Compensation and Performance - Empirical Studies on Wages, Bonus Payments, and Intra-Firm Trainings

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Chapter 1

Introduction

This thesis is about the relationship between compensation and performance. The following four chapters empirically investigate the determinants and performance effects of compensation schemes. The studies presented here give answers to a subset of relevant questions often raised by practitioners and economists. These topics include the effects of a higher differentiation in bonus payments on individual performance, the determinants of wage premia for newly hired employees, the long-term effects of intra-firm training participation, and the effect of the recent financial crisis on the determinants of compensation schemes. Furthermore, if applicable, we derive practical implications based on the empirical results. All chapters have two things in common: First, they are all related to compensation policies, i.e. they all focus either on base salaries or short-term bonus payments or a combination of both. And second, they are based on two large-scaled data sets, because in the end the answers to the questions raised above are empirical ones.

As outlined in the following chapters in detail, the design of competitive and incentive-compatible compensation schemes is one of the major challenges companies have to face in recent times. Pay decisions have an impact on a wide variety of activities along the HR value chain as they influence activities like recruitment, development, and retainment of employees. Also, pay is an important element for the motivation and satisfaction of employ-

ees.[1]

Although compensation schemes are a major part of the internal incentive structure inside firms, the "economic understanding of internal incentive structures is far from complete" (Baker et al. (1988)). This is especially true for non-executive employees, as the majority of studies has predominantly focused on CEO and top executive positions (see e.g. Murphy (1985), Coughlan and Schmidt (1985), Abowd (1990), Barro and Barro (1990), Gibbons and Murphy (1990), Jensen and Murphy (1990b), Jensen and Murphy (1990a), Leonard (1990), Aggarwal and Samwick (1999), Eriksson and Lausten (2000), Aggarwal and Samwick (2003) and Jensen and Murphy (2010)).

In this thesis, we therefore focus on non-executive employees, i.e. lower- and middle-level employees below the top management level. In the following, we will shortly present the main research questions of each chapter and try to highlight similarities and connections between the studies.[2]

The thesis can be divided into two parts. In the first part (chapters 2 to 4), the determinants of compensation schemes in a broader sense are being investigated.

Chapter 2 provides an extensive overview on compensation schemes in one of the main areas of the tertiary sector, namely the banking and financial services industry. This area is of high importance as banks, in their role as financial intermediaries, are responsible for the allocation of financial resources between all participants of the financial system. But more important, poorly adjusted pay systems in this sector may lead to excessive risk-taking behavior of employees leading to immense external effects as the current crisis has quite impressively shown. The research questions we address in this chapter include: What are the determinants of compensation for non-executive employees in this sector? And what is the impact of the current economic crisis on the determinants and outcomes of payment schemes? Analyses include the development of base salaries and short-term bonus payments as well as bonus eligibility rates and pay dispersion. Finally, econometric results on the

[1] For the relevance of non-monetary incentives like e.g. awards see a.o. Frey (2007), Frey and Neckermann (2008), Frey and Neckermann (2009), Frey (2010), Kosfeld and Neckermann (2011).

[2] The relevant literature is presented at the beginning of each chapter.

determinants of fixed and variable compensation for non-executive employees are presented.

The third chapter analyzes wage premia for newly hired employees. It is often claimed by practitioners, that newly hired employees receive a wage premium compared to incumbent employees even if both do the same job. The research questions we study include: Do we observe economically significant wage premia for newly hired employees compared to incumbent employees? And if yes, what are the determinants of these premia? The focus in this chapter is therefore on fixed salaries. It can be shown theoretically as well as empirically that differences in human capital, i.e. the specificity of human capital (general vs. firm-specific), determine whether wage premia are paid to newly hired employees or whether incumbents earn more in the same job.

Chapter 4 investigates the relationship between intra-firm training participation and monetary outcome variables. In these analyses we focus on both fixed salaries and short-term bonus payments. The questions we address include: What are the determinants of intra-firm training participation? And does training participation have a sustainable effect on individual performance, measured by monetary indicators? We therefore analyze if investments in trainings and employee learning are significant determinants of individual compensation. Additionally, we study the effects of training participation on non-monetary indicators like absenteeism, overtime work and employee turnover. To conclude, chapters 3 and 4 analyze the role of human capital as determinants of both base salary and bonus payments, whereas in chapter 2, a broader set of determinants of individual compensation is being studied.

