughly 0.5 in 2006.

German summary

Die vorliegende Dissertation untersucht den Einfluss von nicht-monetären Faktoren wie Moral, Heimatbindung oder Emotionen auf ökonomische Entscheidungen. Zum Beispiel hängt die individuelle Spendenbereitschaft nicht nur von den materiellen Faktoren wie der steuerlichen Absetzbarkeit ab, sondern auch von Motiven wie Prestige oder sozialem Druck.[1] Das bedeutet, dass zumindest teilweise die Spendenzahlung *per se* den Nutzen des Spenders beeinflusst, unabhängig davon wie letztlich die Spende verwendet wird.

Ökonomische Aktivität kann auch negative Begleiterscheinungen auf emotionale Auszahlungen haben, die schwierig zu beobachten sind. Ein Beispiel ist der zu beobachtende Trend, dass immer mehr Zeit dafür verwendet wird, zwischen Arbeitsplatz und Wohnung bzw. Wohnort zu pendeln (Roberts et al. 2011). In diesem Beispiel liegt es nahe, dass dieser Trend eine negative Auswirkung auf "emotionales Wohlbefinden" hat. Vor diesem Hintergrund hat vor kurzem die "Stiglitz-Kommission" einen umfassenden Bericht (Stiglitz et al. 2009) vorgelegt. Eine Kernaussage des Berichts besteht darin, dass Indikatoren wie das Bruttoinlandsprodukt keine ausreichende Informationsbasis für Politikentscheidungen liefern, da sie naturgemäß nur die Wertschöpfung erfassen und Auswirkungen auf emotionales Wohlbefinden unberücksichtigt bleiben.[2]

Hinsichtlich des Einflusses verschiedener nicht-monetärer Faktoren auf ökonomisches Handeln befasst sich der erste Teil der Arbeit mit dem Thema Steuervermeidung und -hinterziehung. Kapitel 2 untersucht den Zusammenhang zwischen dem

[1] Der Begriff "warm glow" geht auf Arbeiten von Andreoni (1989, 1990) zurück. Andreoni bezeichnet in seiner Analyse zur Spendenbereitschaft damit den Fall, dass das Individuum durch das Leisten einer Spende eine nicht-monetäre Auszahlung erhält, z.B in Form des guten Gefühls, geholfen zu haben. Glazer and Konrad (1996) untersuchen das Motiv, durch das Leisten von Spenden den eigenen sozialen Status offenzulegen.

[2] Vgl. Stiglitz et al. (2009, S. 12).

nicht-montären Faktor "Heimatbindung" bzw. "Patriotismus" und der individuellen Entscheidung, freiwillig Steuern zu zahlen. Inspiriert von Andreoni (1990) lautet eine wichtige Annahme für den modelltheoretischen Hintergrund des Kapitels, dass die Bürger durch die Zahlung ihrer Steuern per se eine nicht-monetäre Auszahlung erhalten. Je stärker die Heimatbindung ausgeprägt ist, desto höher ist das gute Gefühl, durch die freiwillige Zahlung der Steuern einen eigenen Beitrag zu leisten. Kapitel 3 geht auf eine höhere Aggregationsebene und untersucht den Zusammenhang zwischen Heimatbindung und der Höhe der Steuersätze, wenn Individuen möglicherweise emigrieren, um der hohen Besteuerung im Heimatland zu entgehen.

Der zweite Teil der Dissertation (ab Kapitel 4) behandelt die ökonomische Analyse von Haushalten und Partnerschaften, inbesondere ihre Entstehung. Die Art und Weise, wie Personen aufeinandertreffen und Partnerschaften begründen, erscheint im Hinblick der Bedeutung von emotionalen Faktoren ein naheliegendes Thema für die ökonomische Analyse. Dennoch wurde in der Literatur zur Entstehung von Haushalten und zur Familienökonomik im Allgemeinen lange der Schwerpunkt auf leichter messbares Verhalten, wie z.B. das Arbeitsangebot oder (Lohn-)ungleichheit, gelegt. Insofern ist die Analyse von emotionalen Faktoren auch in der Familienökonomik nach wie vor ein Gebiet mit verhältnismäßig wenig vorliegender Forschung.

