The gender training gap in Europe –

How equal are inequalities in continuous training?

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PREFACE

Equal Pay Day reminds us annually of the sizable gender pay gap, and there still appears to be a glass ceiling for women, leaving many company boards completely in the hands of men. The Norwegian government responded by imposing a quota of 40 percent women on boards as early as 2006. Some governments have adopted similar initiatives, and the political agenda in most industrialized countries includes equal opportunities.

However, other "gender gaps" get much less attention in the media and the public, though they may actually help explain the less favorable labor market success among women. In particular, women may be disadvantaged in terms of their access to training opportunities. Further training, in particular, paves the way for each individual to update skills and knowledge. Therefore, a person's chances to be promoted to higher rungs of the corporate ladder as well as income opportunities may hinge on continuing training. That is particularly true in a world with strong skill atrophy and the need for lifelong learning. It is therefore surprising that differences between men and women in terms of their access to continuing training are not much studied and not much debated in public.

In her dissertation, Caroline Wozny tackles this issue. She studies the continuing training gap for women in Europe and explores institutional reasons for the observed gap. Caro's contribution is threefold.

First, she is among the first researchers analyzing micro data in the 2005-8 Adult Education Survey for 22 European countries, and definitely the first researcher computing multilevel regressions. She thereby addresses possible gender training gaps for a broad range of economies and avoids false generalizations that often result from single-country studies.

Second, she argues – and finds supporting empirical evidence – that there is a complex interaction between educational attainment, gender, and access to further training. As a result, women with a degree have better access to continuing training than comparable men but women without a degree have worse access to continuing training than comparable men. Conclusions in the literature according to which the gender training gap has disappeared are therefore premature.

As a third contribution, Caroline Wozny explores institutional factors that account for the cross-country differences. Borrowing from the varieties-of-capitalism approach, she is able to show that the system of initial education and training is especially important. In countries with a strong emphasis on vocational training (rather than tertiary education at universities), women without a university degree are particularly disadvantaged in terms of access to continuing training.

It is a daunting task to combine in one coherent piece of work not only micro and macro data but also theoretical arguments relating to individual behavior and to country systems. But Caro has managed to do just that. We need more of such multilevel, cross-country work among scholars in business and economics, work that helps us to understand our globalizing world and to build resilient institutions. I was pleased to see Caro go for that challenge, and it was fun to see her argument grow and unfold. The result is an intriguing book for those interested in comparative institutional analyses, equal opportunities, and the economics of training.

Prof. Dr. Martin Schneider Paderborn, December 2014

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Endphase immer wieder, alles zu geben. Ohne ihn gäbe es diese Arbeit in dieser Form nicht.

Caroline Wozny Paderborn, im Januar 2015

EXECUTIVE SUMMARY

Continuous investments in human capital are crucial for workers' productivity and labour market success, and female disadvantages in continuous training are discussed as being one reason for the persistent gender inequalities in the labour market. However, the existence of such gender training gap is not clearly supported by empirical literature. The aim of this study is to shed light on the determinants of the gender training gap and explain under which conditions a female training disadvantage occurs. Human capital and discrimination theory, traditionally used in economics to predict training differences between men and women, are therefore complemented by two additional approaches. The first approach, based on Lazear & Rosen (1990), predicts women of high ability (approximated by high education) not to be disadvantaged in terms of training, while all other women should have a training disadvantage compared to similar men. The second approach, based on work by Estévez-Abe (2005; 2006; 2009; 2012), assumes the gender training gap to depend on the human capital focus of a country: In countries with a focus on specific human capital, which is reflected in the labour market and the educational system, women have a training disadvantage compared to men. This is because specific human capital is at odds with women's high flexibility needs. Institutional support is thus necessary to encourage employees and employers to invest in female human capital.

To test the hypotheses derived on these theoretical bases, individual training data from the first wave of the Adult Education Survey covering 22 European countries are complemented by macro data referring to the labour market, the educational system and the support for women. The data is scrutinized in three analytical steps. First, individual data is used to run country regressions. Second, the aggregated training differences between men and women at different educational levels are regressed on macro-level variables. This is a preparatory to a multilevel analysis which is then performed. The analysis reveals that while there is a training disadvantage for women without a university degree, women with university education are not disadvantaged. This indicates that theoretical arguments by Lazear & Rosen (1990) should be taken into account when analysing the gender training gap and that empirical analyses that do not differentiate between women of different education may lead to biased conclusions concerning the training gap. This is because human capital and discrimination theory rationales appear to be valid for the prediction of gender differences among employees of lower education but not among employees of higher education. Further, the analyses find that gender differences in training vary significantly across the analysed countries. For highly educated employees, the cross-national differences can be almost entirely explained by characteristics of the labour market (mean tenure and union density) and support for women (the provision of childcare and child benefits), while the initial vocational educational system explains part of the gender differences among lower educated employees.

CONTENT

FIGURES

TABLES

ABREVIATIONS

AES	Adult Education Survey
EU	European Union
GSOEP	German Socio-Economic Panel
ISCED97	International Standard Classification of Education
NLSY79	National Longitudinal Survey of Youth 1979
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
OR	Odds Ratio
VoC	Varieties of Capitalism

Country Abbreviations

AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GR	Greece
HU	Hungary
LT	Lithuania
LV	Latvia
NO	Norway
PL	Poland
PT	Portugal
RO	Romania
SE	Slovak Republic
SK	Sweden
UK	United Kingdom

1 INTRODUCTION

1.1 Relevance

The unequal distribution of employment opportunities and socioeconomic rewards between men and women is widely recognized and one of the main issues in the on-going inequality debate (see e.g. Charles, 2005 or Gornick, 1999). Especially phenomena such as the gender pay gap or the so called “glass ceiling” effect (meaning that women do not reach the top levels in companies’ hierarchies) are frequently discussed in politics and economic literature (European Commission, 2011; Arulampalam, Alison L. Booth, & Bryan, 2007). In the discourse of potential causes of such gender inequalities in labour market outcomes, it has been argued that continuous training is one important explanatory factor (Evertsson, 2004; Mazur, 2001; Tomaskovic-Devey & Skaggs, 2002). The idea is that women have fewer opportunities to participate in continuous training than men because they are more likely to be affected by career interruptions. These interruptions reduce the return on investments in women’s human capital (Grönlund, 2012).

Since human capital must be constantly updated to fulfil the requirements of today’s markets, continuous training has gained in importance vis-à-vis initial education and training (O’Mahony, 2012). From an employee’s point of view, continuous training is important to maintain employability: There is an increasing risk of skill obsolescence due to technological innovations. The acquisition of state of the art knowledge is often crucial for securing the current job or for increasing ones market attractiveness for alternative employers (Ok & Tergeist, 2003). In addition, certain skills are more efficiently learned at the workplace than at school. Not surprisingly, empirical studies find continuous training to be strongly connected with career-perspectives as well as wage premiums (Görlitz, 2011; Melero, 2010). As a result, continuous investments in human capital are crucial for workers’ productivity and labour market success.

From the point of view of standard economic theory, women are assumed to take part in less company training due to higher levels of family responsibilities, more frequent employment interruptions and discriminatory employer practices (Becker, 1985; Estévez-Abe, 2005). While such a training gap might explain part of the observed gender differences in occupational success, empirical studies on the relationship between gender and training lead to heterogeneous results: Many authors find men to train more than women; others do not find any effect or even find women to train more than men (for an overview of studies on gender and training see Table 18 in the Appendix). In order to obtain a comprehensive picture of the training gap between men and women, it is necessary to understand the reasons for this phenomenon. The heterogeneous results might hint at hitherto unrecognized interactions of gender with other factors in its effect on training.

On the one hand, such interactions could occur between gender and other characteristics of the individual. Insights by Lazear & Rosen (1990), Light & Ureta (1990) and Royalty (1998) indicate that the assumptions made by human capital theory, like comparatively lower female labour market attachment, may not be equally valid for women of different ability levels or educational backgrounds. Lazear's & Rosen's (1990) work implies that the gender training gap may differ for employees of different ability and that highly able women may not be disadvantaged compared to equally qualified men while other women should be disadvantaged. The rationale is the following: As human capital theory suggests, average women usually have a lower labour market attachment than men due to higher female abilities in non-market activities such as child rearing. However, in contrast to human capital theory, the authors argue that for women of high ability, non-market returns are less likely to exceed market returns and that their labour market attachment should not differ from men's attachment. The risk of losing investments in female human capital thus decreases with rising female ability. Employers may therefore invest less in human capital of average women while they should treat high ability women equally to men.

While an employee's ability is usually difficult to observe, education can serve as a proxy for ability (Becker, 1962). Light & Ureta (1990) find labour market attachment to rise with education. Empirical results by Royalty (1998) suggest that while lower educated women show higher turnover rates than lower educated men, turnover of highly educated women is not higher than turnover of equally qualified men. Consequently, Lazear's & Rosen's (1990) assumption of differing labour market attachments of women depending on their ability seem to be more realistic than the assumptions made by classical human capital theory, which treats women as a homogeneous group in terms of labour market attachment. Including Lazear's & Rosen's (1990) rationales in the analysis of continuous training may therefore provide interesting insights in the gender training gap as it suggests higher training inequality among the lower educated than among the higher educated.

On the other hand, work by Estévez-Abe, Iversen, & Soskice (2001) and Estévez-Abe (2005; 2006; 2009; 2012) indicates that gender inequality may be influenced by national institutions. Most importantly, institutions supporting specific human capital could be detrimental to women's human capital development. The reason is that due to higher family responsibilities, female employees have higher flexibility needs than male employees and these flexibility needs are at odds with the rather inflexible specific skills. Estévez-Abe et al. (2001) point out that women need more institutional support to invest in specific human capital. The provision of childcare is especially crucial at that point. It serves to minimize the investment risk for employees and employers as it enables mothers to return to their job early after childbirth. Based on Estévez-Abe et al.'s (2001) rationales it is arguable that the gender effect on training interacts with national institutions.

As continuous training is highly important for an employee's labour market success but seems to be unequally distributed between men and women, this study focuses on training differences between men and women. Traditional economic theory may not be adequate for explaining gender differences in training participation as it leaves out potentially important gender interactions at the individual and at the institutional level. Considering complementary approaches that point to interactions between gender and ability (approximated by previous education) as well as national institutions may offer some explanation for the heterogeneous empirical results on the gender training gap. Therefore, this study examines how training probability differs between men and women and in which way gender effects on training differ depending on previous education and institutional characteristics of a country.

1.2 Research gap

This study addresses three research gaps in the field of training: First, there is no quantitative study that explains differences in the gender training gap found in the empirical literature. Second, there is no comprehensive model of continuous training that identifies national institutions and describes their predicted effects on training. Third, there is no empirical study that considers individual and institutional determinants of training participation in a multilevel analysis of cross-national data. This subsection discusses the three research gaps in greater detail.

Heterogeneous results on the gender training gap are not explained.

Traditional economic rationales consistently indicate a female training disadvantage. Although empirical studies on the relationship between gender and training lead to heterogeneous results, to my best knowledge, there has been no meta-analysis that explains these differences in empirical results. Thus, the reasons for these discrepancies remain unclear. While Lazear's & Rosen's (1990) assumptions on the differences in labour market attachment among women found some empirical support (Light & Ureta, 1990; Royalty, 1998), the implications of their rationales for training participation have not been empirically tested yet and there is no study that scrutinizes the gender training gap differentiating between women of higher and lower education.

Furthermore, international comparisons on training find that the gender training gap differs between countries (e.g. Brunello, 2004; Arulampalam, Booth, & Bryan, 2004; Dieckhoff & Steiber, 2011). This supports theoretical arguments by Estévez-Abe et al. (2001) who claim that national institutions have differing impacts on the human capital development of men and women. However, to my best knowledge, until now, there has been no quantitative study that analyses the institutional determinants of the gender gap in continuous training.

Hence, although it is conceivable that gender interacts with other training determinants at the individual and the institutional level which may finally explain part of the inconsistent empirical results regarding the gender training gap, until now, there has been no empirical test of these assumptions.

There is no common framework for institutional determinants of training.

To identify the national institutions that interact with gender determining training participation, it would be useful to refer to an established framework on institutional determinants of training, narrow it down to the ones that theoretically may have differing impacts on men and women and then test their effects on men and women in an empirical model. Unfortunately there is no consensus on a common comprehensive framework to assess the impact of institutions on continuous training, although theoretical work suggests that not only individual determinants but also national institutions can have an impact on training participation by providing incentives for employers and employees to invest in training. One reason seems to be that continuous training is studied by different disciplines. Skill formation is obviously an important aspect of labour market studies but also of educational studies. Traditionally, these fields focus on different institutions when developing explanatory models (Sung, Turbin, & Ashton, 2000). Labour market theories mainly focus on institutions like minimum wages or unions that can lead to wage compression or labour market mobility which may influence the payback horizon for human capital investments (e.g. Acemoglu & Pischke, 1999b; Acemoglu & Pischke, 1999a; Stevens, 1996). Educational studies, in turn, usually point out the importance of the initial educational system for continuous training (e.g. Brockmann, Clarke, & Winch, 2008; Nelson, 2010).

Recently, there have been some interdisciplinary approaches combining different perspectives of human capital development. Sung et al. (2000), for example, develop a framework on skill formation including the state with its education and training systems, companies as well as workers and labour organizations. Along these spheres they describe four alternative models of skill development and apply them to different countries. However, these models are defined by a number of rather specific cultural and institutional characteristics and are difficult to apply to all countries that may be of interest[1]. Moreover, the framework is concerned with skill formation in general which leads to a focus on initial training systems and a rather marginal consideration of continuous training. Based on a literature review, Boeren, Nicaise, & Baert (2010) propose an integrated model of potentially relevant micro, meso and macro determinants of continuous training[2]. On the macro-level, they identify the economic context, the welfare system, the labour market as well as the initial education and skill formation system as crucial for individuals' training behaviour. However, this rather broad model neither defines the specific institutional characteristics that determine the impact, nor the direction of the expected effects of the institutions. Ultimately, there is no commonly agreed framework for analysing the institutional determinants of continuous training, although many authors agree on the importance of the educational system as well as the labour market. Thus, it is not surprising that empirical studies on in-

[1] Chapter 2.2.2.4 will discuss the issue of country classifications in more detail.

[2] The authors use the term "adult education" but basically refer to the same contexts termed "continuous training" in this study.

ternational comparisons in training rather follow an explorative approach.

Cross-country studies on training do not take a multilevel perspective.

For the lack of comparable cross-country data, international comparisons on training are often qualitative or based on case studies (e.g. Brockmann et al., 2008; Finegold, Wagner, & Mason, 2000; Hashimoto, 1994; Ichniowski & Shaw, 1999). Only recently, as comparable data is becoming available, has there been an increasing number of quantitative studies comparing training participation in different countries. However, studies usually only focus either on individual or institutional determinants of training.

One of the first international comparisons on training including more than three countries is provided by Arulampalam et al. (2004) and analyses data of the European Household Panel for ten countries. The authors find significant differences in national training practices. More specifically, their results suggest gender and previous education to have differing effects across countries. However, the aim of their study is to detect differences rather than to explain them and the authors do not systematically trace their observations back to certain country characteristics. Macro-level variables are thus not considered in this study. Dieckhoff & Steiber (2011) analyse gender effects on training in 23 European countries. The authors find a smaller gender training gap in Nordic countries than in the rest of Europe. They explain this result with unique Scandinavian characteristics like the combination of high female labour market participation and a modern gender culture. However, they do not explicitly measure these institutions but include a dummy for Nordic countries in their models. Consequently, the documented effects cannot be clearly ascribed to particular national characteristics.

Other studies focus on country variables to explain training differences between groups. Beck, Kabst, & Walgenbach (2009), using organisational data from 14 countries, analyse training inequalities between employees of different hierarchical levels and trace cross-country differences back to differences in the national context. They find that training is distributed differently across hierarchical levels depending on institutional features of the vocational education and training system. However, they use company data and do not account for individual determinants of training. Two studies by Roosmaa & Saar (2010; 2012) are dedicated to training differences as well. Based on aggregated data from 23 countries, they explain differences in training participation between low-skilled blue collar workers and high-skilled white collar workers by country characteristics. In their 2010 study, they find that inequalities between high- and low-skilled workers can be explained by the educational system, the skill-level in a country as well as trade unions and other labour market characteristics. In Roosmaa & Saar (2012), the authors link their analysis more closely to the Varieties of Capitalism (VoC) literature, but essentially confirm the results of their earlier study. Nonetheless, due to their data structure, neither Beck et al. (2009) nor Roosmaa & Saar (2010; 2012) include micro-level variables in their analyses and thus do not control for individual determinants on training and their possible interactions.

Very few studies consider both macro and micro variables to explain training differences. Brunello (2004) is one of the authors including country and individual determinants simultaneously. Using data on training participation from the European Household Panel for 13 European countries, he analyses the effects of the educational system and the labour market characteristics on training participation while controlling for individual characteristics. Here, he does not only consider direct institutional effects but also indirect ones. His results indicate that features of the educational system as well as the labour market have a significant direct impact on individuals' training participation. Additionally, he finds the structure of the educational system to have differing effects on individuals of different educational backgrounds. Another example including micro and macro data is the work by Bassanini, Booth, Brunello, De Paola, & Leuven (2007). Based on different data sources, the authors analyse individual and institutional determinants of training in 13 European countries. On the individual level, they find women to train more than men and training to increase with education. On the macro-level, they find training to vary depending on characteristics of the schooling system as well as labour market institutions. Neither Brunello (2004) nor Bassanini et al. (2007) are primarily interested in the multilevel structure of data. Hence, instead of applying a multilevel modelling approach, both use adjusted standard errors to take the different levels of data into account. Insights on the interplay of determinants on different levels are therefore limited.[3]

To my best knowledge, the only cross-country study on training which choses a multilevel approach is the one by Edlund & Grönlund (2008). The authors study the effect of labour market coordination on human capital by analysing the individuals' stock of firm-specific skills in different countries. Their results indicate that employees' firm-specific skills differ depending on the labour market regime of a country and that men have higher levels of firm-specific skills than women. However, as their focus is on the individuals' stock of specific human capital, they do not analyse actual training participation but the amount of training on-the-job necessary for a hypothetically newly hired employee. As this measure refers to a rather particular part of training – which is not only essentially firm-specific but also largely introductory – results cannot be easily transferred to training participation in general.

In summary, the existing empirical studies mostly either focus on the individual or on the institutional determinants of training. The few studies including both either do not model the underlying data structure as a multilevel one or do not measure training participation directly.

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[3] A more detailed discussion of the advantages of the multilevel approach follows in Chapter 3.2.

This study addresses these three research gaps.

The principal aim of this study is to make a contribution to closing the research gap on the determinants of the gender training gap. To achieve this goal, a multilevel model on continuous training participation will be developed and empirically tested, this way contributing to narrow the other two research gaps. Hence, this study also adds to the slowly growing field of international comparisons on training and complements it.

Overall, this study gives new insights in the gender training gap, disintegrating the gender effects on employees by previous education. It shows that women without university education are disadvantaged in terms of training whereas women with university education are not. Thereby, it also contributes to the theoretical framework for analysing the gender training gap as it shows that model assumptions by Lazear & Rosen (1990), predicting different human capital investments in different groups of women, should be taken into account when looking at gender differences in training. However, these gender training gaps vary across countries. Using a multilevel approach, this study is able to shed light on the determinants of these variations. It can be shown that for highly educated employees, country differences in the gender training gap can be almost entirely explained by country differences in mean tenure, levels of childcare and generosity of child benefits. Cross-country differences among employees without university education, in turn, can be partly explained by differences in the importance of the initial vocational system.

1.3 Structure

Following the introduction, the underlying theoretical concepts of this study will be outlined in Chapter 2. Here, in a first step, standard economic approaches explaining the relationship between gender and training will be discussed. Principally, these are human capital theory and discrimination theories. These theories consistently predict a female training disadvantage. However, empirical studies reviewed in section 2.1.3 show heterogeneous results: While many studies confirm a male training advantage, others do not find any gender differences or even a female training advantage. These results indicate that classical economic approaches are not able to predict the gender training gap in an adequate way. Therefore, section 2.2 presents two additional approaches that may help to explain gender differences in continuous training. The first is based on theoretical reasoning by Lazear & Rosen (1990) and suggests that average women take less training than men while highly educated women are not disadvantaged compared to equally qualified men. Empirical evidence for the underlying assumptions is provided. The second approach is mainly based on work by Estévez-Abe (2005; 2006; 2009; 2012) who argues that gender differences are exacerbated in countries whose institutions focus on specific human capital. Here, three sets of institutions are identified that may have an impact on the gender training gap: the labour market, the educational system and support for women. For these three sets, the expected impact on training participation of men and women is discussed on a theoretical basis before empirical evidence on these relationships is stated. The chapter closes with a synthesis of the theoretical approaches and the deduction of six main hypotheses.

In Chapter 3, the data and the applied method are presented. As this study assumes individual as well as institutional variables to have an impact on the gender training gap, the empirical analysis is based on micro as well as on macro data. The micro data comes from the first wave of the Adult Education Survey (AES) while the macro data originates from different public sources. Under section 3.1, the AES is presented and the main individual and institutional variables are introduced. The applied method is described in detail in section 3.2. The analysis follows three basic steps: First, individual data is analysed by country. Second, macro-level regressions are conducted to explain the gender training gap by national institutions. Third, micro and macro variables are combined in multilevel models. The function of the single steps and the advantages of the multilevel approach are highlighted in that section.

The results of the empirical analysis are presented and discussed in Chapter 4. First, the descriptive statistics provide an overview of the data basis and its structure. After that, logit regressions with the individual data are run for each of the 22 countries included in the data set. Initially, models do not distinguish between highly educated and other women. Here, the gender training gap does not show a clear pattern of male or female advantage. When a distinction by education is finally made, results confirm differences in the gender training gap depending on the educational background: In most countries, women without a university degree have a training disadvantage compared to men while women with university degree do not. Building on these results, the training differences between men and women are taken as outcome for macro-level analyses in section 4.3. The countries' gender training gaps among all employees and among those with and without university education are regressed on national institutions characterizing the labour market, the educational system and the support for women. This preliminary analysis reveals that different institutions are relevant for explaining the gender training gap among employees of different educational backgrounds. Section 4.4 describes the development of the multilevel models for all employees before repeating this process for employees with university education and employees without university education separately. Three different models, integrating individual as well as institutional variables simultaneously, confirm that different institutional settings help to explain the cross-country differences in the gender training gap at different educational levels.

Section 4.5 closes the chapter by discussing the implications of the results for the proposed hypotheses. The study concludes with a summary of the main results in Chapter 5. Its limitations as well as some suggestions for further research are outlined before reflecting the implications of this study for research and policy-making.

2 THE GENDER TRAINING GAP

Since the importance of continuous training for labour market success is widely recognised (see e.g. Melero, 2010), numerous studies have been dedicated to answer the question: Why are there considerable differences in training participation of different people? In this context, one of the most frequently analysed determinants of training participation is gender (see Mure, 2007:15-23). The aim of this section is to discuss socio-economic theories as well as empirical findings referring to the determinants of the gender gap in continuous training. Thereby, this study takes an educational economic perspective on continuous training. In line with previous research, continuous training is defined as adult training that is not part of an initial formal education system and is therefore characterised as non-formal (see e.g. Arulampalam et al., 2004; Dieckhoff & Steiber, 2011). The participation in these training settings is assumed to lead to the formation of human capital in terms of skills.

This chapter is structured as follows: First, traditional economic theories are reviewed. However, as empirical evidence is not quite in line with these classical explanations, additional approaches, suggesting different gender training gaps among employees of differing ability levels as well as across different institutional settings, are taken into account. Based on that, a multilevel framework is developed which leads to the deduction of the hypotheses to be tested in the empirical section.

2.1 The gender training gap in standard economics

This section reviews standard economic arguments in explaining the gender training gap. Most prominently, this is human capital theory which is complemented by theories of taste and statistical discrimination. After that, empirical findings on the gender training gap are summarized. While theoretical arguments point to a clear training advantage of men over women, empirical findings are far from homogeneous in this aspect.

2.1.1 Men and women have different preferences

Human capital theory points out the importance of education and training in determining employees' productivity and ultimately their labour market outcomes. Differences in wages or employment can therefore be justified by differences in human capital investments (Becker, 1962; Mincer, 1958; Landes, 1977). The theory also provides explanations for differences in human capital investments in men and women. Here, they focus on differing investment rationales of male and female workers due to higher family responsibilities of women.

The different payback horizons for men and women have long been discussed by human capital theorists. As married mothers usually spend considerable time outside the labour market, they are confronted with shorter time horizons for recovering training investments. Compared to men, this provides them with lower incentives to invest in training. And even if they are planning to return to the labour market after childbirth, the skills they acquired previous to childbirth may have depreciated at the time returning to the labour market (Mincer & Polachek, 1974). Becker (1985) extends this argument to full-time working spouses. When comparing full-time working, married men and women, he finds women to dedicate considerably more time to household activities than men. He explains this behaviour by specialization benefits that can be realised due to labour division between the spouses.[4] As wives usually undertake the major part of the household responsibilities, they are not able to dedicate the same amount of energy to labour market activities as men of similar constitutions, even if they work the same hours. If husbands have more energy left for labour market activities than wives, their labour market returns are higher as they are more productive and can consequently realise higher hourly wages. Investments in human capital that are of value in the labour market should therefore be more attractive for men because they can receive higher returns. Accordingly, husbands should invest more heavily in human capital that is of value in the labour market while wives should specialise to a higher extent in household tasks.[5] These investment rationales can be easily extended to unmarried women in case they are planning to have children. If they anticipate lower labour market participation or higher specialization in non-market work, they have a shorter time horizon or less energy left to recover human capital investments than men. Therefore, they would be less likely to invest in human capital than men.

The assumption that women take fertility plans into account when it comes to human capital investments leads Polachek (1981) to conclude that labour market segregation is driven by these investment rationales as well. He argues that women voluntarily sort themselves into occupations with lower rates of skill atrophy. Obviously, these occupations not only promise a lower depreciation of skill investments after a career interruption but should also require lower levels of training.

2.1.2 Employers prefer men over women

Differences in training behaviour of male and female employees can also be caused by employers offering unequal training opportunities to men and women. An employer could simply dislike working with a certain group of employees, even though he or she does not

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[4] Becker (1985) makes clear that the benefits from specialization could be realised by a division of labour independent of the gender if household member were intrinsically identical. Gronau (1977: 1113) points out that the scope of these benefits depends on previous differences between the spouses. If before marriage both participate on the labour market to the same extend, “marriage [and the resulting possibility of specialization] does not yield any gains of trade”. However, as women usually gain less than men (do to discrimination or lower labour market involvement), wives often specialize in home-production while husbands more often than not specialize in market-production.

[5] In a full equilibrium this leads to a complete specialization of husbands in the labour market and wives in household activities.

doubt that the members of that group are as productive as other employees. In this case, working with this group causes a disutility for the employer, which can be interpreted as non-monetary production costs. To balance production costs, the employer would therefore refrain from employing this group at the same wages as other employees. Becker (1971: 14) calls this phenomenon “taste for discrimination”. Applied to gender differences in training, employers can have preferences for working with men or women. If not only wages but also training investments are seen as costs of labour, employers can reduce training investments in the employee group they dislike to balance the costs they bear by working with it. Based on taste discrimination either men or women could be disadvantaged in terms of training, depending on their employer’s preferences.

As economic discrimination theory does not allow predicting the direction of discrimination, social closure theory must be taken into account at this point. The idea of social closure was first introduced by Max Weber and suggests that a social group of advantaged status will defend its privileges and position by restricting non-members’ access to certain resources (Weber & Schluchter, 2009). Gender can be an important characteristic for defining such a social group in the labour market (Mehra, Kilduff, & Brass, 1998). Here, male employees still represent the majority. More importantly, they occupy the majority of executive positions. Based on social closure theory, they could have an interest in defending male dominance against women by excluding them from influential positions (Tomaskovic-Devey, 1993). As training is an important determinant of labour market success, one way to keep women away from influential positions and to defend male status could be by restricting women’s access to training (Tomaskovic-Devey & Skaggs, 2002). Social closure theory therefore indicates that taste discrimination can lead to female disadvantages in training.

However, the assumption that employers would discriminate certain groups only based on their personal preferences is not unanimously shared in economic literature. Arrow (1973) argues that other employers that do not have a taste for discrimination could gain a competitive advantage over the discriminating employers, as the former can choose their employees from a bigger pool of applicants, hire women at comparatively low market wages and gain advantages from investments in human capital of male and female employees equally. In this case, the discriminating employers accept foregone income opportunities to satisfy their preferences, i.e. they act as if they were willing to pay something for the privilege not to work with women (Becker, 1971). In the long run, this would drive the discriminating employers out of the market as other employers are more competitive. Under the assumption of perfect markets, taste discrimination should expire in the long run as discriminating employers should not be able to compete with non-discriminating employers. As inequality still exists in the labour market, Arrow (1973) argues that there should be other driving forces apart from simple preferences. Here, the theory of statistical discrimination comes into play, focussing on the problem of imperfect information: If employers are not able to evaluate their employees’ true productivity (or only at high costs), they might rely on more easily and less costly observable characteristics and use them as a proxy for productivity.

One possible proxy can be the employees' gender. Such employer behaviour is reasonable if the employers have any preconception of the productivity distribution among men and women. This preconception may be based on previous experience with men and women working in these jobs but can also be based on sociological beliefs or other subjective rationales. Based on the employees' gender, the employers then make a prediction concerning their productivity. If the employers are convinced that women are on average less productive, they will only be willing to employ them at lower costs than men (Arrow, 1973; Phelps, 1972). Likewise, if employers are convinced of a lower average labour market attachment of women, they will also be less willing to invest in the labour relation as the payback horizon for these investments will on average be shorter than investments in men. Based on this rationale, employers should prefer training investments in male employees over training investments in female employees.

2.1.3 Empirical findings

Empirical evidence concerning the impact of gender on training is far from homogeneous and is not able to support classical human capital and discrimination theory predictions of a clear training disadvantage for women. Although many studies find men to train more than women, there are many others that do not find any gender effect at all. Recently, there have been also studies that find women to have an advantage in training (for an overview of empirical studies on gender and training see Table 18 in the Appendix).

Most studies find a training advantage of men over women. Pischke (2001), using training data from the German Socio-Economic Panel (GSOEP), finds women to have lower training incidents and shorter training spells. 31% of the male employees received work-related training between 1986 and 1989 while only 22% of the female employees did. The female disadvantage holds true even after controlling for education, industry, occupation and part-time employment. Similarly, Georgellis & Lange (2007) using more recent training data from the GSOEP waves 1989, 1993 and 2000 find women's training incidents to be significantly less likely than men's, especially when it comes to employer sponsored training. Using the Swedish Survey of Living Conditions, Evertsson (2004) analyses pooled cross sectional training data of 10,721 employees aged 18 to 65 covering the years from 1994 to 1998. Training questions in the survey refer to training that took place in the past three years, was paid or organised by the employer, and lasted at least one week. Similar to the results for Germany, Evertsson (2004) finds that about 30% of the male employees participated in on-the-job training while only about 24% of the female employees did. Again, the results show that even after controlling for education, tenure, labour market experience, work hours, industry, socio-economic status, civil status and the presence of small children, women's odds to train are significantly lower than men's.

For the US, Lynch (1992) uses data from the 1980 and 1983 waves of the National Longitudinal Survey of Youth 1979 (NLSY79). Analysing a subsample of non-college graduates, she finds men to be more likely than women to receive employer provided on-the-job training but less likely to receive off-the-job training. Royalty (1996) analyses the relationship between predicted turnover and training of US-American men and women based on the 1980 to 1986 waves of the NLYS79. She finds men to participate in significantly more on-the-job training than women. However, about 25% of the gender differences can be explained by differences in the predicted turnover of men and women. These findings offer some support for the human capital theory assumption that employees invest less in female training because they expect them to be more likely to leave the firm. Barron, Black, & Loewenstein (1993) use data from the American Employment Opportunity Pilot Project. This company survey asks questions concerning the position an employer most recently filled referring to the amount of on-the-job training, the average starting wage and the wage after two years as well as whether the newly hired was male or female. With this information at hand, the authors analyse gender differences in on-the-job training and wages. They find a similar training intensity for men and women in the first three months of employment. However, in general, for positions filled with men, training requirements are more than twice as high as for positions filled with women. Their results suggest that employers hire men in positions that require more training as well as capital investments. The authors assume employers to consider female employees to have a higher likelihood of leaving the firm.

However, there are a number of studies showing mixed or insignificant results. O'Halloran (2008), for example, uses on-the-job training data from all NLSY79 waves until 2004. He finds that, on average, 10.72% of women received on-the-job-training in the past year while only 9.96% men did. However, men reported longer training spells and among those who participated in training, men reported more training incidences than women. Overall, men spent about 2.2% of their working time in on-the-job-training while women trained only 1.8% of their working time. The gender gap in training duration persists even after controlling for labour force attachment and expected tenure. In contrast, analysing on-the-job training data from the 1986 to 1991 waves of the NLSY79, Veum (1996) does not find any gender differences in the probability to participate in training, the number of training incidents or the hours of training. Still, he does find that white females receive higher training intensity (on-the-job training hours per hours worked) due to higher levels of part-time employment and a higher likelihood being employed in an entry-level position. Maximiano (2012), using the Dutch 2005 survey “Monitor Postiniteel Onderwijs” to assess work-related training, initially finds a non-significant gender effect on training. However, a more detailed model reveals that the non-significant effect masks two opposing effects: Firms tend to offer less training for women than for men. Only because women are more willing to participate in training than men, this does not translate into lower training levels for women.

Finally, there are studies which ascertain a female training advantage. Jones, Latreille, & Sloane (2008) explore the development of the gender training gap comparing the British Labour Force Survey data from the winter quarters 1994/1995 and 2000/2001. They distinguish between on-the-job and off-the-job training (employer supported and not supported). The authors find little gender difference when comparing training duration, type of training and training outcome in terms of qualification. They find women to be more likely to train but conclude that most gender differences occur due to different personal as well as job characteristics of men and women, especially in terms of occupation, industry and sector. Simpson & Stroh (2002) use the Adult Education Data File of the US-American National Household Education Survey of 1995 which includes training data of 19,722 adults, aged 16 years and older. The survey includes data of work-related adult education in terms of on-the-job training as well as off-the-job training. They show that women are more likely to participate in training than men. One important reason for this finding is occupational segregation which accounts for roughly one-third of the female advantage in the likelihood of overall training participation and for about 40% of the female advantage in employer-supported training (Simpson & Stroh, 2002: 44). The authors argue that this occurs due to technological changes and more computerised workplaces which affect typical female workplaces to a higher extent than male workplaces.

Apart from analyses based on national data, there are a few studies that examine the gender training gap in an international context. The results usually show cross-country differences when it comes to the effect of gender on training. Using data from the European Community Household Panel for ten countries, Arulampalam et al. (2004) analyse gender differences in continuous training participation between 1994 and 1999. Their training data, which samples employees aged 25 to 54 who work at least 15 hours per week, focuses on more formal courses of instruction and not on informal on-the-job training. Estimating separate equations for each of the ten countries in their sample, the authors find women to be typically not less likely to train than men. In Denmark, Finland, Italy and Spain women are even more likely to participate in training. For the latter two countries, these results can be explained by women's characteristics that favour training. In Denmark and Finland different returns of training seem important, too.

Leuven & Oosterbeek (1999) compare the demand and supply of work-related training in Canada, the Netherlands, the United States and Switzerland based on data of the International Adult Literacy Survey. They find women in Canada and in the Netherlands to be more likely to suffer from training constraints than men. Moreover, for all countries but Switzerland, they find women to receive less training than men. In Canada, the Netherlands and the United States, the main reason for the female disadvantage seems to be employer preferences. These results are in line with Bassanini et al. (2007) who analyse training data from eleven countries from the 1995-2001 waves of the European Community Household Panel. The authors find women to have higher training demands than men while the training supply for women is lower than for men. Although the authors find women to train more than men, the analysis shows that this is because women are more likely to pay for their training themselves. Especially at younger ages, women get less employer-sponsored training than men. The authors explain this by more frequent career interruptions.

The most extensive international comparison on gender differences in training so far has been conducted by Dieckhoff & Steiber (2011). The authors use the European Social Survey 2004/05 to compare continuous training participation of men and women in 23 countries. Their sample includes data of 4,957 employees, aged 25 to 45 who live with a partner. They analyse the effect of fertility plans, childcare responsibilities and the sex composition of occupations on the likelihood of training in the past 12 months while controlling for career orientation, gender attitudes, age, education, household income, part-time status, unemployment experience, firm size and sex of the supervisor. They find women to train less than men and test different theoretical explanations for this gender training gap: human capital theory, gender role specialization (meaning that mothers specialize in home-production such as childcare and have less time or energy left than men or childless women), occupational sex segregation and statistical discrimination. However, none of these theories turns out to have explanatory power for training behaviour of female employees. The authors find no evidence that women planning to have children train less than other women, nor do they find any negative effect of the presence of young children on women's training participation. Hence, neither human capital theory rationales, that suggest women who are planning to (at least temporarily) leave the labour market should invest less in training, nor gender role specialization, suggesting that women with children have less energy left for the labour market, can be supported. Statistical discrimination of female employees by employers cannot be detected either, since younger women who might have children in the future train even more than childless women aged 33 and above (controlling for age). Most strikingly, the authors find occupational segregation theory reversed. They find employees (independent of their gender) to train less in male-dominated occupations and conclude that in these (mainly low-skilled manual) occupations, continuous updating of human capital is less needed than in other occupations. On the other hand, the proposed theories turn out to explain male training participation to a certain extent: Planned as well as actual fatherhood increases the probability of training. Taken as a sign of higher labour market attachment, this supports human capital theory, discrimination theories (positive discrimination of fathers) as well as gender role specialization. Assuming that the authors controlled for all relevant variables, they conclude that the remaining gender gap must occur due to employers' taste discrimination of female employees.

In summary, results on the gender training gap are mixed. Many studies find a male advantage in training but others do not find any gender differences in training or even a female advantage. In addition the results of international comparative studies indicate the gender training gap to differ between countries (e.g. Arulampalam et al., 2004; Dieckhoff & Steiber, 2011). Therefore it is not surprising that studies based on data from different countries lead to heterogeneous conclusions: Jones et al. (2008) find a female advantage in Britain while Pischke (2001) and Georgellis & Lange (2007) find a female disadvantage in Germany and Evertsson (2004) in Sweden. Recent results for the US are mixed.

2.2 The gender training gap and additional approaches

The differing empirical results on the gender training gap cannot be explained by human capital or discrimination theory. The cross-national variances rather suggest that country characteristics may have an impact on the gender training gap. Further, women may not be the homogeneous group economic theory takes them for. Different groups of women may show different training preferences and employers may not discriminate all women to the same extent. Therefore, this section discusses two theoretical approaches that refer to human capital and discrimination theory but extend them in ways that offer explanations for differences in the gender training gap between different employee groups as well as across countries.