In the second part of the thesis (chapter 5), the focus switches from the determinants to potential effects of compensation schemes. Here, the performance effects of a higher differentiation in individual bonus payments are being studied. This is one of the main challenges practitioners are dealing with in recent times and many companies discuss this topic quite controversially.[3]

[3]For discussions on the controversial issues in the popular press see for instance "Performance Reviews: Many Neeed Improvement" in the *New York Times*, September 10, 2006 or "The Struggle to Measure Performance" in *Business Week*, January 9, 2006.

The design of compensation schemes in companies is always characterized by a potential trade-off between fairness considerations and the provision of incentives. The key question is whether to treat employees equally, i.e. to pay equal wages to all workers, or to reward higher levels of efforts adequately leading to more differentiated pay schemes. The research questions we address include: Does a higher differentiation lead to increased individual performance? What are potential economic effects? And are there areas where higher levels of differentiation may be harmful?

The analyses presented in this thesis are based on two data sets.[4] The studies presented in chapter 2, 3, and 5 are based on the INbank compensation data base obtained from the management consultancy Towers Watson[5]. This data base is one of the largest of its type in the European financial services sector. We contribute to the literature on compensation research by making use of some new elements of the data set, as a large number of different companies of a whole industry, the banking and financial services sector, are included in the survey. Additionally, detailed firm-specific information that is comparable between companies is available as a multitude of specific job functions is defined through a detailed set of job descriptions and profiles of knowledge and skills required for the relevant position. We also make use of new waves of the data set including years between 2005 and 2009. This allows us to analyze the first effects of one of the most severe financial crises on the determinants and outcomes of compensation schemes. The second data set, used in chapter 4 for the analyses of intra-firm training participation on individual performance, comprises personnel records from a large, multinational company headquartered in Germany. Detailed information on training participation, compensation elements and demographic background is available.

We now discuss the content of the following chapters in more detail. The first part of chapter 2 shows descriptive statistics for the main compensation variables base salary, short-term bonus payments and the bonus-to-base

[4]Due to reasons of confidentiality, the data sheets had to be anonymized. Sparkassen (publicly owned savings banks), Volks- and Raiffeisenbanken (cooperative banks) and the Deutsche Bundesbank (German central bank) are not part of the sample.

[5]Formerly known as Towers Perrin.

ratio. We find the typical positive, convex relationship between base pay and hierarchical level, with highest average wages in Switzerland. Regarding functional areas, wages in investment banking, asset management and treasury and capital markets dominate, with a steadily convergence of wage levels over time between countries. The financial services sector is also characterized by a high number of employees that are eligible for short-term bonus payments, especially at upper levels in the hierarchy. But there are also employees who, although being actually eligible, receive no (positive) bonus payment at the end of the year. We find that for Germany and Austria, the financial crisis leads to a significant increase in the proportion of employees with zero bonuses at all levels, whereas Swiss banks seemed to be afraid of bonus cuts as the proportion is quite stable over time. Compared to fixed wages, the convex relationship between bonus payments and hierarchical level is very pronounced and average bonuses are the highest in capital market-based functions like investment banking, asset management and treasury and capital markets. We further investigate the impact of the financial crisis on variable payments. A key result is the massive decrease in bonuses especially at upper levels in the year 2009. Interestingly, these employees also face a loss in bonuses compared to pre-crisis reference years, whereas lower-level employees are financially better off in 2009 than before the crisis.

The second part of this chapter presents regression results for the determinants of fixed and variable compensation. Coefficients in estimates with base salary as dependent variable are quite stable over time and broadly confirm the descriptive evidence and the typical age-earnings profile. Econometric results for estimates with variable payments, however, are much more different between countries with quite volatile regressions coefficients over time. Large differences are visible when comparing the results for functional areas and the impact of the financial crisis on bonus payments. In a last step, structural differences in the explanatory power of the models are investigated. The results show that fixed compensation packages are highly standardized between companies in all of the three countries, with hierarchical level as the main single determinant. Bonus payments, however, are stronger related to

individual efforts. In Germany, bonuses vary to a high extent across companies, whereas in Switzerland and Austria company differences are almost negligible with only marginal increases in R-squared due to additional firm controls.

In chapter 3, wage differences between newly hired and incumbent employees are being investigated. This question is studied theoretically as well as empirically for employees in the financial services sector.