Kapitel 4 analysiert einen "Heiratsmarkt", der von Suchfriktionen gekennzeichnet ist. Der Forschungsbeitrag besteht in der Einführung von nicht-monetären Auszahlungen in ein dynamisches Modell, d.h. dass die Individuen nicht nur ein "vertikales" Merkmal wie z.B. Produktivität aufweisen, sondern auch ein horizontales Merkmal, welches die emotionalen Auszahlungen erfasst. Kapitel 5 analysiert aus einer dynamischen Perspektive den Zusammenhang von Lebenszufriedenheit und Partnerschaft. Insbesondere wird überprüft, ob Partnerschaften zu einem längerfristigen Anstieg von Lebenszufriedenheit führen. Kapitel 6 befasst sich mit der Dynamik von Lohnungleichheit und präsentiert ein Modell zur Aufspaltung von einer im Querschnitt gemessenen Lohnungleichheit in eine permanente und eine transitorische Komponente.

In allen Kapiteln liegt der Schwerpunkt der Analyse auf der Ebene der individuellen Entscheidungsfindung. Die meisten Kapitel liefern zunächst eine theoretische Analyse oder kennzeichnen den theoretischen Hintergrund, um dann im zweiten Schritt die theoretische Vorhersage empirisch zu überprüfen. Die theoretische Analyse verwendet

den etablierten "Rational choice"-Ansatz und erfolgt in Form einer positiven Analyse. Die Zielsetzung besteht insofern darin, die Auswirkungen der nicht-monetären Auszahlungen herauszuarbeiten, ohne dabei konkrete Politikempfehlungen abzugeben. Dennoch bleibt anzumerken, dass eine systematische positive Analyse die Voraussetzung für politische Entscheidungsfindung darstellt. Die Auswahl der ökonometrischen Methoden erfolgt ebenfalls vor dem Hintergrund der Ausrichtung auf eine positive Analyse. Die verwendeten Modelle sind größtenteils Standard-Modelle der Mikroökonometrie, wobei der Schwerpunkt auf dem Herausarbeiten von robusten Korrelationen und nicht auf der Schätzung von kausalen Effekten liegt. Dafür sprechen im Wesentlichen zwei Gründe: Erstens sind die verfügbaren Datensätze häufig sehr eingeschränkt und nur als Querschnittsdaten verfügbar. Zweitens lassen sich aufgrund des untersuchten Themas nicht die Standard-Methoden zum Schätzen von kausalen Effekten anwenden. Inwiefern z.B. eine Person starke Heimatbindung aufweist oder nicht, hängt von der verwendeten Definition ab und ist daher z.B. nicht vergleichbar mit der Frage, ob die Teilnahme an einer Fortbildung zu einer Erhöhung des Lohns führt. Aus diesen Gründen liegt der Schwerpunkt darin, mit Hilfe verschiedener Spezifikationen robuste Zusammenhänge zu erkennen. Im Folgenden werden kurz die Hauptergebnisse der jeweiligen Kapitel erläutert.