2.2.1 Not all women are the same

Theoretical background

Lazear & Rosen (1990) apply the rationale of statistical discrimination to differences in promotion between men and women and point out that since the promotion of an employee leads to costly training investments, employers see a promotion as an investment in a specific employee. In line with human capital theory, the authors refer to expected gender differences in the probability of leaving the training firm in order to explain the differences in employers' investment in male and female employees. As women are generally assumed to have a lower labour market attachment, employers require higher ability thresholds for women than for men to compensate for their investment risk.

Lazear & Rosen (1990: 108-113) argue that these differences in labour market attachment occur because women, though having the same abilities in the labour market, have an advantage in non-market activities, especially in child rearing. This advantage can translate into higher non-market returns for women compared to their market returns. Nonetheless, at very high levels of labour market abilities (which promise very high returns), labour market returns should exceed non-labour market returns for women, so women are no longer more likely than men to leave the firm. In this case, investing in human capital of women is no longer more risky than the investment in men. Moreover, human capital investment incentives for a highly able woman herself should not be different from those for a highly able man, as investment horizons are similar. Differences in skill investments of men and women should therefore not exist at very high ability levels as neither employers nor employees have to fear the loss of their investment. On the contrary, women of average ability and below should be disadvantaged compared to equally able men as they are expected to have a lower labour market attachment, and consequently shorter investment horizons than men.

Empirical findings

Using personnel records of 4,379 full-time employees of a major financial institution in Great Britain, Jones & Makepeace (1996) empirically test the model developed by Lazear & Rosen (1990). As regressors they include marital status, education, tenure, age-on-entry and whether the employer had allocated the employee to a “fast track”. Their results indicate “that women have to meet more stringent criteria than men for promotion, but that much of the difference between men and women’s attainment is due to their attributes” (Jones & Makepeace, 1996: 401), which basically supports the main model assumptions. Further, they find that promotion barriers for women are highest at lower hierarchical levels and vanish at higher levels. This is in line with Lazear’s & Rosen’s (1990) hypothesis that gender differences disappear at high ability levels. Similarly, Winter-Ebmer & Zweimüller (1997), using data from the Austrian Microcensus 1983 and taking educational achievement as a proxy for ability, find that women “have to fulfill higher ability standards to be promoted” (Winter-Ebmer & Zweimüller, 1997: 43). The authors further find “that the assignment of career positions reacts significantly to higher separation risk of female workers” (Winter-Ebmer & Zweimüller, 1997: 67). However, higher female turnover is not able to explain gender differences entirely. Other explanations like discrimination by the employer seem to be relevant as well.

Using panel data on Finnish metal workers for the years 1990-2000, Pekkarinen & Vartiainen (2006) are able to test Lazear’s & Rosen’s (1990) model with a more direct ability measure than earlier studies as the panel data provides information on individual performance bonuses. The authors find women to be less likely to be promoted than men, although women appear to be more productive among promoted as well as non-promoted workers. In fact, “promoted women were approximately 12.5% more productive at the initial job than promoted men“ (Pekkarinen & Vartiainen, 2006: 299). The authors therefore conclude that female workers must face higher promotion thresholds than male workers. Since they also find quit rates among young women to be considerably higher than those of young men, their results support Lazear’s & Rosen’s (1990) interpretation that employers demand higher ability thresholds of women to compensate the higher risk of losing human capital investments. However, as gender differences in promotion do not completely vanish at older ages, when female separation rates are comparable to men, alternative explanations like taste discrimination by the employer may still be relevant.

Pema & Mehay (2010) test the model with personnel data from white-collar workers of the U.S. Defense Department, which covers information on individual performance, firm-specific human capital, and promotion history. Their sample includes 27,965 employees aged 20 to 55, who work full-time and have at least a Bachelor’s degree. The authors find that women who did not get promoted in the past, are less likely to be promoted than comparable men while women who did get promoted in the past are more likely to be promoted than men who got promoted. This may be interpreted as support for Lazear's & Rosen's (1990) hypothesis that women differ from men in unobserved characteristics like their abilities in child rearing and that for some women non-labour market returns exceed labour-market returns but for others not. Pema & Mehay (2010) further find that at lower hierarchy levels, women have to pass a higher performance threshold to be promoted whereas this is not true at higher hierarchical levels. This finding supports Lazear's & Rosen's (1990) assumption that at very high levels of ability, differences between men and women vanish because the employer is able to identify the more career-oriented women.

There is also some empirical evidence for Lazear's & Rosen's (1990) underlying supposition that women's labour market attachment depends on their labour market abilities. Whereas ability is often difficult to observe, empirical studies comparing women of different levels of education support the idea that labour market attachment strongly varies between different groups of women. Light & Ureta (1990), analysing work continuity of US-American women between 24 and 30, find female labour force participation to rise considerably with education. Comparing turnover of men and women of different educational backgrounds, Royalty (1998) finds that women with lower levels of education show higher levels of turnover than comparable men. This is largely due to higher levels of job-to-non-employment turnover. However, for men and women with education above the higher secondary level, Royalty (1998) does not find any evidence of a higher turnover probability of females. In fact, when looking at job-to-job turnover, men actually show higher turnover rates than women in this group. The overall probabilities for staying in the same job are highest for women with a higher education.

Propositions

As women of average ability are assumed to have a lower labour market attachment than men, their training disadvantage compared to men may be explained by two parallel processes: On the one hand, average women themselves invest less in their own human capital as their payback horizons are shorter than men's. This may be due to long maternity leaves or even a complete drop out of the labour market. On the other hand, employers invest less in human capital of average women as the risk of losing this investment is higher than the risk of losing investments in average men. These arguments should not be important for highly able women. As their labour market attachment is similar to men's, these women have expected returns to training similar to men. Consequently, their training investments should also be similar to men's. Employers should not fear the loss of their investments, either, and therefore invest similar amounts of training in highly able women as in comparable men. As ability is hard to measure empirically, economic studies usually proxy it by educational achievement (e.g. Becker, 1962, Mincer, 1958). This may also be valid for Lazear's & Rosen's (1990) model (see e.g. Winter-Ebmer & Zweimüller, 1997). Therefore, this study assumes that women of average education and below (without a university degree) have a training disadvantage compared to similar men, while highly educated women who hold a university degree should not be disadvantaged compared to similar men.

In the previous line of argument differences in labour market attachment lead to training disadvantages of average women, which may be induced by both employee and employer preferences. Both the employer and the employee preferences are in line with Lazear's & Rosen's (1990) approach as both processes predict the same outcome: A female disadvantage among average employees next to training equality among the highly educated employees. Since both processes point in the same direction, this study does not distinguish between employee preferences or employer discrimination as possible sources of training inequalities between men and women. But most importantly, if we assume Lazear's & Rosen's (1990) model assumptions to be true and if we expect that the underlying reason for training differences is the lower labour market attachment of a certain group of women, with reference to policy-implications, it does not matter if gender differences are ultimately caused by differences in training supply or demand: Measures increasing women's labour market attachment could then help increasing employees' and employers' training investments simultaneously.

2.2.2 Not all countries are the same

The VoC approach puts human capital in the centre of attention and considers labour market aspects and the educational system as important determinants of human capital development (Hall & Soskice, 2001b). It distinguishes between different types of market economies and highlights competitive advantages that originate from particular human capital features of these economies. Most relevant for this study, the contributions by Estévez-Abe indicate that gender inequality is related to these skill differences originating from national institutions (Estévez-Abe, 2005; 2006; 2009; 2012; Estévez-Abe et al., 2001). Although the approach strongly focuses on initial education at universities or in vocational programmes and does not discuss continuous training, its insights are highly relevant for the analyses of gender differences in continuous training as well.

Specific skills and gender inequality

Estévez-Abe's assumption that gender differences in training are influenced by national institutions is grounded on Becker's (1993) distinction between general and specific training. Becker (1993) defines general training as training that is useful in many firms. This type of training not only increases the marginal product of an employee in the training firm but in many others as well. Contrary to general training, Becker (1993) defines specific training as training that increases the employee's productivity in the training firm to a higher level than in other firms. Completely specific training is even useless outside the training firm. Most training is neither completely general nor completely specific but lies somewhere in between. Therefore, if it increases productivity in the training firm to a greater amount than in other firms, it is defined as specific whereas it is defined as general when it increases productivity in other firms at least as much as in the training firm. In line with that, Clark & Fahr (2002: 244) note that general training could be defined by means of its transferability.

The distinction between general and specific training offers a starting point for predicting training behaviour of male and female employees.[6] Estévez-Abe (2006: 151-152) points out that women are confronted with three gender-specific uncertainties: "(1) the risk of dismissal due to pregnancy and other family-related contingencies; (2) the risk of forsaking any return on their skill investments during 'voluntary' work interruptions such as child rearing; and (3) the risk of skill depreciation and missed opportunities for continuing skill formation during these work interruptions." These risks entail higher flexibility needs of women and discourage them to invest in specific human capital while causing a strong preference for general skills. Though only few empirical studies explicitly distinguish between general and specific training, the existing evidence mainly supports theoretical reasoning of a female preference for general training over specific training. Estévez-Abe (2006) shows that in 12 out of 14 countries, men are more likely than women to obtain a vocational degree, which is assumed to be strongly related to specific skills. Lynch (1992) finds that women participate in less on-the-job but more off-the-job training, and that off-the-job training is more general while on-the-job training is more specific. Supporting this idea, Chisholm, Larson, & Mossoux (2004: 43) find men to be significantly more likely than women to prefer learning in working environments and at the workplace, which is assumed to be more specific. Women, on the contrary, have a somewhat stronger preference for learning in non-working environments, which is associated with more general training. Edlund & Grönlund (2008), using data from the 2004 wave of the European Social Survey for 21 countries, find men to have more firm-specific skills than women.

To invest in specific training in spite of the disadvantages that specific skills provide, Estévez-Abe (2006) claims that women need institutional support to mitigate their risks. Coun-

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[6] Some of Becker's (1993) model assumptions are controversial. Especially the importance of completely firm-specific training is doubted as there are only very few examples of purely specific human capital (Lazear, 2003). For the following analyses, the important insight of the theory is the assumption that there is training that generates human capital which is of similar value inside and outside the training firm, i.e. enables the employee to demand similar wages in many firms, while there is other training that generates human capital that has a higher value in the training firm than in other firms, enabling the employee to generate higher wages in the training firm than elsewhere. For the purpose of this study it is irrelevant if these differences in the marketability of human capital arise from actual differences in productivity in different firms or if they arise due to market imperfections which might affect some types of training to a greater extent than others (e.g. certified training should be more marketable than non-certified training on-the-job, see Acemoglu & Pischke, 1999a); the focus lies on the differences in flexibility for the employees. Therefore, the distinction between purely general or purely specific training is not an essential assumption for this study. Preferences for general or specific training could exist even if there was neither completely specific nor completely general training if the types of training differ in their flexibility. The crucial feature here is the difference in flexibility as there should be differences in preferences between men and women.

tries differ in such institutional support. Moreover, as the VoC approach assumes, general and specific human capital is valued differently across countries. Consequently, the author concludes that women's preferences for general human capital have different implications, depending on the country where they live and work.

Based on the VoC approach and the work by Estévez-Abe (2005; 2006; 2009; 2012), three sets of institutions seem to be relevant for the gender gap in training participation: The labour market and the educational system, which both reflect the focus on general or specific training, as well as the institutional support for women, which possibly helps to mitigate gender differences by incentivizing and securing investments in female human capital. In the following subsections, the assumed impact of these institutions on the gender training gap is presented in detail. The theoretical and empirical work on the relationship between the institutions and gender equality will be discussed covering theoretical and empirical results of previous studies.

2.2.2.1 The labour market, training and gender equality

A country's labour market is supposed to reflect the skill needs of the companies acting in this market. As Hall & Soskice (2001a) argue, the demand and support for specific human capital are caused by companies' production strategies that concentrate on high-quality production. They require employees with a sound knowledge of the firm or industry, who are able to work autonomously, perform a wide range of tasks and detect and solve problems in the production process. In those settings, coordination between the labour market actors and a focus on long-term employment are necessary to encourage employers and employees to invest in human capital, especially in specific human capital. Employees can otherwise be expected to underinvest in such skills because without labour market coordination and long-term employment, they do not have the security that their specific investment will pay back. On the other hand, there are countries with labour markets that focus on general human capital. These countries are characterized by more market-driven relationships between the actors that result in rather short-term employments. The countries' labour markets usually have a strong focus on general human capital as this fosters employee mobility and supports the radical innovation strategies pursued by many companies in these countries (Hall & Soskice, 2001a).

Thus, the VoC literature links the skill focus to the long-term orientation and the degree of coordination in a country's labour market respectively. The labour market coordination is mirrored in the industrial relations of a country. As the possible effects of long-term orientation and industrial relations on training in general and more specifically on the gender training gap are rather complex, this section discusses the theoretical arguments in detail before referring to empirical evidence. At the end of this subsection, a short summary of the most important insights is given and propositions for the following analysis are derived.

2.2.2.1.1 Long-term orientation, training and gender equality

Since long-term employment lowers the risk for employers and employees to lose their skill investments, it is assumed to favour training and especially specific training (Scoones, 2000; Stevens, 1994; Stevens, 1996). The reason is that investments in specific skills increase the mutual employer and employee dependency since the investments can be seen as sunk costs for both parties. Both employee and employer are less likely to end the employment relationship because neither party would be able to recover these costs outside the specific relation. This again raises tenure and makes further investments in specific human capital less risky. Hence, there is a mutually reinforcing relationship between long-term employment relations and the accumulation of specific human capital (Becker, 1993; Hall & Soskice, 2001a). Conversely, the accumulation of purely general human capital does not depend on long-term employment. Estévez-Abe et al. (2001: 169) suggest that short tenure rates, a sign for short-term orientation, can be interpreted as a sign of a focus on general human capital because general human capital can be accumulated by job experience from many different firms. Consequently, labour markets with more long-term employment relations should foster specific skills to a higher extent than labour markets with shorter employment relations while labour markets with more short-term employment should provide incentives for employees to invest in more general training.

Though from an employee's perspective, long-term employment may appear to be something plainly positive at first sight, Estévez-Abe (2005: 193-194) points out that it also has the potential to cause disadvantages for women. First, maternity leaves in labour markets with typically long-term employment can be more detrimental for women's careers as they miss time in the company and have fewer possibilities to build up specific human capital than their male colleagues. Second, in labour markets with long-term orientation, employers may prefer employing men as they are expected to have lower turnover rates, which not only enhances the accumulation of specific human capital but also involves lower risks of losing training investments. Furthermore, in countries with a long-term orientation, it is typically more difficult for employers to hire maternity-replacement on a short-term basis. This is not only because hiring and firing costs are generally higher than in countries with short-term employment relations but also because the specific skills usually necessary to work in these companies are not readily available on the labour market. This leaves the employer with two options: To divide the tasks among the remaining workers or to hire replacement and invest in the specific skills of this new employee. With an increasing proportion of young women among the employees, the first option becomes less viable and expensive replacement investments are more likely to be necessary. As maternity-replacement is thus more expensive in labour markets with long-term orientation, in these countries it is rational for employers to prefer hiring men instead of women. Consequently, statistical discrimination against women should be exacerbated in countries focussing on specific human capital and women should have fewer possibilities to acquire specific skills. Empirically, Estévez-Abe (2005) finds that in countries with high tenure rates, women are less likely to occupy managerial posts. This can be interpreted as a sign of stronger vertical segregation due to a stronger focus on specific human capital in labour markets with a prevalent long-term orientation.

2.2.2.1.2 Industrial relations and training

Theoretical Background

Exit-voice-theory suggests that trade unions give employees the possibility to express criticism if they are discontent: When employees are unhappy with their working conditions, instead of just leaving their employer, they can communicate problems via union representatives without fearing any personal sanctions by their employer (Freeman & Medoff, 1984; Hirschman, 1970). This, in turn, gives employers the opportunity to solve these problems if they want to. Thus, unions have the potential to lead to improvements at the workplace and to raise workers' morale. Freeman & Medoff (1984) argue that through this mechanism, unions are able to reduce turnover and increase tenure rates. Hence, if unionised firms are less likely to lose their trained staff, they have higher incentives to invest in training.

Moreover, trade unions have the potential to lead to wage compressions, especially at the lower end of the wage distribution (Freeman & Medoff, 1984). On the one hand, these wage compressions can be reflected in the economic returns to skills and compress the returns to training for employees (Blau & Kahn, 1996). This way, employees are not able to gain wages at their full marginal productivity and cannot recover their investment even though they took general training. This may disincentivize employees to invest in their own training (Acemoglu & Pischke, 1999a). On the other hand, wage compressions can be an incentive for employers to invest in training as they are able to pay wages lower than their employees' marginal product after training (Acemoglu & Pischke, 1999b). This is especially true when it comes to lower educated employees since in markets with wage compression employers have to pay relatively high wages to low-skilled employees compared to high-skilled employees. After training, the employers can recapture their investments in the low-skilled by wages below their marginal product (Pischke, 2005). Streeck (1992: 259) puts it more drastically. He argues that when unions lead to "rigid and high wages, an egalitarian wage structure", they make it impossible for companies "to be profitable in mass market for standardised, price-competitive products." However, firms being prevented from having to compete in a low-wage, mass production segment may realize that these constraints can actually be beneficial for them and provide a competitive advantage because the "excess skills" offer the possibility to produce for differentiated, quality-competitive, customized markets (Streeck, 1997: 203).

However, unions may not only indirectly affect training through higher tenure rates or wage compression. To raise employability and to reduce the risk of unemployment, unions should have an interest in directly fostering continuous training by including it in their collective bargaining (Heyes, 2007). Therefore, there might be a direct effect of unions on training as well.

Concerning the type of training, the indirect union effects caused by increased tenure and wage compression providing employer incentives to invest in training, should especially foster the provision of specific training. Nevertheless, Heyes (2007: 243) points out that employers and employees do not have the same preferences when it comes to training investments. Employers should be interested in training that is mainly useful in their own company, hence specific. While workers might share these preferences to a certain extent, as this kind of training can augment job security with their current employer, they should also be interested in general training which is useful outside the training company to raise their overall employment security. Edlund & Grönlund (2008: 250) claim that since unions want to minimise their members' dependence on one employer, they should push for training contents that are more general and applicable in other than the training firm as well. Similarly, Dieckhoff, Jungblut, & O'Connell (2007: 84-85) argue that when unions are weak and do not oppose this practice, employers are more likely to invest in specific training to increase employee dependence and to bind them to the company. Thus, while trade unions may indirectly support the provision of specific training through higher levels of tenure, they may directly engage in bargaining over training that is of more general nature to lower their members' dependence on one employer.

Empirical findings

The assumption that unions strive to foster their members' employability is supported by empirical evidence: In a number of countries, unions are involved in bargaining over the access to employer provided training (Ok & Tergeist, 2003). Mahnkopf (1992) identifies several bargaining agreements negotiated by German unions to improve continuous training. In Spain, the first Tripartite Agreement on training was signed in 1992 and has been followed by renegotiated agreements since (Rigby, 2002). Studies by Dundon & Eva (1998), McIlroy (2008) and Bacon & Hoque (2011) stress the importance of union involvement in training initiatives in Britain. In several European countries, unions even established specialised union posts that focus on training issues (Dekker, Grip, & Heijke, 1994: 388). However, as Heyes (2007) points out, the fact that training is included in collective bargaining may not be enough. Although unions may be aware of the importance of continuous training, they may not have the power to enforce such agreements at firm level and may be unable to influence training supply. One reason for this may be that for union representatives at the workplace level, there are a number of other issues that have a higher priority than training. Another reason may be that they have little influence in the training plans at the company level (Rigby, 2002: 507-508).

While early U.S. studies found a negative relationship between unions and training (e.g. Duncan & Stafford, 1980; Mincer, 1981; Barron, Fuess, & Loewenstein, 1987), more recent studies usually find a positive link. Lynch (1992) finds evidence of a positive effect of union membership on training of young American workers. Green & Lemieux (2007) find unionised workers in Canada to participate in more training than non-unionised workers. Controlling for sector, firm-size and tenure, however, results in a negative relationship between unionization and training participation. Nevertheless, the authors find some evidence that for male unionised workers, employers' participation in the financing of training is higher than for non-unionised workers. The authors suggest that one reason for the weak union effects may be that the effect of unions is rather indirect and raises tenure and job stability, which in turn increase employers' involvement in the supply of training.

Yet, the results of the relationship between individual union membership and training might suffer from a selection problem as individuals that decide to become union members might differ from other employees in unobserved characteristics which make them more or less likely to train. Other studies therefore include union coverage at the workplace to scrutinise the effect of unions on training. For Germany, Dustmann & Schönberg (2009) find that training in apprenticeship programmes is higher in firms that recognise union wage agreements. Similarly, Kennedy, Drago, Sloan, & Wooden (1994) using data from the Australian Workplace Industrial Relations Survey find a net positive training effect of unions that are active in the workplace (and not only have representatives in the work-force). Booth, Francesconi, & Zoega (2003) look at the impact of bargaining coverage on training of British males. They provide an overview of the different potential effects of unions on training and verify them empirically. They find union-covered workers more likely to receive training and to receive more days of training compared to non-covered workers. The effects are quite large: Training incidence among union-covered workers is five percentage points higher and union-covered workers receive four additional days of training. After training, these workers also get higher wage premiums. The authors suggest higher retention rates of experienced union-covered workers to be a reason for this, as these larger gains were obtained by union-covered workers with long tenure. These results are in line with those by Kennedy et al. (1994: 321) who found that unions lead to an emphasis of long-term employment relationships. Almeida-Santos & Mumford (2005) measure unionism not only in terms of an individual's current union membership but also take into account whether the workplace recognises unions in the wage negotiation process. They find union membership to be positively related to training participation, both duration and incidence, while union representation at the workplace does not seem to be positively associated with training. Nevertheless, they find higher levels of relative wage compression to be associated with more training. Consequently, there might be indirect union effects on training through wage compression.

The previously stated studies look at union variables at the individual-level and may not be directly transferable to the macro-level, especially since the relationship between unions and training is found to be quite complex. One of the few studies that analyses this relationship at the country-level is conducted by Brunello (2004) and looks at unions and training participation in ten European countries. Although the author does not find any significant impact of union density on training, he finds the likelihood of training to be higher in countries that have a more compressed wage structure. The author therefore argues that unions may have an indirect effect on training if they achieve wage compression. Bassanini, Booth, Brunello, De Paola, & Leuven (2005) analyse the relationship between unions and training in countries with low extension of union contracts. Here, they find a positive, but imprecisely estimated relationship which does not reach the 10% level of significance. Dieckhoff et al. (2007) study training participation in seven European countries. In a multilevel analysis, they include measures of union density and wage compression at the sector level. Not only do they find significant positive relations between wage compression and training but also between union density and training. This direct link to union density indicates that unions are involved in bargaining to increase work-related training.

There are only a few empirical studies explicitly referring to the type of training supported by unions. Rigby (2002: 505-506) finds union representatives at the federal and confederal level in Spain to be highly concerned about the importance of the transferability of training. In interviews, the representatives characterised the supply of training that is transferable to other companies as important. Nevertheless, the transferability of skills does not have the same importance for union representatives at workplace level. General training was mostly promoted in larger and better organised companies, while it did not reach high importance in smaller firms. However, training directly supplied by unions indeed was general. The heterogeneous priorities of union representative found by Rigby (2002) may be mirrored in the results of a multilevel study by Edlund & Grönlund (2008). Based on data of the European Social Survey, the authors examine the level of firm-specific skills across 21 European countries. Analysing the determinants of the level of on-the-job training required for performing the employees’ jobs (an indicator for skill specificity), the authors do not find a significant relationship between skill specificity and union density. Still, they find high union density to be significantly positively related to employee-power (defined as the ability of the employee to find an equally attractive job) and significantly negatively related to mutual employer-employee dependence (employee-power relative to the ability of the employer to find an equally qualified employee). While the assumption that employees’ independence and flexibility is fostered by unions can be supported by the empirical results, it remains unclear if this is due to differences in training or other aspects of union policy.

Thus, empirical findings seem to reflect the complex relationship between training and unions suggested by theory. Direct union effects on training are usually not found, although union representatives (at least at higher hierarchal levels) appear to campaign for training, especially for general training. Still, several studies find relationships between unions, tenure, wage compression and training and therefore suggest an indirect relationship between unions and training.

2.2.2.1.3 Industrial relations and gender equality

Theoretical background

The previously described union effects on general and specific training could have differing effects on training of men and women. Because women are assumed to have a stronger preference for general human capital than men, union policies fostering either general or specific training should have an indirect impact on the gender training gap. These processes might not follow a conscious union strategy of supporting training for either men or women but simply be part of general union strategy to raise employment security. In addition to that, unions may however directly engage in gender equality issues. In other words, unions may explicitly defend interests of men and women to a different extent if male and female employees have differing needs.

Median-voter theory suggests that organizations like unions should be most interested in maximizing the utility of their median members (Downs, 1957). Since union leaders strongly depend on the votes of this group to be re-elected as union representatives, they should be most concerned about the needs of their median members (Farber, 1978). In most unions, these are male, senior, full-time employed manufacturing workers (Oswald, 1985; Waddington, 2000). Traditionally, women occupied marginal jobs, worked reduced hours and were not covered by unions. Even today, they are often atypical or non-standard workers and are concentrated in industries and occupations that are typically not covered by collective agreements (Dickens, 2000). This could have an impact on union policy when it comes to defending the interests of female workers as male interests may dominate the trade unions' agendas.

However, changes in the composition of employment away from manufacturing towards the private service sector have led to a decline in union membership and unions' influence in many European countries (Ebbinghaus & Visser, 1999). Faced with this trend, many unions have been forced to change policies and to engage in reform processes to survive. With their previous focus group declining in number and relative importance, the attraction of workers from formerly underrepresented groups becomes essential (Waddington, 2000). By taking into account specific female needs, trade unions would not only attract new groups of potential union members previously marginalised but also defend their innate goals and values of social justice and equality. Widening their focus away from the typical male manufacturing worker, unions could gain in legitimacy as they would represent the interests of a larger proportion of the employees in the labour market. Hence, trade unions should have an interest in defending women's equality in the labour market. One way to attract female union members could be campaigning for continuous training. As McIlroy (2008: 242, 299) states, by following a training strategy, unions might not only become more attractive for existing members but also appeal to more women. However, as training preferences of men and women differ, the same training may not be equally attractive for men and women.

Empirical findings

Mahnkopf (1992: 76) finds German trade unions making explicit efforts to recruit more women. But apart from recruiting activities, union policies have to engage in defending women's interests if unions want to become attractive for female workers. Dickens (2000) states that for that reason, there are efforts to strengthen women's influence in union policy – even though the majority of decision-makers and office-holders in unions is still male. Several unions installed women's sections as well as reserved seats systems, which have not only raised the number of women involved in union policy but also strengthened the profile of female trade unionists. Although these mechanisms have not lead to gender equality so far, they have increased female influence in unions (Waddington, 2000). This shows that the topic of gender inequality has reached the agendas of union policy. In line with that, empirical findings by Heery (2006: 539) indicate that unions have the potential to fight gender inequality. He finds that unions can promote gender equality and that the issue of equal pay is part of unions' bargaining agenda. He concludes that strong unions should lead to more gender equality at the workplace. Likewise, Günseli's & Bilginsoy's (2000) analysis of apprenticeship programmes in the US reveals that apprenticeships which are jointly sponsored by unions and employers, support the graduation of female apprentices to a higher extent than programmes that are sponsored by the employer only. Results by Rigby (2002) summarize the issue of gender equality and unions in a vivid way: On the one hand, he finds unions to be highly concerned about equality issues. One goal explicitly expressed by union representatives is to reach equality in training access, widening training access for women, low-skilled and older employees. In union sponsored training plans, equality issues are also of high importance. However, in practice, the focus of these equality efforts is mainly on training access for low skilled employees rather than on women.

While there is no empirical evidence of unions' gender equality effects on the macro-level, Roosmaa & Saar (2010) analyse training inequality between high and low skilled individuals in 23 European countries. Based on the EU Labour Force Survey of 2003, the authors find that a higher degree of trade union coverage in a country decreases inequality in continuous training. These results are relevant for this study since ability and gender are assumed to interact in their effects on training.

2.2.2.1.4 Summary and propositions concerning the labour market

A long-term orientation in the labour market should raise training incentives – especially when it comes to specific training – because the risk of losing these investments is reduced. Nonetheless, it can cause disadvantages for women compared to men since in these labour markets employers should have a higher preference for employing men instead of women. Moreover, in long-term oriented labour markets, maternity leaves are more detrimental for human capital development as specific human capital can only be acquired at the workplace. Thus, a focus on long-term employment should lead to gender differences in training participation and a female disadvantage because it fosters investments in specific training.

The effects of unions on training are more complex. Based on theoretical reasoning, unions can be assumed to raise employer incentives to invest in continuous training, while lowering employee incentives to invest in training. Net effects obviously depend on the relative importance of the contradicting effects. However, since most work-related training is largely employer paid (see Bassanini et al., 2007: 214), it may be reasonable to argue that the presence of strong unions is likely to lead to an overall raise in work-related training. Nevertheless, there may be differing effects of unions on training of different groups of employees. Wage compressions at the bottom of the wage distribution scale should make the employment of unskilled labour less efficient than skilled labour and raise incentives for employers to invest especially in training for the lower skilled. The direction of the union effects on women seems to depend on the focus of union policy. If unions focus on attracting new members, they may engage in combating gender inequality in the labour market. One way to do this is to foster training for women. This training should then preferably be of a general nature, which is in line with union goals in terms of employability. By contrast, if unions are most concerned about the needs of their median voter, male interests should be the most important basis of union policy. Male unionists may have a stronger interest in long-term employment and specific human capital opposed to a more flexible employability concept and general human capital that should be attractive for women.

The empirical results on unions and training are consistent with the complex relationship proposed by theory and it is unclear whether union effects on training arise from direct bargaining or indirectly through longer tenure rates and wage compression. The direction of the effect seems to be clear, though: Most empirical studies find union membership or union presence to be positively related to training participation. Still, empirical findings also point to discrepancies in unions' policy agendas and their actual practice at the workplace. Although union representatives at higher levels point out the importance of general training, support for general training does not seem to be strongly implemented at workplace level. Concerning gender equality and union policy there is a similar picture: While unions seem aware of the importance of gender equality, women are still underrepresented in unions, and efforts to increase training equality are still rather focussed on the support of lower educated than on the support of female employees. As women have a strong preference for general training whereas men do not, it can be assumed that the stronger the industrial relations are the higher is the training advantage of men.

For lower educated women, union effects on training should be stronger than for highly educated women since collective bargaining agreements and wage compression are less likely to have an impact on training of highly educated employees. Employees of higher education usually have a better bargaining position vis-à-vis their employers as their skills are less frequent at the labour market. Lower educated workers should therefore depend to a higher degree on union policy and strong industrial relations should especially support training for employees without university education. Cross-country differences in union strategies should then be especially relevant for the gender training gap between men and women without university education while it should matter less for employees with university education. Thus, the (in)equality effects of unions on training should be more pronounced for employees without university education than for employees with university education. It can therefore be assumed that the stronger the industrial relations system is, the less training do women receive compared to men while this relationship is more pronounced among lower educated employees.

2.2.2.2 The educational system, training and gender equality

Theoretical background

The educational system is often discussed as a determinant of social class equality (Ambler & Neathery, 1999; Hanushek & Wößmann, 2006). However, the educational system may not only have an impact on class equality but on gender equality as well (Estévez-Abe, 2012).

The skill needs of a countries' labour market have to be met by its educational system. Differences in skill needs should therefore translate into differences in the national education systems. At universities, students usually get a quite general education that prepares them for working in different companies, jobs or even industries. For that reason, university education is usually seen as generating general human capital. On the contrary, vocational education is usually more specific. Especially when firms are involved in defining curricular, like in company-based training schemes (partly in the Netherlands or Luxembourg) or in apprenticeship systems (e.g. in Germany or Switzerland), the specificity of the training content is considerably higher compared to university education since it usually prepares for a specific job in a specific industry and oftentimes contains skills or knowledge necessary in a specific firm. However, Estévez-Abe (2012) argues that vocational programmes whether they have a strong employer involvement or not, are less gender neutral than general programmes as the former lead to qualifications in a specific field and induce gender segregation. Not only are gender stereotypes likely to be reinforced by early sorting into occupational fields but, most importantly, women planning to have children may be more likely to select occupations that offer higher flexibility and are more compatible with family responsibilities while avoiding other occupations. Countries relying heavily on university systems can therefore be seen as having a stronger focus on general human capital and being more gender-neutral whereas countries relying on a vocational training system can be seen as having a stronger focus on specific human capital and being less gender-neutral (Estévez-Abe et al., 2001).

Estévez-Abe et al. (2001) assume that in countries where product market strategies mainly rely on specific human capital, societies are more likely to be egalitarian than in countries where general human capital is prevalent. They argue that vocational schools and apprenticeships in specific skill regimes offer an alternative to reach a certified qualification for those who are academically weak. On the contrary, in general skill regimes, there are no good alternative means of achieving labour market success for those students who are academically weak. Hence, they are usually trapped in low-paid, unskilled jobs. Roosmaa & Saar (2010: 184) apply this rational to the provision of continuous training and assume that training opportunities are more equally distributed in countries that focus on specific skills than in countries that focus on general skills. They suppose the training gap between high- and low-skilled employees to be lower, the higher the proportion of workers with vocational skills.

Even so, Estévez-Abe (2005: 193-194) claims that systems relying on specific human capital provide disadvantages for women: As women have a higher probability of career interruptions, the accumulation of specific human capital which has limited market value outside the training firm is less attractive for them than for men. She further suggests that employers that value specific skills prefer employing men because of their expected lower turnover, which not only enhances the accumulation of specific human capital but also involves lower risks of losing training investments. Additionally, in specific-skills-countries parental leaves are more expensive since replacement workers having all necessary skills are not easily found on the labour market. Consequently, statistical discrimination against women and labour market segregation should be exacerbated in countries focussing on specific human capital and women should have fewer possibilities to acquire specific skills.

Though not explicitly stated, it can be deduced from the VoC literature that the focus on specific training in countries with a strong vocational training system continues throughout an employee's career and results in a focus on specific continuous training. By the same token, countries with an emphasis on initial training at universities, that generates general human capital, would focus on general continuous training afterwards (Hall & Soskice, 2001a).[7] If the focus of continuous training is in line with the focus of the initial training system, more general continuous training will be conducted in countries with strong uni-

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[7] On the other hand, there is some empirical evidence that suggests initial and continuous training to be compensating which could result in a change of focus from initial to continuous training (Beck, Kabst, & Walgenbach, 2009; Goergen, Brewster, & Wood, 2009; Backes-Gellner, 1999). In this case employers and employees in countries with a strong vocational system would focus on general continuous training to complement their specific human capital generated by the initial training system. In contrast, in countries with university systems the focus would be on specific continuous training to complement the general human capital generated at universities. However, against the background of the VoC approach, the complementarity argument does not make sense when it comes to the type of human capital. The VoC approach argues that economies gain competitive advantage precisely because of their rather one-sided focus on general or specific training. A change in focus from general to specific human capital or vice versa would macerate this comparative advantage.

versity systems, and more specific training in countries with strong vocational systems.

In summary, specific training should be more prevalent in countries with strong vocational training systems. On the contrary, university systems can be taken as a sign for a stronger focus on general training. This may have differing effects on training participation of men and women and employees of different educational backgrounds: While inequalities between employees of different education might be moderated in specific training systems, gender inequalities could be aggravated. The opposite may be true in countries focussing on general training.

Empirical findings

In the few quantitative studies that analyse institutional determinants of employee training, the educational system and skill structure are usually found to have an important impact on continuous training (e.g. Bassanini et al., 2007). Brunello (2004) finds a positive training externality in the relationship between education and training. He shows that training does not only increase with individual education but also with the proportion of educated employees in the labour market. This portion is obviously reflects a country's educational system.

Estévez-Abe (2006) offers some empirical evidence for the assumption that the educational system has an impact on gender equality in a country. She shows that in countries where vocational education is important (a high share of the population has a vocational degree) women are less present in the private sector workforce. Moreover, analysing occupational segregation in 14 countries, Charles (2005) finds women to be more strongly represented in skilled manufacturing or managerial occupation in countries with higher rates of university graduates.

Empirical evidence on the impact of the educational system on training equality is scarce. The only study addressing this topic is conducted by Roosmaa & Saar (2010) and refers to training inequality between employees of different educational backgrounds. Though not targeting the gender training gap, it gives insights into the relation between previous education and training and may therefore be relevant for understanding the gender training gap at different educational levels. The authors find that the vocational specificity of the education system (percentage of upper secondary school students enrolled in vocational education) has no significant impact on training inequality. Concerning the importance of the university system, the analysis shows mixed results. For the EU-15 countries the authors find inequalities to be lower in countries with high levels of university graduates. However, for the new member states, the relationship is reversed. Thus, the study does not provide support for the claim that countries strongly focussing on university education (and general human capital) provide disadvantages for the lower educated when it comes to training while countries focussing on vocational education (and specific human capital) lead to more training equality.

Propositions

The educational system determines the human capital stock in the labour market and lays the ground for further continuous training. Following the VoC approach, there are educational systems focussing on the provision of specific human capital while others focus on general human capital. In countries focussing on specific human capital, chances for women's career development should be lower than in countries focussing on general human capital. On the one hand, this is because specific human capital is at odds with women's training preferences. On the other hand, this is because employers fear the loss of their human capital investment. Further, maternity replacement is costly in specific human capital regimes. Yet, as highly able women have higher incentives to return to the labour market early after childbirth, these problems should be less pronounced for them (though still existent since even short maternity leaves impose additional costs on the employers). The problem of the specific skill system should, however, be very relevant for average women whose non-market returns are likely to exceed their market returns while they have small children at home. As these women are assumed to take longer maternity leaves, specific human capital appears especially unattractive for them while employers should refrain from investing in these women's specific human capital, too.

In summary: The stronger the focus on specific human capital in the educational system is, the less training should women receive compared to men. This relationship should be especially detrimental for women of average ability. Women of very high ability should be less affected as their labour market attachment is similar to men's.

2.2.2.3 The support for women, training and gender equality

Theoretical background

Estévez-Abe et al. (2001) claim that women need more institutional support than men to invest in specific training. Apart from a stable employment situation, they need protection against dismissal in case of pregnancy as well as guarantees of reinstatement at the same level when returning to work. To prevent women from falling behind their male colleagues when it comes to investments in specific human capital, the authors emphasise that affordable childcare is most important. Employers could be more reluctant to invest in training of female employees, too, since the probability of losing this investment might be higher compared to investments in male human capital. This is especially true in countries were institutional support in terms of childcare etc. is not extensively available as in those countries, mothers have more difficulties returning to their job after childbirth.