A formal model is used to derive hypotheses on the determinants of these wage premia, i.e. the sign and the size of the effect. The model assumes that employees have similar experience on the labor market, are qualified for only one type of job in the industry and care for wages as well as match-specific utility (e.g. satisfaction with colleagues, supervisor or corporate culture). It is shown that incumbents earn less than new recruits if and only if firm-specific human capital is not too important. If firm-specific human capital is very important, firms will pay a higher wage to incumbents to increase the likelihood that the employees stay with their current employer and the specific skills are not lost.

The conjectures of the model are then being investigated using the INbank data set on wages in the German banking and financial services sector. The results show that average wage premia for newly hired employees are statistically and economically significant, controlling for demographic, workplace as well as firm characteristics. As the model makes predictions on the influence of hierarchical levels and functional areas, results of interaction terms are also presented. Relative wage premia for new recruits are larger at higher hierarchical levels, where general managerial human capital is more important. Regarding functional areas, highest premia are found in capital market-based areas such as treasury and capital markets as well as investment banking and corporate banking where transferable client-specific human capital seems to be more important than firm-specific human capital as it is very valuable for competitors. In a last step, wage differentials for management and expert positions are being investigated and higher premia in managerial positions can also be confirmed. In the second part of this chapter, a measure for the importance of firm-specific human capital is generated that allows a direct

test of the model. The results indeed show a negative correlation between the measure of the importance of firm-specific human capital and average wage premia for newly hired employees.

In chapter 4, the determinants and effects of intra-firm training participation on earnings and job performance are being investigated. The main research question we address is whether company training sustainably increases the productivity of employees, as the empirical results in the literature are mixed so far. Previous studies mainly focussed on the organizational level, whereas research using individual-level data is mainly based on national survey data sets. Empirical research based on company data sets, however, is rare. We contribute to the literature by using a unique company data set of a large, multinational German company that contains detailed information on compensation and classroom training participation. Besides fixed and variable compensation, we also have information on several job indicators like absenteeism and overtime hours as well as turnover probabilities. Furthermore, we can identify a bundle of different training categories, like e.g. leadership, project management, business administration or technical trainings.

Probit regressions show a higher likelihood of training participation for junior managers compared to non-exempt employees and senior managers indicating that the training program of the company mainly focuses on younger university graduates with less labor market experience. A striking result is the negative selection effect of employees into trainings, i.e. less productive employees are more likely to participate in classroom trainings. Regressions with the different training categories as dependent variable show that even leadership and project management trainings are more likely to be staffed with less productive employees.

Applying panel data methods to eliminate unobserved heterogeneity, we do not find an economically significant short-term performance effect measured by base salary. Using individual bonus payments as a productivity measure, we find an economically significant short-term effect. But one year later the effect disappears, so we do not find a long-term effect of training participation on performance measured by these monetary indicators. Several

robustness checks confirm these results, as only the incidence of participation matters and not the number or composition of the training mix. A possible explanation is the link between training participation and the performance measurement system of the company. In the second part of this chapter, the effects of training participation on non-monetary job indicators are being investigated. We find a positive relationship between training participation and overtime hours. Furthermore, training negatively affects the absence of employees and turnover probability rates.

Chapter 5 analyzes the performance effects of differentiation in bonus payments on subsequent individual performance. The majority of bonus contracts, except those in sales functions, are based upon subjective performance evaluations rather than on objective output indicators. Empirical researchers often claim that supervisors do not differentiate enough between high performing and low performing employees when evaluating performance. This leads to a compression in performance ratings what in turn should reduce the incentive effects of bonus plans and lead to a lower performance of employees. But practitioners sometimes argue that a higher differentiation like e.g. forced distribution systems may lead to a decrease in employee's motivation or a crowding out of intrinsic motivation. We therefore contribute to the literature by studying the impact of differentiation in bonus payments on performance empirically with a large panel data set for the financial services industry.