Nach einer Einleitung der Forschungsfrage und Skizzierung der wesentlichen Literatur (Kapitel 1) beginnt Kapitel 2 mit der Analyse von Heimatbindung und Steuerehrlichkeit. Die Idee, dass der Staat das Appellieren an den Patriotismus der Bürger strategisch für eigene Zwecke nutzen kann, ist nicht neu. Insbesondere die USA machten im Zweiten Weltkrieg davon Gebrauch (Jones 1996) und der englische Schriftsteller Samuel Johnson bezeichnete Patriotismus "als letzte Zuflucht eines Schurken"[3] und spielte damit auf die missbräuchliche Verwendung von Heimatbindung seitens der Politik an. Die Anlehnung des theoretischen Hintergrunds des Kapitels an die Arbeiten von Andreoni (1989, 1990) liefert die Annahme, dass die Bereitschaft, freiwillig den Finanzbehörden das eigene Einkommen wahrheitsgemäß mitzuteilen um so höher ist, je mehr Heimatbindung eine Person empfindet. Daraus folgt, dass Steuerzahler mit hoher Heimatbindung trotz niedriger erwarteter Strafen und niedriger

[3]Die Johnson-Biographie von Boswell (herausgegeben und erweitert von Croker), datiert die berühmte Aussage "Patriotism is the last refuge of a scoundrel" auf den 7. April 1775 (Boswell und Croker 1848, S.446).

Aufdeckungswahrscheinlichkeit ihr Einkommen offenlegen. Obwohl die theoretische Idee einfach ist, ist es keineswegs offensichtlich, ob dieser Zusammenhang einer empirischen Überprüfung standhält. Insbesondere für die USA wird häufig der historische Zusammenhang zwischen Patriotismus und Widerstand gegen Steuergesetzgebung erwähnt (Lavoie 2011).

Die empirische Analyse von Kapitel 2 basiert auf internationalen Umfragedaten und trägt in mehrfacher Weise zu der umfragegestützten Literatur bei. Erstens integriert das Kapitel eine umfangreiche Literatur aus der Politikwissenschaft und entwickelt ein Konzept zur Messung von Patriotismus. Ein wichtiger Unterschied zwischen Patriotismus und Nationalismus besteht darin, dass nur das letztgenannte Konzept die Ablehnung von "Außenstehenden" wie z.B. Migranten umfasst. Zweitens liefert das Kapitel die erste Studie in der ökonomischen Literatur, die den Zusammenhang zwischen Patriotismus und Steuerehrlichkeit systematisch für eine Zeitperiode untersucht, die nicht von kriegerischen Auseinandersetzungen geprägt ist. Die empirische Auswertung zeigt, dass der statistische Zusammenhang zwischen den Variablen Patriotismus und Steuerehrlichkeit robust und relativ groß ist. Die Erhöhung der Patriotismus-Skala um eine Standardabweichung hat einen positiven Einfluss auf die Steuerehrlichkeit. Der positive Effekt ist von der Größenordnung her vergleichbar mit dem negativen Effekt von Selbständigkeit auf Steuerehrlichkeit.

Kapitel 3 analysiert das Zusammenspiel von Patriotismus und Steuerwettbewerb zunächst theoretisch. In dem Zwei-Länder-Modell können Individuen in das jeweils andere Land migrieren, um der (hohen) Steuerbelastung im eigenen Land zu entgehen. Individuen mit starker Heimatbindung verlieren bei Emigration jedoch diese nicht-monetäre Auszahlung. Im Gleichgewicht ist das Land mit im Durchschnitt höherer Heimatbindung in der Lage, höhere Steuersätze zu etablieren. Im empirischen Teil werden die Umfragedaten aus Kapitel 2 mit Daten zu Steuersätzen der OECD zusammengeführt, um die theoretische Hypothese empirisch zu überprüfen. Die Analyse ergibt einen positiven Zusammenhang zwischen Steuersätzen und Patriotismus auf der Aggregationsebene der Länder und auf Ebene von Einkommensgruppen.

Wie oben erwähnt, ist die Zielsetzung eine positive Analyse. Die Empfehlungen der Kapitel 2 und 3 lauten keinesfalls, dass die Politik Instrumente wie Heimatbindung einsetzen sollte. Sie sind eher als Warnung zu verstehen, dass politische Entscheider im Hinblick auf den zunehmenden Steuerwettbewerb einen Anreiz haben, diese

Instrumente zu nutzen. Am Ende von Kapitel 2 werden einige Beispiele von Organisationen wie die amerikanischen Boy Scouts[4] genannt, die das Ziel haben, zu einer Verbreitung von Patriotismus beizutragen, insbesondere bei Jugendlichen.