However, as Estévez-Abe (2005: 192-193) argues, "*women-friendly*" policies do not always lead to more gender equality in the labour market. Many countries offer paid parental leaves and child benefits to protect families against high losses of income after childbirth. These policies can have negative effects on female human capital development as generous maternity leaves augment mothers' time out of the labour market. This is especially detrimental as child rearing years collide with the early years of career that are usually decisive for labour market success. Consequently, maternity leave policies may widen the differences in labour market participation between men and women as prolonged maternity leaves delay women's acquisition of human capital. Further, long parental leaves are costly for employers, as they have to replace the missing worker by redistributing tasks to other workers or hiring a new one. Extensive childcare, allowing mothers to return to their workplace early, reduces such costs for employers and makes hiring women less risky and hence more attractive.

Further, Estévez-Abe (2006) points out that cultural aspects are likely to translate into gender differences in the labour market. As she postulates, "traditional gender norms…reduce overall female labor-force participation rates" (Estévez-Abe, 2006: 164) and lead to a higher female specialization in non-market work. The negative attitudes towards female labour market participation, which may cause inequality between men and women in general aspects like labour market participation, pay or qualification, are likely to lower women's training participation, too. It is thus likely that labour markets which show inequality between men and women in general aspects also show differences in training participation of men and women.

Empirical findings

Using employee data from the European Social Survey, Dieckhoff & Steiber (2011) analyse gender effects on training in 23 European countries. Controlling for individual and occupational characteristics, they find women to train less than men. While the gender gap in training appears rather similar in most European countries, the authors identify a smaller gap in Nordic countries than in the rest of Europe. They explain this result with unique Scandinavian characteristics like the combination of high female labour market participation and a modern gender culture. However, they do not measure these characteristics as such but include a dummy for Nordic countries in their models. Consequently, the lower gender training gap in Scandinavia cannot clearly be attributed to these factors.

Propositions

Women appear to need more institutional support than men to invest in specific training. Policies providing the possibilities and incentives for women to return to the labour market early after childbirth can mitigate gender differences in the labour market in general and in training participation. However, effects on women of different ability levels are likely to differ. Average women should depend on these policies to a stronger extent. As their labour market returns are usually lower, their labour market attachment is assumed to be lower as well. Thus, their time out of the labour market should be more strongly affected by "*women-friendly*" policies. On the contrary, women of high ability are usually in a better bargaining position per se and depend to a lower extent on favourable institutions.

Therefore, it can be assumed that the higher the incentives for women to return to the labour market early after childbirth, the more training women receive compared to men. The relationship between these incentives and training should be more pronounced among lower educated employees. Moreover, a modern gender culture at the labour market could translate into more gender equality in training. Thus, in countries where men and women are more equal in terms of other labour market characteristics, training should be more equally distributed as well.

2.2.2.4 On the complementarity of institutions

Analysing the institutional determinants of the gender training gap, this study follows a variable oriented approach, meaning that all previously described relationships between an institutional characteristic and the gender training gap will be looked at separately. An alternative would be to choose a case-oriented or configurational approach, where countries are clustered by bundles of institutions. Such an approach is frequently used in the VoC literature as it is argued that national institutions complement each other leading to specific combinations of institutions that compose two stable equilibriums: A liberal or a coordinated market economy. For example, it is argued, that in coordinated market economies, strong vocational education systems, which foster specific human capital, complement labour markets with long-term employment relationships, which favour specific human capital as well. On the other hand, in liberal market economies, university systems focussing on general human capital complement short-term oriented labour markets, which need employees with general skills to fulfil their flexibility needs. In both configurations, the different institutions are assumed to mutually reinforce each other (Hall & Soskice, 2001a).

Although the previously discussed institutions might somehow complement each other (Estévez-Abe, 2005), this study chooses not to cluster countries or bundle characteristics into classifications. This is because existing country classifications based on national institutions are highly controversial (see Becker, 2007: 263). The VoC approach, despite offering a convenient framework for theoretical reasoning, does often not hold true when it comes to an empirical analysis of its country classifications or its assumption of institutional complementarities that are supposed to lead to either coordinated or liberal market economies. Many studies criticise Hall & Soskice (2001b) for a somewhat arbitrary alignment of some countries to these categories (e.g. Becker, 2007). Especially the group defined as coordinated market economies is often found to be highly heterogeneous (e.g. Dieckhoff et al., 2007; Busemeyer, 2009). Nevertheless, the group of liberal market economies is not homogeneous in many aspects either. Estévez-Abe (2005) points out, that countries classified as liberal market economies differ in their vocational training systems. Most prominently, Britain, which is classified as a typical liberal market economy, has an apprenticeship system, something usually termed as a typical sign of coordinated market economies. As Hall & Soskice (2001a) depart from a conclusion by Finegold & Soskice (1988) that the British initial vocational training system, though existing, is not working effectively in terms of supporting international competitiveness, they treat it as an unimportant nuance and do not include it in further reasoning. Estévez-Abe (2005) criticises that view as she finds vocational training systems (independent from their effect on international competitiveness) to be related to occupational segregation and equality of men and women in the labour market and therefore worth including in a comparative analysis. Further, as the VoC approach argues that liberal and coordinated market economies represent a stable equilibrium of institutional characteristics, the classifications do not allow for dynamic change. However, Schneider & Paunescu (2012) find institutions to vary over time. Out of the 26 OECD countries analysed, they find that between 1990 and 2005, four had moved from a coordinated labour market economy closer to a more liberal one.

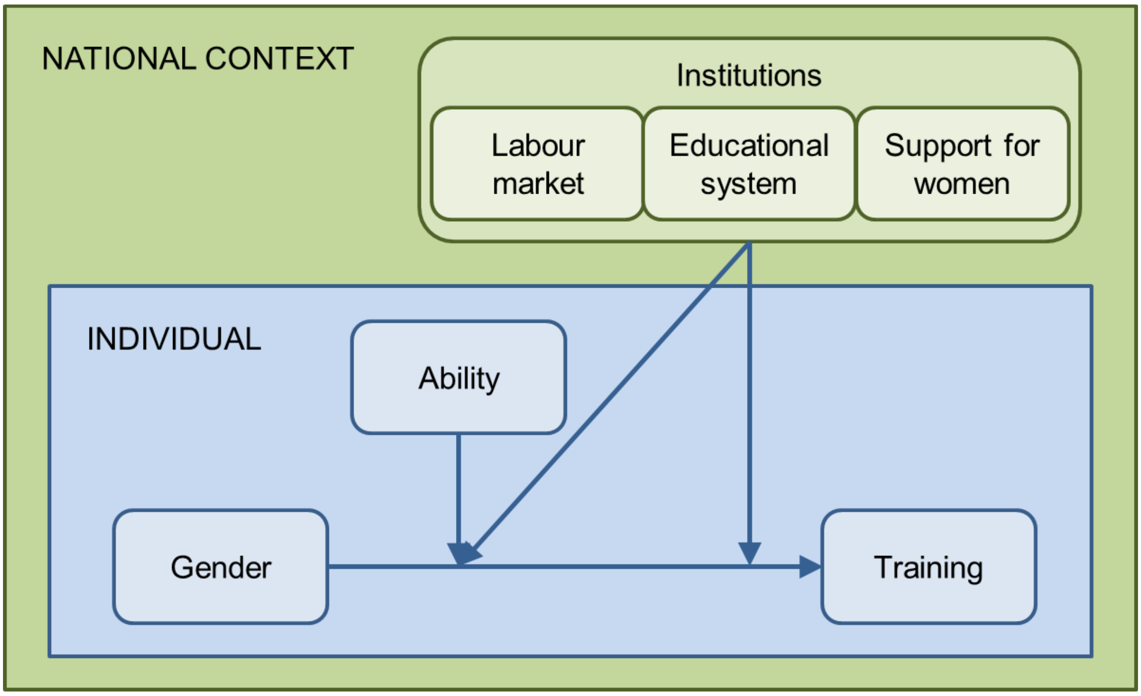
Therefore, it is not surprising that empirical studies that analyse the link between training and the VoC classifications do not provide a clear picture. Dieckhoff et al. (2007) do not find any clear relationship between continuous training and the VoC categories. However, when looking at single features of the labour market (union density and wage compression) the authors do find positive effects on training.

Consequently, the configurations of capitalism proposed by Hall & Soskice (2001b) do neither meet the requirements of a study on gender differences nor on educational and training matters as they ignore important national differences. Other configurational approaches usually resemble the disadvantages of the broad categories and inflexibility in terms of dynamic developments discussed for the VoC configurations (e.g. Esping-Andersen, 1990; Amable, 2003). Yet, they must be seen as less relevant for this analysis than the framework by Hall & Soskice (2001b) and Estévez-Abe et al. (2001), since they do not put human capital in the centre of attention. For these reasons, this study chooses to use a non-configurational approach and to analyse the possible effects of institutional characteristics independently from of each other.

2.2.3 Synthesis of the theory and deduction of hypotheses – a multilevel model

As shown in this section, classical human capital theory, which predicts a clear training advantage of men over women, is not able to explain recent empirical results on the gender training gap. Hence, additional approaches should be taken into account when analysing the gender training gap. On the individual level, arguments by Lazear & Rosen (1990) suggest that classical human capital rationales are only valid for average women, while highly able women should not be disadvantaged. On the institutional level, Estévez-Abe (2005; 2006; 2009; 2012) indicates that gender differences are driven by a country's focus on general or specific human capital, which is reflected in its labour market and educational system. These differences may be mitigated by institutions supporting investments in women's specific human capital. Consequently, the labour market, the educational system and the support for women could help to explain cross-country difference in the gender training gap.

Figure 1: Summary of the assumed relationships – a multilevel model



Graphically, the relationships relevant for the following analyses are summarised in Figure 1. Most importantly, the effect of gender on training is assumed to interact with ability as suggested by Lazear & Rosen (1990): Being a woman may have no impact on training participation among highly able employees, while having a negative impact among average employees. Further, institutions describing characteristics of a country's labour market, the educational system and support for women are suggested to have differing effects on training participation of men and women. Here, an interaction with ability is supposed to be relevant as well, i.e. the institutional setting may have differing effects on women (and men) of differing ability levels. In the following, the assumed effects of the proposed determinants on training and their operationalization are described in greater detail before deriving the hypotheses to be tested in Chapter 4.

Ability, education and the gender training gap

Although classical human capital theory points to a consistent training disadvantage for women, insights by Lazear & Rosen (1990) suggest that this is only true for a proportion of female employees. Women with high ability should not suffer from statistical discrimination. Moreover, if their labour market attachment is comparable with the attachment of men, investment rationales from an employee's perspective should also not differ between men and women.

While the ability of an individual is usually difficult to observe, education is a common proxy for ability in economic studies. This is because human capital theory assumes investments in human capital to be directly related to the expected returns of these investments. Individuals of higher ability should be willing to invest more heavily in their education and training than others as they can expect higher returns from that training than individuals of lower ability (Becker, 1962: 46; Mincer, 1958: 285-287). This rationale is equally valid for previous education as for continuous training: Highly able individuals seek higher educational levels at younger ages and train more often during their employment career than less able individuals. This leads to a strong correlation between initial education and continuous training. Besides, Cunha & Heckman (2007: 31) argue that skill investments at different stages are complements and individuals that already possess certain skills can acquire others more easily. The authors point out the importance of dynamic skill complementarity. This means that skills acquired in one period augment the productivity of skill investments at later periods, i.e. skills are synergistic. Hence, educational investment at early ages makes later investment more fruitful. In a similar vein, the authors assume a self-productivity of skills, i.e. they assume skills to be "self-reinforcing and cross fertilizing" (Cunha & Heckman, 2007: 35). Following Cunha & Heckman (2007), if skill complementarity and self-productivity are important for skill development, all current skill development can be seen as determined by previously acquired skills. Therefore, if previous skill investment was rather meagre, an individual may lack certain skills necessary to be trained efficiently. For example, for someone who already has good general computer skills, learning to use a new software program is usually much easier than for somebody who has only very basic computer skills. Further, an employee having broad computer skills can combine the skills learned for the new program with the existing skills and create synergies. Consequently, for an individual that is already highly skilled, picking up new skills is not only easier than for lower skilled individuals; investments in new skills also promise higher returns since they can be combined with existing skills.[8]

As a result, there should be a high correlation between initial education and training, due to different individual returns caused by differences in ability and the opportunities to realize synergy effects between existing and newly acquired skills. Employers' decisions to invest in their employees' training should be determined by similar rationales. As they also seek for the highest returns on their investments they should attempt to invest in the most able employees (Acemoglu & Pischke, 1998). Although ability is difficult to observe for em-

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[8] Fahr (2005: 92) explains training differences between higher and lower educated employees by an alternative approach. He finds higher educated employees to have a taste for training as they invest considerable more time in (non-formal and informal) educational activities than lower educated employees do. They appear to "love to learn" since they train more than others, even if their wages are not influenced by their educational activity. In a similar vein, Fouarge, Schils, & de Grip (2013) find lower educated to have a lower willingness to train than higher educated even though training promises high returns for them. The authors explain this with differences in preferences, which is in line with Fahr's (2005: 76) notion of a "taste for educational activities". As long as these tendencies do not differ between men and women, they should not have an impact on the model assumptions on the gender training gap in this study.

ployers, they can proxy it by previous education. This may also provide information on possible synergies between new and existing knowledge. Consequently, more highly educated employees would not only be willing to invest more in training themselves, they would also receive more employer provided training.

Thus, in line with previous economic studies, in this study, education will serve as a proxy for ability. Here, a distinction will be made between individuals with and without a degree in tertiary education (hereafter synonymously called "university education" or "degree") while more detailed distinctions in terms of education will be ignored. This makes sense as the assumptions by Lazear & Rosen (1990) referring to the differences in investment incentives for women's human capital distinguish between highly able employees and others. When education is used as a proxy, the highest level of ability should be equal to the highest level of education, which is a degree in tertiary education. Henceforth, individuals holding a university degree will be defined as "highly educated employees" (or "highly able employees") while individuals without university education will be denoted "lower educated employees" (or "employees of average ability").

Based on theoretical arguments, lower educated women could be disadvantaged in two ways: First, because they are women and second because they did not receive higher education. These two effects do not necessarily add up but may interact, as proposed by Lazear & Rosen (1990). Highly educated women should suffer less statistical discrimination by their employer and have higher self-interest in investing in their human capital as they are similar to men in their labour market attachment and turnover. On the contrary, women without university education should be confronted with labour market returns that are more easily outweighed by non-market returns. This not only offers them lower incentives to invest in human capital but also induces statistical discrimination by the employer. Consequently, lower educated women should be disadvantaged compared to men as proposed by classical human capital theory, while highly educated women should not be affected to the same extend. Therefore, **Hypothesis 1a** and **b** assume:

> There is a gender training gap among employees without a university degree (Hypothesis 1a).
>
> The gender training gap among employees with a university degree is smaller than among employees without a university degree (Hypothesis 1b).

The labour market and the gender training gap

A focus on long-term employment should foster investments in specific training which is at odds with female training preferences. Further, employers should have a preference for investing in long-term employment relations with men instead of women, as long-term investments in men are less risky. To describe the long-term orientation in a labour market the mean tenure of all employees in the labour market is frequently used in empirical studies (e.g. Estévez-Abe et al., 2001). In line with that, differences in mean tenure will be considered in order to analyse differing effects of the labour markets' long-term orientation on men and women. This leads to **Hypothesis 2**:

> The longer the mean tenure in a country, the less do women train compared to men.

To raise employability, unions should have an interest in fostering training for their members. Additionally, wage compressions caused by collective bargaining as well as long tenure rates should lead to a raise in training as it provides employers with incentives to train. Strong industrial relations should consequently lead to more training. However, union policies could have differing effects on training participation of men and women. Empirical results support median voter theory, which indicates that unions focus more strongly on the interests of their male members. As women's training preferences differ from men's, strong industrial relations could lead to a training advantage for men. This relationship should be stronger for lower educated employees than for highly educated ones, as unions are more likely to have an impact on training of lower educated employees. Therefore, the presence of strong unions should be especially relevant for the gender training gap between men and women without university education.

Union density is frequently used as a proxy for union influence (e.g. Brunello, 2004, Bassanini et al., 2007; Dieckhoff et al., 2007; Edlund & Grönlund, 2008). However, as Bassanini et al. (2007: 239) state, this often happens due to data availability, while "the variable of interest in the empirical analysis is union coverage". The reason is that training participation of all employees covered by collective bargaining should be influenced by unions' policies independently of the question if the individual is a union member or not. On the contrary, union members that work in jobs, which are not covered by collective bargaining might not be influenced by union policies. To ensure comparability with other studies but also to depict the possible effects of unions' policy on training in a better way, the following analysis includes both union density and bargaining coverage. A higher union density and bargaining coverage are seen as a sign for strong unions. These rationales lead to **Hypothesis 3a** and **b**:

> The higher union density and bargaining coverage, the less do women train compared to men (Hypothesis 3a).
>
> This relationship is more pronounced among employees without a university degree (Hypothesis 3b).

The educational system and the gender training gap

Following the VoC approach, educational systems either focus on specific or general human capital. Specific human capital, which is supposed to be negatively related to gender equality, is mostly imparted in vocational programmes while general human capital, which is more gender neutral, is imparted at universities (Estévez-Abe et al., 2001). The focus in the initial education system should then be perpetuated in the continuous training.

Since labour market attachment of lower educated women is assumed to be lower than of highly educated women, the latter are assumed to be more likely to drop out of the labour market (at least temporarily). Because lower educated women are less likely to return to their previous job after childbirth, they and their employers are less likely to invest in these women's specific human capital. Highly educated women, in turn, are more likely to return to their former post, which makes investments in their specific human capital more likely.

Estévez-Abe et al. (2001) suggest that the importance of the vocational system is reflected in the share of a cohort that participates in initial vocational training programmes. Countries with a high share of vocational participants are therefore assumed to appreciate specific human capital, which leads to more gender inequalities. Analogously, the importance of the university system may be mirrored in the rate of university graduates in a cohort. Countries with a high share of university graduates are assumed to appreciate general human capital, which is related to less gender inequalities. Overall, this leads to **Hypothesis 4a** and **b**:

> The stronger the focus on specific human capital in the educational system (high share of vocational students, low share of university graduates), the less do women train compared to men (Hypothesis 4a).
>
> This relationship is more pronounced among employees without a university degree (Hypothesis 4b).

Support for women and the gender training gap

As Estévez-Abe (2005) points out, women need more institutional support than men to invest in specific training. Gender differences in the labour market in general and in training participation may be mitigated by policies providing incentives for women to return to the labour market early after childbirth. Estévez-Abe et al. (2001) postulate that affordable childcare is the most important institution leading to more gender equality on the labour market. Childcare, supporting mothers to return to their jobs early after childbirth, should lead to higher incentives to invest in female human capital. On the contrary, other family policies may widen inequalities between men and women in the labour market. Following Estévez-Abe (2005), it is argued that long maternity leaves give incentives for mothers to stay out of the labour market for a longer period of time. Child benefits could have a similar effect as maternity leave policies. Especially for lower educated women who may have low expected labour market returns, generous benefits could be an incentive not to return to their job early after childbirth. Thus while high levels of childcare should support female labour market participation and reduce female disadvantages in terms of training, long maternity leaves and generous child benefits should lead to a training disadvantage for women.

These effects are likely to differ for women with and without university degree. As labour market returns of lower educated women are usually lower, their time out of the labour market should be more strongly linked to public provision of childcare, maternity leave policies and child benefits. In contrast, highly educated women usually have a better bargaining position at the labour market and do not depend as much on institutional support. This leads to **Hypothesis 5a** and **5b**:

> The higher the incentives for women to return to the labour market early after childbirth (high levels of childcare, short maternity leaves, low child benefits), the more do women train compared to men (Hypothesis 5a).
>
> The relationship between these incentives and training is more pronounced among employees without a university degree (Hypothesis 5b).

The previous hypotheses describing relationships between national institutions and training are based on socioeconomic arguments. However, there might also be systematic gender inequalities that are caused by underlying cultural effects not accounted for in the previous assumptions. The institutional support for women could also take other forms like generally positive attitudes towards female labour market participation and success etc. which are difficult to assess but should have an impact on training participation of women as well. Here, observable gender differences in the labour market can serve as proxies for these underlying supportive institutions. Estévez-Abe (2006) states that employment equality can indirectly capture cultural effects which also affect other gender differences in the labour market. Likewise, Dieckhoff & Steiber (2011) interpret their finding of a lower gender training gap in Scandinavian countries as the consequence of high female labour market participation and a modern gender culture. In line with that, this study uses employment equality as a proxy for favourable overall labour market conditions for women (which may be constituted by a diverse range of policies in a particular country). Further, pay equality may reflect the overall conditions for women's labour market success while educational equality between men and women may reflect attitudes towards women's education in a country.

Gender equality in terms of labour market participation, pay and education serve as proxies for labour market structures that facilitate gender equality in general. The measures may be also interpreted as reflecting attitudes towards traditional gender roles, especially concerning women's labour market participation and success. Therefore, they are assumed to be related to training equality between men and women. They are included in the model to control for underlying cross-country differences not accounted for by the national institutions referring to the support for women or the other two spheres. The relationships should be equally relevant for all women, since they depict a general pattern on the labour market. This is pointed out in **Hypothesis 6**:

> The higher the gender equality in the labour market, the more do women train compared to men.

3 DATA AND METHOD

This section describes the statistical basis of the empirical analyses performed in Chapter 4. First, the micro and macro data used for the analysis are presented. After that, the different methodological steps are explained in detail and the rationale for choosing a multilevel approach is outlined.

3.1 Data

To test the hypotheses on determinants of training participation referring to the micro- and macro-level, this study includes individual as well as institutional data. This section gives an overview of the dependent as well as the main independent variables used and describes their operationalization as well as their sources. A more detailed overview of all variables used, including definitions and sources is provided in Table 19 in the Appendix.

3.1.1 Individual variables

Individual training data from the first wave of the Adult Education Survey (AES), which is part of the EU statistics on lifelong learning, is analysed to test the hypotheses.[9] This household sample survey contains information on training participation of individuals aged 25 to 64 and was conducted in the European Union, the European Free Trade Association and candidate countries between 2005 and 2008.

Cross-country comparisons on training are usually difficult to conduct since training is often defined in different ways (Brunello, 2004: 188). A major advantage of the AES is that the same questionnaire is adopted by the national data collection units in each participating country, which obviously increases comparability.[10] Data for the following countries is currently publicly available: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom. Due to data restrictions Italy, the Netherlands, Croatia and Slovenia are not included in the following analyses.[11] This leads to a dataset containing complete information on 87,843 employees from 22 countries.

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[9] The responsibility for the results and conclusions lies with the author and not with Eurostat, the European Commission or any of the national authorities whose data have been used.

[10] Nonetheless, there is still the problem that the same question might be interpreted differently in different national contexts (Brunello, 2004: 188).

[11] For individuals from Italy and Slovenia it is not possible to distinguish between full-time and part-time employed. Additionally, tenure cannot be controlled for Italians. The Dutch survey does not provide information on the industry. For Croatia information is only available for six out of the twelve institutional variables analysed.

In the survey, individuals were asked about their training participation in the past twelve months. Although the AES also states the total number of training incidents, training participation is considered as a binary variable as there is a substantial number of employees that did not take part in any training at all. Hence, it appears more important to scrutinise the differences between participants and non-participants than considering the amount of training. As a measure of participation in continuous training, the following survey question is used (Eurostat, 2007: 20):

“During the last 12 months have you participated in any of the following activities with the intention to improve your knowledge or skills in any area (including hobbies)?

a. Private lessons or courses (classroom instruction, lecture or a theoretical and practical course)
b. Courses conducting through open and distance education
c. Seminars or workshops
d. Guided on the job training”

Since the aim of the study is to analyse training differences between men and women that may have an impact on labour market success, only work-related training should be taken into account. As the stated question mixes work-related training with non-work-related training, further information has to be considered to limit the outcome variable to work-related training only. First of all, training that is imparted as guided on-the-job training (response “d.”) is work-related per definition. Further, the reason for participating is taken into account as well. For a randomly chosen training incident, participants were asked: “What was the main reason for participating in <<the name of the….activity>>? 1. Mainly Job related, 2. Mainly Personal/Non-job related reasons” (Eurostat, 2007: 23). If the individual defined the training activity as mainly job related, the outcome variable “work-related training” takes the value 1. Additionally, to cover other work-related training that might not be defined as strictly job-related, the outcome takes the value 1 as well if an employee agreed to one of the following purposes for training participation: “1. To do my job better and/or improve carrier prospects, 2. To be less likely to lose my job, 3. To increase my possibilities of getting a job, or changing a job/profession, 4. To start my own business, 5. I was obliged to participate[12]” (Eurostat, 2007: 23). To sum up, the outcome variable “work-related training” takes the value of 1 if the first training incident mentioned by the individual is guided on-the-job training, is explicitly defined as mainly job-related, or was done for purposes that refer to labour market activities.[13]

[12] Since the analyses only consider employees, training obligation most probably comes from the employer and is thus most likely work-related.
[13] As the dependent variable takes the value of 1 only if the first training incident is defined as work-related, participation in work-related training may be underestimated: If an individual took for example two trainings,

The survey provides information about the individual's gender and previous education, the main explanatory variables of interest. Education is categorised according to the International Standard Classification of Education (ISCED97), where levels 0-2 cover less than upper secondary education, level 3 upper secondary education, level 4 post-secondary non-tertiary education and levels 5-6 tertiary education. In the following analyses, a distinction will only be made between individuals with ISCED97 levels 0-4 and levels 5-6 as the theoretical framework distinguishes between employees with and without university education. A more detailed distinction between the remaining educational levels is therefore not necessary from a theoretical point of view. Moreover, it does not prove to be very practical either, as national education systems below university level are quite heterogeneous in terms of the prominence of the different levels. Especially the importance of ISCED97 levels 1 and 4 considerably varies across countries as the AES data shows.

Consistent with previous studies on training, further information provided by the survey is included as controls. Age is usually associated with lower levels of training (Mure, 2007). Warr & Birdi (1998) conclude that lower participation rates of older employees are partly a result of a lower mean level of education among older employees. Since female labour market participation is nowadays higher than in the past decades, labour market outcomes of young men and women are, though still different, more equal than in older generations (see e.g. Light & Ureta, 1990 or Pencavel, 1998). When analysing the effects of gender and previous education on training, it is therefore important to control for age in order to avoid mixing up gender, educational and age effects. To control for possible age effects on training, the year of birth is used to calculate the individual's age by subtracting it from the year the individual was surveyed. As the minimum age of survey participants is 25, 25 is subtracted from the actual age of the individual. Age is included in raw and squared form since it was found to have a positive impact on training participation for younger workers but a negative effect on older workers' participation (see e.g. Thangavelu, Haoming, Cheolsung, Heng, & Wong, 2011).

The following analyses also control for occupational details that are supposed to be correlated with the main explanatory variables gender and education. Tenure is included as it is

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one work-related and one non-work-related, and stated the non-work-related first, this individual would be characterized as not having participated in training, though he or she actually did participate. However, only a very small share of individuals qualifies for such a possible underestimation of training: Only 1.5% of all individuals in the sample were found to take non-work-related training while having participated in more than one non-formal training incident. Further, as this study focusses on training differences, i.e. a relative measure, and not on absolute training levels, this underestimation of training participation would only be relevant if different groups of employees were affected differently by this phenomenon. In fact, about 3.4% of highly educated women in the sample might suffer from this underestimation while 2.1% of highly educated males might be underestimated in terms of training participation; among lower educated females the share is 1.3% while it is 0.7% among lower educated men. Relative female training participation might therefore be slightly underestimated among both highly and lower educated employees. Still, such possibility of underestimation does not mean that an underestimation really happened for these women. They might just as well have actually taken part in more than on training incident but none of these trainings was work-related.

found to have an impact on training (see e.g. Bassanini et al., 2007 or Jones et al., 2008) but may also correlate with gender and education because lower educated women are supposed to have higher turnover and hence shorter tenure rates than men (Royalty, 1998). Further, a dummy for part-time employment is included to take into account the higher probability of women working in part-time employment. This is necessary to avoid confounding the effect of part-time on training with the gender effect as several studies find part-time employed to take part in less training than full-time employed (e.g. Büchel & Pannenberg, 2004; Bassanini et al., 2007; Maximiano, 2012).

The incident of training differs between different occupations (Polachek, 1981; Desjardins, Rubenson, & Milana, 2006) and industries (O'Halloran, 2008; Evertsson, 2004; Veum, 1996). Since individuals of different gender and education might not be equally distributed among different occupations and industries, the occupation is considered as ISCO-88 (International Standard Classification of Occupations), coded at 2-digit level and the economic activity of the local unit is taken into account by the inclusion of dummy variables for different NACE (Nomenclature statistique des activités économiques dans la Communauté européenne) classes. Further, employees in small companies train less than employees in bigger companies (Dieckhoff & Steiber, 2011; Desjardins et al., 2006). Again, an equal distribution of women and people without tertiary education cannot be assumed. Unfortunately, the AES does not include company size. Still, it asks for the number of persons working at the local unit. Therefore, dummies for different number of persons in the local unit are included in the models.

The survey was conducted between the first quarter of 2005 and the second quarter of 2008. However, the single national surveys usually only took a few months (between one and seven quarters between the first and the last individual surveyed). To avoid measuring effects of the overall economic cycle instead of actual country-effects, year dummies are included as controls. Previous studies suggest people living in densely populated areas have different training patterns than people in thinly populated ones (Desjardins et al., 2006). Therefore, analyses also control for the degree of urbanisation. The survey interviews were conducted in different ways. Most countries used face-to-face interviews while others used a mix of different interview methods. To control for possible selection bias due to differences in the interview methods, dummies for the different types of interviewing are also included.

Although the AES surveys individuals independently of their employment status, analyses are restricted to employees. Unemployed individuals also frequently participate in work-related training. However, their training usually differs from training in companies and is often financed by the state. Self-employed individuals are excluded from the analyses, since their training behaviour is supposed to differ from the behaviour of employees (Pfeiffer & Reize, 2001). This might be due to specific characteristics of the self-employed. Further, as this analysis focuses on inequalities, assumptions for employees and self-employed should differ since training decisions of employees do not entirely depend on their own perceptions but also on the employer's preferences. So employees may be affected by discrimination while self-employed may not.

In summary, the AES offers the ideal data basis to answer the proposed research questions and to test the hypotheses. Most importantly, the survey refers to work-related training and includes the conventional variables necessary to control for when analysing the gender training gap. Further, the AES provides survey information that is comparable across 22 European countries. This allows scrutinizing cross-country differences in the gender training gap and running multilevel models in the empirical analyses. Moreover, all country samples are large enough to allow limiting certain analyses to subsamples of employees of higher and lower education without fearing to loose representativeness due to too few observations.

3.1.2 Institutional variables

In addition to the AES, macro data on the different national institutions is taken into account. If available, data for 2006 is used since most national surveys were conducted in 2006 and 2007 and therefore (mostly) refer to training incidents in 2006.

To cover the characteristics of the labour market, mean tenure, union density, bargaining coverage and female union membership are used. Mean tenure is calculated on the basis of the AES data for every country as average years employees have been working for the same employer. Measures for union density and bargaining coverage are based on Visser (2011) and defined as "net union membership as a proportion [of all] wage and salary earners in employment" and as "number of employees covered by collective bargaining agreements as a percentage of all wage and salary earners" (data on bargaining coverage is not available for Romania). A higher union density and bargaining coverage are seen as a sign for strong industrial relations in a country.

The proposition of a male training advantage in the presence of strong unions which based on the median voter theory requires a male dominance in trade unions. However, the share of women among union members strongly differs across European countries: While the share of women is well below 50% in many European countries, women in Scandinavia and the Baltic countries are more strongly represented in unions than men (see Table 26). Thus, data form the European Trade Union Institute (2012) serve to depict the percentage of women among union members. This is a proxy for women's influence in trade unions and helps to verify assumptions based on the median voter theory. Unfortunately, data on female union participation is not available for all unions in the countries analysed.[14] As the

[14] For Greece and Cyprus, no data is available. For Denmark, France, Hungary, Lithuania, Portugal, and Romania data for one union is always missing. Measures for these countries may therefore be biased.

share of female unionists in the country is only based on the available data, results based on this measure ought to be interpreted with caution.

The educational system is described by two indicators. On the one hand, the rate of university graduates in a cohort is taken as a sign for a more general human capital focus in the educational system. This data is provided by Eurostat (2011d). Moreover, as a measure of skill specificity in the educational system the share of a cohort that participates in initial vocational training is taken from the publicly available UNESCO (n.d.) data centre.

Different measures of support for women in a country are considered. Most importantly, institutional support for mothers in terms of childcare, maternity leave and child benefits is taken into account. Levels of childcare are measured by two indicators provided by Eurostat: The share of children below the age of three in childcare for at least 30 hours per week (Eurostat, 2011c) and the share of children from the age of three to compulsory school age in childcare for at least 30 hours per week (Eurostat, 2011b). Maternity leave is defined as paid maternity leave for a single child in weeks and child benefits as the maximum amount paid per child in 100€ (European Commission, 2012). Additionally, employment equality, degree equality and pay equality serve to measure means of support for women that are not captured by the previous variables. These three more indirect measures of support should provide an understanding for overall gender equality on the labour market. Gender employment equality is measured as the employment gap in percentage of the working men, multiplied by (-1) (Eurostat, 2011a). Gender degree equality serves to take into account differences in qualification patters of men and women in the national contexts and is measured as the gender degree gap in percentage of men with a degree in tertiary education, multiplied by (-1) (Eurostat, 2013). Furthermore, gender pay equality is included to operationalize gender differences in labour market outcomes. It is calculated on the basis of data by Eurostat (2012) as hourly pay of men minus hourly pay of women in percentage of men's pay, multiplied by (-1).

3.2 Applied method

Table 1 describes the methodological procedure. The analysis will follow three basic steps, leading to a multilevel analysis. First, individual (level-1) data on participation in work-related training is analysed for each country. Effects for women with and without higher education are separated by the inclusion of an interaction term for females without a university degree. Afterwards, the difference in training participation between men and women in a country will be explained by national institutions, summarizing the three potentially relevant areas deduced in the previous chapter: the labour market, the educational system, and the support for women. This country-level (level-2) analysis gives a first impression of the relationships between the theoretically proposed variables and continuous training. As it uses both macro and aggregated micro data, it can be seen as the first step to a multilevel analysis. This stepwise proceeding helps to introduce the concepts underlying a multilevel analysis, which is finally conducted in the third step. Contrary to the second step, multilevel analysis allows including individual data in a non-aggregated form. This way individual and country data can be analysed simultaneously. More specifically, multilevel logit models are developed to explain work-related training by gender, education and national institutions. Initially, this is done on the basis of the entire sample. However, as the importance of the institutional variables is supposed to differ for men and women with different educational backgrounds, eventually, this process is repeated for employees with and without a degree separately.

Table 1: Methodological procedure

	Level	Dependent variable	Method	Independent variables
1	individual (level-1)	work-related training	logit (by country)	gender, education & interaction gender*education
2	country (level-2)	linearly transformed female OR of work-related training by country	simple OLS-regressions	national institutions
3	individual & country (level-1 & level-2)	work-related training	multilevel logit (all employees & by education)	gender, education, national institutions & interactions gender*institution

The multilevel approach is appropriate because the theoretical models include assumptions on characteristics at individual- as well as at country-level. Since individuals living in one country are likely to be more similar in unobserved characteristics than randomly chosen individuals from different countries, error terms within a country are likely to be correlated. As Kreft & Leeuw (2007: 9) put it: "The sharing of the same context is a likely cause of dependency among observations." In this case, a simple logit-estimation, which assumes individual observations to be independent, would lead to biased standard errors. Standard errors would be underestimated for country-level variables because simple logit models do not control for the fact that the within-country-variance of these variables is zero, i.e. the value of these variables is equal for all individuals in the same country. On the other hand, standard errors would be overestimated when looking at individual-level covariates where the between-country-variance is zero, i.e. the mean value of the variables at country-level is equal to the overall mean of that variable (E.g. the age composition of employees may be fairly similar across all European countries. Country means should therefore not differ much from the overall mean.).[15] Thus, assuming an ordinary regression model when a multilevel model is true can lead to too small p-values for variables at country-level, and to too large p-values for variables at individual-level (Rabe-Hesketh & Skrondal, 2008: 130).

[15] For a formal discussion of this problem see Rabe-Hesketh & Skrondal (2008: 129-130).

Another method of challenging the problems caused by the data structure would be to use clustered standard errors. Nevertheless, this method treats the structure of data as a nuisance and not as a matter of interest. It delivers the correct standard errors and accounts for the fact that level-1 units are not independent. However, it does not allow the examination of the residual between-cluster-variability in the model. On the contrary, multilevel analysis does not only lead to correctly estimated standard errors, but it also explicitly models the clustered nature of the data. This way, it allows investigating the possible sources of variations within and across countries and provides the possibility to analyse which variables explain individual differences and which variables explain country-level differences. Moreover, it permits statements on the scope of the cross-country variation that can be explained by the model variables (Carle, 2009: 1-2).[16]

Applied to this study, when analysing differing effects of gender in different national settings, multilevel analysis allows estimating a "fixed" gender effect (included in the "fixed part" of a model) that depicts the mean gender effect on training across all countries. This coefficient is the comparable to the one usually estimated in ordinary regression analysis. In addition to that, multilevel models can compute a "random effect" (included in the "random part" of a model) that defines the cross-country variation of the gender effect. Further, the multilevel analysis shows how these random effects may be explained by interactions of national institutions with individual variables. To sum up, multilevel analysis is used because it permits to consider the micro-macro structure of the data and describe the interaction of individual and national characteristics in one empirical model.

To get a better overview of the data and its structure, a stepwise approach, based on the "two-step-analysis" by Kreft & Leeuw (2007), is performed in the first place. Therefore, individual-level data is scrutinized by country. After that, results of the individual country models are regressed on macro-level data. This can be seen as a first step towards multilevel modelling and provides a first impression on the relationships between national institutions and the gender training gap. Only after that, a multilevel analysis is performed. The following subsections describe each of the three analytical steps leading to a multilevel analysis.

3.2.1 Individual-level

The individual-level data can provide a picture of the individual determinants of training participation in different countries. Therefore, separate logistic regressions are run for each country. First, as usually found in the literature, models are estimated without distinguishing between women of different educational backgrounds. Afterwards, models distinguish

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[16] A more detailed description of the method and the interpretation of its results will be given in chapters 3.2.3 and 4.4.

between women with and without a university degree by including an interaction term for females without tertiary education. Formally, the models can be described as

$$logit\{Pr(y_i=1|x_i)\} = ß_0 + ß_1x_1 + ß_2x_2 + \zeta\tilde{X} + \varepsilon_i \qquad (1)^{17}$$

$$logit\{Pr(y_i=1|x_i)\} = ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_1x_2 + \zeta\tilde{X} + \varepsilon_i \qquad (2)$$

with $y_i=1$ indicating an individual's training participation in the past 12 months, x_1 indicating the individual being female and x_2 having no degree, while $\tilde{X}$ is a matrix covering a number of control variables (age (simple and squared), tenure, part-time employment, occupation, industry, size of the local unit, year of the survey, degree of urbanization, and interview method) and ε_i is the logistically distributed error term. Equation (1) shows the conventional model without distinguishing between women with and without a degree. Equation (2) specifies the extended model which includes the interaction between gender and education $ß_3x_1x_2$, representing an additional effect on training for women without a degree.

3.2.2 Country-level

To explore possible connections between the gender training gap and institutional settings, estimates for female training participation previously calculated in the country regressions are used as outcome for simple regressions with institutional variables. These country-level variables cover the potentially relevant institutions deduced in Chapter 2.2. Similar to the "two-step-analysis" explained by Kreft & Leeuw (2007: 35-47) this is a first step towards multilevel modelling. In the two-step-analysis, separated models with individual variables are first estimated for each country. The parameters estimated in the first step, are then used as outcome variables to be explained by macro-variables.

The two-step-analysis usually predicts all level-1 coefficients by macro variables. Nevertheless, as the primary interest of this study lies in gender differences in training, the two-step procedure will only be used to explain the differences in the training probability of women compared to men. Thus, applied to this study, the gender coefficients estimated for each country will be explained by institutional variables referring to the labour market, the educational system or the support for women. Even so, the underlying principles outlined by Kreft & Leeuw (2007) still apply.

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[17] The following interpretation of the empirical results of the individual-level and multilevel analyses will be based on odds ratios instead of log odds which are implied by the formulas displayed in this section. This is because the interpretation of the results as odds ratios fits well with the statements in the proposed hypotheses (advantages of the use of odds ratios will be discussed in detail in Section 4.2). However, as odds ratios are only a different way to express the empirical results of logit regressions and logit formulas are usually not expressed in odds ratios, the above stated way is chosen to formalize the assumed relationships.

Usually, two-step-analysis uses OLS as an estimation method for the micro as well as for the macro-level regressions. However, since training participation is a binary variable, in this study, logit regressions will be used at the micro-level. Compared to OLS outcomes, they cannot be directly used as dependent variables in the macro-level OLS regressions, since they do not follow a linear distribution. Therefore, estimates are transformed into a linear pattern first.[18] The macro-level regressions of the transformed estimates on national institutions can provide a first impression on which institutions might explain the differing gender training gaps across Europe. Formally, the regressions can be illustrated as

$$ß_j = \delta_0 + \delta_1 z_j + \varepsilon_j \qquad (3)$$

with $ß_j$ representing the training participation of females relative to comparable males in a specific country, z_j representing an institutional characteristic of the country referring to the labour market (mean tenure, union density, bargaining coverage, share of female unionist), the educational system (university graduates, vocational students) or the support for women (childcare, maternity leave, child benefits, employment equality, degree equality, pay equality) and ε_j being a normally distributed error term. In line with the individual-level analysis, the country-level analysis first considers institutional effects for women in general and then for women of different educational backgrounds. For all women, independent of their education, $ß_j$ is represented by the country specific coefficients for $ß_1$ estimated by Equation (1). When distinguishing by previous education, for women holding a university degree $ß_j$ takes the country specific values for $ß_1$ estimated by Equation (2). For women without a degree, the difference to equally qualified men is composed by the estimates for $ß_1$ and $ß_2$ from Equation (2). Therefore, for these women, values for $ß_j$ equal the country estimates for ($ß_1 + ß_2$).

The two-step-analysis is useful to obtain a first overview of the impact of the macro determinants on individual training participation and to introduce the concepts of multilevel modelling. However, it has some disadvantages. As it analyses each country as a separate cluster, it is a good way to represent the uniqueness of each country. However, it ignores the fact that European countries have many things in common, most importantly for this study, shared goals concerning lifelong learning, gender equality and other labour market related issues (European Commission, 2010; European Parliament & Council of the European Union, 2006a; 2006b). In the two-step-analysis, information on individuals of different countries is not connected because the countries are perceived as being completely isolated entities. As this is an unrealistic assumption, the approach does not properly specify the error structure at individual-level and leads to p-values that are somewhat questionable. Further, calculating separate regressions for each country leads to level-1 estimates that differ in their standard errors, e.g. the “Female” dummy may be highly significant in one

[18] The transformation process will be described in Chapter 4.3.

country while being insignificant in another country. The two-step-analysis does not account for that. In the second step of the analysis, country-values of the level-1 variable of interest are included in the level-2 regressions, regardless whether their coefficients are significant or not. Thereby, they are treated as if they were equally significant (Kreft & Leeuw, 2007: 39, 47).

The multilevel analysis described in the following paragraph has the advantages of the two-step-analysis but also takes into account the possible similarities between European countries. It avoids the statistical inaccuracies of the two-step-approach and as the multilevel model does not estimate unique parameters for every country-context, it is statistically more parsimonious.

3.2.3 Multilevel

To combine individual and institutional data in one model, ultimately a multilevel analysis is performed. The underlying assumptions are similar to the ones outlined for the two-step-analysis. Most importantly, both methods allow supposing that the effects of certain determinants vary systematically across countries. However, one main advantage of multilevel models is that although they allow different intercepts and slopes for each country, coefficients are not estimated separately for each country. Multilevel models rather estimate common parameters across all countries. In addition, they can take into account the macro-level variances of micro-level parameters. These variances are expressed in the "random part" of the models – opposed to the "fixed part" which includes the common parameter estimates for the coefficients (Kreft & Leeuw, 2007: 41).

This structure turns multilevel models into an intermediate solution between a standard regression, which is highly restricted and ignores the common context within the countries, and the two-step-analysis, which is completely unrestricted but defines the context too strictly and hence ignores similarities between the countries. In practice, while standard regression would interpret individuals from different European countries as completely identical, the two-step-analysis would treat them as if they had nothing in common. Statistically, multilevel models therefore lay in the middle of these two poles as they estimate more parameters than standard regression but fewer parameters than the two-step-models. Thus, to take into account the possible variance in the impact of certain micro-level parameters between the countries, instead of estimating models for each country separately, multilevel models can estimate "fixed effects" (as in ordinary regressions) next to "random effects" for micro-level parameters. The latter then represent the countries' deviation from the mean solution (Kreft & Leeuw, 2007: 39, 43).

The decision to include the variance of a parameter, i.e. to estimate a "random effect" in addition to its "fixed effect", can be taken separately for each parameter. In their simplest form, multilevel models only suppose a "random intercept". In such a model, the regression equation is calculated assuming different intercepts for the considered clusters. In other words: The differences between the clusters are expected to manifest in terms of the mean value of the explained variable. In this study, it would mean that countries differ by the overall probability in which training provided. In multilevel models, these differences are expressed by the intercept variance, which characterises the countries' deviation from the fixed intercept. Thus, the random intercept is a country-level error component, which expresses the joint effects of omitted country characteristics or unobserved heterogeneity (Rabe-Hesketh & Skrondal, 2008: 95).

In addition to that, "random slope" (also called "random coefficient") models assume one or more other coefficients to vary across the different clusters. This implies differing effects of certain determinants on individuals from different countries. Graphically, the slope of a particular variable differs between the countries, i.e. there is no common slope for all individuals in the data set but a different one for each country. To take into account these differences, in addition to the variable's ordinary coefficient (fixed effect), random slope models compute the parameter's standard deviation across countries (random effect). This way, the countries' deviation from the estimated coefficient is expressed by the level-2 variance of that coefficient. Applied to the gender training gap in Europe, a random slope model would account for differing gender effects across countries by assuming varying gender coefficients across countries. Thus, country differences in gender effects can be modelled by including a random slope for gender (see e.g. Snijders & Bosker, 2012). Formally, such a model can be written as:

$$logit\ \{Pr(y_{ij}=1|x_{ij}, \varepsilon_{ij}, U_{ij})\} =$$

$$(\delta_{00} + \delta_{01}z_j + U_{0j}) + (\delta_{10} + \delta_{11}z_j + U_{1j})x_{1j} + \zeta\tilde{X} + \varepsilon_{ij} =$$

$$\underbrace{\delta_{00} + \delta_{01}z_j + \delta_{10}x_{1j} + \delta_{11}z_jx_{1j} + \zeta\tilde{X}}_{\text{Fixed part}} + \underbrace{U_{0j} + U_{1j}x_{1j} + \varepsilon_{ij}}_{\text{Random part}} \qquad (4)$$

where the first parenthesis represents the parameters that refer to the country specific intercept, i.e. the baseline training probability in a country and the second parenthesis depicts the country specific slope which represents the gender effect on training in a country.

The lower line where the brackets are solved can be interpreted as follows: δ_{00} is a random parameter which defines the mean value of the intercept (i.e. the baseline probability of training for individuals across all countries). $\delta_{01}z_j$ is the effect of a country specific institution, explaining part of the intercept variance (i.e. explaining country differences in the baseline probability of training). $\delta_{10}x_{1j}$ defines the effect of the main explanatory variable on the individual-level which is gender. $\delta_{11}z_jx_{1j}$ represents the cross-level interaction, more specifically the interaction between the individual and the institutional variable, explaining part of the slope variance (i.e. explaining country differences in the gender effect on training). The effects of other explanatory variables (age (simple and squared), tenure, part-time employment, occupation, industry, size of the local unit, year of the survey, degree of urbanization, and interview method) are illustrated by $\zeta\tilde{X}$. These five terms denote the fixed part of the multilevel model.

The random part of the model is composed of three parts: U_{0j} is a logistically distributed random variable. The variance of this level-2 residual represents the remaining intercept variance across the countries, which is not explained by $\delta_{01}z_j$. $U_{1j}x_{1j}$ is the interaction of the gender variable and a country specific residual (where U_{1j} is a logistically distributed random variable). Its variance characterizes the remaining slope variance that cannot be explained by the cross-level interaction term $\delta_{11}z_jx_{1j}$. ε_{ij} is the logistically distributed individual-level error term.[19]

In order to detect the institutions relevant for explaining the gender training gap, Equation (4) is run including one institutional variable at the time. This rather pragmatic approach is chosen due to the limited number of countries (and hence degrees of freedom at country-level) in the data set. As a result not all theoretically relevant variables may be included in the model at once. After that, a comprehensive model is estimated, including all institutional determinates that showed statistically significant coefficients in the single-institutions-models. This model building process is done for all employees, before it is repeated for employees with and without university education separately and leads to three different models: One for all employees, one for employees with university education and another one for employees without university education.

Table 2 relates the described methods and data to the hypotheses derived in the theoretical section. Preliminary evidence will be drawn from the first two stages of analysis where individual and country data is inspected separately. After that, the hypotheses will be tested using multilevel analyses as this allows considering individual and country information simultaneously and analysing complex structure of the data.

[19] For a detailed description of the underlying assumptions of random slope models see Snijders & Bosker (2012: 74-77).

Table 2: Summary of hypotheses and method

Hypothesis	Identification strategy
Differences between women with and without university degree	
H1a: There is a gender training gap among employees without a university degree. H1b: The gender training gap among employees with a university degree is smaller than among employees without a university degree.	Training odds for women without a degree should be lower than training odds for men without a degree. Among employees with a degree, odds ratios for women should be higher than among employees without a degree. ⇨ Individual-level analyses by country ⇨ Multilevel analyses by educational groups
Labour market	
H2: The longer the mean tenure in a country, the less do women train compared to men.	Training odds for women should decrease compared to training odds for men when mean tenure increases. ⇨ Regression of country-level odds ratios for females on mean tenure ⇨ Multilevel analyses for all employees
H3a: The higher union density and bargaining coverage, the less do women train compared to men. H3b: This relationship is more pronounced among employees without a university degree.	Training odds for women should decrease compared to training odds for men when union density and bargaining coverage increase. The effects should be stronger for women without a university degree. ⇨ Regression of country-level odds ratios for females on industrial relations indicators ⇨ Multilevel analyses by educational groups
Educational system	
H4a: The stronger the focus on specific human capital in the educational system (high share of vocational students, low share of university graduates), the less do women train compared to men. H4b: This relationship is more pronounced among employees without a university degree.	Training odds for women should decrease compared to training odds for men when the share of vocational students increases and the share of university graduates decreases. The effects should be stronger for women without a university degree. ⇨ Regression of country-level odds ratios for females on educational system indicators ⇨ Multilevel analyses by educational groups
Support for women	
H5a: The higher the incentives for women to return to the labour market early after childbirth (high share of childcare, short maternity leaves, low child benefits), the more do women train compared to men. H5b: The relationship between these incentives and training is more pronounced among employees without a university degree.	Training odds for women should increase compared to training odds for men when levels of childcare increase and maternity leaves and child benefits decrease. The effects should be stronger for women without a university degree. ⇨ Regression of country-level odds ratios for females on different incentives to return to the labour market ⇨ Multilevel analyses by educational groups
H6: The higher the gender equality in the labour market, the more do women train compared to men.	Training odds for women should increase compared to training odds for men when gender equality in terms of payment, employment and degree increase. ⇨ Regression of country-level odds ratios for females on equal opportunity indicators ⇨ Multilevel analyses for all employees

As the data used for the analyses mainly consists of survey data, the question of proper weighting of the data comes up (see Särndal, Thomsen, Hoem, Lindley, Barndorff-Nielsen, & Dalenius, 1978). However, in the following analyses, raw data is used. This is done for various reasons: Most importantly, because simulation work and analyses with real data show that findings from weighted data diverge only slightly from findings based on un-weighted data. Weighted and un-weighted data do not seem to diverge widely and therefore do not lead to different inferential decisions. Further, estimates become less biased as cluster sizes increase (Carle, 2009). Carle (2009: 3) suggests "that with sufficiently sized clusters, an analyst may worry less about scaling the weights." The country-subsamples in this analysis range, depending on the specification, from 358 to 11,475 individuals and may therefore be concerned as quite large.

Although several weighting methods for unequal probability of selection have been proposed for multilevel models, there is no well-established estimation method that generates consistent parameter estimates (Asparouhov, 2006). More importantly, there is no established method or best practice on how to handle the sampling weights in multilevel analyses when only a subgroup of the sampled population is analysed and it is unclear if the available methods lead to unbiased results. Besides, little is known about the role of missing data in multilevel analysis and in addition there is no established method to follow in this case (Carle, 2009). Carle (2009: 3) warns against use sampling weights without properly adopting them to the data as this could lead to biased parameters. He recommends analysing the data without weighting it as the next best option.

In the following analyses training behaviour of employees is scrutinised, leaving economically inactive, unemployed and self-employed individuals aside. Further, a considerable number of individuals had to be left out of the analyses due to missing data. Most importantly, hypothesis-testing requires separate estimating for employees of different levels of education. Since it appears far from clear that the available methods to adapt the AES survey weights would lead to unbiased estimates when analysing these subsamples, sample weights will not be taken into account.

4 EMPIRICAL RESULTS

This section presents the empirical findings. After illustrating some descriptive statistics, the analysis proceeds as described in the previous chapter: Individual data is first examined by country, then institutional variables referring to the suggested institutional spheres labour market, educational system as well as support for women are taken into account to explain differences in the gender training gap. Eventually, the multilevel analysis integrates both micro and macro variables. A multilevel model is developed for all employees before separating the data set into two subsamples depending on previous education. This allows contrasting different institutional determinants for the gender training gap between employees of differing educational backgrounds. These models serve as the principal basis for the discussion and the evaluation of the hypotheses.

4.1 Descriptive statistics

The dataset contains complete information for 87,843 employees, including 44,236 men and 43,607 women. 25,625 employees have a degree of tertiary education (ISCED97 5 or 6) while 62,218 do not have a university degree or similar (for sample sizes by country and employee groups see Table 20 in the Appendix). Table 3 gives an overview of the sample. For each country, the table illustrates the proportion of employees who took part in training by country and employee group. About 37% of all employees in the sample received work-related training in the past twelve months. Overall, European women seem to be more likely to train than men, and employees with a university degree train considerably more often than other employees. A t-test indicates that these differences are statistically significant (both at p=0.000).

Nevertheless the incidence of training varies substantially between the countries. Employees in Sweden are the ones who are most likely to receive training. In the previous twelve months 73% of the Swedish employees in the sample received training. By contrast, in Romania, Hungary and Greece, only a small minority of employees received any training (8%, 13%, and 17% respectively). These findings are similar to the results by Bassanini et al. (2007).

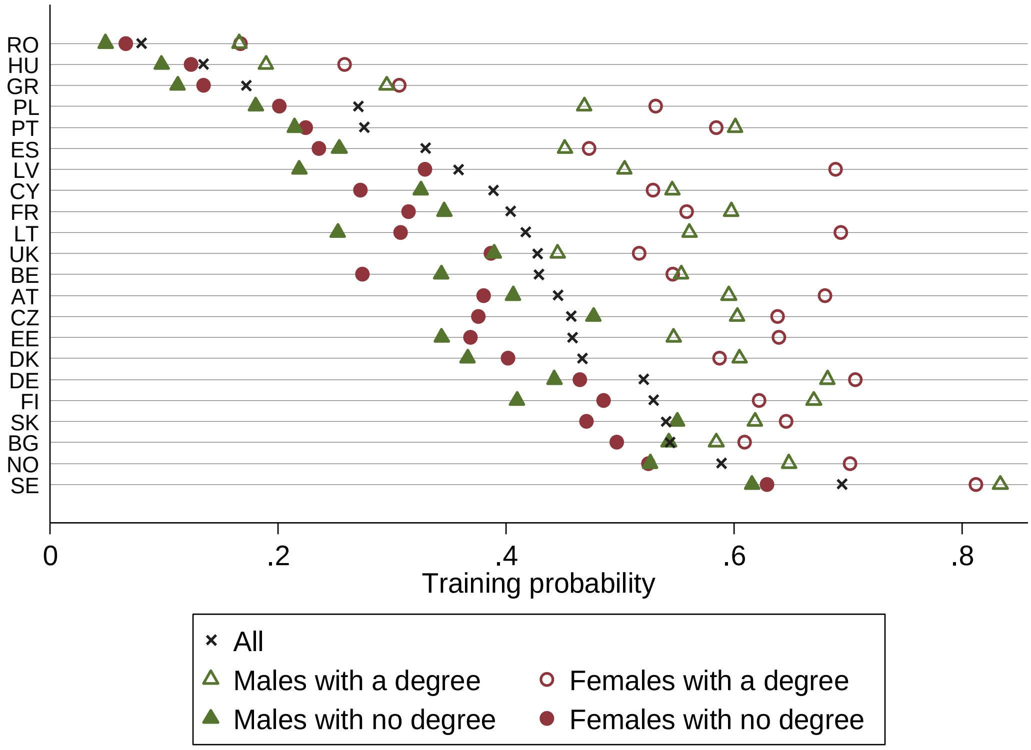
Table 3: Overall training participation by country and employee group

Country	Training participation				
	Males	Females	Degree	No degree	All
AT	0.45	0.44	0.63	0.39	0.46
BE	0.43	0.42	0.55	0.31	0.45
BG	0.55	0.54	0.60	0.52	0.55
CY	0.40	0.38	0.54	0.30	0.43
CZ	0.50	0.41	0.62	0.43	0.47
DE	0.52	0.52	0.69	0.45	0.53
DK	0.45	0.48	0.59	0.38	0.47
EE	0.39	0.49	0.62	0.36	0.46
ES	0.32	0.34	0.46	0.25	0.33
FI	0.50	0.55	0.64	0.44	0.54
FR	0.41	0.39	0.58	0.33	0.41
GR	0.16	0.19	0.30	0.12	0.17
HU	0.11	0.16	0.23	0.11	0.13
LT	0.34	0.47	0.65	0.28	0.42
LV	0.27	0.45	0.62	0.27	0.36
NO	0.57	0.61	0.68	0.53	0.59
PL	0.24	0.31	0.51	0.19	0.28
PT	0.26	0.29	0.59	0.22	0.28
RO	0.07	0.09	0.17	0.06	0.08
SE	0.69	0.70	0.82	0.62	0.73
SK	0.57	0.51	0.63	0.51	0.55
UK	0.41	0.44	0.48	0.39	0.46
Total	0.35	0.38	0.54	0.30	0.37
N	44,236	43,607	25,625	62,218	87,843

Country codes: AT = Austria, BE = Belgium, BG = Bulgaria, CY = Cyprus, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, ES = Spain, FI = Finland, FR = France, GR = Greece, HU = Hungary, LT = Lithuania, LV = Latvia, NO = Norway, PL = Poland, PT = Portugal, RO = Romania, SE = Sweden, SK = Slovak Republic, UK = United Kingdom. Estimates based on the AES 2005-2008.

In most countries, women are more likely to participate in training than men. The female training advantage is especially pronounced in the Baltic countries Latvia, Lithuania and Estonia (0.45 vs. 0.27, 0.47 vs. 0.34, and 0.49 vs. 0.39). Nonetheless, in the Czech and the Slovak Republic, France, Cyprus, Bulgaria, Austria, Belgium and Sweden, the share of male employees trained in the past twelve months is higher than the share of female employees. Hence, figures indicate that the link between gender and training participation varies across European countries. The same is true for education. While training participation of employees with and without a university degree in Bulgaria and the UK differs by less than 10 percentage points, the difference in participation in Portugal and Lithuania is as high as 37 percentage points. Again, these findings are in line with previous research (Arulampalam et al., 2004; Dieckhoff & Steiber, 2011; Roosmaa & Saar, 2010).

Figure 2: Probability of training of males and females by education and country



Country codes: AT = Austria, BE = Belgium, BG = Bulgaria, CY = Cyprus, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, ES = Spain, FI = Finland, FR = France, GR = Greece, HU = Hungary, LT = Lithuania, LV = Latvia, NO = Norway, PL = Poland, PT = Portugal, RO = Romania, SE = Sweden, SK = Slovak Republic, UK = United Kingdom. Estimates based on the AES 2005-2008.

Figure 2 summarises training participation by country, gender and education. Employees are divided into four groups: males that have a university degree, males without one as well as females with and without a degree. The black Xs indicate the overall likelihood of training participation in each country. Countries are sorted by this indicator. The figure shows that differences between the groups exist in all countries. However, there are countries where training participation differs to a greater extent than in others. Again, it is the Baltic countries Latvia and Lithuania that show the greatest training gap between the group that is most likely to participate (females with a degree) and the group that is least likely to participate (males without a degree). The figure also shows that the gender training gap varies across different educational levels. In nine countries (Portugal, Spain, Austria, Czech Republic, Denmark, Finland, Bulgaria, Slovak Republic, and Sweden) the relationship between gender and training is actually reversed between employees with and without a degree. This is a first indication that a distinction between different educational levels is important when analysing the gender training gap.

Additional descriptive statistics of all model variables and correlations of the main variables are provided in the Appendix (Tables 21-27).

4.2 Individual-level regressions by country

This section presents the results of the individual-level analysis by country, described as the first analytical step in Chapter 3.2. Table 4 contains the results of the logistic regressions on work-related training for 22 European countries. The model follows the specification typically found in previous work without distinguishing between women of different educational backgrounds (e.g. Draca & Green, 2004, Green & Zanchi, 1997 or Pischke, 2001). The estimated coefficients are reported in odds ratios which are generated by exponentiating logit-coefficients. As Buis (2010: 306) states: “Odds have a bad reputation for being hard to understand”. Nonetheless, odds ratios are used in the following analyses, as their interpretation relative to the baseline perfectly fits the questions raised. Odds ratios are a convenient way of analysing inequalities between different groups because they allow expressing the odds of training participation of female employees relatively to the training participation of males (see also Roosmaa & Saar, 2010: 191). They represent “the ratio by which the dependent variable changes for a unit change in an explanatory variable; that is, the effect is presented on a multiplicative scale” (Buis, 2010: 305). More specifically, for “a unit change in x_k, the odds are expected to change by a factor of $\exp(\beta_k)$, holding all other variables constant. For $\exp(\beta_k)>1$, you can say that the odds are ‘$\exp(\beta_k)$ times larger’; for $\exp(\beta_k)<1$, you can say that the odds are ’$\exp(\beta_k)$ times smaller’” (Freese & Long, 2006: 178).

The constant, or baseline odds, is not an odds ratio but the odds when all covariates are zero (Rabe-Hesketh & Skrondal, 2012: 506). It indicates how often an event happens (training) relative to how often it does not happen (no training) for the reference group (Long, 1997: 51). In Table 4 the baseline odds are the odds of training participation of a newly hired, 25 year old male employee with a university degree, working full-time as a technician or associate professional in a workplace with 50 or more employees in the manufacturing industry, living in a densely populated area.[20] For example, in Austria the baseline odds are 0.969 meaning that within this category, we expect to find about 97 employees participating in training for every 100 employees that do not participate in training. The odds ratio for “Female” means that the odds of training for women are lowered by the factor 0.785 compared to men (see Buis, 2010).

[20] See Tables 23-25 in the Appendix for the distribution of males and females across industries, occupations and establishment sizes.

Table 4: Conventional country models without interaction (odds ratios)

	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR
Female	0.785**	0.882	1.072	0.775**	0.736***	0.958	0.982	1.054	1.004	0.923	0.860***
No degree	0.784*	0.661***	0.888	0.872	0.741***	0.704***	0.722**	0.721***	0.673***	0.863	0.646***
Age	1.049***	1.000	0.980	1.018	1.016	1.024	1.100***	1.010	1.026***	1.024	1.003
Age^2	0.998***	0.999	1.000	0.999**	1.000	0.999***	0.997***	0.999**	0.999***	0.999**	0.999***
Tenure	1.000	1.003	1.000	1.011*	1.010***	1.001	0.999	1.011*	1.007**	1.011**	1.005*
Part-time	0.928	0.851	0.561**	0.544**	0.711**	0.649***	1.120	0.692*	0.636***	0.406***	0.749***
Constant	0.969	2.766***	1.679**	1.361	1.251	3.804***	0.787	1.465	0.957	1.380	1.797***
Pseudo R^2	0.133	0.097	0.040	0.130	0.076	0.125	0.081	0.158	0.088	0.090	0.095
N	2,602	2,479	3,026	2,649	5,308	3,393	1,847	2,548	8,821	2,444	9,377

	GR	HU	LT	LV	NO	PL	PT	RO	SE	SK	UK
Female	1.015	1.238*	0.938	1.505***	0.934	0.962	0.917	0.910	0.843	0.782***	1.151
No degree	0.705**	0.678**	0.562***	0.765	0.852	0.523***	0.632***	0.714**	0.731**	0.816*	0.972
Age	0.998	1.001	1.050***	1.032	1.012	1.036***	0.995	0.978	1.039**	1.037**	0.996
Age^2	0.999	0.999	0.998***	0.999**	0.999*	0.999***	0.999	1.001	0.999**	0.999***	1.000
Tenure	1.008	0.991	1.028***	1.004	1.007	1.003	1.010**	0.997	1.000	1.010**	1.004
Part-time	1.693*	0.565*	0.963	1.531	0.966	0.900	0.939	1.115	0.746**	1.173	0.621***
Constant	0.534**	0.288***	2.144	0.626	1.283	0.939	1.712***	0.217***	2.146***	2.184***	0.754
Pseudo R^2	0.111	0.068	0.227	0.209	0.087	0.136	0.162	0.101	0.091	0.064	0.042
N	2,579	4,103	2,222	1,386	2,209	11,450	5,063	6,395	2,477	3,105	2,164

*** $p<0.01$, ** $p<0.05$, * $p<0.1$, Models further control for industry, occupation, size of the local unit, degree of urbanization, year of the survey and interview method. Country codes: Country codes: AT = Austria, BE = Belgium, BG = Bulgaria, CY = Cyprus, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, ES = Spain, FI = Finland, FR = France, GR = Greece, HU = Hungary, LT = Lithuania, LV = Latvia, NO = Norway, PL = Poland, PT = Portugal, RO = Romania, SE = Sweden, SK = Slovak Republic, UK = United Kingdom. Sizes of the country samples partly differ from the information given in Table 20 because in some countries certain industries or occupations had to be dropt as they predicted no variation in the outcome.

The findings for the gender training gap are heterogeneous across the European countries. In most countries, the estimated odds ratios are roughly around a value of 1 without being statistically significant. In Austria, Cyprus, the Czech Republic, France and the Slovak Republic, the statistically significant odds ratios below 1 indicate a gender training gap for women. However, there is evidence for a reverse gender training gap in other countries. The female odds ratios in Hungary and Latvia are above 1 and statistically significant. This suggests that women in these countries are more likely to train than men.

The “No degree” dummy is below 1 in all countries and significantly so in 16 out of the 22 countries indicating a clear training disadvantage for employees lacking university education. The control variables show the previously expected signs in nearly all countries (the only exception is the significantly positive coefficient for part-time employment in Greece).

The regressions reported in Table 4 follow the conventional model. To examine the gender training gap for women with and without a degree separately, regressions in Table 5 include the variable “Female x no degree”, representing the interaction between the “No degree” dummy and the “Female” dummy. The inclusion of interaction terms in logistic regressions can lead to serious problems in the interpretation of marginal effects (Ai & Norton, 2003). However, these problems do not occur when using odds ratios because odds ratios depict “the multiplicative effects…relative to the baseline odds in their own category” (Buis, 2010: 307). Contrary to marginal effects, the “interpretation of the odds ratio assumes that the other variables have been held constant, but it does not require that they be held at any specific values” (Freese & Long, 2006: 179).

The odds ratio for “Female x no degree” in Table 5 measures the effect of the interaction after controlling for both the “Female” and the “No degree” dummy. In other words, the “Female” dummy now represents the odds ratio of women holding a university degree while the “No degree” dummy stands for the odds ratio of men without university education. The interaction term indicates the additional effect on training participation of lower educated women, i.e. it measures how much the effect of having a degree differs between men and women. The findings thus shed light on the idea that the gender training gap may be higher for women without a university degree.

Table 5: Extended country models including interaction for females with no degree (odds ratios)

	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR
Female	0.897	1.110	1.168	0.897	1.206	1.072	0.909	1.404*	1.084	0.810	0.867*
No degree	0.834	0.885	0.950	1.020	0.982	0.767*	0.670**	0.995	0.722***	0.748*	0.650***
Female x no degree	0.838	0.592***	0.888	0.761	0.541***	0.846	1.149	0.648**	0.859	1.286	0.988
Age	1.049***	1.001	0.980	1.019	1.018	1.023	1.099***	1.011	1.027***	1.023	1.003
Age^2	0.998***	0.999	1.000	0.999**	0.999*	0.999***	0.997***	0.999**	0.999***	0.999**	0.999***
Tenure	1.000	1.002	1.000	1.010*	1.009**	1.001	0.999	1.011*	1.007**	1.011**	1.005*
Part-time	0.933	0.856	0.560**	0.549**	0.708**	0.653***	1.114	0.694	0.637***	0.407***	0.749***
Constant	0.923	2.411***	1.598**	1.252	0.999	3.630***	0.826	1.194	0.920	1.522*	1.789***
Pseudo R^2	0.133	0.100	0.040	0.130	0.078	0.126	0.082	0.159	0.088	0.090	0.092
N	2,602	2,479	3,026	2,649	5,308	3,393	1,847	2,548	8,821	2,444	9,377

	GR	HU	LT	LV	NO	PL	PT	RO	SE	SK	UK
Female	1.027	1.748***	1.128	1.772**	1.069	1.148*	0.875	0.889	0.784	1.077	1.346**
No degree	0.712*	0.932	0.685*	0.895	0.956	0.620***	0.609***	0.697**	0.691**	1.045	1.150
Female x no degree	0.978	0.592**	0.727	0.772	0.781	0.745***	1.061	1.042	1.118	0.636**	0.739
Age	0.998	1.002	1.050***	1.032	1.013	1.036***	0.995	0.978	1.038**	1.039***	0.995
Age^2	0.999	0.999	0.998***	0.999**	0.999*	0.999***	0.999	1.001	0.999**	0.999***	1.000
Tenure	1.008	0.990	1.028***	1.004	1.007	1.003	1.010**	0.997	1.000	1.010**	1.004
Part-time	1.695*	0.568*	0.965	1.534	0.981	0.905	0.937	1.114	0.744**	1.187	0.628***
Constant	0.532**	0.238***	1.928	0.576	1.174	0.852	1.762***	0.219***	2.241***	1.834***	0.690
Pseudo R^2	0.111	0.069	0.228	0.209	0.087	0.137	0.162	0.101	0.091	0.065	0.042
N	2,579	4,103	2,222	1,386	2,209	11,450	5,063	6,395	2,477	3,105	2,164

*** p<0.01, ** p<0.05, * p<0.1, Models further control for industry, occupation, size of the local unit, degree of urbanization, year of the survey and interview method. Country codes: AT = Austria, BE = Belgium, BG = Bulgaria, CY = Cyprus, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, ES = Spain, FI = Finland, FR = France, GR = Greece, HU = Hungary, LT = Lithuania, LV = Latvia, NO = Norway, PL = Poland, PT = Portugal, RO = Romania, SE = Sweden, SK = Slovak Republic, UK = United Kingdom. Sizes of the country samples partly differ from the information given in Table 20 because in some countries certain industries or occupations had to be dropt as they predicted no variation in the outcome.

Only for Denmark, Finland, Portugal, Rumania and Sweden are the estimated odds ratios of the interaction above 1 but none of these coefficients is statistically significant. For the remaining 17 countries, the odds ratios for “Female x no degree” are below 1. The effect is statistically significant for Belgium, the Czech Republic, Estonia, Hungary, Poland and the Slovak Republic. This means that in these countries, the combination of being female and lacking a university degree reduces the training odds on top of the main effects “Female” and “No degree”. The findings show that the gender training gap differs for employees of different educational backgrounds and suggest a training disadvantage for women without a university degree.

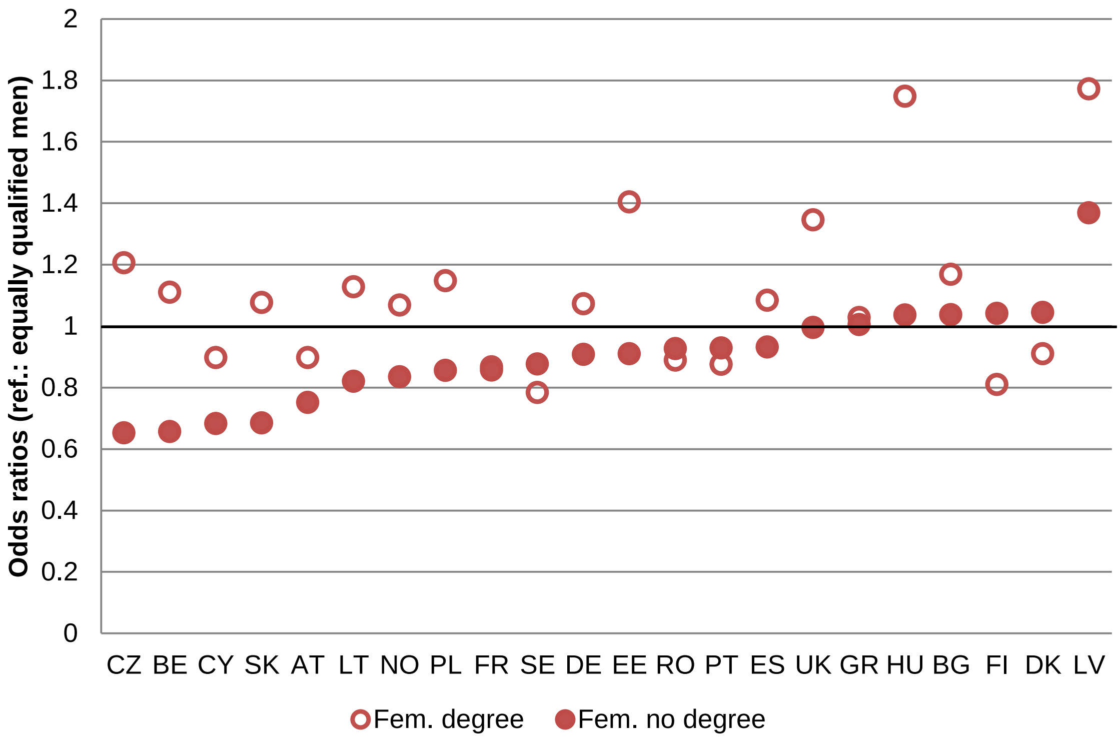
In the new specification, the odds ratios for the “Female” dummy – now representing only women with a university education – are generally larger than the ones for the conventional models in Table 4, representing all women. Although for eight countries (Austria, Cyprus, Denmark, Finland, France, Portugal, Romania and Sweden) the estimated coefficient is still below 1, it is only significantly so for France. In France, it seems, women holding a university degree have a disadvantage in training and for women without university education the odds are only slightly (and not significantly) lower than for women holding a degree. The odds ratios for highly educated women in the remaining 14 countries are above 1. For five countries the coefficients are statistically significant (Estonia, Hungary, Latvia, Poland and the UK) indicating a training advantage of highly educated women over men.

The comparison with Table 4 reveals that for some countries not only the size but also the implied direction of the “Female” dummy changes when distinguishing between women of different education. Austria, Cyprus, the Czech Republic and the Slovak Republic, which have significantly lower training odds of women compared to men in general, do not show a significant disadvantage for women with university education. Further, in Poland and the UK, training odds for women with a university degree are significantly higher than for equally educated men while this is not true for women in general in these countries.

In most countries, the estimated odds ratios for the “No degree” dummy – now representing only the values for men without a degree – are larger than in Table 4 but for most countries the odds ratios are still below 1, indicating a disadvantage for male workers without a degree compared to males holding a degree. However, this disadvantage is smaller than the one for the entire group including women and in many countries the coefficients are not significant anymore. While in the conventional model, in which the dummy “No degree” represents both men and women, odds ratios are significantly lower than 1 in 16 countries, models in Table 5 show significantly lower odds for men without a degree in only eleven countries. The “No degree” dummy becomes statistically insignificant for Austria, Belgium, the Czech Republic, Estonia, Hungary and the Slovak Republic. Only for Finland does the formerly insignificant odds ratio become significantly lower than 1, indicating a training disadvantage for lower educated men compared to highly educated men even though results for all employees in Table 4 do not indicate statistically significant differences between all employees of different education. This suggests that in many countries, the negative relationship between lower education and training is driven by women without a university degree and not significantly by men.

Overall, the results in Table 5 show that, outside of France, women holding a degree are not less likely to train than men. In fact, in some countries, they even have a training advantage over men. It appears that the combined effect of being a women and having no university degree drives an important part of the gender training gap in many countries. Essentially, the analyses revealed that, in most countries, women holding a degree are less disadvantaged (or in some cases even more advantaged), compared to equally educated men, than women without a degree compared to men without a degree. The distinction between the two groups of women may be important to understand the pattern of the gender training gap.

Figure 3: Female training participation compared to male training participation



Country codes: AT = Austria, BE = Belgium, BG = Bulgaria, CY = Cyprus, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, ES = Spain, FI = Finland, FR = France, GR = Greece, HU = Hungary, LT = Lithuania, LV = Latvia, NO = Norway, PL = Poland, PT = Portugal, RO = Romania, SE = Sweden, SK = Slovak Republic, UK = United Kingdom.

The regression findings allow for decomposing the training gap for women in general into one gap relating to women with a university degree and another one for women without a degree. In Figure 3, the estimated odds ratios inferred from the regressions in Table 5 are summarised. The hollow circles depict the "Female" dummy from Table 5. Here, the indicated odds ratios only concern women that have a university degree. Values state the training odds of women with a university degree relatively to equally qualified men. The solid circles define the odds ratios of women without a university degree relatively to men without a university degree. As odds ratios are expressed on a multiplicative scale, for each country these values are calculated as the product of the “Female” dummy and the interaction term “Female x no degree” as displayed in Table 5. Countries are sorted by this measure.