Kapitel 4 bildet den Anfang des zweiten Themenkomplex dieser Dissertation, in dem die Bildung von Haushalten und die Dynamik von Lohnungleichheit untersucht wird. Wie in den anderen Kapitel bildet das individuelle Entscheidungsproblem den Kern der Analyse. Das Kapitel betrachtet einen zweiseitigen "Heiratsmarkt". Suchfriktionen führen dazu, dass die Marktteilnehmer einen Kompromiss zwischen Suchdauer und "Qualität" des Partners eingehen müssen. Der Hauptbeitrag des Kapitels besteht darin, "horizontale" Präferenzen in die theoretische Literatur zu zweiseitigen dynamischen Suchproblemen der Familienökonomik einzuführen. Das Kapitel entwickelt ein Modell, in dem die Individuen sowohl ein vertikales Merkmal wie z.B. Produktivität als auch ein horizontales Merkmal aufweisen. Das horizontale Merkmal repräsentiert Aspekte wie emotionale Verbundenheit oder auch positive nichtmonetäre Auszahlungen durch gemeinsame Freizeitaktivitäten.

Das vorgestellte dynamische Modell liefert für die Analyse von horizontalen Präferenzen einige Implikationen, die in dem statischen Modell von Konrad and Lommerud (2010) naturgemäß nicht sichtbar sind. Zum Beispiel verändern die Marktteilnehmer die Menge der von ihnen akzeptierten Partner kontinuierlich, wenn sich die Suchfriktionen ändern. Das Kapitel zeigt auch anhand eines Beispiels, dass der erwartete Nutzen derjenigen Marktteilnehmer, die gemessen an der vertikalen Dimension (wie z.B. Produktivität) die niedrigen Werte aufweisen, bezüglich der Suchfriktion nicht monoton ist. Das heißt, dass diese "vertikal niedrigen" Individuen in bestimmten Bereichen der Suchfriktionen eine Erhöhung der Suchfriktion präferieren würden, obwohl sie dadurch weniger potentielle Partner treffen. Obwohl die Resultate vor allem die Literatur der Familienökonomik erweitern, sind auch Anwendungen des theoretischen Modellrahmens für Fragestellungen bezüglich des Arbeitsmarkts denkbar.

Ausgehend von der theoretischen Analyse untersucht dann Kapitel 5 den Zusammenhang von Partnerschaften (Heirat) und Lebenszufriedenheit. Da der positive Effekt von gemeinsamer Freizeitaktivitäten und emotionaler Bindung naturgemäß

[4]Siehe Kapitel 2, Fußnote 5, vgl. auch die Beispiele in Konrad (2008).

schwer messbar ist, ist der Rückgriff auf Umfragedaten notwendig. Die empirische Analyse stützt sich auf Daten des sozio-ökonomischen Panels (SOEP) und untersucht die Dynamik der Lebenszufriedenheit von Personen, die innerhalb eines Zeitfensters von 10 Jahren heiraten. Die Analyse zeigt, dass Personen auch fünf oder mehr Jahre nach der Änderung des Familienstatus substantiell höhere Werte von Lebenszufriedenheit aufweisen. Die Ergebnisse des Kapitels lassen daher Zweifel an der sich verbreitenden Sichtweise aufkommen, dass der positive Effekt von Partnerschaften aufgrund von Gewöhnungseffekten nur temporärer Natur ist. Die theoretische Überlegung, dass Menschen sich an alle Umstände gewöhnen, wurde von Brickman and Campbell (1971) als "hedonic treadmill" bezeichnet und impliziert, dass die Lebenszufriedenheit von genetischen Prädispositionen bestimmt ist und daher nur temporäre Abweichungen möglich sind.