The figure visualises the finding that the gender training gap differs depending on the level of education level: While the odds ratios of women with a degree are usually above the value of 1, the odds ratios of women with no degree are mostly below the value of 1. In 17 countries, women lacking a degree face a stronger disadvantage (compared to similar men) than women holding a degree (compared to similar men). In other words, odds ratios of lower educated women are lower than odds ratios of highly educated women. Only in five countries (Bulgaria, Denmark, Finland, Hungry and Latvia), women lacking a degree are estimated to have higher odds of training than men lacking a degree. Conversely, in 15 countries, women lacking a degree are estimated to have lower odds of being trained than men without a degree (in Greece and the UK the odds ratio is almost exactly 1). In other words, a gender training gap still exists in most countries for lower educated women. In contrast, the gap is not present in most countries for highly educated women.

The results show that the gender training gap for women with and without a university degree clearly differs. In fact, in half of the countries the gender gap is actually reversed for the two educational groups. In nine countries, (Belgium, the Czech Republic, Germany, Estonia, Spain, Lithuania, Norway, Poland and the Slovak Republic), women with a university degree have higher odds of training compared to men with a university degree, meanwhile among employees without a degree women have lower training odds than men. In Denmark and Finland though, we see the opposite relationship: The training odds of women without a degree are slightly higher than the odds of men without a degree while the odds of women with a degree are slightly lower than for men with a degree.

Overall, the results of the individual-level analyses show a consistent pattern. The interaction term “Female x no degree” in Table 5 exerts a negative effect on the odds of training participation in most countries. Hence, there is a positive interaction of the two presumed disadvantages: Lacking a degree decreases the likelihood of training for women more strongly than for men. As this implies, the conventional model as proposed in Table 4 glosses over a possible negative gender training gap by failing to account for the difference between women with and without a degree. Summarizing the results in Figure 3 confirms that decomposing the gender training gap between women with and those without a degree shows a gender training gap for women lacking a degree in most European countries. A distinction between women of different educational levels seems therefore important when measuring the gender training gap.

4.3 Country-level regressions on national institutions

The previous section revealed important differences in the gender training gap in different European countries. The aim of this section – representing the second step of the analysis described under 3.2 – is to find a systematic pattern that may explain these differences. Before doing this, however, it is useful to get a better understanding of the country differences that have been found. Figures 4 and 5 graphically display the relationship between gender and training by education in different European countries as displayed in Table 5 after controlling for other individual and occupational variables. While the representation of the impact of a nominal variable like gender in the form of a continuous line is methodologically objectionable, it is convenient to explain the further proceeding of the study and the need for a multilevel approach. The figures depict the finding that not only the overall levels of training differ strongly across European countries but also the relationship between gender and training. This is mirrored in the country specific differences in the intercepts and slopes of the lines.

The different interpretations of slopes and intercepts in a multilevel context can be neatly illustrated by the two bottom lines (Romania and Hungary) and the two top lines (Germany and Belgium) in Figure 4. While the regression lines for Romania and Hungary are quite similar in their intercepts (OR of 0.219 and 0.238), i.e. in their training odds for men holding a degree, they clearly differ in their slopes: Highly educated women in Hungary have higher training odds compared to highly educated men (OR of 1.748) while highly educated women in Romania are slightly less likely to train than their male counterparts (OR of 0.889). This means, that while the baseline levels of training in both countries are similar, the relationship between gender and training clearly differs across these countries. On the other hand, while the absolute training probabilities of men (as well as women) holding a degree considerably differ between Germany and Belgium (OR of 3.630 and 2.411), the training differences between highly educated men and women are fairly similar as indicated by the roughly parallel slopes of the regression lines for the two countries (OR of 1.072 and 1.110). Thus, in these countries, gender seems to have a very similar impact on training probability of highly educated employees although overall levels of training are different. When comparing Figure 4 and Figure 5, it becomes obvious that training levels of highly educated employees vary to a higher extent between European countries than levels of lower educated employees.

Figure 4: Training odds of employees with university degree in European countries[21]

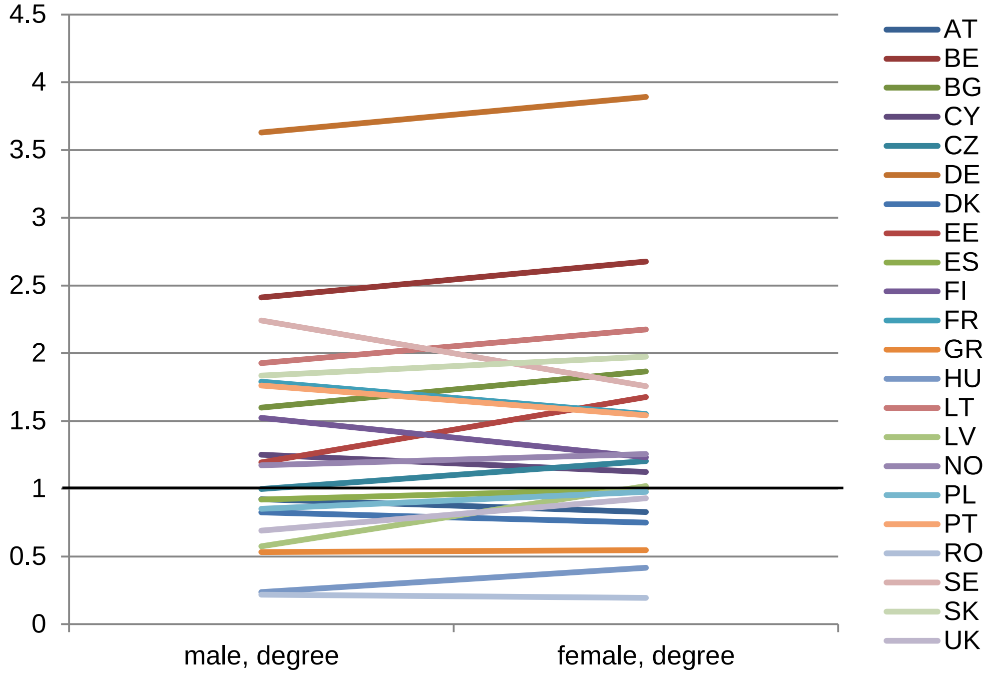
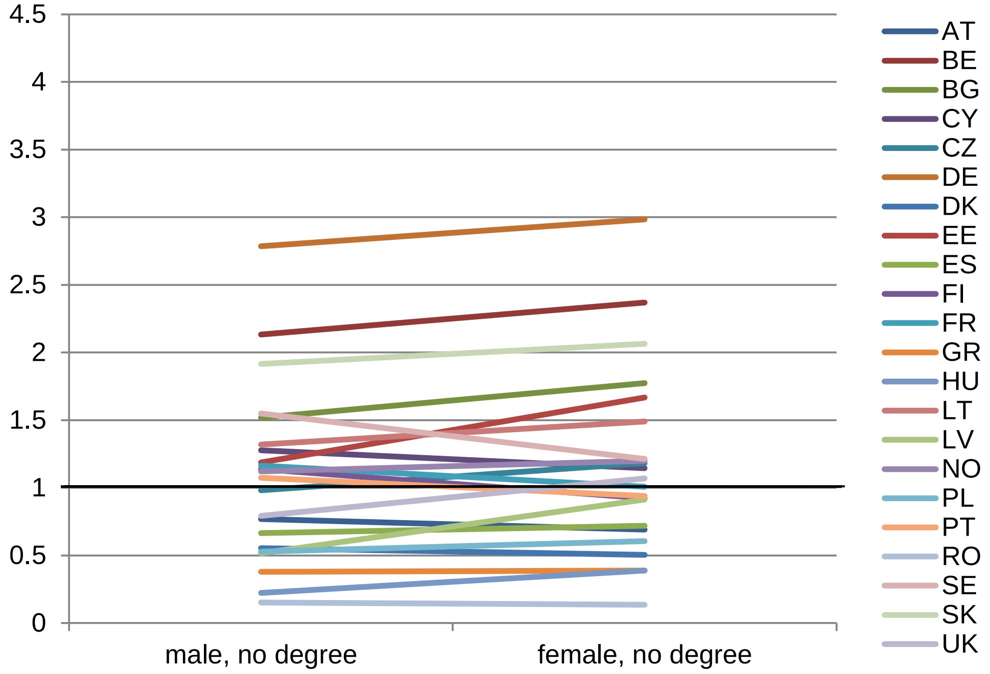


Figure 5: Training odds of employees without university degree in European countries



[21] Training odds in Figures 4 and 5 refer to newly hired employees who are 25 years old, work full-time as technicians or associate professionals in local units of more than 50 employees in the manufacturing industry.

As the aim of this study is to identify and explain training differences between men and women, these relationships are in the centre of interest. The focus of this section will consequently lie on these training differences while ignoring the absolute training probability of the different groups. Therefore, only the odds ratios for women relative to men of the same educational group, as represented by the slopes of the country lines in Figures 4 and 5 (and the "Female" dummy in Table 4 for all women), will be considered in the following analyses. The female odds ratios (i.e. the relative training odds of women compared to men) will serve as dependent variable in the regression analyses on country-level, while differences in the intercepts (i.e. the absolute training odds of men) are ignored at this point. The aim is to give a first impression of which institutional variables are relevant to explain the gender training gap, independently of the overall probability of training. This procedure is the first step to a multilevel analysis, as it is similar to the two-step-analysis. Analogous to the two-step-analysis, after estimating different slopes for each country, parameter estimates for slopes are taken as dependent variables in macro-level regressions including country-level explanatory variables (see Kreft & Leeuw, 2007: 38).

To run OLS regressions at country-level, the odds ratios of women compared to men (as summarised in Figure 3 and represented by the "Female" dummy in Table 4) have to be transformed into linear patterns first. For odds ratios between 0 and 1 the counter values are calculated (i.e. instead of odds for women compared to men, the odds for men compared to women were used). This makes sense, since the "[m]agnitudes of positive and negative effects should be compared by taking the inverse of the negative effect (or vice versa)" (Freese & Long, 2006: 179). After that, all values are centred at 0 by subtracting 1. The values previously calculated as counter values are finally multiplied by (-1) to depict a training disadvantage for women.[22]

The transformed odds ratios are then used as dependent variables in single regressions testing associations with indicators of cross-country differences in terms of labour market, educational system and support for women. To avoid very small coefficients, all independent variables except mean tenure and child benefits are divided by 100. As odds ratios are constant across the distribution of independent variables in logistic regressions and a higher estimated odds ratio consistently indicates a female advantage, this procedure provides a convenient way of linking micro relations to explanatory macro variables. Since the data set contains only 22 countries, simple regressions, instead of multiple regressions, are calculated. Findings should therefore be interpreted with caution as some of the institutional indicators are correlated (see Table 27 in the Appendix). Thus, significant results may be biased because of a "clustering" of institutional variables (Deeg, 2007).

[22] For example, among the highly educated, the odds ratio for Swedish women is 0.784. The counter value is 1.276; subtracting 1 and multiplying the result by (-1), leads to a value of -0.276 for Sweden. The odds ratio for highly educated women in Germany is 1.072; as it is above 1 it transformed in a value of 0.072 by subtracting 1.

Table 6 shows the regression coefficients for the estimated training gap for women compared to men. Column (1) resumes the results for all women while columns (2) and (3) contain the regression coefficients for the estimated training gap of women holding and those lacking a university a degree.

The long-term orientation of the labour market, as measured by mean tenure, seems to hamper women's training participation compared to men's. While the coefficient for all women slightly misses the 10% significance-level for women holding a university degree, it clearly indicates a negative impact of mean tenure on the relative training participation compared to men. Regressions on the measures concerning industrial relations show an interesting pattern. While union density and bargaining coverage do not seem to have an impact on the relative training odds of women without a degree, women holding a degree train comparatively less in the presence of strong unions. As men have a training disadvantage among employees holding a degree, the findings support the view that unions strive for equality among employees. However, when looking at employees without higher education there is no evidence for union effects on training equality: Women's training disadvantage among employees without a degree is not balanced by union strength. The median voter argument may explain this phenomenon. Since the median union voter is usually male, unions primarily support training interests of men. This should be especially the case when men are at risk of falling behind women, as it is true among highly educated workers. Findings for the female union ratio marginally miss the 10% significance-level but generally support this idea: The higher the share of women among union members, the more training do women receive compared to men. This is especially true for the more disadvantaged women lacking a university degree. The finding indicates that the more important women are in unions the more do disadvantaged women benefit from union policies in terms of training.

Findings on the education and skill system widely support previous assumptions. Women train more in countries with strong university systems that are supposed to support the generation of general human capital while they train less in countries with strong vocational systems which are supposed to support more specific skills. While the signs of the measures are equal for women with and without a degree, the importance of the determinants seems to vary depending on educational background. The vocational system appears to disproportionally handicap women without a degree while the negative coefficient for this indicator is not statistically significant for women holding a degree.

Table 6: Country-level factors and the gender training gap

	(1) **Female vs. male**	(2) **Female, degree vs. male, degree**	(3) **Female, no degree vs. male, no degree**
Labour market			
Mean tenure	-0.026	-0.055**	-0.015
	(0.115)	(0.020)	(0.436)
R^2	0.119	0.243	0.031
Union density	-0.232	-0.652**	-0.092
	(0.236)	(0.015)	(0.684)
R^2	0.069	0.260	0.008
Bargaining coverage	-0.309**	-0.677***	-0.175
(N=21)	(0.034)	(0.000)	(0.314)
R^2	0.216	0.507	0.053
Fem. union members	0.810	0.681	0.901
(N=20)	(0.111)	(0.380)	(0.111)
R^2	0.135	0.043	0.135
Educational system			
University	0.408*	0.299	0.383
	(0.084)	(0.396)	(0.161)
R^2	0.141	0.036	0.096
Vocational	-0.865**	-0.826	-0.893*
	(0.035)	(0.179)	(0.059)
R^2	0.205	0.089	0.167
Support for women			
Childcare < 3	0.050	-0.618	0.326
	(0.866)	(0.138)	(0.328)
R^2	0.001	0.107	0.048
Childcare ≥ 3	0.129	0.143	0.102
	(0.563)	(0.660)	(0.691)
R^2	0.017	0.010	0.008
Maternity leave	-0.148	-0.240	-0.035
	(0.649)	(0.611)	(0.926)
R^2	0.011	0.013	0.000
Child benefits	-0.037	-0.077*	-0.022
	(0.189)	(0.056)	(0.502)
R^2	0.085	0.170	0.023
Employment equality	0.382	-0.211	0.791
	(0.504)	(0.800)	(0.219)
R^2	0.023	0.003	0.074
Degree equality	0.396***	0.285	0.461***
	(0.008)	(0.216)	(0.006)
R^2	0.307	0.076	0.318
Pay equality	0.580	-0.286	0.653
	(0.396)	(0.775)	(0.403)
R^2	0.036	0.004	0.035

*** p<0.01, ** p<0.05, * p<0.1; p-values in parentheses; all regressions are simple regressions with N=22 if not specified otherwise; the regression on bargaining coverage does not include Romania; the regression on female union membership does not include Greece and Cyprus.

Most of the measures for the institutional support of women show no significant coefficients. For all women, only the "Degree equality" indicates higher female training participation the higher the gender equality in terms of education is. As the dependent variable was generated from the country regressions, which controlled for the educational level on an individual basis, this effect cannot be interpreted as a simple aggregated effect of women's individual education. Gender degree equality can rather be seen as a proxy for attitudes towards female education. Such attitudes are not only relevant for initial but also for continuous education and training. The finding of a significantly positive coefficient for females without a degree supports this idea: In countries, where the share of highly educated women is high, training participation among women that do not hold a degree themselves is also high (compared to men without a degree). Hence, in line with previous assumptions, gender degree equality appears to reflect a general positive attitude towards female education that favours work-related training of women.

The second indicator of women's support that suggests an effect on training is the one measuring child benefits. The higher child benefits are in a country, the lower the training participation of highly educated women is. The effect is in line with the previous assumption that child benefits incentivise women to stay away from the labour market after childbirth and hence invest less in their continuous training. However, contrary to the findings, effects on women without a university degree have been assumed to be stronger than for women holding a degree, as opportunity costs of the former are lower when leaving the labour market.

Although a number of the coefficients of the simple regressions are not statistically significant, they generally show the previously expected signs and give a first indication on the importance of the different institutional variables for female training participation and the gender training gap: High tenure and strong industrial relations are negatively linked to relative training participation of highly educated women, whereas a strong initial vocational training system is negatively related to training of lower educated employees. High child benefits are negatively connected to the relative training participation of highly educated women and degree equality appears to especially favour training of lower educated women. In the following chapter, female training will be further scrutinised in different multilevel models.

4.4 Multilevel analysis

After analysing individual and country data separately, which allowed looking into the single countries in greater detail, in the third step a multilevel analysis is performed. This way, theoretical underpinnings concerning the micro-macro structure of the data can be considered in a more accurate way. It further allows including more than one institutional variable at a time, controlling for cluster effects and taking into account the complex data-structure in one model. Another advantage is that the multilevel logit models permit interpreting not only the direction but also the size of the indicated effects, which, due to the logit regression at individual-level, was not possible in the previous analysis.

The multilevel models are estimated with the xtmelogit command as implemented in STATA 12 which provides log likelihood estimates by using Gaussian adaptive quadrature as approximation method for the integrals involved (Hamilton, 2011; Rabe-Hesketh & Skrondal, 2008). During the process of model fitting the Laplacian approximation (i.e. the application of one quadrature point only) is chosen as an option for the estimation procedures. This is convenient to speed up the computational processes. As Hamilton (2011) points out, odds ratios and their standard errors are usually well approximated by the Laplacian procedure. Although estimates of the random part might exhibit bias, the resulting model log-likelihoods and likelihood-ratio tests should be close to the actual ones. Simulation studies support that idea (Pinheiro & Chao, 2006). Further, asymptotic theory indicates that this approximation improves with larger clusters. In the following analyses, cluster sizes range from 358 to 11,475 individuals, depending on the specification. Hence, the Laplacian option is used during the model building process, when competing models are compared by using likelihood-ratio tests. However, once the final models are identified, the number of quadrature points will be increased to obtain more accurate estimates of variance components for further study.[23]

The multilevel analysis proceeds in three steps. Initially, the basic model with the individual-level variables and its fixed and random part is set up. This step provides insights into the structure of the gender training gap. More specifically, it helps to answer two questions. First: Is there a statistically and economically significant gender training gap in Europe? And second: If there is, are there statistically significant differences in this gender training gap between European countries (as indicated by the results in Chapter 4.2)? The first question can be answered looking at the fixed parts of the estimated models. The second question is addressed when interpreting the random parts of the models.

In the next step, institutional determinants of the gender training gap are analysed. Country variables defining the labour market, the educational system and the support for women as well as their interaction terms for female employees are included one-by-one to help explaining cross-country differences in overall training levels as well as the gender training gap. Statistically significant or economically important effects are interpreted and discussed at that point.

The two steps are done for all employees and are repeated afterwards for employees of different educational backgrounds separately because national institutions are assumed to have differing effects on men and women with and without university education. Finally, based on these findings, different multilevel models are estimated including all institutional variables and cross-level interactions that have been found to be related to training in a

[23] In the final models, 30 quadrature points are used. As these results are almost identical to the ones by Laplacian approximation (only very few estimates and p-values change by at most 0.003), it can be assumed that the size of the dataset leads to largely unbiased estimates in the model development process as well.

statistically significant way. This is a pragmatic approach for developing a comprehensive multilevel model on training and the gender training gap as the limited number of countries in the data set does not allow including all institutional variables that might be of theoretical relevance at once.

4.4.1 All employees

Table 7 illustrates the stepwise model development as proposed by Snijders & Bosker (2012: 102-108), explaining participation of work-related training for the whole sample of European employees. Model 1 depicts the empty model (also: unconditional model or null model) with no explanatory variables but a random intercept at country-level. The model serves as a baseline for comparison with more elaborated models and allows statements about the model fit and the explanatory value of the added variables (see Kreft & Leeuw, 2007: 63-64). The constant in the empty model indicates that the unconditional odds of training for all individuals in the sample are 0.638 to 1: For every 100 employees that do not train about 64 employees participate in training. However, the statistically significant standard deviation of the random intercept indicates that these training levels vary across European countries. The highly significant likelihood-ratio test (which in this case compares the empty multilevel model to the empty simple model) shows that a multilevel model is indicated as it fits the data structure better than a conventional logit model.

Table 7: Model development for all employees – level-1

	1	2	3	4
FIXED PART				
Female		0.924***	0.955	0.954
No degree		0.704***	0.706***	0.706***
Level-1 controls		✓	✓	✓
Constant	0.638***	0.830	0.801	0.847
RANDOM PART				
SD slope			0.197***	0.197***
SD intercept	0.735***	0.693***	0.736***	0.746***
Corr. slope-int.				-0.600***
MODEL STATISTICS				
Log likelihood	-53441.2	-48948.1	-48900.7	-48897.1
Parameters	2	42	43	44
LR test	***	***	***	***
Individuals	87,843	87,843	87,843	87,843
Countries	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; ✓ means that level-1 controls are included; reference model for the likelihood-ratio test of Model 1: conventional logit model, reference model for Models 2 to 4: always the previous model.

In Model 2 in Table 7, level-1 variables are included based on theoretical considerations. In line with the logit models in the Chapter 4.2, these are gender and education as well as additional variables controlling for age (raw and squared), tenure, part-time employment, occupation, industry, size of the local unit, degree of urbanization, year and interview method. Using the Wald test, all sets of dummy variables included in the model are found to be significantly related to training participation (not displayed). Not surprisingly, the model fit significantly improves compared to the empty model, which is the reference model in this case. Moreover, the standard deviation of the random intercept is reduced. This reflects the fact that the inclusion of level-1 variables accounts for some of the cross-country variation in training levels. That is reasonable, since the composition of job-related characteristics like occupation, industry and establishment size that are controlled for in Model 2 are likely to differ across European countries. The model further suggests that, in contradiction to the impression given by the descriptive statistics, being a woman does not result in a higher probability of training participation. Odds ratios even point to a negative link between being a women and training participation: Women's training odds are 0.924 times lower than men's training odds. Thus, the fact that female employees are more likely to participate in training than men appears to be caused by gender differences in other individual or firm characteristics such as occupation, industry or establishment size. Despite controlling for other variables, employees without university education still seem to be clearly disadvantaged when it comes to training. Compared to employees holding a degree, training odds of lower educated employees are lowered by the factor 0.706.

After the level-1 variables are included, the option of allowing for random slopes is considered. Although random slopes are possible for all level-1 variables, parsimonious models are preferred (see Snijders & Bosker, 2012: 105). This has not only a theoretical reason of the general preference for simpler models but also a practical one. Data usually contain less information about random effects than about fixed effects. Therefore, including many random slopes can lead to long iteration processes of the estimation algorithm. In some cases, the algorithm may even fail to converge. Consequently, a variable should only be considered as having a random slope when theoretical reflections indicate that its effect on the outcome varies across different contexts. In this case, this is true for the gender variable as previous theoretical arguments indicate the gender training gap to differ across countries. Thus, Model 3 in Table 7 includes a random effect for the "Female" dummy. The standard deviation at country-level is 0.197 and highly statistically significant, indicating that training odds of women compared to men differ across countries. The inclusion of the random effect not only improves the model fit but also affects the fixed coefficient of the variable: Including the random slope leads to a statistically non-significant fixed coefficient of the "Female" dummy. This indicates that being a woman does not have a negative effect on training per se, i.e. there does not seem to exist a general gender training gap. Instead, the association between being female and training participation varies considerably across countries which leads to significantly different gender effects in different countries.

The range of these country differences in the gender training gap can be illustrated, when taking into account the fixed and random part of the "Female" dummy (see Snijders &

Bosker, 2012: 77-78). A variable with a random slope can be interpreted as a logistically distributed random variable with a mean equal to its fixed effect and a country-level standard deviation as depicted by its random effect. These measures can serve to describe the scope of the variance between countries, since in large samples, the logistic distribution converges to the normal distribution, and 95% of the probability of a normal distribution lies within 1.96 standard deviations from the mean. When expressed in log odds, the fixed part of the female dummy coefficient takes the value of ln(0.954)=-0.047.[24] Consequently, 95% of the slopes range from (-0.047-(1.96*0.197) to (-0.047+(1.96*0.197)) log odds. Expressed in odds ratios, this means that in most of the countries, odds ratios of women compared to men should lie between the value of exp(-0.047-(1.96*0.197))=0.648 and exp(-0.047+(1.96*0.197))=1.404. That is a considerable variation as it means that women train between 0.648 times less than men and 1.404 times more than men. Though generally in line with the results in Section 4.2, multilevel analysis hints to slightly more negative "Female" effects than the separate country regressions. Here the odds ratios of the "Female" dummy ranged from 0.782 in the Slovak Republic to 1.505 in Latvia (Table 4).

Model 3 does not consider the covariance structure between the random parts of the model, i.e. assumes all covariance parameters to take the value of zero. Snijders & Bosker (2012: 79) warn of making this strong assumption since in social sciences the origin of the majority of variables is arbitrary. Therefore, they claim the intercept-by-slope covariance in random slope models to be a free parameter. It should not be a priori assumed to be zero but should be estimated from the data. For that reason, the model is re-estimated including a covariance parameter for the random effects, in particular the correlation between the random slope and the random intercept. The new Model 4 shows a better model fit than Model 3, which is indicated by the highly significant likelihood-ratio test. The correlation between random intercept and slope turns out to be significantly negative. This negative correlation suggests that in countries with high baseline levels of training (i.e. male training odds, represented by the intercept) the effect of being a woman (represented by the slope) tends to be more negative than in countries with low levels of training.

In the further process of model development, Model 4 will serve as the reference model for the interpretation of the random part. This is useful, because the definition of a coefficient of determination R^2 to express the explanatory qualities of a model is problematic in the suggested multilevel models. Opposed to single-level models where there is only one source of variance, in a two-level model as proposed in this study, "two potential sources of variation may be 'explained' by explanatory variables" (Kreft & Leeuw, 2007: 64): The individual-level differences and the country-level differences. As coefficient of determination for multilevel models, Snijders & Bosker (2012: 111-113) therefore suggest a measure of the proportional reduction in total residual variance compared to the empty model which

[24] As odds ratios are the exponentiated logit coefficients, log odds can be generated by taking the natural logarithm of the odds ratio (Buis, 2010).

is calculated as an index of the reduction in individual-level variance and country-level variance as well as the residual variance. Alternatively, Raudenbush & Bryk (2002) propose to estimate the proportional reduction in the variance for both levels separately, leading to one coefficient of determination at the individual- and another one at the country-level. However, in multilevel models including a random slope, such coefficients of determination cannot be defined straightforwardly. This is the case because including a random slope leads to a total residual variance that is not constant (as it is in random intercept models) but depends on the value of the explanatory variable (here the gender variable) and is therefore heteroskedastic (for a more detailed description see Rabe-Hesketh & Skrondal, 2008: 150-153). But most importantly, the measures suggested by Snijders & Bosker (2012) and Raudenbush & Bryk (2002) refer to linear models. While a STATA code allowing calculating these measures has recently become available (Möhring & Schmidt, 2013), hitherto they have been neither comparable measures nor codes available to calculate coefficients of determination for multilevel logit models. The interpretation of the changes in explained variance in this study can therefore only be based on the observed changes in the estimates for random intercepts and slopes between simpler and more complex models.

After including all level-1 variables that appear to be relevant, level-2 variables are considered as well. Level-2 variables can serve to explain the random intercept variance as they may account for differences in training levels between the countries. Further, cross-level interactions, i.e. the interaction of an individual- and a country-level variable, can serve to explain the slope's variance at country-level as the cross-level interactions account for differing macro-level effects on the outcomes of different groups of individuals. In this study, we assume that certain institutions have different effects on the training of men and women. This difference can be modelled by the inclusion of an interaction term between the institution and the "Female" dummy. In such a model, the regression coefficient of the institutional variable represents the effect on male employees (the main effect). The difference in the institution's training effects on men and women is represented by the coefficient of the interaction term.

As interaction terms are correlated with the original variables, they are a source of multicollinearity and are hence likely to lead to instability in the models (Snijders & Bosker, 2012: 105-106). Therefore, in the multilevel models, they will be introduced one-by-one for those variables that are theoretically assumed to interact. To model the theoretical assumptions that the labour market, the educational system and the support for women have an impact on the gender training gap, the variables describing these institutions and their interactions with the "Female" dummy are considered in the process of the model development.

Table 8 summarizes the results of different models including one institution at the time.[25] For every institution, either the model with only the institution or the model with the institution and its interaction with the "Female" dummy are displayed, depending on which of the two models showed a better fit in terms of the likelihood-ratio test. Whenever the model includes only the institutional variable without the interaction, the coefficient of the institution refers to a change in training levels of all employees in the sample. In models including the institutional variable next to its interaction with the "Female" dummy, the institution's coefficient represents the "main effect" of the institution, which in this case is the effect on men's training. The coefficient of the interaction term represents the additional effect of the institution on women, i.e. the difference in the institution's effect on men and women. The statistical and economic significance of this interaction suggests the importance of the institutional variable for the gender training gap. The entire institutional effect that is supposed to influence women's training is composed by the coefficient of the institution multiplied by the coefficient of the interaction term.

Concerning the institutions referring to the labour market, only "Mean tenure" is statistically and economically significantly related to overall training levels: For every year mean tenure rises, training is lowered by the factor 0.840, ceteris paribus. The relevance of the effect can be illustrated by taking into account the standard deviation of the variable (SD=2.504, see Table 22): A change in "Mean tenure" by one standard deviation is related to a decrease in training levels by the factor $0.840^{2.504}=0.646$ which can be considered a strong and economically significant relationship.[26] This strong relationship is also reflected in the random part of the model: When "Mean tenure" is included, the standard deviation of the random intercept decreases considerably compared to the reference model without any institutional variables (Model 4 from Table 7). This indicates that variations in mean tenure explain part of the cross-country difference in the overall training levels.

The other institutions depicting the labour market do not relate to overall training levels. Nevertheless, the ratio of female union members is positively related to training participation of women and thus affects the gender training gap: For every percentage point the share of female unionists rises, training odds of women increase by the factor 1.009 while training odds of men are not significantly influenced. A change of one standard deviation (SD=8.718) of the variable is, ceteris paribus, related to a rise in women's training by the factor $1.009^{8.718}=1.081$, which can be interpreted as a moderate effect.

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[25] The complete tables documenting the process of the level-2 model development for all employees can be found in the Appendix (Tables 28-31).

[26] In the course of this analysis, odds ratios between 1.1 and 1/1.1=0.91 per standard deviation are interpreted as moderate effects, odd ratios above 1.1 or below 1/1.1=0.91 as intermediate effects and odds ratios above 1.25 or below 1/1.25=0.80 as strong effects.

Table 8: Summary of the level-2 model development for all employees

	Labour Market				Educ. System		Support for Women						
Model	M. ten.	U. dens.	Bar cov.	F. u. m.	Uni	Vocat.	Chc. <3	Chc. ≥3	M. leave	Ch. ben.	Empl. e.	Deg. e.	Pay e.
FIXED PART													
Female	0.954	0.954	0.957	0.962	0.954	0.954	0.954	0.954	0.954	0.954	0.953	0.954	0.954
Institution	0.840***	1.007	0.998	1.005	0.998	1.042***	1.007	1.012*	1.031***	0.921	1.057***	1.002	0.971
Female x Inst.				1.009*	1.004*	0.989***			0.995				
RANDOM PART													
SD slope	0.198***	0.197***	0.203***	0.190***	0.183***	0.166***	0.197***	0.198***	0.188***	0.196***	0.196***	0.197***	0.198***
SD intercept	0.623***	0.722**	0.645***	0.746*	0.745*	0.635***	0.734**	0.698**	0.634***	0.752*	0.728**	0.750**	0.709**
Corr. slope-int.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

*** p<0.01, ** p<0.05, * p<0.1; ✓ means that a correlation between slope and intercept is considered; models control for previous education, age (raw and squared), tenure, part-time employment, occupation, industry, size of the local unit, degree of urbanization, year and interview method; the complete level-2 model development is displayed in Tables 28-31 in the Appendix.

Both institutions defining the educational system are related to training participation, and for both institutions the training effects seem to differ between men and women. Interestingly, when the vocational system is included without its cross-level interaction (see Table 29 in the Appendix), i.e. without distinguishing between the effects for men and women, the coefficient for "Vocational" is statistically insignificant and of moderate size. However, including the cross-level interaction reveals that the former model masks two significantly different effects on men and women. A highly statistically and economically significant coefficient of the institutional variable indicates a strong and positive effect on training odds of men while a statistically highly significant cross-level interaction of intermediate size indicates that in the presence of strong vocational systems, women are disadvantaged compared to men. For every percentage point the ratio of students in vocational programmes increases, training odds for men increase by the factor 1.042. Meanwhile, for every unit change in "Vocational", female training odds compared to males are lowered by the factor 0.989. However, even for women, the overall effect of the vocational system on training still seems to be positive: For every percentage point the ratio of students in vocational programmes increases, female training odds increase by the factor 1.042*0.989=1.031. Taking into account that the variable "Vocational" has a standard deviation of 9.983, for men a change of one standard deviation is associated with a training increase by the factor $1.042^{9.983}$=1.508, which can be interpreted as a strong and economically significant relationship. For women a change in one standard deviation is associated with a considerably lower increase in training odds, namely only by the tor $(1.042*0.989)^{9.983}$=1.350. A change in the vocational system can consequently have a substantial impact on the gender training gap.

While strong vocational systems seem to disproportionally favour men, strong university systems appear to favour women without having a significant impact on training for men. Women are significantly more likely to train than men when university education is strong: With every percentage point the share of university graduates rises, women's training odds rise by the factor 1.004. The economic effect is moderate, though: A change in one standard deviation rises women's training odds compared to men's odds by the tor $1.004^{17.599}$=1.073. Still, as men's training odds are not significantly related to the university system, a change in this institutional characteristic can have some impact on the gender training gap. This effect is opposed to the one of the vocational system, as women seem to benefit here whereas the vocational system appears to favour men.

In the random part of the model, the inclusion of the variables of the educational system lead to a decrease in standard deviation of the random intercept compared to the reference model. This indicates that the university system and – even more so – the vocational system explain part of the cross-country variation in overall training levels. Further, in both models, the slope variance is reduced by the inclusion of the cross-level interaction. This indicates that part of the cross-country differences in the gender effects on training can be explained by differences in the strength of the university and the vocational system. This reflects the finding that the vocational system is more positively related to the training of men than of women and that the university system is positively related to female training but does not seem to have an effect on male training participation. Overall, the results on the educational system are in line with the results of the country-level regressions in Table 6.

In terms of support for women, childcare for children between three and schooling age is statistically significantly related to overall training levels. When childcare increases one percentage point, overall levels of training rise by the factor 1.012. At first sight, this change may appear economically unimportant. However, when taking into account the rather high standard deviation of the variable (SD=19.265), the economic relevance of the factor becomes obvious: A change in one standard deviation is associated with an increase in training levels by the factor $1.012^{19.265}=1.258$. This strong effect is reflected in the considerable decrease of the random intercept, indicating that the cross-country variance in childcare for children below the schooling age explains part of the cross-national variation in overall training levels. However, as implied by the fact that a cross-level interaction between "Female" and "Childcare ≥3" does neither improve the model nor turn out to be significant (see Table 30 in the Appendix), women do not especially benefit from high levels of childcare.

Maternity leave is positively related to training levels. The relationship is statistically and economically highly significant: Results suggest that when paid maternity leave is extended by one week, training increases by the factor 1.031. When maternity leave changes by one standard deviation, overall training levels even increase by the factor $1.031^{13.232}=1.500$ Though not significantly so (p=0.16), maternity leave is negatively related to women's relative training participation compared to men: One week increase in maternity leave is related to a decrease in training by the factor 0.995. The overall effect of maternity leave on women's training appears still positive, though less than on men's training: One week of paid maternity leave appears to increase training for women by the factor 1.031*0.995=1.026; a change in one standard deviation by $(1.031*0.995)^{13.232}=1.402$. The result is in line with the previous assumption that long paid maternity leaves provide incentives for employers and employees to invest less in female than in male human capital. Again these findings are mirrored in the random part of the model: The decrease in the standard deviation of the random intercept indicates that cross-national differences in maternity leave policies account for part of the cross-country differences in training levels while the decrease in the random slope suggests that differences in maternity leave policies explain part of the cross-national differences in the gender training gap.

Employment equality is strongly positively related to training levels. The results indicate that a one percentage point increase in employment equality increases training levels by the factor 1.057; an increase by one standard deviation increases training levels by $1.057^{7.52}=1.517$. As the standard deviation of the intercept is reduced by the inclusion of the variable, employment equality seems to explain cross-country differences in training levels. In summary, some variables referring to the support of women in a country are related to training participation but none of them are found to have significantly differing effects on men and women.

4.4.2 Employees with university education

After explaining training participation by micro and macro variables for all employees, a separate analysis scrutinizes training participation of the 25,625 employees with university education. Results of the model development including level-1 variables are displayed in Table 9. Model 1, depicting the "empty model", shows that for highly educated employees, the unconditional odds of training are 1.242. That means that in this group, for 100 employees that did not train, there are about 124 employees that participated in training in the past 12 months. When compared with the results for all employees in Table 7, it becomes obvious that training participation among the higher educated is considerably higher than among employees in general, where only 64 employees trained for every 100 who did not. A multilevel model is appropriate as indicated by the highly significant likelihood-ratio test.

Model 2 confirms the results from the previous analyses in Section 4.2, indicating that among the highly educated employees, women are in fact significantly more likely to train: Women's odds to train are 1.064 times higher than men's. The inclusion of level-1 variables reduces the cross-country variance in training probability and the model fit improves.

The inclusion of a random slope for the "Female" dummy in Model 3 further improves the model fit. The highly significant parameter estimate indicates that the gender effect varies across countries. Again, the size of the cross-country variation can be illustrated: Expressed in log odds, the fixed part of the "Female" dummy coefficient takes the value of ln(1.085)=0.082. Hence, 95% of the slopes range from (0.082-(1.96*0.137)) to (0.082+(1.96*0.137)) log odds, which means that in most of the countries' odd ratios of women compared to men lie between exp(0.082-(1.96*0.137))=0.830 and exp(0.082+(1.96*0.137))=1.420. This interval is somewhat narrower than indicated by the results from the separate country regressions in Table 5 which show odds ratios for the "Female" dummy ranging from 0.784 to 1.772.

In Model 4, the intercept-slope correlation is included. However, neither is the estimated correlation statistically significant nor does the model fit improve. This means that in contrast to the results for all employees, among highly educated employees there is no relationship between overall levels of training in a country and the gender training gap. Therefore, the intercept slope correlation will not be further considered in the model development process. Model 3 will hence serve as reference for further model comparisons.

Table 9: Model development for employees with degree – level 1

	1	2	3	4
FIXED PART				
Female		1.064**	1.085*	1.085*
Level-1 controls		✓	✓	✓
Constant	1.242	0.570**	0.551***	0.543***
RANDOM PART				
SD slope			0.137***	0.135***
SD intercept	0.668***	0.632***	0.627***	0.624***
Corr. slope-int.				0.087
MODEL STATISTICS				
Log likelihood	-16689.5	-16118.7	-16115.3	-16115.3
Parameters	2	41	42	43
LR test	***	***	***	n.s.
Individuals	25,625	25,625	25,625	25,625
Countries	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; ✓ means that level-1 controls are included; reference model for the likelihood-ratio test of Model 1: conventional logit model, reference model for Models 2 to 4: always the previous model.

Table 10 summarizes the level-2 model development for employees with university education. Again, for every institution either the model including the institution alone or including the institution and its cross-level interaction is displayed, depending on which of the two models showed the better model fit in terms of the likelihood-ratio test.[27]

Among the institutions characterizing the labour market, “Mean tenure” is strongly negatively related to overall training levels. In addition differences in mean tenure appear to relate to the gender training gap. A rise in mean tenure by one year is related to a decrease in training for men by the factor 0.874; a rise in one standard deviation by $0.874^{2.504}=0.713$. The negative effect seems even stronger for women as they appear to suffer from an additional negative effect of 0.963. Their training odds decrease by the factor 0.874*0.963=0.843 for every year, and by $(0.874*0.963)^{2.504}=0.649$ for every standard deviation that mean tenure rises. These strong effects are reflected in the random part of the model: A comparison with the random part of Model 3 in Table 9 reveals that the standard deviations of the intercept and slope decrease considerably, indicating that a substantial part of the differences in the gender training gap as well as the level of training in general can be explained by mean tenure and its distinct effects on men and women.

Union density is not statistically significantly related to training of male employees. However, high union density appears to reduce women’s training participation: With every percentage point union density increases, training participation of highly educated women

[27] The complete tables documenting the process of the level-2 model development for employees with a university degree can be found in the Appendix (Tables 32-35).

decreases by the factor 0.996. However, as women generally hold an advantage among this group, union density does not lead to female disadvantage until union density rises more than 18.970 percentage points.[28] Considering that the standard deviation of the variable is SD=21.652 reveals that women's training advantage would be consumed within an increase of union density of less than one standard deviation. With every increase of union density by one standard deviation, women's training odds decrease by the factor $0.996^{21.652}= 0.917$, which can be interpreted as an effect of moderate size that causes a male advantage in the presence of strong unions. The random part of the model shows that part of the standard deviation of the slope can be explained by the interaction term, which confirms the assumption that gender differences in training can be explained by union density.

A similar pattern can be observed when bargaining coverage is included in the model. While the main effect of bargaining coverage is insignificant, the significant interaction term between the "Female" dummy and bargaining coverage indicates that among highly educated employees, for every percentage point that bargaining coverage rises, female training compared to male is lowered by the factor 0.996. However, to consume the female training advantage in this employee group, bargaining coverage has to increase by more than 23.1 percentage points.[29] As the standard deviation of this variable is 29.377, female training advantage vanishes when bargaining coverage increases by less than one standard deviation. For every standard deviation bargaining coverage increases, women's training odds decrease by the factor $0.996^{29.377}= 0.889$. This suggests that cross-country differences in bargaining coverage are related to the gender training gap, more specifically to women's training disadvantage compared to men. Further, a comparison of the random parts of the model with and without the cross-level interaction shows that the standard deviation of the slope is reduced by 64% when the cross-level interaction is included (SD slope=0.139 vs. SD slope=0.050, see Table 32 in the Appendix). Supporting the findings from the fixed part of the model, this indicates that a major part of the cross-country variation of the gender training gap among highly educated employees can be explained by differences in bargaining coverage. Thus, when analysing the effect of union strength on training participation, it appears important to distinguish between men and women of higher education.

Results on variables of the educational system indicate, that the importance of the university system in a country is not significantly related to training. Nevertheless, a strong vocational system appears to increase training levels of the higher educated: For every percentage point the share of vocational students rises, training participation increases by the fac-

[28] When union density increases 18.970 percentage points, the female training advantage of 1.079 (indicated by the coefficient of the "Female" dummy) is consumed by women's disadvantage of 0.996 (relative to men's training odds of 1.009) that is related to every percentage point unions density increases: $1.009^x=1.079*(1.009*0.996)^x \leftrightarrow x=18.970$.

[29] $1.003^x=1.097*(1.003*0.996)^x \leftrightarrow x=23.1$.

tor 1.029. A change in one standard deviation is related to a change in training levels by the factor $1.029^{9.983}=1.330$ which can be considered a rather strong effect. This finding is also reflected in the considerable decrease in the standard deviation of the intercept compared to Model 3 in Table 9. Thus, cross-country differences in the importance of the vocational system appear to explain part of the cross-country variation in overall training levels among highly educated employees. However, in contrast to the findings for all employees displayed in Table 8, the variables of the educational system in Table 10 do not appear to explain cross-country differences in the gender training gap.

Institutions depicting the support for women appear to be related to training levels as well as to the gender training gap. While the coefficient of the main effect of childcare for children below the age of three is not statistically significant, the odds ratio of the interaction term turns out to be significant. Opposed to previous assumptions, the odds ratio indicates a negative effect of the level of childcare on female training odds: For every percentage point the level of children in day care rises, the training odds for women compared to men are lowered by the factor 0.933. But, not only do training odds of women decrease compared to men. Multiplied by the main effect, training odds for women still seem to be negatively influenced by the provision of childcare: The overall female training odds decrease by the factor 0.944. This means that the female training advantage is balanced when levels of childcare rise by 1.070 percentage points.[30] Compared to the variable's standard deviation of 14.622, that is a very small increase. For every standard deviation childcare for young children increases, women's training participation compared to men's decreases by the factor $0.933^{14.622}=0.363$, which indicates a very strong negative effect of childcare on training for women of higher education. The strong interaction is also reflected in the decrease of the standard deviation of the slope and shows that part of the cross-country differences in the gender training gap can be explained by differences in the provision of childcare.

[30] $1.012^{x}=1.077*(1.012*0.933)^{x} \leftrightarrow x=1.070$.

Table 10: Summary of the level-2 model development for employees with degree

	Labour market				Educ. system		Support for women						
Model	M. ten.	U. dens.	Bar cov.	F. u. m.	Uni	Vocat.	Chc. <3	Chc. ≥3	M. leave	Ch. ben.	Empl. e.	Deg. e.	Pay e.
FIXED PART													
Female	1.084**	1.079*	1.097***	1.096*	1.085*	1.087*	1.077*	1.084*	1.085*	1.086*	1.083*	1.085*	1.085*
Institution	0.874***	1.009	1.003	1.011	1.003	1.029**	1.012	1.012	1.020**	1.023	1.042**	1.000	0.977
Female x Inst.	0.963**	0.996**	0.996***				0.933***			0.953***			
RANDOM PART													
SD slope	0.091***	0.127***	0.050**	0.145***	0.136***	0.141***	0.098***	0.135***	0.139***	0.076***	0.132***	0.137***	0.131***
SD intercept	0.532***	0.610***	0.523***	0.612***	0.625***	0.563***	0.617***	0.591***	0.577***	0.629***	0.571***	0.626***	0.614***

*** p<0.01, ** p<0.05, * p<0.1; models control for age (raw and squared), tenure, part-time employment, occupation, industry, size of the local unit, degree of urbanization, year and interview method; the complete level-2 model development is displayed in Tables 32-35 in the Appendix.

Maternity leave is positively related to overall training levels: For every week maternity leave rises, training odds rise by the factor 1.020. For every standard deviation maternity leave rise training odds rise by the factor $1.020^{13.232}=1.300$ which can be interpreted as a strong effect. This effect is similar for men and women. On the contrary, child benefits do not influence overall levels of training. Yet, as previously assumed, high child benefits are negatively related to female training participation and explain part of the cross-country variation in the gender training gap among highly educated employees. The female training advantage is consumed when child benefits rise more than 171.38€, ceteris paribus.[31] The variable's standard deviation is 1.481 which represents a variation of 148.10€. Thus, child benefits have to increase more than one standard deviation to consume women's training advantage. An increase of child benefits of one standard deviation is related to a decrease in women's training odds by the factor $0.953^{1.481}=0.931$.

Employment equality appears to raise the overall level of training: For every unit change in employment equality, training odds of employees holding a degree increase by the factor 1.042. With every standard deviation in employment equality, training levels increases by the factor $1.042^{6.265}=1.294$. Intercept variance is reduced, which means that gender employment equality explains part of the country-level variation in the overall odds of training. However, women do not benefit from this to a higher extend than men. Neither does the cross-level interaction turn out to be statistically significant, nor does the model fit improve when an interaction between the institution and the "Female" dummy is included (see Table 35 in the Appendix). Thus, a distinction of the institutional effect on men and women does not appear to be relevant. Degree and pay equality do neither seem to make a difference for training levels of highly educated employees nor for training differences between men and women.

4.4.3 Employees without university education

Analogue to the previous section analysing training of employees of higher education, in this section, institutional determinants for the gender training gap among employees without university education are examined. Table 11 shows that a multilevel approach is appropriate for the data of this subsample as well, and that model fit improves with increasing complexity from Models 1 to 4. Model 1 shows that among the lower educated, only about 46 employees train for every 100 employees that do not take part in training. This shows that employees without a degree train considerably less than employees with university education where 124 employees train for every 100 employees who do not train.

[31] $1.023^x=1.086*(1.023*0.953)^x \leftrightarrow x=1.7138$. The variable "Child benefits" is measured in 100€.

Table 11: Model development for employees with no degree – level 1

	1	2	3	4
FIXED PART				
Female		0.846***	0.886**	0.885**
Level-1 controls		✓	✓	✓
Constant	0.462***	0.717	0.700	0.721
RANDOM PART				
SD slope			0.205***	0.205***
SD intercept	0.776***	0.726***	0.773***	0.796***
Corr. slope-int.				-0.681***
MODEL STATISTICS				
Log likelihood	-34626.3	-32641.8	-32603.6	-32598.9
Parameters	2	41	42	43
LR test	***	***	***	***
Individuals	62,218	62,218	62,218	62,218
Countries	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; ✓ means that level-1 controls are included; reference model for the likelihood-ratio test of Model 1: conventional logit model, reference model for Models 2 to 4: always the previous model.

Contrary to employees holding a degree, among lower educated employees, females are less likely to train than men. Model 4 indicates women's training odds are 0.885 times lower than the odds of men. The statistically significant parameters in the random part of the model further suggest that in this employee group, overall training levels as well as the gender training gap significantly vary between countries. In contrast to the results for highly educated employees, both random measures are negatively correlated. This suggests that, for this specific employee group, countries with higher overall levels of training tend to show lower training odds for women compared to men. Taking into account the random and the fixed part of the "Female" dummy leads to the conclusion that for this employee group, at country-level, 95% of the odds ratios for women lie between 0.593 and 1.324. These results are slightly more pessimistic for women than the results displayed in Figure 3, which indicate the lowest female odds ratio to be 0.652 for the Czech Republic and highest to be 1.368 for Latvia.

Table 12 shows the results of the models including the institutional variables.[32] It appears that labour market institutions, while being related to overall levels of training among the lower educated do not have an impact on gender differences in training. High mean tenure appears to be strongly negatively related to training of employees without university education: For every year that mean tenure rises, training odds are lowered by the factor 0.852; for every change in one standard deviation women's training is lowered by the factor $0.852^{2.504}$=0.670. High union density seems to be related to higher overall training levels

[32] The complete tables documenting the process of the level-2 model development for employees without a university degree can be found in the Appendix (Tables 36-39).

among employees without university education: For every standard deviation union density increases, training odds increase by the factor $1.013^{21.652}=1.325$. The strong effects of mean tenure and union density are reflected in the random part of the models. The considerable drops in the intercepts' standard deviation suggest that differences in mean tenure and union density account for cross-country differences in training levels. While bargaining coverage is not related to training of the lower educated, a high share of female union members is. Although the model including this institutional measure reveals that overall levels of training do not significantly increase with high shares of female unionists, the cross-level interaction with the "Female" dummy – although only significant at 11% – supports the assumption that a high rate of women in unions has a positive impact on female training participation: For every standard deviation the share of female unionist rises, training odds for women increase by the factor $1.010^{8.718}=1.090$, which can be interpreted as an effect of moderate size.

When comparing these findings to the results for highly educated employees in Table 10, it becomes obvious that correlations between training and labour market characteristics vary for employees of different educational backgrounds. High mean tenure, which is generally related to lower training levels, appears to present an additional disadvantage for women of higher education compared to men, while it does not have significantly differing effects on men and women of lower education. While for the lower educated, a high union density is consistently related to a higher training probability, among the highly educated, union strength basically favours men. Moreover, while a high share of women in trade unions is positively related to female training participation among the lower educated, it is neither significantly related to training levels nor gender differences among university graduates.

The results on the educational system reveal that the importance of the university system is not related to training participation of employees without a degree. On the contrary, the importance of the vocational system appears to have an effect on both the overall level of training and the gender training gap, as indicated by the statistically significant odds ratios of the institutional coefficient and the interaction term as well as the reduction of the random parameters. For every percentage point the share of pupils in vocational programmes rises, male training odds rise by the factor 1.052; for every standard deviation by the factor $1.052^{9.983}=1.659$. However, women benefit significantly less from vocational systems as their training odds compared to men are lowered by the factor 0.990. Still, the overall relationship between the vocational system and training is strongly positive for women as well: With every increase in standard deviation women's training increases by $(1.052*0.990)^{9.983}=1.500$. Overall, the results on the educational system are similar to the results for employees with a degree displayed in Table 10.

Table 12: Summary of the level-2 model development for employees with no degree

	Labour Market				**Educ. System**		**Support for Women**						
Model	M. ten.	U. dens.	Bar cov.	F. u. m.	Uni	Vocat.	Chc. <3	Chc. ≥3	M. leave	Ch. ben.	Empl. e.	Deg. e.	Pay e.
FIXED PART													
Female	0.886**	0.887**	0.884**	0.894**	0.885**	0.884***	0.885**	0.886**	0.886**	0.885**	0.883**	0.884**	0.885**
Institution	0.852***	1.013*	1.000	1.002	1.002	1.052***	1.014	1.012	1.027***	0.927	1.037	0.997	0.971
Female x Inst.				1.010		0.990**					1.010	1.003	
RANDOM PART													
SD slope	0.206***	0.203***	0.209***	0.196***	0.205***	0.179***	0.204***	0.205***	0.205***	0.204***	0.191***	0.191***	0.206***
SD intercept	0.657***	0.770***	0.695***	0.805***	0.801***	0.655***	0.786***	0.747***	0.676***	0.798***	0.777***	0.788***	0.751*
Corr. slope-int.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

*** p<0.01, ** p<0.05, * p<0.1; ✓ means that a correlation between slope and intercept is considered; models control for previous education, age (raw and squared), tenure, part-time employment, occupation, industry, size of the local unit, degree of urbanization, year and interview method; the complete level-2 model development is displayed in Tables 36-39 in the Appendix.

The measures of support for women do not show many statistically significant relationships to training. Maternity leave seems to raise overall levels of training considerably, without differing in the effects on men and women. For every standard deviation paid maternity leave increases, training odds of lower educated employees increase by the factor $1.027^{13.232}$=1.423.

When included without a cross-level interaction term, employment equality appears to raise overall levels of training participation (see Table 39 in the Appendix). However, as model fit improves with the interaction term for females, the model including the interaction is preferred and thus displayed in Table 12. The odds ratios indicate a strongly positive relationship for men (significant at 13%) but an even stronger positive effect for women (significant at 12%): With every change in standard deviation, men's training odds increase by the factor $1.037^{26.663}$=2.635 while women's training odds even increase by the factor $(1.037*1.010)^{26.663}$=3.435. Degree equality is not significantly related to training levels. The interaction between the "Female" dummy and degree equality is significant at 12% error probability, indicating that in countries where the level of women holding a university degree is high, training odds for women without a degree rise in comparison to equally qualified men. The effect appears moderate in size ($1.003^{6.265}$=1.019). Still, it reflects the result on this indicator from the country-level analyses shown in Table 6.

Overall, the result on the indicators for women's support slightly differ to the ones for employees with university education displayed in Table 10: While childcare for children under the age of three is related to a comparative training disadvantage of women with university education, it does not have an impact on gender equality among the lower educated. However, for employees of lower education, childcare for children aged three and older appear to raise overall training levels while it does not seem to have an impact on training levels of the highly educated. Child benefits appear to be negatively related to relative training participation of highly educated women but not of lower educated women.

4.4.4 Final multilevel models

Table 13 summarizes the results of the multilevel analyses of the three different samples. The most striking findings concern the "Female" dummy: While there is no significant difference between men and women in general in terms of training, there is a female training advantage among employees of higher education and a female disadvantage among employees without university education. However, the random part of the regressions implies that for all three samples, the gender effects significantly vary across countries. The same is true for the overall levels of training (indicated by the significant random intercept). While there is a negative correlation between the overall level of training and female training odds among employees without a degree, there is no such association among higher educated.

Table 13: Summary of the multilevel results

	All	Degree	No degree
FIXED PART			
Female	0	+	-
Mean tenure	-	-	-
Mean tenure x f.	0	-	0
Union density	0	0	+
Union density x f.	0	-	0
Bargaining coverage	0	0	0
Bargaining coverage x f.	0	-	0
Female union membership	0	0	+
Female union membership x f.	+	0	0
University	0	0	0
University x f.	+	0	0
Vocational	+	+	+
Vocational x f.	-	0	-
Childcare <3	0	0	0
Childcare <3 x f.	0	-	0
Childcare ≥3	+	0	+
Childcare ≥3 x f.	0	0	0
Maternity leave	+	+	+
Maternity leave x f.	0	0	0
Child benefits	0	0	0
Child benefits x f.	0	-	0
Employment equality	+	+	(+)
Employment equality x f.	0	0	(+)
Degree equality	0	0	0
Degree equality x f.	0	0	0
Pay equality	0	0	0
Pay equality x f.	0	0	0
RANDOM PART			
SD slope	+	+	+
SD intercept	+	+	+
Corr. slope-int.	-	0	-

0= no significant relationship, + = statistically significant positive relationship, (+) = statistically insignificant but economically significant positive relationship, - = statistically significant negative relationship.

The previous analyses indicate that the training of employees with a degree is explained by other institutions than training for employees without a degree: While for highly educated “Mean tenure”, “Vocational”, “Employment equality” and “Maternity leave” explain overall levels of training, training of employees without a degree can be explained by “Mean tenure”, “Union density”, “Female union membership”, “Vocational”, “Childcare ≥3”, “Maternity leave” and “Employment equality”.

Similarly, the gender training gap is explained by different institutions. Differences in the training odds of men and women with university education can be explained by “Mean tenure”, “Union density”, “Bargaining coverage” and “Childcare ≥3” (indicated by the statistically significant interactions between these institutions with the “Female” dummy). For employees without a degree, differences are only explained by cross-country differences in the variable “Vocational”.

The variables that were found to be significantly related to training in the previous analyses are now combined into one model for each employee group. Whenever an interaction was found to be statistically significant, both the interaction and the main effect are included. Regression results are presented in Table 14. Columns (1) and (2) display the results for all employees, columns (3) and (4) for employees with a university degree and columns (5) and (6) for employees without university education. In columns (1), (3) and (5), models include only those institutional variables that are available for all countries; that is, neither the ratio of women in unions nor bargaining coverage is considered. Columns (2), (4) and (6) display the models including all variables that are found to be correlated with training, including the ratio of female unionists or bargaining coverage if relevant. These models consequently refer to a smaller set of countries (the ratio of female unionists is not available for Greece and Cyprus while bargaining coverage is not available for Romania).

The table shows that the direction of the implied effects basically stays the same as in the separate analyses. However, many of the coefficients lose their significance. This may either be due to the few degrees of freedom at the macro-level or due to correlations between the macro variables. For all employees, the variables “Mean tenure” as well as “Vocational” and their interactions for women turn out to be statistically significantly related to training. More specifically, results in column (1) indicate that long mean tenure is significantly related to lower training odds: For every year that mean tenure rises, training odds are lowered by the factor 0.825. Moreover, for every percentage point the ratio of students in vocational training programmes rises, training probability of all employees is raised by the factor 1.047. However, male and female training odds do not rise equally, as for every percentage point the vocational student ratio increases, female training odds compared to males are lowered by the factor 0.990. However, this turns into a positive effect on training for women as well: Although female training odds rise significantly less than male, they still rise by the factor 1.037. Every increase in standard deviation of the variable “Vocational” is related to an increase in the training odds of men by the factor $1.047^{9.983}=1.582$ and by the factor $1.047*0.990^{9.983}=1.431$ for women. For both men and women, this indicates a strong positive effect, though it is significantly lower for women than for men. A comparison of the random part of the model with Model 4 from Table 7 reveals that the interaction terms included in the model are able to explain part of the cross-country variation in the gender training gap, while the included main effects explain part of the cross-country variation in the training levels. The inclusion of the interaction between the ratio of women in unions and the “Female” dummy in column (2) does not change the results: Neither does the variable itself show a significant relation to training participation, nor does it change any of the implications for any of the other variables.

Table 14: Final multilevel models for the different employee groups

	(1)	(2)	(3)	(4)	(5)	(6)
	All		**Degree**		**No degree**	
FIXED PART						
Female	0.954 (0.229)	0.975 (0.526)	1.077** (0.017)	1.075** (0.027)	0.889*** (0.010)	0.907** (0.031)
No degree	0.706*** (0.000)	0.700*** (0.000)				
Mean tenure	0.825*** (0.000)	0.827*** (0.000)	0.857*** (0.001)	0.988 (0.875)	0.832*** (0.000)	0.829*** (0.000)
Mean ten. x f.			0.965** (0.011)	0.948* (0.052)		
Union density			1.006 (0.402)	0.998 (0.843)	1.006 (0.136)	1.004 (0.560)
Union dens. x f.			0.999 (0.586)	0.999 (0.592)		
Bargaining cov.				1.009 (0.205)		
Bar. cov. x f.				1.000 (0.883)		
F. union mem.		0.989 (0.637)				0.992 (0.622)
F. u. mem. x f.		1.005 (0.304)				
University	0.992 (0.191)	0.999 (0.949)				
University x f.	1.003 (0.127)	1.001 (0.836)				
Vocational	1.044*** (0.000)	1.053*** (0.000)	1.028** (0.040)	1.009 (0.518)	1.048*** (0.000)	1.055*** (0.000)
Vocational x f.	0.990** (0.011)	0.987*** (0.003)			0.990** (0.020)	0.986*** (0.003)
Childcare <3			1.003 (0.740)	0.996 (0.658)		
Childc. <3 x f.			0.994** (0.021)	0.993** (0.032)		
Childc. ≥3	0.996 (0.421)	0.998 (0.849)			0.996 (0.411)	0.998 (0.812)
Maternity leave	1.009 (0.173)	1.010 (0.192)	1.004 (0.656)	1.010 (0.219)	1.011* (0.082)	1.012* (0.084)
Child benefits			1.121 (0.149)	0.958 (0.652)		
Child ben. x f.			0.972* (0.050)	0.977 (0.174)		
Employ. equ.	1.019 (0.226)	1.022 (0.384)	1.012 (0.434)	1.053*** (0.006)	1.013 (0.364)	1.023 (0.396)
Constant	0.865 (0.307)	0.858 (0.301)	0.693* (0.068)	0.750 (0.121)	0.775* (0.098)	0.747* (0.065)

*** $p<0.01$, ** $p<0.05$, * $p<0.1$; p-values in parentheses; models further control for the level-1 variables identified in the previous models.

Table 14 (continued): Final multilevel models for the different employee groups

	(1)	(2)	(3)	(4)	(5)	(6)
	All		**Degree**		**No degree**	
RANDOM PART						
SD slope	0.156***	0.145***	1.24e-08	3.81e-07	0.177***	0.163***
	(0.000)	(0.000)	(1.000)	(1.000)	(0.000)	(0.000)
SD intercept	0.390***	0.368***	0.398***	0.339***	0.405***	0.376***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Corr. slope-int.	-0.636***	-0.519**			-0.766***	-0.675***
	(0.000)	(0.014)			(0.000)	(0.004)
MODEL STATISTICS						
Individuals	87,843	82,485	25,625	24,279	62,218	58,629
Countries	22	20	22	21	22	20

*** p<0.01, ** p<0.05, * p<0.1; p-values in parentheses; models further control for the level-1 variables identified in the previous models.

Column (3) presents the results for highly educated employees without taking into account the measure of bargaining coverage. “Mean tenure”, its interaction for females, “Vocational” and the interactions “Childcare <3 x female” and “Child benefits x female” are significantly related to training participation of highly educated employees. For every year that mean tenure rises, training odds are lowered by the factor 0.857 for men and by 0.857*0.965=0.827 for women. A change in one standard deviation should lower men’s training odds by $0.857^{2.504}$=0.679 and women’s by $0.857*0.965^{2.504}$=0.621. This suggests strong negative effects of mean tenure on both men and women. Still, the negative effects on women are significantly stronger. All else equal, mean tenure has to rise 2.082 years[33] to balance the female training advantage among highly educated employees. This is less than one standard deviation of the variable. From that point on, rising mean tenure translates into a male training advantage.

A strong vocational system is related to higher overall levels of training of highly educated employees: For every percentage point the ratio of vocational students rises, training odds for both men and women rise by the factor 1.028. As assumed, child benefits are negatively associated with training for female employees: For every 100€ child benefits are raised, women’s training odds relative to men’s are lowered by the factor 0.972. For every standard deviation, women’s training odds decrease by the factor $0.972^{1.481}$=0.959 compared to men’s odds. This indicates an effect of moderate size. If child benefits rise more than 261.20€[34], ceteris paribus, highly educated women become disadvantaged compared to men. Child benefits have to rise almost two standard deviations to compensate women’s training advantage over men. Controlling for other factors, this relationship appears weaker than assumed by the single-institution-model displayed in Table 10.

[33] $0.857^x=1.077*(0.857*0.965)^x \leftrightarrow x=2.082$.
[34] $1.121^x=1.077*(1.121*0.972)^x \leftrightarrow x=2.612$. The variable “Child benefits” is measured in 100€.

Contrary to the assumed direction, childcare for children under the age of three is negatively related to training of women holding a university degree: For every percentage point the ratio of children under the age of three in childcare rises, the training odds of highly educated women compared to highly educated men are lowered by the factor 0.994. This leads to a female training disadvantage when childcare rises more than 12.326 percentage points[35], ceteris paribus. This relationship is considerably weaker than indicated in the single-institution-model in Table 10. Now, for every standard deviation, women's training odds are only lowered by the factor $0.994^{14.622}=0.916$, which indicates a moderate effect size instead of a strong one. The effects of other institutions correlated with high levels of childcare, which are controlled in the final model, might have led to the strong results in Table 10. However, though the negative relationship of childcare and women's training is weaker than suggested by the single-institution-model, it still opposes theoretical arguments outlined in section 2.2.2.3, which assumed a female training advantage in the presence of high levels of childcare. A reason for this surprising finding might be that in countries with high levels of childcare, women return to their jobs early after childbirth, while in other countries, women with young children stay out of the labour market. Though having childcare available may enable women to return to their jobs, they may still have not as much time to spare for the participation in training as men. In contrast, in countries with low levels of childcare, many mothers do not return to their jobs while their children are small. These women are then not included in this analysis since it only covers individuals in employment. It is thus conceivable that in countries with low levels of childcare the sample contains fewer mothers of small children than in countries with high levels of childcare. Such a difference could explain the negative relationship between childcare and training of women.

To verify this interpretation, a variable is generated that measures the ratio of women under the age of 40 who live with children below the age of three, among all employees of a country.[36] In this case the AES provides data for all countries except Greece, Poland and the UK. Linking this measure with childcare for children below the age of three reveals a highly significant correlation of 0.787. There are different explanations for this: Either high levels of childcare enable women to return to the labour market early after childbirth or high levels of childcare allow women to reconcile family and job issues, instead of forcing them to choose between children and career. In other words, low levels of childcare could, on the one hand, hinder mothers from returning to the labour market after childbirth but also may initially have an impact on women's fertility decision: Women in countries with high levels of childcare may just be more likely to become mothers in the first place. Either way, this obviously has an impact on the analysed country samples: In countries with high levels of childcare, we appear to find more mothers of small children in the sample than in

[35] $1.003^x=1.077*(1.003*0.994)^x \leftrightarrow x=12.326$
[36] Though this measure does not clearly indicate that the woman is the mother of the child, it may serve as a proxy since women at this age living with small children are usually their mothers.

countries with lower levels of childcare. It therefore very well may be that these women manage to go back to employment but do not have enough time left to invest in training.

Column (4) displays the results of the model for the highly educated including the measure for bargaining coverage. Though neither the main effect nor the interaction indicate a significant effect on training participation of men or women, the inclusion of the variables changes the implication of some other variables. This might be due to clustering of the macro variables or due to the different sample composition, since in this specification Romanian data is no longer included. Romania is an outliner in terms of very high mean tenure (19.02 years, while all other countries' mean tenures range from 7.50 to 13.57 years, see Table 26 in the Appendix) combined with the lowest training rate of all countries in the dataset. In the model including bargaining coverage but excluding the Romanian data, the variables "Mean tenure" and "Vocational" do no longer show a significant relationship to training participation. However, the interaction between mean tenure and being female still indicates that women are significantly disadvantaged compared to men, when mean tenure rises. The same is true for the interaction between childcare for children under the age of three and being a woman. Unlike the previous model, the effect of employment equality on training is found to be significantly positive while the interaction "Child benefits x female" loses its statistical significance.

The most striking finding in columns (3) and (4) is however found in the random part: Not only does the standard deviation of the random slope in column (3) shrink to 0.0000000124, it also turns out to be not significant any more. This indicates that the included interaction terms basically explain the entire cross-country variation in the gender training gap for highly educated employees. Compared to Model 3 in Table 9, the standard deviation of the random intercept of the model in column (3) is reduced as well. This further implies that part of the variation in overall training levels is explained by the macro variables.

In columns (5) and (6), referring to employees without a degree, no significant impact of union density, childcare or employment equality on training can be detected. Nevertheless, training odds seem to be positively related to strong vocational systems. Men seem to benefit from these systems to a stronger extent than women: While for every percentage point students in vocational programmes rise, male training odds rise by the factor 1.048 whereas female odds only rise by 1.048*0.990=1.038. Like for all employees, this indicates strong effects for lower educated men and women, which becomes obvious when the standard deviation of the variable is taken into account.[37] However, it also indicates that the gender training gap increases with increasing importance of the initial vocational train-

[37] Men's training odds increase by $1.048^{9.983}=1.597$ with every standard deviation "Vocational" changes while women's training odds increase by $1.048*0.990^{9.983}=1.444$.

ing system. High mean tenure is negatively correlated to training levels while long maternity leaves are positively correlated. The variable “Female union members” added in the model in column (6) does neither show a significant odds ratio nor does its inclusion change the implications of the other variables.

The results in column (4) raised the question if the findings might be driven by a specific sample composition since other institutional estimates changed when bargaining coverage was included and Romanian data was dropped. To find out if the previous results are robust to changes in the sample composition or are rather driven by the low training values of Romania, the multilevel analysis is repeated without Romania. A summary of the model development process can be found in Table 40 in the Appendix. The newly specified final models for the three employee groups are displayed in Table 15.

The final models excluding data from Romania mainly reproduce the results of the previous analyses in terms of the institutions explaining the gender training gap. The only difference here is that the negative relationship between child benefits and female training participation previously found among the highly educated is no longer significant at the 10% level. However, the models do suggest different overall effects of some institutions on training. Most importantly, the coefficient of the variable “Mean tenure” which was found to be negatively related to training participation in all specifications which included Romania, is only statistically significant for lower educated employees. It appears consequently, that the negative relationship between tenure and training among highly educated employees was mainly driven by Romania. Moreover, the vocational system no longer appears to be positively related to training levels of the highly educated. Most strikingly, the models suggest a highly significant positive relationship between employment equality and training across all employee groups, which was not found in the models including Romania. Further, degree equality appears to be negatively related to overall training levels of the lower educated. This last finding, however, appears to be caused by clustering with any of the other institutional variables, as “Degree equality” was not found to be statistically significant in the single-institution-model (Table 12) but only included because its cross-level interaction appeared to be positively related to training. In the final model, though, the interaction turned statistically insignificant, while the main effect turned significant.

Table 15: Final multilevel models for the different employee groups excluding Romania

	(1)	(2)	(3)	(4)	(5)
	All		**Degree**	**No degree**	
FIXED PART					
Female	0.952 (0.217)	0.973 (0.496)	1.075** (0.027)	0.877*** (0.003)	0.897** (0.014)
No degree	0.705*** (0.000)	0.699*** (0.000)			
Mean tenure	0.922 (0.118)	0.923 (0.128)	0.988 (0.875)	0.832*** (0.000)	0.829*** (0.000)
Mean ten. x f.			0.948* (0.052)		
Union density	1.003 (0.436)	1.000 (0.990)	0.998 (0.842)	1.005 (0.185)	1.004 (0.489)
Union dens. x f.			0.999 (0.593)		
Bargaining cov.			1.009 (0.205)		
Bar. cov. x f.			1.000 (0.883)		
F. union mem.		0.987 (0.420)			0.993 (0.679)
F. u. mem. x f.		1.005 (0.326)			1.004 (0.429)
University	0.992 (0.165)	1.000 (0.950)			
University x f.	1.003 (0.125)	1.001 (0.827)			
Vocational	1.038*** (0.000)	1.047*** (0.000)	1.009 (0.518)	1.031*** (0.006)	1.037*** (0.008)
Vocational x f.	0.989*** (0.007)	0.986*** (0.001)		0.989** (0.016)	0.986*** (0.004)
Childcare <3			0.996 (0.658)		
Childc. <3 x f.			0.993** (0.032)		
Maternity leave	1.008 (0.223)	1.011 (0.111)	1.010 (0.219)	1.015* (0.024)	1.015** (0.031)
Child benefits			0.958 (0.652)		
Child ben. x f.			0.977 (0.174)		
Employ. equ.	1.034** (0.030)	1.041* (0.081)	1.053*** (0.006)	1.052*** (0.000)	1.053** (0.040)
Degree equality				0.991** (0.018)	0.994 (0.124)
Degree e. x f.				1.002 (0.168)	1.001 (0.641)
Constant	1.063 (0.678)	1.001 (0.997)	0.750 (0.121)	1.012 (0.938)	0.973 (0.864)

*** p<0.01, ** p<0.05, * p<0.1; p-values in parentheses; models further control for the level-1 variables identified in the previous models.

Table 15 (continued): Final multilevel models for the different employee groups excluding Romania

	(1)	(2)	(3)	(4)	(5)
	All		**Degree**	**No degree**	
RANDOM PART					
SD slope	0.155*** (0.000)	0.144*** (0.000)	3.81e-07 (1.000)	0.163*** (0.000)	0.149*** (0.000)
SD intercept	0.364*** (0.000)	0.331*** (0.000)	0.339*** (0.000)	0.401*** (0.000)	0.381*** (0.000)
Corr. slope-int.	-0.664*** (0.000)	-0.523*** (0.007)		-0.788*** (0.000)	-0.713*** (0.000)
MODEL STATISTICS					
Individuals	81,440	76,082	24,279	57,161	53,572
Countries	21	19	21	21	19

*** p<0.01, ** p<0.05, * p<0.1; p-values in parentheses; models further control for the level-1 variables identified in the previous models.

Overall, the multilevel analyses clearly support the idea that the gender training gaps among different employee groups vary across European countries. Most interestingly, these variations can be explained by interactions between gender and national institutions. As indicated by the extremely low and statistically insignificant standard deviation of the random slope, almost the entire cross-country variation of training differences among the highly educated can be explained by the cross-level interactions included in the model. In other words, the cross-country differences in the gender training gap among the highly educated can be explained by differing effects of mean tenure, union density, childcare and child benefits on men and women. The higher these measures are the lower is women's training participation among highly educated employees.

These findings can also be deducted from the results of the individual-level analyses in Section 4.2. Table 16 summarizes mean tenure, union density, childcare and child benefits for those countries for which individual-level regressions indicated a (usually not statistically significant) training disadvantage or a statistically significant training advantage of highly educated woman compared to men (see Table 5). Countries where highly educated women are somewhat disadvantaged show above average values in at least two of these measures. On the contrary, almost all countries, where highly educated women were found to have a statistically significant training advantage over men, score below average in all these institutions. This supports the finding from the multilevel analysis that mean tenure, union density, childcare and child benefits explain cross-country differences in the gender training gap among highly educated employees.

Table 16: Institutional indicators for countries with opposing gender gaps among employees with a degree

	Mean tenure	Union density	Childcare <3	Child benefits
Countries with training disadvantage of highly educated women				
AT	+	-	-	+
CY	+	+	+	+
DK	-	+	+	+
FI	+	+	+	+
FR	+	-	+	+
PT	+	-	+	-
RO	+	+	-	-
SE	+	+	+	-
Countries with significant training advantage of highly educated women				
EE	-	-	-	-
HU	-	-	-	-
LV	-	-	-	-
PL	+	-	-	-
UK	-	-	-	-

+ = value of the institutional variable above the mean across all countries in the data set,
- = value of the institutional variable below the mean across all countries in the data set,
Country codes: AT = Austria, CY = Cyprus, DK = Denmark, EE = Estonia, FI = Finland, FR = France, HU = Hungary, LV = Latvia, PL = Poland, PT = Portugal, RO = Romania, SE = Sweden, UK = United Kingdom.

For employees without a university degree, only the vocational system explains part of the cross-country differences in the gender training gap: Women are disadvantaged compared to men in countries with strong vocational systems. However, differences in the gender training gap cannot be entirely explained by this institution. Though the interaction between gender and the vocational system explains part of the cross-country variation in the gender training gap, there still remains a significant random slope of the “Female” dummy, indicating significant unexplained cross-country variance in the effect of being female on training. With reference to the individual-level country regressions, this is mirrored in the fact that among lower educated there is not such a clear pattern of institutional values as for highly educated employees (see Table 41 in the Appendix compared to Table 16).

4.5 Discussion

In this section, results of the analysis are discussed the with reference to the previously stated hypotheses. Table 17 provides a fist overview before the most important findings concerning each of the hypotheses are pointed out in detail.