Zwar besteht in der neueren psychologischen Literatur weitgehend Konsens darüber, dass diese Theorie nicht für alle Lebensumstände gilt (vgl. z.B. Diener et al. 2006), jedoch gibt es gerade im Kontext von Partnerschaften und Heirat einige prominente Studien, die eine vollständige Gewöhnung im Sinne von Brickman und Campbell (1971) nahelegen. Zum Beispiel verwendet die Studie von Clark et al. (2008) ebenfalls die Paneldaten vom SOEP und argumentiert, dass Individuen sich nicht an Arbeitslosigkeit, jedoch an andere Lebensumstände wie Heirat oder Scheidung gewöhnen. Andererseits argumentieren Zimmermann und Easterlin (2006) für einen kleinen jedoch permanenten positiven Effekt von Heirat.

Kapitel 5 zeigt, dass diese divergierenden Ergebnisse durch die unterschiedlichen empirischen Methoden erklärbar sind. Einerseits verwenden manche Studien lineare gemischte Modelle (Multilevel-Modelle bzw. Random-Effects-Modelle), während die neueren Studien vor allem fixe Effekte für Individuen annehmen. Der wichtigere Faktor ist jedoch die Wahl der Referenzperiode. Die Studie von Clark et al. (2008) verwendet für alle untersuchten Lebensumstände als Referenzperiode ein Jahr vor der entsprechenden Änderung. Während diese Wahl für das Hauptthema der Studie, Arbeitslosigkeit, angemessen erscheint, ist die Wahl im Kontext von Partnerschaften problematisch, da gerade die nicht-monetären Auszahlungen wie gemeinsame Freizeitaktivitäten bereits vor der Heirat zum Tragen kommen. Das Kapitel zeigt, dass unter Modellierung von individuellen fixen Effekten mit derselben Stichprobe, die bei Verwendung einer geeigneteren Referenzperiode langfristige positive Effekte auf die

Lebenszufriedenheit zeigt, das Ergebnis von Clark et al. (2008) reproduziert werden kann.

Kapitel 6 behandelt ebenfalls eine Fragestellung aus dem Bereich der Messmethoden. Die Literatur zur Dynamik der Löhne zeigt für viele Länder eine Zunahme der Lohnspreizung über die Zeit. In Deutschland ist die Zunahme der Lohnungleichheit seit dem Ende der 1990er besonders stark (Gernandt und Pfeiffer 2007, Müller und Steiner 2008). Die Betrachtung der Lohnentwicklung im Querschnitt reicht jedoch nicht aus, um die Auswirkungen der Lohnspreizung zu erfassen. Hinter einer steigenden Lohnspreizung können zwei sehr unterschiedliche Szenarien verborgen sein. Im ersten Szenario gibt es keine Einkommensmobilität, sodass die Arbeitnehmer jede Periode den gleichen Lohn erhalten. Im zweiten Szenario wird der Lohn in jeder Periode zufällig gezogen, sodass alle Individuen im Durchschnitt über die Zeit den gleichen Lohn erhalten.

Kapitel 6 verwendet den Paneldatensatz des SOEP aus Kapitel 5 und verwendet eine Stichprobe von männlichen Arbeitnehmern, die Vollzeit arbeiten. Das Kapitel entwickelt ein Modell zur Zerlegung der Lohnungleichheit in eine transitorische und eine permanente Komponente. Die Analyse zeigt, dass ingesamt von 1994 bis 2006 die permanente Ungleichheit zugenommen hat. Jedoch war diese Entwicklung in den Jahren 2001 bis 2003 stark rückläufig. In der präferierten Spezifikation beträgt der Anteil der permanenten Ungleichheit im Jahr 2001 in etwa 60 %, im Jahr 2003 ca. 40 % und im Jahr 2006 wieder um die 60 %.