Table 17: Summary of the results

Hypothesis	Results
Differences between women with and without university degree	
H1a: There is a gender training gap among employees without a university degree.	• Individual-level analyses: Supported for most countries • Multilevel analyses: Supported
H1b: The gender training gap among employees with a university degree is smaller than among employees without a university degree.	• Individual-level analyses: Supported for most countries • Multilevel analyses: Supported
Labour market	
H2: The longer the mean tenure in a country, the less do women train compared to men.	• Country-level analyses: Supported for women with a university degree • Multilevel analyses: Supported for women with a university degree
H3a: The higher union density and bargaining coverage, the less do women train compared to men.	• Country-level analyses: Supported for women with a university degree • Multilevel analyses: Supported only in the single-institution-model for women with a university degree
H3b: This relationship is more pronounced among employees without a university degree.	• Country-level analyses: Rejected • Multilevel analyses: Rejected
Educational system	
H4a: The stronger the focus on specific human capital in the educational system (high share of vocational students, low share of university graduates), the less do women train compared to men.	• Country-level analyses: Supported • Multilevel analyses: Supported in terms of the vocational system (in terms of university system only in the single-institution-model)
H4b: This relationship is more pronounced among employees without a university degree.	• Country-level analyses: Supported in terms of the vocational system • Multilevel analyses: Supported in terms of the vocational system
Support for women	
H5a: The higher the incentives for women to return to the labour market early after childbirth (high levels of childcare, short maternity leaves, low child benefits), the more do women train compared to men.	• Country-level analyses: Supported for women with a university degree in terms of child benefits • Multilevel analyses: Mixed results for females with a university degree (supported in terms of child benefits, rejected in terms of childcare below the age of three)
H5b: The relationship between these incentives and training is more pronounced among employees without a university degree.	• Country-level analyses: Rejected • Multilevel analyses: Rejected
H6: The higher the gender equality in the labour market, the more do women train compared to men.	• Country-level analyses: Supported for in terms of degree equality • Multilevel analyses: Supported for in terms of degree equality in the single-institution-model when Romania is excluded

Hypotheses 1a and 1b: Women are different – and so are countries.

The previous analyses showed clear differences in the gender training gap between highly and lower educated employees. These results obviously support Hypotheses 1a and 1b: While women without a university degree have a significant training disadvantage compared to men (Hypotheses 1a), women holding a university degree have a smaller training disadvantage (Hypotheses 1b). In fact, highly educated women were even found to have a training advantage over men. In a first step, this could be shown for most of the analysed countries separately. Later, the result was confirmed by the multilevel analysis. This suggests that arguments by Lazear & Rosen (1990) are not only relevant for human capital investments related to promotion decisions. The distinction between highly and lower educated women appears to be relevant for other training investments as well. It seems that human capital and statistical discrimination theory rationales predicting a female training disadvantage are valid for women without university education but not for highly educated women. Consequently, when analysing the gender training gap, arguments by Lazear & Rosen (1990) should be taken into account and higher and lower educated employees should be analysed separately.

While the training disadvantage for lower educated women is in line with previous assumptions, the finding that highly educated women hold a training advantage compared to men was not expected. The surprising finding might be explained by the results by Bassanini et al. (2007) who found women to train more than men because they are more willing to pay for their own training. Such behaviour can be explained by signalling theory (Spence, 1973). Chatterji, Seaman, & Singell Jr., Larry D. (2003), analysing educational returns of British employees, find that women gain more from education than men. This difference largely occurs as a result of two reasons: On the one hand, for women, education appears more important to get a job higher up in the hierarchy. On the other hand, holding this factor constant, signalling by educational achievement is significantly positively related to wages of women but not to wages of men. Thus, the authors conclude that "the signalling aspect of education appears to be more important for women relative to that of men" (Chatterji et al., 2003: 210). Chatterji et al. (2003) discuss education primarily as a signal of ability and explain part of the differences in the signalling requirements of men and women by differences in job types because jobs hold by females are more likely to require educational signals. However, interpreting education as a signal of labour market attachment could offer an additional way of explaining the gender differences. As men's average labour market attachment is assumed to be higher than women's, a woman has to send stronger signals to convince employers of her labour market attachment. Thus, by making strong investments in her own human capital, a woman may want to signal her (potential) employers that her labour market attachment is high and that the employers' risks in investing in an employment relation with her are low. A woman, who decided to send such signals in terms of higher education, may be likely to continue this strategy throughout her employment career. This would explain why in most countries, women now represent the majority of university graduates (see "Degree equality" in Table 26 in the Appendix) and why in most countries, women holding a university degree train more than equally educated men.

In line with previous findings by Arulampalam et al. (2004) and Dieckhoff & Steiber (2011), this analysis further revealed considerable cross-country differences in terms of the gender training gap. Initially, the separated country estimations on individual data already suggested cross-country differences because some countries showed male whereas others showed female advantages in training. While the country-separated analyses could not make any statement concerning the significance of these differences, the multilevel analyses could: The highly significant random slopes of the "Female" dummies in the multilevel models (Model 3 in Tables 7, 9 and 11 respectively) confirmed that for all analysed employee groups, the gender training gap significantly varies across European countries. Thus, the next step was to answer the question: Which national institutions can explain these differences in the gender training gap between countries?

Hypotheses 2, 3a and 3b: The labour market is related to training of men and women.

The hypotheses concerning the labour market characteristics and the gender training gap received mixed support. The detrimental effect of long tenure rates on female training participation as stated in Hypothesis 2 could be supported by the findings for women with university education. Their training participation is in fact significantly lower in comparison to the one of men when mean tenure rises. This result was found in the country-level analysis as well as in the multilevel analyses (including and excluding Romania) and suggests that highly educated women have a comparative training disadvantage in labour markets with a long-term orientation. The results are strongly in line with arguments by Estévez-Abe (2005) and may be explained by two simultaneous processes: On the one hand, maternity replacement becomes more expensive because the specific skills necessary for performing the job are not readily available on the labour market. Thus, employers can choose between training investments in maternity replacement workers or the redistribution of tasks between the remaining employees. However, the higher the percentage of young women a company employs, the higher the risk that this latter option is not feasible. On the other hand, the investments in specific skills that are needed in long-term oriented labour markets are at odds with women's flexibility needs. Hence, while long-term orientation provides incentive for men to invest in specific human capital, it does not for women. In summary, this fuels a female training disadvantage.

Hypothesis 3a, that assumes a negative effect of industrial relations on female training, is supported in the country-level regressions for women with university education. In the multilevel analyses, the result was repeated when the interaction terms of the "Female" dummy with the measures for union density and bargaining coverage were found to be negative related to female training odds in the single-institution-models. However, in the final model, the coefficients of these interactions turned out to be insignificant. The reason for this may be a correlation with other institutions included in the model (industrial relations are significantly correlated to mean tenure, childcare and child benefits, see Table 27) or too few degrees of freedom at country-level, which make it difficult to detect the presumably complex and therefore imprecisely estimable effects of unions on the gender training gap. For women without university education, the analyses did not find any significant industrial relations effects. Consequently, Hypothesis 3b, which assumes a stronger negative effect on women without university education, can be clearly rejected by both country-level and multilevel analyses.

The findings might be interpreted as an indication that unions strive for equality. Since among employees with university education men are the disadvantaged group, the negative union effect on women is really a reduction of their training advantage rather than an increase of a disadvantage. In fact, overall training odds of highly educated women still slightly rise in the presence of strong unions, though less than training odds of men. However, as unions do not seem to have any equality effect when it comes to employees without university education – here women being the disadvantaged group – median voter rationales may play a role as well: Unions foster equality where men – their traditional focus group – are disadvantaged but not where women are disadvantaged. This rationale is supported by the positive relationship between the ratio of females in unions and training for women that was found in the single-institution-model for all employees as well as for lower educated employees (though here, the positive relationship slightly missed the 10% level of significance when Romania is included). It seems that, when the importance of women in unions rises, unions support women's training needs to a stronger extent than they support men's. The fact that this result is mainly driven by union effects on lower educated women points to unions' equality efforts again.

The finding that gender differences between men and women of lower education are not influenced by strong industrial relations measures may also be explained by Waddington's (2000) conclusion that female influence in unions has increased – but is not yet comparable to male influence. Among employees of lower education, where unions' influence can be assumed to be highest while gender differences in labour market attachment provide the strongest training disadvantages for women, unions may not have been successful in improving women's situation compared to men's. However, they neither appear to favour men over women as observed among highly educated employees but appear to treat them equally to men. So there might be favourable union efforts for lower educated women in place which are just not strong enough to significantly reduce their training disadvantage.

The results on industrial relations are in line with Rigby (2002). He finds that though union representatives are aware of the importance of training equality, actual union efforts to tackle the problem typically concentrate on training for lower qualified workers, without much addressing of the problem of the gender training gap. Moreover, though union representatives at higher levels seem to be determined to promote general training, at the workplace level, unions do not follow a clear practice in promoting general training. Such union behaviour could explain the results for the different employee groups in the multilevel analyses. While the relationship between unions and training is not significant for the higher educated, there is a significantly positive relationship between union density and training odds for the lower educated in the single-institution-model (which misses the 10% level in the final model). These findings may be interpreted as union efforts to support training among the lower educated while training of the higher educated is not in the focus of union policies. The insignificant interactions of the “Female” dummy and the industrial relations indicators for the lower educated further suggest that there are no strong union efforts to support training for disadvantaged women. Moreover, if unions, through fostering training, are not able to influence the type of the training as suggested by Rigby (2002), the training increase that unions might accomplish could be mainly concentrated on specific training. This is, as Edlund & Grönlund (2008) argue, because employers are likely to provide specific training if unions are not strong enough to enforce general training. Specific training would again be a source of gender inequality causing a relative disadvantage for women. Thus, a lack of union support for general training could provide an additional explanation for the relative male training advantage among highly educated employees in the presence of strong unions.

Both tenure rates and union strength were assumed to raise overall levels of training, especially when it comes to specific skills (Hall & Soskice, 2001a). However, multilevel analyses showed that high rates of mean tenure in a country are negatively related to training participation of employees. Nevertheless, this effect seemed to be mainly driven by Romania, which is an outliner in terms of extremely high mean tenure combined with the lowest levels of training among the 22 countries analysed. Excluding Romania resulted in non-significant estimates for mean tenure for all employees. Further, the multilevel analyses did not show a clear relationship between union strength and overall levels of training. Only in the single-institution-model was union density positively related to training participation of the lower educated (see Table 12). However, when controlling for other institutions that proved statistically significant in the previous analyses, the estimate for union density was no longer significant at the 10% level. Bargaining coverage did not show a significant relation to overall training participation in any of the specifications. These results reflect previous findings by Bassanini et al. (2005) who find a positive but imprecisely estimated relationship between unions and training. An explanation for this might be as theoretical arguments by Streeck (1992) and Acemoglu & Pischke (1999b) as well as empirical findings by Brunello (2004) suggest that unions’ effects on training are often rather indirect through compressed wage structures.

Hypotheses 4a and 4b: The educational system is related to training of men and women.

Hypothesis 4a assumed that a stronger focus on specific human capital should lead to a training disadvantage of women compared to men. The hypothesis finds broad support in the country-level analyses where the rate of university graduates, indicating a general skill focus, is positively correlated with the relative training participation of women while the rate of vocational students, indicating a specific focus, is negatively correlated. In the multilevel analyses the single-institution-models confirm these results. However, in the final model the female interaction for the university system, though still indicating a positive relationship, is no longer significant. Nevertheless, a strong vocational system is still significantly related to a female training disadvantage. Thus, the results strongly support Estévez-Abe's (2006) claim that "[t]he importance of vocational training…[is] expected to exacerbate the skill gap between the sexes by encouraging…male investments in specific skills." Hypothesis 4a can therefore be supported in terms of the initial vocational training system: The higher the share of vocational students, the less do women train compared to men.

Hypothesis 4b suggests that the negative relationship between skill specificity and training is stronger for lower educated women, as they are assumed to have a lower labour market attachment and thus to assumed to be more likely to leave the labour market and take long maternity leaves. Compared to highly educated women, this makes investments in lower educated women's specific human capital more risky for the women themselves as well as for their employers. The results concerning the vocational system clearly support Hypothesis 4b: Both country-level as well as multilevel analyses reveal that the negative relationship between strong vocational systems and women's training is basically driven by lower educated employees. While for highly educated women, the negative relationship is not statistically significant, it is highly significant for women without a university degree (see Table 6 for the country-level analyses and Table 14 for the multilevel analyses).

In terms of overall training levels, the multilevel analyses revealed no significant impact of the share of university graduates in a country and the training probabilities of individuals. This finding differs from Brunello's (2004) results who found a positive relationship between a high supply of educated workers and training. The reason for this discrepancy might be that Brunello (2004) defined educated workers as those who attained at least upper secondary education which is a definition including a much greater share of the employees than the share of university graduates included in this study. Nevertheless, in this study, the vocational system was found to be significantly related to training participation: A high share of vocational students was positively related to employees' training participation across almost all model specifications (except the model for highly educated employees including bargaining coverage and excluding Romanian data).

Hypotheses 5a, 5b and 6: Support for women is related to training of women – and men.

Hypothesis 5a suggests that high levels of childcare, low child benefits and short maternity leaves provide incentives for women to return to the labour market early after childbirth, which in turn reduces the investment risks in female human capital for employers as well as employees. Consequently, these incentives should increase female training participation. In the country-level analysis, this was supported for women with university education in terms of child benefits. While this finding was reproduced in the multilevel analyses (though not when Romania is excluded), the models also revealed a negative relationship between childcare for children below the age of three and training for women. This clearly opposed the assumptions in Hypothesis 5a. A possible explanation for this finding is that the provision of childcare is correlated with the composition of the country sample: The more childcare is provided, the more mothers of young children are among the employees of the countries. Though childcare facilitated these women's returns to the labour market, they may have less time left to participate in training than men. This interpretation was supported by the highly significant correlation between the share of young female employees living with a young child and the share of children in childcare. The strong correlation of 0.787 also supports Estévez-Abe's (2005) claim that available childcare is one of the most important factors enabling women to return to the labour market after child bearing.

Hypothesis 5b assumes lower educated women to be more likely to be incentivized to participate in training by supportive institutions than highly educated women. This hypothesis can be clearly rejected. Neither in the country-level regressions nor in the multilevel models for lower educated employees do any of the direct institutional measures for women's support show differing effects on men and women.

However, contrary to highly educated women, lower educated women do not seem to train less than men when levels of childcare are high. One reason for this finding might be that the incentives to return to the labour market collide with the lower labour market attachment of women with lower education. Though they may well depend on institutional support to a higher extent than women of higher education, they may in general be less determined to return to the labour market after child bearing than women of higher education. Their threshold for institutional support might therefore be higher than for women of higher education. Further, labour market return of lower educated women may also depend more strongly on other factors than the ones measured in the models, e.g. the costs and not only the extension of childcare. These assumptions can be supported when the relationship between female employees with small children and childcare is observed separately for women of higher and lower education: Although both correlations are highly significant, the correlation between childcare and employment of women without university degree is 0.758 while it is 0.816 for women with university education. A similar pattern can be observed in the relationship between employment participation of women living with children aged four to five and childcare for children above three:[38] The share of highly educated female employees with children significantly correlates with the provision of childcare (0.569) while there is no statistically significant correlation for the employment of women with lower education and childcare.

Hypothesis 6 assumed that higher gender equality in the labour market would lead to higher training participation of women. In the country-level analyses, this could be supported for degree equality, especially when it comes to lower educated women. In the multilevel analyses this finding was reproduced in the single-institution-model for lower educated employees when Romania was excluded (including Romania, the odds ratio of "Degree equality" of the same model was significant at 12%). However the estimate was rendered insignificant in the final model.

Obviously there is no strong relationship between the equality measures and training for women. Thus, Dieckhoff's & Steiber's (2011) claim that the gender training gap is smaller in countries with high levels of female labour market participation cannot be supported. However, as the equality measures were merely proposed to capture a quite broad picture of the gender equalities in the labour market, these results may not be that surprising after all. In other words, the findings do not necessarily lead to the conclusion that general gender equality in the labour market is not related to the gender training gap but rather, that the underlying processes may be too complex to be revealed by the previous analyses. This could be because the few degrees of freedom at country-level allow for capturing quite strong and precisely estimated relationships but might reach their limits when effects are more complex and imprecise. Such interpretation is backed by rationales by Estévez-Abe (2006: 164) who points out that cultural aspects are likely translate into gender differences in the labour market. She predicts traditional gender norms to reduce female labour market participation and to lead to a higher female specialization in non-market work. Such negative attitudes towards female labour market participation that should have an effect on inequality between men and women in general aspects like labour market participation, pay or qualification, may also have an indirect effect on women's training participation. However, as cultural effects are highly complex, these effects may be quite weak or varying and hence difficult to grasp within a small set of countries.

The cultural interpretation of the gender difference in the labour market further offers a persuasive way to interpret the differences in the findings on the three equality measures. Women's educational achievement should be related to cultural norms referring to the human capital of women. Similar norms could be valid when it comes to work-related training for women. On the contrary, female labour market participation and success in terms of

[38] Unfortunately the age ranges of the AES and the childcare data provided by Eurostat do not match exactly. However, these measures should provide an acceptable approximation.

payment might be related to additional sets of cultural norms that go far beyond a skill perspective. From this point of view, it may not be surprising to find degree equality to be more clearly related to the gender training gap than the other measures. Another argument why the cultural interpretation is quite tempting is that the relationship between the gender training gap and degree equality was found for lower educated women, i.e. among employees who do not hold a degree themselves. As models controlled for the educational level on individual basis, this effect cannot be interpreted as a simple aggregated effect of women's individual education. By contrast, gender degree equality could be interpreted as a sign for attitudes towards female education. These attitudes should not only be relevant for initial but also for continuous education and training.

The variables that measured the support for women were not assumed to explain country differences in the overall levels of training. Nonetheless, multilevel analyses on the single institutions indicated a positive training effect of childcare for children aged three and older, maternity leave, employment equality as well as degree equality (the first only when Romania was included, latter only when Romania was excluded). In the final models, the positive relationship only remained significant for maternity leave among lower educated employees and, when Romania was excluded, it also remained significant for employment equality in all models. While there is no clear theoretical explanation for these findings, it might be argued that these *"women-friendly"* policies are characteristics of modern labour markets designed to make the most of a country's human capital. High levels of training would be strongly in line with the goals of such labour markets.

5 CONCLUSION

5.1 Summary of the main results

Economic literature finds continuous training to be highly relevant for employees' labour market success, and training differences between men and women are discussed of being one reason for gender equalities in the labour market (Melero, 2010; Tomaskovic-Devey & Skaggs, 2002). This study focussed on the question of how previous education and national institutions can help explain training differences between men and women. To that end, first, standard economic theory referring to gender differences in human capital development was reviewed. However, as human capital theory and discrimination theory consistently predict a male training advantage neither was helpful in explaining the heterogeneous results of empirical studies on the gender training gap.

Two additional approaches were identified that are based on traditional human capital and statistical discrimination theory, but suggest varying human capital investments in and by women depending on their ability and the national institutions of the country they are living in. The first approach by Lazear & Rosen (1990) implies that while women of average ability fulfil the human capital prediction of a lower labour market attachment, women of high ability should be equally attached to the labour market as comparable men. In terms of continuous training, this would mean that though average women should be disadvantaged compared to men, highly able women should not. While ability is difficult to measure, it can be approximated by education. The second approach by Estévez-Abe (2005; 2006; 2009; 2012) suggests gender equality to depend on the human capital focus of a country, which is reflected in its labour market and its educational system. A strong focus on specific skills is assumed to lead to female disadvantages in labour market participation and success because investments in specific human capital of women are more risky than in human capital of men. To lower these investment risks, institutional support for women is necessary. Applied to the prediction of gender differences in training, this indicates that women face training disadvantages in countries with labour markets and educational systems focussing on specific human capital. These training disadvantages could only be mitigated by institutional support for women.

To test the hypotheses generated on this theoretical background, micro and macro data from 22 European countries was used. With the individual data at hand, separate country regressions were run to get a first overview of the gender training gap in the single countries. This unveiled that the gender training gap varies considerably across countries. Separating the training gap by educational background further revealed that, in many countries, women of lower education are disadvantaged while women of higher education have a training advantage over men. In a second step, regressing the cross-country differences on national institutions of the labour market, the educational system and the support for women, indicated that these three spheres are relevant for explaining cross-country differences in the gender training gap. Consequently, the analysis preceded developing multilevel models on the training participation of employees with and without university education including these three sets of variables.

The multilevel approach allowed inclusion of micro and macro data simultaneously and thus permitted an analysis of the complex data structure as well as interactions between individual and institutional variables on a non-aggregated level. It further allowed statements on the significance of the cross-country differences and the strength of the institutional relationships. The multilevel analysis confirmed that while there is no clear relationship between gender and training when analysing all employees together, there is a gender training gap for lower educated women and a reversed training gap for highly educated women: Among highly educated employees, women's training odds are 1.077 times higher than men's, while among lower educated employees women's training odds are 0.889 times lower than men's. This underscores the importance of distinguishing between employees of different levels of education when analysing the gender training gap.

Not only educational but also cross-country differences were found to have an impact on the gender training gap. In a first step, multilevel analysis showed that the gender training gap for all employee groups significantly varies across European countries. For all employees, the analysis indicated that women's training odds are between 0.648 times lower and 1.404 times higher than men's in different European countries (for highly educated employees these values rage from 0.830 to 1.420 whereas they range from 0.593 to 1.324 for lower educated employees). In a second step, part of these differences could be explained by national institutions referring to the labour market, the educational system and support for women. Among highly educated employees, mean tenure, union density, childcare for young children and child benefits were negatively related to women's training participation. At certain levels these institutions even appear to compensate women's training advantage and lead to a training disadvantage of highly educated women in some countries. Together, these measures were able to explain the entire cross-country variation of the gender training gap among highly educated employees. This reflects results from the individual-level analyses: Countries for which individual-level regressions indicated a (usually not statistically significant) training disadvantage of highly educated woman compared to men showed above average values in at least two of these measures. On the contrary, almost all countries that had statistically significant training advantages of highly educated women showed values below average in all these measures.

The most surprising finding was the negative relationship between childcare for children below the age of three and women's training participation. A possible explanation for that finding is that the composition of the country samples differs according to the provision of childcare: In countries with high levels of childcare, there appear to be more working mothers with small children who may lower the women's average training levels in a country.

The results further indicate that different national institutions are relevant for gender differences among highly and lower educated employees. While measures of the labour market and the support for women virtually explained the entire cross-country differences in the gender gap among the highly educated, cross-country differences among lower educated employees can be partly explained by differences in the educational system: Lower educated women are disadvantaged in countries with strong initial vocational training systems. This relationship is strong and in line with previous assumptions. However, cross-country differences in the gender training gap among lower educated employees cannot be entirely explained by this measure (nor by the other proposed institutions). A significant variation of the gender gap in this group remains unexplained.

Overall, the different steps of the empirical analysis revealed that the gender training gap is clearly related to previous education as well as national institutions resuming characteristics of the labour market, the educational system and the support for women. This way, the study helps to get a better understanding of training differences between men and women.

5.2 Limitations and suggestions for further research

Different types of training

To assess cross-country differences in the gender training gap, it was necessary to include data from as many countries as possible. However, as national surveys varied in the depth of the questions referring to continuous training, an analysis including as many AES-countries as possible could only refer to work-related training defined as a binary variable. This leads to some limitations of this study as well as suggestions for further research.

Explaining differences in the gender training gap across different employee groups and countries, this study helps to understand the basis of training differences between men and women. Thereby, it strictly focuses on observed gender differences in training participation without distinguishing between the reasons that lead to these differences. This makes sense since the theoretical framework of this study refers to two possible causes of these differences: Women’s own preferences and employers’ statistical discrimination. Both explanations are assumed to be caused by a lower labour market attachment of lower educated women and lead to the same results: A training disadvantage of lower educated women next to training equality among highly educated employees. A distinction between the two causes is therefore neither necessary for policy implications (both causes could be addressed by similar measures) nor feasible as they lead to the same observable training distribution. Still, the study is not able to rule out the possibility of taste discrimination by employers. With women holding a training advantage over men, there is indeed no obvious indication of employers’ taste discrimination against women. However, women might be more willing than men to pay for their own training (Bassanini et al., 2007). This could mask existing discriminatory practices by employers.

To get a clearer picture of the underlying causes of the training disadvantage of lower educated women and the training advantage of highly educated women, further research is necessary. Employer and employee financed training should be analysed separately to find out whether the gender training gap among the lower educated is driven by employee preferences or employer discrimination. Such a distinction may also help to explain the training advantage of highly educated women found in the previous analysis. If results support Bassanini et al. (2007) and show that women are in fact more likely to pay for their own training, signalling theory offers an explanation for the higher training probability of women with university education.

The theoretical underpinnings of this study assume a strong female preference for general opposed to specific training as the latter is much less flexible. Still, as the empirical distinction between general and specific training proved difficult based on the available data, information of all training incidents in the past 12 months was considered, without distinguishing between general and specific training. Further, restricting the outcome variable to a binary structure did neither allow distinguishing between employees that took part in one or more training incidents, nor between trainings of different durations. This might have an impact on the results. O'Halloran (2008) finds women to be more likely to participate in training while among those employees who take training, men are the ones who participate in more training incidents and trainings of longer duration. The latter finding is also mirrored in findings by Barron et al. (1993). Such a pattern would lead to an overestimation of women's training compared to men's in the results of this study. The training disadvantage of lower educated women may thus be underestimated in the previous analysis and the training advantage of highly educated women might be overestimated. Nevertheless, as long as differences between lower and higher educated women are not affected by the definition of the outcome variable, the theoretical framework of this study is even more strongly supported if such training pattern is present in the analysed sample. In this case, the previous results should be considered conservative.

In summary, in order to make more precise statements on the reasons for the gender training gap, it would be interesting to analyse employer- and employee-financed as well as general and specific training separately. Controlling for training frequency and length would allow estimating the gender gap more precisely.

Determinants at the individual-level

Data of the AES did not provide information on the sector in which an employee works. As public sector employees were found to participate in more training than private sector employees and women are more likely to be public sector employees (Jones et al., 2008), sector is an often included control in the analyses of training (e.g. Bassanini et al., 2007; Brunello, 2001; Büchel & Pannenberg, 2004; Draca & Green, 2004). A large part of this effect should be captured by the occupational and industry dummies in the previous analyses. Still, not taking into account the sector could lead to an overestimation of female training participation. Nevertheless, this would again mean that the female training disadvantage among lower educated employees was underestimated whereas the female training advantage among highly educated employees was overestimated, which would still be in line with the theoretical framework.

The results of this study indicate that women are not the heterogeneous group economic theory takes them for. While the distinction between women with a university degree and other women revealed opposing gender gaps, the group of women without university education is still heterogeneous in terms of education and vocational qualifications. As these differences may give rise to varying levels of training participation, future studies should examine the group of women without a university degree more closely.

Determinants at the country-level

In the final multilevel models, some of the coefficients that have been found significant in the single-institution-models turned out to be insignificant. This was especially true for measures of industrial relations and the support for women. Reasons for that may be the correlation of the variables (see Table 27 in the Appendix) or the few degrees of freedom that make detecting weak or imprecise effects rather difficult. Analyses looking at a greater number of countries could help answer the question, which one of these explanations is more likely to be true.

Moreover, in-depth analyses of selected countries may offer interesting insights in the relationship between national characteristics and the gender training gap. Denmark and Finland, where training odds of lower educated women are higher than the odds of men and the odds of highly educated women are lower than those of men, may be contrasted with a selection of the countries where the opposite relationships have been found (Belgium, the Czech Republic, Germany, Estonia, Spain, Lithuania, Norway, Poland and the Slovak Republic). Another interesting case is France, which is the only country where highly educated women train significantly less than highly educated men. Conversely, lower educated women train significantly more than comparable men in Hungary and Latvia. Case studies on the institutional settings of these countries might explain these remarkable findings.

Apart from the gender training gap, the analyses also provided some insights on the institutional determinants of the overall levels of training in a country. However, as the focus of this study is the gender training gap, institutions were selected concerning the expected difference in the training effects on men and women. Although a number of these institutions appeared to be related to overall training participation, there may be additional determinants relevant for training participation in general. For future research, it would be interesting to develop a comprehensive multilevel model on continuous training participation of employees and to test this model empirically on a cross-national data set.

5.3 Implications for theory and practice

This study sheds light on the determinants of the gender training gap, which have not been analysed so far, and offers explanations for the highly heterogeneous results of empirical studies on gender differences in training (see Table 18 in the Appendix). First, the finding that lower educated women hold a training disadvantage while highly educated women have an advantage, may explain why many empirical studies did not find any significant difference in training participation of men and women (e.g. Veum, 1996, Warr & Birdi, 1998 or Draca & Green, 2004). As empirical studies usually do not distinguish between highly and lower educated employees, a non-significant gender training gap may mask two opposing effects: Training disadvantages of lower educated women next to training advantages of higher educated women. However, depending on the actual sample composition in terms of previous education, these opposing effects can also lead to the finding that gender differences do exist. A good example is the widely cited study by Lynch (1992). Analysing training participation of non-college graduates, she finds that women are less likely to train than men. Nevertheless, studies referring to her results often do not discuss the specific sample composition but cite the study as an indication of a female disadvantage in training (see e.g. Veum, 1996, Sicilian & Grossberg, 2001 or Fahr & Sunde, 2009). The previous analysis however shows that results on the gender training gap among highly and lower educated employees may not be comparable.

Second, in line with previous results, this study shows that the gender training gap differs across different European countries (Arulampalam et al., 2004; Dieckhoff & Steiber, 2011). It goes beyond existing studies, as it is able to explain cross-country differences in the gender training gap by national institutions. Differences in the gender training gap among highly educated employees can be nearly entirely explained by labour market characteristics and the support for women. More specifically, gender differences can be explained by differing effects of mean tenure, union density, childcare and child benefits on training of men and women: The higher these measures are, the lower is the relative training participation of highly educated women compared to men. The gender training gap for the lower educated can be partly explained by differences in the educational system. Here, a strong focus on specific human capital (measured by the share of students in vocational programmes) is related to a considerable training disadvantage of women compared to men.

The study therefore indicates that traditional economic arguments of human capital and discrimination theory, predicting gender differences in training, should be complemented by additional approaches when analysing the gender training gap. On the individual level, the point by Lazear & Rosen (1990) that though women of average ability have a lower labour market attachment than men, labour market attachment of highly able women is not different from the labour market attachment of highly able man, should be taken into account. Education appears a valid proxy for ability in this context. Although the authors apply this rationale to promotion decisions, the previous findings indicate that it is equally valuable to predict other training decisions. This means that human capital and discrimination theory rationales are valid for the prediction of gender training differences among individuals of average ability (or education) but not among individuals of higher ability (or education). The empirical finding of a female advantage in training among highly educated further suggests that signalling theory may play a role explaining gender differences among highly educated employees. The reason for this could be that women aim to convince employers of their high labour market attachment by investing in their own human capital. On the institutional level, the results of this study imply that arguments by Estévez-Abe (2005; 2006; 2009; 2012), suggesting that the skill focus of a country, mirrored in its labour market and educational system, as well as the institutional support for women have an impact on women's labour market success, should be taken into account when analysing the gender training gap.

More generally, this study contributes to the comparative literature on continuous training. It shows that not only the gender training gap but also the overall level of training is related to a country's national institutions. Most prominently, a strong vocational education system is strongly positively related to overall levels of training for all employees (though more strongly for men than for women). In addition, strong unions and long maternity leaves appear to be positively related to training participation of the lower educated.

The study offers some policy implications as well. The finding that there is a considerable gender training gap among the lower educated while highly educated women have a training advantage suggests that policy makers should focus their efforts on training for the lower educated women. As the training disadvantage of these women is assumed to be caused by their lower labour market attachment, measures should be designed to strengthen these women's attachment to the labour market. The previous analyses indicate that labour market participation of highly educated mothers is more strongly related to the share of children in childcare than labour market participation of lower educated mothers. One reason for this finding may be that although available, childcare might be too expensive for lower educated women as they usually earn less than highly educated women. Thus, the provision of free childcare might especially help women of lower education to return to the labour market early after childbirth.

Though the measure of pay equality did not turn out to be statistically significant, the positive odds ratio of the cross-level interaction still suggests a moderately positive relationship between pay equality and training of lower educated women (see Table 39 in the Appendix). One reason for this might be that the higher labour market returns of women in countries with a more equal pay structure lead to a higher labour market attachment of women. Nevertheless, women in virtually all countries in the world still earn considerable less than men. In the European Union, the unadjusted gender pay gap in 2006 was 17.7%. Though the European average is slowly decreasing there are still several countries where the gap exceeds 20% (e.g. Germany, Austria and the UK, Eurostat, 2012). Part of this gap may be explained by employment interruptions of female employees (which could be reduced by provision of subsidized childcare, see Arulampalam et al., 2007) while another part is caused by labour market segregation and low wages of typical "female" occupations (Petersen & Morgan, 1995). Because gender differences persist even after controlling for job requirements, it has been argued that this is due to an undervaluation of female work (Johnson & Solon, 1986). Sorensen (1990) for example finds that 20 to 23% of the gender pay gap can neither be explained by differences in job requirements nor by personal characteristics (including work experience and time spent out of the labour market). Findings like this gave rise to a demand for "comparable worth policies" that are aimed to pay equal wages to employees performing comparable jobs (in terms of skill, effort, responsibility, or working conditions, Hartmann & Aaronson, 1994: 71). Comparable worth policies that raise pay equality between men and women may also raise women's labour market attachment and ultimately their training participation as well.

The results of this study further suggest that unions may be a helpful partner in supporting equality efforts. Though strong unions did not appear to have an impact on the gender training gap among lower educated, they seem to be positively related to overall training participation of lower educated employees, and high shares of female unionists appear to support female training in this group. As women and equality issues gain importance in unions (Heery, 2006), the support for women's training may strongly agree with future union goals and make unions a potentially strong partner for policy makers fighting gender inequality.

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APPENDIX

Table 18: Empirical studies on gender and training

Study	Dependent Variable	Controls	Dataset	Results on gender & training
Male training advantage				
Booth (1993)	Dependent variable is a dummy variable "CURTRN" that indicates whether the worker received any form of training.	Age, marital status, number of children, race, education, firm characteristics, months out of workforce/unemployed,	Paper uses the 1986 British National Survey of graduates from a university or polytechnic in 1980. The sample consists of 2294 men and 1305 women who were, at the survey date, in a full-time paid job expected to last at least three months. Graduates over 35 years of age at graduation as well as those with missing birth date, training data and earnings were excluded.	General result; Men graduates are more likely to receive training than otherwise identical women. More precise, for an average man, the probability to receive training is 76 % and for an identical woman 21 %. Further, in case the same individuals shift to an organisation employing at least 5000 workers, the training probability increases for a man to 96 % but for an identical women only to 44 %. Moreover, men with a first class degree are more likely to be trained than identically qualified women.
Dieckhoff & Steiber (2011)	During the last twelve months, have you taken any course or attended any lecture or conference to improve your knowledge or skills for work?	Workers' age, education, household income, part-time or full-time status, past unemployment experience, firm size and sex of boss/supervisor, workers' career orientation and gender attitudes	European Social Survey (ESS), fielded in 2004/05: 2,392 women and 2,565 men, aged 25–45, in dependent employment (non-executive) and living in co-residential union with a partner	Women are less likely to train than men, all else being equal.
Evertsson (2004)	Annual earnings (derived from the income tax return form and comprises wage income and wage-dependent social benefits)	Survey year, industry, socio-economic status,	Swedish Survey of Living Conditions (interviews with a random sample from the population in the age range 16-84., Survey from 1994-1998	More men then woman take part in on the job training; if they do receive training, they are less likely to take part in training that increases promotion opportunities and earnings. Women are more likely than men to take part in industry-specific training and less likely to take part in general training.
Georgellis & Lange (1997)	Dummy variable for the probability of training participation for men and women	Age, age², income, children, marital status, education, firm size, industry, occupation, unemployment experience	For the empirical analysis, the 1984 and 1992 cohorts of the GSOEP are used. The sample includes workers between the age of 19 and 51 who were employed in 1984. The sample then consists of 1262 males and 719 females.	The results suggest that male workers are more likely to participate in training than female workers. Further, the number of training spells completed has a strong positive effect on the probability of training participation mainly for men rather than women.

Study	Dependent Variable	Controls	Dataset	Results on gender & training
Male training advantage				
Pischke (2001)	Training incidence and duration	Occupation, industry and part time status	German Socio Economic Panel, 1986-1989, training questions for respondents ages 16-64	Training incidence is lower for women; they also have shorter training spells
Lynch (1992)	Probability of receive training	Industry and Occupation	NLSY Data (National Longitudinal Survey youth cohort); 12,686 males and females, 14-21years of age at the end of 1978	Women are much less likely receive training within a firm
Pfeiffer & Reize (2001)	Probability of participating in formal and informal training	Job experience (and its squared), tenure (and its squared), employment interruptions, education, industry, firm size, marital status, children, region, employee vs. self-employed	Survey "Qualifikation und Berufsverlauf" ("Bundesinstitut für Berufsbildung" & "Institut für Arbeitsmarkt und Berufsforschung"), years 1991 and 1992	Female employees have a 5.3% lower probability of training participation than males with similar socio-economic characteristics. However, there are no significant gender differences when looking at self-employed.
Edlund & Grönlund (2008)	Firm specific skill (On-the-job-training)	Class, workplace size and age.	European Social Survey (ESS), 2004, a weighted sub-sample comprising employees only is used (n=17,056).	Men tend to have more firm-specific skills than women. No results concerning the incidence and intensity of on-the-job training for women.
Fahr & Sunde (2009	Participation in formal further training	Age, education, marital status, part-time employment, children age <6, type of shift, nationality (German (yes/no)), living area, change of occupation	Data from the 1998 to 1999 cross-section of the Qualification and Career Survey data (Qualifikation und Berufsverlauf)	Gender differences pertain to the use of apprenticeship skills in the aftermath of the apprenticeship at least for occupation movers. Women form less new human capital than men after having completed apprenticeship. This is particularly the case when they leave their initial occupation.

Study	Dependent Variable	Controls	Dataset	Results on gender & training
Female training advantage				
Jones et al. (2008)	Gender decomposition	Age, marital status, number of dependent children (if head of household or their spouse), disability, ethnicity and highest qualification, together with job- and employer-related characteristics such as tenure, full-time/part-time and permanent/temporary employment status, second job-holding, occupational group, industrial sector, employer ownership (public/private sector), employer size and region	Labour Force Survey (Winter quarters of 1994–1995 and 2000–2001)	Women are more likely to receive job-related education than men. Women may receive 'favourable treatment' in respect of training.
Simpson & Stroh (2002)	Training incidence	Age, race, education, income, probability of layoff	Adult Education Data File of the National Household Education Survey (NHES) of 1995 (US Department of Education 1996); The survey for the National Center for Education Statistics (NCES) was a random digit dial (RDD) telephone survey. For the adult education (AE) component, information was collected on participation in adult education based on interviews with 19,722 adults, 16 years and older; Data were collected from January through Februar y 1995.	Levels of training participation were higher for women than for men in 1995. Women's participation rate in employer-supported off-the-job training was higher than for men.

Study	Dependent Variable	Controls	Dataset	Results on gender & training
Effects depend on model				
Altonji & Spletzer (1991)	Participation in training (indicator for whether the individual received or participated in employer-provided training benefits or training programmes on the current or last job). Another model tests the quantity, measured in hours, of the training received (dependent variable)	Region, city size, race, job experience, job experienced squared, year and year squared, vocational education, occupation, education.	The NLSHS72 is a Department of Education survey of 22,652 people who were high school seniors during the 1971-72 academic year. 12,841 individuals were resurveyed in 1986. The sample was restricted, first, to the 16,683 individuals from the schools that participated in the base year survey; then, further, to 15,680 persons for whom high school test information was available; then to the 12,980 individuals who were surveyed in each of the 1973, 1974, 1976 and 1979 follow-ups. Information from the 1986 follow-up was then added, and only those 7,358 persons who were in the earlier 12,980 sample were included.	They find that the intensity of training and the duration of training were negatively related; the incidence of training was slightly higher among women than among men, but the amount of training was higher among men. The results for the composite measure D86SUM indicate that women receive about 90 hours less training than men, which is 58% of the sample mean of D86SUM. A slightly smaller gender difference with regard to the incidence is obtained when controls for aptitude and high school curriculum are added, and controlling for occupation further reduces the gender difference.
Bassanini et al. (2007)	Probability of training (different models: overall training, employer financed training, employee financed training; separate models for overall training by country; models with national institutions)	Upper secondary education, less than upper secondary education, tenure (+ squared), married, age-group, public sector, part-time, fixed-term contract, casual job, other type of contract, country, firm size, occupation, industry, and country by year effects	European Community Household Panel, waves 1995 to 2001	Women have a greater probability of taking training than men, although the differences associated with gender are small (0.6 percentage points). However, when focusing on employer-sponsored training only, the advantage of women disappears. Women are ready to pay for their own training more often than men, but firms are not ready to train them more often. Women have higher training demands. However, young women at ages when career interruptions are more frequent get training comparatively less frequently than men. This is essentially due to employer-sponsored training: on average, the probability of receiving employer-sponsored

Study	Dependent Variable	Controls	Dataset	Results on gender & training
Effects depend on model				
				training is 1.5 percentage points smaller for young women than for their male peers. Gender effects vary across countries: In Anglo-Saxon countries, women take training more frequently than men; in Greece, the opposite is true.
Boeren (2004)	Participation in adult learning by gender		The Flemish Eurostat Adult Education Survey (Contract number AES/2009/02) conducted in 2007 is used.	In the analysis, men and women have on average equal participation, but the participation differs by type of learning activity. Men's participation is clearly stronger in non-formal job-related settings. More precise, it is demonstrated that men and women have comparable participation rates in 'adult education and training', but that significant differences appear at the level of the learning type, referring to formal, non-formal and informal adult learning.
Büchel & Pannenberg (2004)	Probability of participating in courses or seminars (separate models for overall training, training during working hours and employer financed training) and total volume of training hours	Age 45–64, vocational education, tertiary education, foreigner, women with children, part-time employed, white collar-worker, self-employed, public sector, large firm (>200 employees), commuter, has a car	"Sozio-oekonomisches Panel (SOEP)", year 2000	No significant gender effects when looking at overall training, but significantly lower rates of training of women when it comes to training participation during working hours and participation in employer financed training.
Holtmann & Idson (1991)	Training participation by gender	Education, marital status, union membership	1972-1973 Quality of Employment Survey. The requirements for respondents eligibility were that they be at least 16 years old and work for pay at least twenty hours per week. The sample consists of 760 males and 407 females	Being female has in general a negative effect on training. Though, this effect is attenuated in larger companies. Females receive significantly more training than males in the 10-49 size category. The general differential is the opposite sign, or insignificant in the other categories, and tends to diminish with increase in size.

Study	Dependent Variable	Controls	Dataset	Results on gender & training
No significant gender effect				
Draca & Green (2004)	Incidence and intensity of employer funded training	Personal and job characteristics	Survey of Employment and Training Experience (SETE) conducted by the Australian Bureau of Statistics (ABS) from 1997	Non-unionised women are 6% less likely to gain training than women who are in a union. Flexible work appears to have similar effects on hours in training and number of courses attended. Men in flexible working arrangements receive 1.5 to 4 hours less training than women in similar arrangements
Green & Zanchi (1997)	Training participation	Age, age-squared, occupation dummies, region dummies, job tenure dummies, highest qualification dummies; 0/1dummies for part-time, married, whether more than 25 employees at establishment, and whether in manufacturing industry.	Labour force survey (Britain), spring quarter 1992, 63,000 households in the UK	Women have been catching up with men in terms of four-week training participation and in terms of off-the-job training experienced on average every week. Mode of interview (direct or indirect) has a notable effect on the gender differences in training participation. Part-time work of women effects access to training.
Veum (1996)	Training received		NLSY Data (National Longitudinal Survey of Youth), 1986-1991	No gender or race differentials in the likelihood of received training, in participation of multiple training events or in hours of training received. White women were more likely to receive more training per hour worked than white men.
Thangavelu et al. (2011)	Probability of participating in training programmes	Years in education (+ squared), age (+ squared), gender, citizenship, race, marital status, family background (number of children in the household, family income etc.), job-related characteristics (own labour income, industry and occupation etc.)	Labour Force Survey for Singapore	The results indicate that gender does not have any significant effect on training participation. However, the coefficient on female dummy is positive, suggesting women might be slightly more likely to participate in training programmes.
Warr & Birdi (1998)	Participation in voluntary development activities		Questionnaire of 1798 manufacturing workers (vehicle manufacturing organisation in the UK), 95% of the respondents were men	Gender is unrelated to development activity.
Brunello (2004)	Probability of participating in education or train-	Tertiary education, upper secondary education, age, experi-	European Community Household Panel, waves 1994 and 1996 (lim-	The results indicate that gender does not have any significant effect on training participation.

Study	Dependent Variable	Controls	Dataset	Results on gender & training
No significant gender effect				
	ing	ence, marital status, days of absence from work, health conditions, average hours worked per week, sector of employment (private vs. public), and previous unemployment	ited to individuals between 16 and 60)	However, the coefficient on male dummy is negative, suggesting women might be slightly more likely to participate in training programmes.
Arulampalam et al. (2004)	"Have you at any time since January (in the previous year) been in vocational education or training, including any part-time or short courses?"	Industry, occupation, firm-size	The first six waves of the European Community Household Panel (ECHP), a survey collected annually since 1994, men and women who are: between the ages of 25 and 54 years and working at least 15 hours per week; observed in at least two consecutive waves; not employed in agriculture; and with valid observations on all the variables used in the training equations	In most countries training participation rates for women and men are quite similar and the differences are only statistically significant in four countries—Denmark, Finland, Italy and Spain—where women are more likely than men to begin a training course.

Table 19: Variables used

Variable	Explanation	Source
Individual		
Work-related training	guided on-the-job training, training that is defined to be work-related by the individual or training that was taken due to improve skills for the current or future occupations, to increase job security or because the individual was obliged to participate	AES
Female	dummy for females	AES
No degree	dummy for education according to ISCED97 levels 0-4	AES
Female x no degree	interaction term referring to females with education according to ISCED levels 0-4	AES
Age	(year of birth – year of survey) - 25	AES
Age²	((year of birth – year of survey) – 25)²	AES
Tenure	year individual started working with the employer – year of survey	AES
Part-time	"The distinction between full-time and part-time work should be made on the basis of a spontaneous answer given by the respondent. It is impossible to establish a more exact distinction between part-time and full-time work, due to variations in working hours between Member States and also between branches of industry." (Eurostat, 2007: 54)	AES
Occupation	dummy variables for occupations considered as ISCO-88, coded at 2 digit level: 0) Armed Forces, 1) Legislators, senior officials managers, 2) Professionals, 3) Technicians and associate professionals 4) Clerks, 5) Service workers & shop & market sales workers", 6) Skilled agricultural and fishery workers, 7) Craft and related trades workers, 8) Plant and machine operators and assemblers, 9) Elementary occupations.	AES
Industry	dummy variables for NACE classes of the local unit coded at 2 digit: A) Agriculture, hunting and forestry, B) Fishing, C) Mining and quarrying, D) Manufacturing, E) Electricity, gas water supply, F) Construction, G) Wholesale & retail trade; repair of motor vehicles & household goods, H) Hotels and restaurants, I) Transport, storage & communication, J) Financial intermediation, K) Real estate, renting & business activities, L) Public administration and defence, M) Education, N) Health and social work, O) Other community, social and personal service activities, P) Activities of households, Q) Extra territorial organizations and bodies.	AES
Size of local unit	dummy variables for local units of 10 employees or less, 11-49 employees, and 50 employees or more	AES
Year	dummy variables for years 2005 – 2008	AES
Degree of urbanization	dummy variables for densely-populated area, intermediate area and thinly-populated area	AES
Interview method	dummy variables for postal (paper and pencil), face-to-face (paper and pencil), face-to-face (electronic version), telephone (paper and pencil), telephone (electronic version), through the Internet, mixed mode of data collection (e.g. interview and postal)	AES
Institutional		
Mean tenure	average years employees have been working for the same employer in that country	own calculation based on the AES
Union density	net union membership as a proportion wage and salary earners in employment	Visser (2011)
Bargaining coverage	number of employees covered by collective bargaining agreements as a percentage of all wage and salary earners; no data available for Romania	Visser (2011)
Female union membership	percentage of females among union members; for Greece and Cyprus, no data is available; for Denmark, France, Hungary, Lithuania, Portugal and Romania data for one union is always missing	European Trade Union Institute (2012)
University	defined as the ratio of graduates from tertiary education (tertiary graduates (ISCED97 5-6) per 1000 inhabitants aged 20-29	Eurostat (2011d)
Vocational	ratio of students in the vocational programmes (technical/vocational enrolment in ISCED97 2 and 3 as % of total enrolment in ISCED97 2 and 3)	UNESCO (n.d.)

Variable	Explanation	Source
Childcare < 3	share of children below the age of three in childcare for 30 or more hours a week	Eurosstat (2011c)
Childcare ≥ 3	share of children from the age of three to compulsory school age in child-care for 30 or more hours a week	Eurostat (2011b)
Maternity leave	paid maternity leave for a single child in weeks	European Com-mission (2012)
Child bene-fits	maximum amount paid per child in 100€	European Com-mission (2012)
Gender em-ployment equality	employment gap in percentage of the working men, multiplied by -1	Eurostat (2011a)
Gender de-gree equality	tertiary degree, age group 30-34, gap expressed in percentage of men with a tertiary degree in the same age group, multiplied by -1	Eurostat (2013)
Gender pay equality	hourly pay of men minus hourly pay of women, net of intervening factors, in percentage of men's pay, multiplied by -1	Eurostat (2012)

Table 20: Sample size by country and gender

Country	**Probability of training participation & sample size**				
	Males	**Females**	**Degree**	**No degree**	**All**
AT	1,410	1,203	573	2,040	2,613
BE	1,215	1,264	1,218	1,261	2,479
BG	1,535	1,495	818	2,212	3,030
CY	1,234	1,415	1,001	1,648	2,649
CZ	2,710	2,598	856	4,452	5,308
DE	1,584	1,811	936	2,459	3,395
DK	874	979	730	1,123	1,853
EE	832	1,716	970	1,578	2,548
ES	4,826	3,995	3,361	5,460	8,821
FI	1,221	1,225	1,063	1,383	2,446
FR	4,539	4,838	2,796	6,581	9,377
GR	1,574	1,135	768	1,941	2,709
HU	2,094	2,012	830	3,276	4,106
LT	926	1,299	815	1,410	2,225
LV	714	672	358	1,028	1,386
NO	1,155	1,054	915	1,294	2,209
PL	6,049	5,426	2,939	8,536	11,475
PT	2,557	2,506	766	4,297	5,063
RO	3,480	2,923	1,346	5,057	6,403
SE	1,228	1,249	895	1,582	2,477
SK	1,501	1,605	783	2,323	3,106
UK	978	1,187	888	1,277	2,165
Total	44,236	43,607	25,625	62,218	87,843

Table 21: Descriptive statistics of individual-level variables (87,843 observations)

	Mean	Std. dev.	Min.	Max.
Individual & job				
Work-related training	0.366	0.482	0	1
Female	0.496	0.500	0	1
No degree	0.708	0.455	0	1
Age	42.051	10.009	25	64
Tenure	10.978	10.057	0	50
Part-time	0.098	0.297	0	1
Occupation				
Armed Forces	0.007	0.083	0	1
Legislators, senior officials managers	0.058	0.233	0	1
Professionals	0.157	0.364	0	1
Technicians and assoc. professionals	0.163	0.369	0	1
Clerks	0.112	0.315	0	1
Service, shop & market sales workers	0.125	0.331	0	1
Skilled agricultural and fishery worker	0.011	0.104	0	1
Craft and related trades workers	0.157	0.364	0	1
Plant and machine operators	0.104	0.305	0	1
Elementary occupations	0.107	0.309	0	1
Industry				
Agriculture, hunting and forestry	0.025	0.156	0	1
Manufacturing	0.222	0.416	0	1
Electricity, gas water supply	0.017	0.128	0	1
Construction	0.078	0.268	0	1
Wholesale & retail trade; repair	0.121	0.326	0	1
Hotels and restaurants	0.033	0.180	0	1
Transport, storage & communication	0.066	0.249	0	1
Financial intermediation	0.028	0.166	0	1
Real estate, renting & business activity	0.061	0.239	0	1
Public administration and defence	0.094	0.292	0	1
Education	0.099	0.299	0	1
Health and social work	0.102	0.303	0	1
Other community, social and personal	0.041	0.199	0	1
Activities of households	0.011	0.103	0	1
Extra territorial organizations	0.001	0.029	0	1
Size of local unit				
≤10 employees	0.220	0.414	0	1
11-49 employees	0.346	0.476	0	1
≥50 employees	0.434	0.496	0	1
Year				
2005	0.071	0.258	0	1
2006	0.380	0.485	0	1
2007	0.367	0.482	0	1
2008	0.182	0.386	0	1
Degree of urbanization				
Densely-populated area	0.451	0.498	0	1
Intermediate area	0.206	0.405	0	1
Thinly-populated area	0.343	0.475	0	1
Interview method				
Postal	0.021	0.145	0	1
Face-to-face (paper & pencil)	0.583	0.493	0	1
Face-to-face (electronic version)	0.338	0.473	0	1
Telephone (electronic version)	0.043	0.202	0	1
Through the internet	0.015	0.122	0	1

Table 22: Descriptive statistics of institutional-level variables

Institution	Obs.	Mean	Std. dev.	Min.	Max.
Mean tenure	22	10.808	2.504	7.500	19.029
Union density	22	31.614	21.652	7.300	74.100
Bargaining coverage	21	59.643	29.377	12.000	99.000
Female union membership	20	46.155	8.718	30.800	62.000
University	22	56.460	17.599	30.600	89.500
Vocational	22	23.926	9.983	6.651	40.757
Childcare <3	22	15.091	14.622	1.000	66.000
Childcare ≥3	22	46.068	19.265	16.000	80.000
Maternity leave	22	23.214	13.232	14.000	68.570
Child benefit	22	1.310	1.481	0.140	7.175
Employment equality	22	16.930	7.520	6.290	36.240
Degree equality	22	-28.433	26.663	-84.270	10.290
Pay equality	22	17.768	6.265	7.500	29.800

Table 23: Industry by gender

Industry	Males	Females	Total
Agriculture, hunting and forestry	1,495	687	2,182
Manufacturing	12,116	7,394	19,510
Electricity, gas water supply	1,151	304	1,455
Construction	6,224	641	6,865
Wholesale & retail trade; repair	4,519	6,084	10,603
Hotels and restaurants	1,000	1,941	2,941
Transport, storage & communication	4,114	1,697	5,811
Financial intermediation	1,046	1,457	2,503
Real estate, renting & business activity	2,717	2,648	5,365
Public administration and defence	4,350	3,932	8,282
Education	2,233	6,463	8,696
Health and social work	1,540	7,426	8,966
Other community, social and personal	1,621	2,021	3,642
Activities of households	65	884	949
Extra territorial organizations	45	28	73
Total	44,236	43,607	87,843

Table 24: Occupation by gender

Occupation	Males	Females	Total
Armed Forces	551	62	613
Legislators, senior officials managers	3,020	2,046	5,066
Professionals	5,658	8,113	13,771
Technicians and assoc. professionals	5,916	8,385	14,301
Clerks	2,695	7,141	9,836
Service, shop & market sales workers	3,303	7,701	11,004
Skilled agricultural and fishery worker	666	297	963
Craft and related trades workers	11,466	2,322	13,788
Plant and machine operators	7,190	1,950	9,140
Elementary occupations	3,771	5,590	9,361
Total	44,236	43,607	87,843

Table 25: Size of local unit by gender

Size of local unit	Males	Females	Total
Size ≤10 employees	8,678	10,651	19,329
Size 11-49 employees	15,456	14,972	30,428
Size ≥50 employees	20,102	17,984	38,086
Total	44,236	43,607	87,843

Table 26: Training participation at country-level and institutional variables

Country	Variables													
	Training	Mean tenure	Union density	Bar. cov.	F. union mem.	Uni-versity	Voc-ational	Child-care <3	Child-care ≥3	Mat. leave	Child benefits	Employ. equ	Degree equality	Pay equality
AT	0.44	11.61	31.00	99.00	33.30	33.40	38.66	1.00	16.00	16.00	1.53	-17.00	-5.05	-25.50
BE	0.42	12.70	54.10	96.00	42.20	62.50	40.76	23.00	62.00	15.00	2.13	-20.54	26.23	-9.50
BG	0.54	8.76	21.20	25.00	47.20	40.80	29.91	16.00	53.00	45.00	0.51	-13.59	84.27	-12.40
CY	0.39	11.29	58.90	75.00	n.d.a.	30.60	6.65	18.00	38.00	16.00	1.90	-23.55	3.08	-21.80
CZ	0.45	10.76	18.70	44.00	45.00	44.40	39.42	1.00	39.00	28.00	0.87	-23.13	-9.49	-23.40
DE	0.52	10.62	20.70	63.00	30.80	37.00	21.88	7.00	26.00	14.00	1.79	-15.80	-10.29	-22.70
DK	0.46	8.29	69.40	82.00	48.90	76.10	26.80	66.00	80.00	18.00	1.52	-10.74	22.48	-17.60
EE	0.46	7.50	7.30	22.00	55.10	58.00	15.73	12.00	78.00	20.00	0.19	-8.81	44.91	-29.80
ES	0.32	10.50	15.00	80.00	34.30	43.40	15.60	19.00	44.00	16.00	0.24	-30.11	28.36	-17.90
FI	0.53	11.12	71.70	90.00	53.70	60.20	28.80	21.00	56.00	15.00	1.72	-6.29	49.06	-21.30
FR	0.40	12.53	7.70	95.00	39.50	80.30	19.43	17.00	42.00	16.00	7.17	-14.82	25.28	-15.40
GR	0.17	13.06	24.70	85.00	n.d.a.	40.80	17.74	8.00	20.00	17.00	0.67	-36.24	12.75	-20.70
HU	0.13	9.61	17.00	35.00	42.80	46.70	13.64	6.00	51.00	24.00	0.91	-20.31	50.00	-14.40
LT	0.42	8.14	10.50	12.00	61.30	89.50	9.26	4.00	47.00	18.00	0.40	-9.18	23.58	-17.10
LV	0.36	8.24	17.60	20.00	62.00	78.20	14.86	14.00	56.00	16.00	0.16	-11.64	71.13	-15.10
NO	0.59	9.45	54.90	72.00	56.10	59.60	32.60	25.00	57.50	43.00	1.62	-9.01	31.77	-16.00
PL	0.27	11.24	16.80	35.00	40.80	78.50	23.50	3.00	21.00	16.00	0.17	-21.10	42.16	-7.50
PT	0.28	13.57	20.80	62.00	48.00	47.50	16.72	32.00	66.00	17.14	1.27	-16.29	77.44	-8.40
RO	0.08	19.03	34.40	n.d.a.	45.80	51.50	33.91	3.00	16.00	18.00	0.59	-17.84	11.97	-7.80
SE	0.69	11.24	74.10	92.00	52.10	56.70	27.98	27.00	58.00	68.57	2.24	-7.22	30.90	-16.50
SK	0.54	9.40	20.60	35.00	40.60	43.70	34.30	4.00	63.00	28.00	0.14	-22.92	12.50	-25.80
UK	0.43	9.12	28.40	33.50	43.60	82.70	18.22	5.00	24.00	26.00	1.07	-16.34	2.49	-24.30

n.d.a. = no data available; for variable definitions see Table 19.

Table 27: Pairwise correlation between institutions and training

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	**Training**	1.000												
2	**Mean tenure**	-0.516*	1.000											
3	**Union density**	0.402*	0.114	1.000										
4	**Bargaining cov.**	0.139	0.682*	0.586*	1.000									
5	**F. union mem.**	0.164	-0.316	0.209	-0.382	1.000								
6	**University**	0.042	-0.265	-0.047	-0.268	0.512*	1.000							
7	**Vocational**	0.309	0.279	0.315	0.332	-0.263	-0.190	1.000						
8	**Childcare <3**	0.266	-0.149	0.592*	0.407*	0.234	0.182	-0.004	1.000					
9	**Childcare ≥3**	0.410*	-0.488*	0.241	-0.103	0.515*	0.185	-0.030	0.656*	1.000				
10	**Maternity leave**	0.563*	-0.174	0.333	-0.020	0.255	-0.075	0.261	0.124	0.228	1.000			
11	**Child benefit**	0.187	0.222	0.139	0.574*	-0.216	0.179	0.031	0.223	-0.008	-0.002	1.000		
12	**Employment equ.**	0.551*	-0.325	0.310	-0.138	0.703*	0.461*	0.064	0.322	0.466*	0.328	0.175	1.000	
13	**Degree equality**	-0.055	-0.197	-0.095	-0.309	0.490*	0.197	-0.223	0.284	0.518*	0.164	-0.146	0.334	1.000
14	**Pay equality**	-0.403*	0.466*	0.054	0.044	0.087	0.244	0.056	0.206	-0.026	0.031	0.076	0.006	0.496*

* p<0.1

Table 28: Model development for all employees – labour market

	5	6	7	8	9	10	11	12
FIXED PART								
Female	0.954	0.954	0.955	0.954	0.957	0.957	0.959	0.962
No degree	0.706***	0.706***	0.706***	0.706***	0.705***	0.705***	0.700***	0.700***
Level-1 controls	✓	✓	✓	✓	✓	✓	✓	✓
Mean tenure	0.840***	0.847***						
Mean ten. x. F		0.996						
Union density			1.007	1.011				
Union dens. x f.				0.998				
Bargaining cov.					0.998	1.001		
Bar. cov. x f.						0.999		
F. union mem.							1.027*	1.005
F. u. mem. x f.								1.009*
Constant	0.829	0.829	0.925	0.926	0.916	0.916	0.935	0.952
RANDOM PART								
SD slope	0.198***	0.198***	0.197***	0.194***	0.203***	0.200***	0.203***	0.190***
SD intercept	0.623***	0.623***	0.722***	0.718***	0.645***	0.642***	0.770***	0.746***
Corr. slope-int.	-0.706***	-0.706***	-0.594***	-0.588***	-0.613***	-0.608***	-0.733***	-0.709***
MODEL STATISTICS								
Log likelihood	-48890.7	-48890.7	-48896.6	-48896.2	-47249.9	-47249.6	-46191.9	-46190.5
Parameters	45	46	45	46	45	46	45	46
LR test	***	n.s.	***	n.s.	-	n.s.	-	*
Individuals	87,843	87,843	87,843	87,843	81,440	81,440	82,485	82,485
Countries	22	22	22	22	21	21	20	20

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: Model 4, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 29: Model development for all employees – educational system

	13	14	15	16
FIXED PART				
Female	0.954	0.954	0.955	0.954
No degree	0.706***	0.706***	0.706***	0.706***
Level-1 controls	✓	✓	✓	✓
University	1.007	0.998		
University x f.		1.004*		
Vocational			1.025	1.042***
Vocational x f.				0.989***
Constant	0.870	0.866	0.859	0.859
RANDOM PART				
SD slope	0.197***	0.183***	0.197***	0.166***
SD intercept	0.765***	0.745***	0.656***	0.635***
Corr. slope-int.	-0.655***	-0.620***	-0.519***	-0.466***
MODEL STATISTICS				
Log likelihood	-48896.7	-48895.3	-48896	-48892.9
Parameters	45	46	45	46
LR test	***	**	***	***
Individuals	87,843	87,843	87,843	87,843
Countries	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for models with a simple institution: Model 4, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 30: Model development for all employees – support for women, part 1

	17	18	19	20	21	22	23	24
FIXED PART								
Female	0.954	0.954	0.954	0.954	0.955	0.954	0.954	0.954
No degree	0.706***	0.706***	0.706***	0.706***	0.706***	0.706***	0.706***	0.706***
Level-1 controls	✓	✓	✓	✓	✓	✓	✓	✓
Childcare <3	1.007	1.012						
Childc. <3 x f.		0.998						
Childcare ≥3			1.012*	1.016*				
Childc. ≥3 x f.				0.998				
Maternity leave					1.023**	1.031***		
Mat. leave x f.						0.995		
Child benefits							0.921	0.977
Child ben. x f.								0.975
Constant	0.907	0.907	0.936	0.937	0.855	0.855	0.802	0.803
RANDOM PART								
SD slope	0.197***	0.195***	0.198***	0.194***	0.198***	0.188***	0.196***	0.193***
SD intercept	0.734***	0.732***	0.698***	0.694***	0.641***	0.634***	0.752***	0.747***
Corr. slope-int.	-0.597***	-0.596***	-0.590***	-0.589***	-0.528***	-0.514***	-0.631***	-0.627***
MODEL STATISTICS								
Log likelihood	-48896.9	-48896.7	-48895.8	-48895.5	-48894.6	-48893.7	-48896.8	-48896.5
Parameters	45	46	45	46	45	46	45	46
LR test	**	n.s.	***	n.s.	***	*	**	n.s.
Individuals	87,843	87,843	87,843	87,843	87,843	87,843	87,843	87,843
Countries	22	22	22	22	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: Model 4, reference model for models with institution and its cross-level interaction: previous model with simple institution.

Table 31: Model development for all employees – support for women, part 2

	25	26	27	28	29	30
FIXED PART						
Female	0.953	0.954	0.954	0.954	0.955	0.954
No degree	0.705***	0.705***	0.706***	0.706***	0.706***	0.706***
Level-1 controls	✓	✓	✓	✓	✓	✓
Employ. equ.	1.057***	1.041*				
Employ. e. x f.		1.006				
Degree equality			1.002	0.998		
Degree e. x f.				1.002		
Pay equality					0.971	0.963
Pay e. x f.						1.005
Constant	1.034	1.033	0.845	0.844	0.854	0.854
RANDOM PART						
SD slope	0.196***	0.191***	0.197***	0.191***	0.198***	0.195***
SD intercept	0.728***	0.718***	0.750***	0.743***	0.709***	0.707***
Corr. slope-int.	-0.772***	-0.762***	-0.609***	-0.594***	-0.581***	-0.577***
MODEL STATISTICS						
Log likelihood	-48892.8	-48892.2	-48897.1	-48896.4	-48896.2	-48896
Parameters	45	46	45	46	45	46
LR test	***	n.s.	**	n.s.	***	n.s.
Individuals	87,843	87,843	87,843	87,843	87,843	87,843
Countries	22	22	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: Model 4, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 32: Model development for employees with degree – labour market

	5	6	7	8	9	10	11	12
FIXED PART								
Female	1.082*	1.084**	1.086*	1.079*	1.098**	1.097***	1.096*	1.101**
Level-1 controls	✓	✓	✓	✓	✓	✓	✓	✓
Mean tenure	0.863***	0.874***						
Mean ten. x f.		0.963**						
Union density			1.008	1.009				
Union dens. x f.				0.996**				
Bargaining cov.					1.001	1. 003		
Bar. cov. x f.						0.996***		
F. union mem.							1.011	1.009
F. u. mem. x f.								1.006
Constant	0.543***	0.543***	0.611**	0.615**	0.626**	0.627**	0.603**	0.600**
RANDOM PART								
SD slope	0.126***	0.091**	0.140***	0.127***	0.139***	0.050*	0.145***	0.140***
SD intercept	0.533***	0.532***	0.608***	0.610***	0.523***	0.523***	0.612***	0.611***
MODEL STATISTICS								
Log likelihood	-16111.7	-16109	-16114.8	-16112.5	-15521.9	-15507.1	-15004.6	-15004.1
Parameters	43	44	43	44	43	44	43	44
LR test	***	**	n.s.	**	-	***	-	n.s.
Individuals	25,625	25,625	25,625	25,625	24,279	24,279	23,856	23,856
Countries	22	22	22	22	21	21	20	20

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: Model 3, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 33: Model development for employees with degree – educational system

	13	14	15	16
FIXED PART				
Female	1.085*	1.084*	1.087*	1.086*
Level-1 controls	✓	✓	✓	✓
University	1.003	1.003		
University x f.		1.002		
Vocational			1.029**	1.030**
Vocational x f.				0.996
Constant	0.555***	0.555***	0.583**	0.582**
RANDOM PART				
SD slope	0.136***	0.136***	0.141***	0.140***
SD intercept	0.625***	0.624***	0.563***	0.563***
MODEL STATISTICS				
Log likelihood	-16115.2	-16114.9	-16113.6	-16113.2
Parameters	43	44	43	44
LR test	n.s.	n.s.	**	n.s.
Individuals	25,625	25,625	25,625	25,625
Countries	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: Model 3, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 34: Model development for employees with degree – support for women, part 1

	17	18	19	20	21	22	23	24
FIXED PART								
Female	1.086*	1.077*	1.084*	1.082*	1.085*	1.084*	1.086*	1.086*
Level-1 controls	✓	✓	✓	✓	✓	✓	✓	✓
Childcare <3	1.010	1.012						
Childc. <3 x f.		0.933***						
Childcare ≥3			1.012	1.013				
Childc. ≥3 x f.				0.999				
Maternity leave					1.020**	1.021**		
Mat. leave x f.						0.998		
Child benefits							1.015	1.023
Child ben. x f.								0.953***
Constant	0.611*	0.617*	0.622**	0.624**	0.564***	0.564***	0.557**	0.558**
RANDOM PART								
SD slope	0.139***	0.098***	0.135***	0.133***	0.139***	0.140***	0.137***	0.076*
SD intercept	0.614***	0.617***	0.591***	0.591***	0.577***	0.577***	0.626***	0.629***
MODEL STATISTICS								
log likelihood	-16115	-16111.6	-16114.1	-16113.9	-16113.4	-16113.3	-16115.3	-16112.4
Parameters	43	44	43	44	43	44	43	44
LR test	n.s.	***	*	n.s.	**	n.s.	n.s.	***
Individuals	25,625	25,625	25,625	25,625	25,625	25,625	25,625	25,625
Countries	22	22	22	22	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: Model 3, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 35: Model development for employees with degree – support for women, part 2

	25	26	27	28	29	30
FIXED PART						
Female	1.083*	1.083*	1.085*	1.085*	1.085*	1.088*
Level-1 controls	✓	✓	✓	✓	✓	✓
Employ. equ.	1.042**	1.041**				
Employ. e. x f.		1.000				
Degree equality			1.000	1.000		
Degree e. x f.				1.000		
Pay equality					0.977	0.979
Pay e. x f.						0.994
Constant	0.628**	0.628**	0.552***	0.552***	0.557***	0.557***
RANDOM PART						
SD slope	0.132***	0.132***	0.137***	0.136***	0.135***	0.131***
SD intercept	0.571***	0.571***	0.626***	0.626***	0.613***	0.614***
MODEL STATISTICS						
Log likelihood	-16113.2	-16113.2	-16115.3	-16115.3	-16114.8	-16114.4
Parameters	43	44	43	44	43	44
LR test	**	n.s.	n.s.	n.s.	n.s.	n.s.
Individuals	25,625	25,625	25,625	25,625	25,625	25,625
Countries	22	22	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: Model 3, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 36: Model development for employees with no degree – labour market

	5	6	7	8	9	10	11	12
FIXED PART								
Female	0.886**	0.886**	0.887**	0.887**	0.884**	0.884**	0.890**	0.894**
Level-1 controls	✓	✓	✓	✓	✓	✓	✓	✓
Mean tenure	0.852***	0.839***						
Mean ten. x f.		1.009						
Union density			1.013*	1.013				
Union dens. x f.				1.000				
Bargaining cov.					1.000	1.000		
Bar. cov. x f.						1.000		
F. union mem.							1.027*	1.002
F. u. mem. x f.								1.010
Constant	0.693*	0.693*	0.851	0.851	0.780	0.780	0.797	0.797
RANDOM PART								
SD slope	0.206***	0.205***	0.203***	0.203***	0.209***	0.208***	0.209***	0.196***
SD intercept	0.657***	0.656***	0.770***	0.770***	0.695***	0.694***	0.830***	0.805***
Corr. slope-int.	-0.681***	-0.679***	-0.738***	-0.738***	-0.620***	-0.620***	-0.784***	-0.765***
MODEL STATISTICS								
Log likelihood	-32594.4	-32594.3	-32597.3	-32597.3	-31554.4	-31554.4	-30999.3	-30998
Parameters	44	45	44	45	44	45	44	45
LR test	***	n.s.	***	n.s.	-	n.s.	-	*
Individuals	62,218	62,218	62,218	62,218	57,161	57,161	58,629	58,629
Countries	22	22	22	22	21	21	20	20

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: model 4, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 37: Model development for employees with no degree – educational system

	13	14	15	16
FIXED PART				
Female	0.885**	0.886**	0.885**	0.884**
Level-1 controls	✓	✓	✓	✓
University	1.002	0.996		
University x f.		1.003		
Vocational			1.034**	1.052***
Vocational x f.				0.990**
Constant	0.726	0.725	0.750	0.751
RANDOM PART				
SD slope	0.205***	0.200***	0.205***	0.179***
SD intercept	0.801***	0.792***	0.680***	0.655***
Corr. slope-int.	-0.688***	-0.670***	-0.646***	-0.601***
MODEL STATISTICS				
Log likelihood	-32598.9	-32598.4	-32596.7	-32594.4
Parameters	44	45	44	45
LR test	***	n.s.	***	**
Individuals	62,218	62,218	62,218	62,218
Countries	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: model 4, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 38: Model development for employees with no degree – support for women, part 1

	17	18	19	20	21	22	23	24
FIXED PART								
Female	0.885**	0.885**	0.886**	0.885**	0.886**	0.885**	0.885**	0.886**
Level-1 controls	✓	✓	✓	✓	✓	✓	✓	✓
Childcare <3	1.014	1.014						
Childc. <3 x f.		1.000						
Childcare ≥3			1.012	1.016*				
Childc. ≥3 x f.				0.998				
Maternity leave					1.027***	1.033***		
Mat. leave x f.						0.997		
Child benefits							0.927	0.950
Child ben. x f.								0.991
Constant	0.829	0.829	0.796	0.797	0.733	0.733	0.684	0.685
RANDOM PART								
SD slope	0.204***	0.204***	0.205***	0.202***	0.205***	0.201***	0.204***	0.204***
SD intercept	0.786***	0.786***	0.747***	0.744***	0.676***	0.671***	0.798***	0.798***
Corr. slope-int.	-0.708***	-0.708***	-0.663***	-0.664***	-0.672***	-0.665***	-0.699***	-0.699***
MODEL STATISTICS								
log likelihood	-32598.2	-32598.2	-32597.8	-32597.5	-32595.4	-32595	-32598.7	-32598.6
Parameters	44	45	44	45	44	45	44	45
LR test	***	n.s.	***	n.s.	***	n.s.	***	n.s.
Individuals	62,218	62,218	62,218	62,218	62,218	62,218	62,218	62,218
Countries	22	22	22	22	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: model 4, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 39: Model development for employees with no degree – support for women, part 2

	25	26	27	28	29	30
FIXED PART						
Female	0.882**	0.883***	0.885**	0.884***	0.886**	0.885**
Level-1 controls	✓	✓	✓	✓	✓	✓
Employ. equ.	1.065***	1.037				
Employ. e. x f.		1.010				
Degree equality			1.003	0.997		
Degree e. x f.				1.003		
Pay equality					0.971	0.959
Pay e. x f.						1.006
Constant	0.889	0.891	0.717	0.717	0.726	0.725
RANDOM PART						
SD slope	0.205***	0.191***	0.204***	0.191***	0.206***	0.202***
SD intercept	0.801***	0.777***	0.807***	0.788***	0.751***	0.746***
Corr. slope-int.	-0.859***	-0.848***	-0.701***	-0.675***	-0.657***	-0.650***
RANDOM PART						
Log likelihood	-32593.8	-32595.7	-32598.8	-32597.6	-32598.1	-32597.8
Parameters	44	45	44	45	44	45
LR test	***	*	***	*	***	n.s.
Individuals	62,218	62,218	62,218	62,218	62,218	62,218
Countries	22	22	22	22	22	22

*** p<0.01, ** p<0.05, * p<0.1; reference model for the LR test for models with a simple institution: model 4, reference model for models with an institution and its cross-level interaction: previous model with simple institution.

Table 40: Summary of the multilevel analyses without Romania (differences to estimations including Romania marked in red)

	all	degree	no degree
FIXED PART			
Female	0	+	-
Mean tenure	-	0	-
Mean ten. x f.	0	-	0
Union density	(+)	+	+
Union dens. x f.	0	-	0
Bargaining cov.	0	0	0
Bar. cov. x f.	0	-	0
F. union mem.	0	0	0
F. u. mem. x f.	+	0	+
University	0	0	0
University x f.	+	0	0
Vocational	+	+	+
Vocational x f.	-	0	-
Childcare <3	0	0	0
Childc. <3 x f.	0	-	0
Childcare ≥3	0	0	0
Childc. ≥3 x f.	0	0	0
Maternity leave	+	+	+
Mat. leave x f.	0	0	0
Child benefits	0	0	0
Child ben. x f.	0	-	0
Employ. equ.	+	+	+
Employ. e. x f.	0	0	0
Degree equality	0	0	0
Degree e. x f.	0	0	+
Pay equality	0	0	0
Pay e. x f.	0	0	0
RANDOM PART			
SD slope	+	+	+
SD intercept	+	+	+
Corr. slope-int.	-	0	-

0 = no significant relationship, + = positive relationship, - = negative relationship.

Table 41: Importance of vocational education in countries with opposing gender gaps among employees with no degree

	Vocational
Countries with significant training disadvantage of lower educated women	
AT	+
BE	+
CY	-
CZ	+
FR	-
PL	-
SK	+
Countries with training advantage of lower educated women	
BG	+
DK	+
FI	+
HU	-
LV	-

+ = value of the institutional variable above the mean across all countries in the data set; - = value of the institutional variable below the mean across all countries in the data set; country codes: AT = Austria, BE = Belgium, BG = Bulgaria, CY = Cyprus, CZ = Czech Republic, DK = Denmark, FI = Finland, FR = France, HU = Hungary, PL = Poland, SK = Slovak Republic, LV = Latvia. Significance of women's training disadvantage is estimated by running individual-level regressions by country with integration-term for highly educated women (not displayed).