We indeed find that, on average, a stronger differentiation in a given work unit has a substantial positive effect on individual performance in this unit in the subsequent year, all other factors constant. Compared to departments with rather undifferentiated incentives, the performance of employees in departments where the supervisor is among the 20% strongest differentiators is on average about 31% higher. This effect is the larger the higher the hierarchical level. But differentiation has no significant effect or even becomes harmful at the lowest levels in the data set. As objective performance measures are only rarely available at lower levels, biased subjective assessments may therefore outweigh the incentive effects of differentiation, whereas employees at higher levels are more visible what makes assessing

their performance easier. Looking at functional areas, differentiation has the strongest effect in retail banking and corporate and private banking, both areas with a high coverage of objective performance indicators. A negative relationship between differentiation and performance can be found for the lower-skilled service functions, where subjective performance measures dominate. We also find a stronger effect of differentiation for managerial employees than for functional experts. In the second part of this chapter we present some robustness checks and give a first indication of the effects of differentiation on firm performance using a firm-level data set combined with information on financial statements. The results show a positive relationship between higher differentiation levels and firm performance measured by the return on equity before the financial crisis, but indicate that a higher differentiation in the past may have enforced risk-taking behavior of employees in the first year of the crisis.

Chapter 2

The Impact of the Financial Crisis on Non-Executive Compensation[1]

2.1 Introduction

Human capital as an intangible asset gets increasingly important in modern economies. More and more companies operate in employee-intensive businesses where human capital is regarded as a critical asset and not purely a cost factor (Lev (2001)). As personnel costs often represent the largest part of total costs in these companies, the design of pay packages is of strategic importance and therefore directly influences corporate performance. Important parameters include the right adjustment between fixed and variable elements and the pay-for-performance relationship. Second, variable pay systems become more and more popular for companies to make pay costs more volatile, as increases in fixed compensation become part of future salaries (Milkovich and Newman (1996)). This is expensive in the long run, even more as nominal wage cuts are only rarely observable in companies. Variable pay, however, is much more flexible as it depends to a higher extent on divisional and corporate performance. This implies that bonus payments

[1] This chapter is based upon Kampkötter (2010).

will typically decrease in times of economic downturn and increase otherwise. Additionally, the structure of the pay mix is highly important for the motivation, commitment, and behavior of employees inside the company as well as for activities along the HR value chain like e.g. recruiting, developing and retaining employees. Pay systems therefore have to be internally consistent and externally competitive (Milkovich and Newman (1996)). And, most important, performance-related pay helps to align the goals of managers and employees with those of the company respectively the shareholders**.** Hence, the design of competitive compensation schemes is one of the major challenges companies have to face with in recent times.

But a closer look on previous research about compensation systems and their practical implementation is necessary. Companies vary extremely with respect to the design of their compensation systems, even in the same industry. Especially variable payment schemes gained increasing attractiveness in recent times[2] and are implemented with various modifications between companies. Past research has predominantly focused on the analysis of CEO and top management compensation. There is a vast amount of studies on the determinants[3] and effectiveness of top management compensation systems in the economic literature as required data sets are often publicly available. These studies mainly address two research questions: 1) Is there a relationship between (executive) compensation and corporate performance? And 2) What are typical determinants of (top) management and executive compensation? The first relationship is often referred to as pay-for-performance sensitivity. Relevant studies include a.o. Murphy (1985), Coughlan and Schmidt (1985), Abowd (1990), Barro and Barro (1990), Gibbons and Murphy (1990), Jensen and Murphy (1990b), Jensen and Murphy (1990a), Leonard (1990), Aggarwal and Samwick (1999), Eriksson and Lausten (2000), Aggarwal and Samwick (2003) and, more recently, Jensen and Murphy (2010).[4] A recent

[2]For a recent survey on more than 1,400 U.S. companies see the 2010 Hewitt U.S. Variable Compensation Measurement Survey.

[3]See Tosi et al. (2000) for a meta-analytic review.

[4]Studies on executive compensation often also include the analysis of long-term incentive payments like stock option plans, because this is an important element of top management compensation (for a comprehensive overview see e.g. Murphy (1999)). As our

study by Kampkötter and Sliwka (2011) analyzes this relationship for non-executive employees.

Although compensation policies as part of the internal incentive structure seem to be very important, the "economic understanding of internal incentive structures is far from complete" (Baker et al. (1988)). Limitations are predominantly visible for employees below the top management level. This may include middle and lower-level as well as non-exempt employees. Up to now empirical evidence on the practice of compensation schemes, i.e. its determinants and performance consequences, for these group of employees is relatively scarce. Indeed, those employees are characterized by a reduced impact on corporate results compared to the top management team. But they still have a positive impact and are important for the cascading of the corporate strategy like e.g. the head of a functional area or a branch manager (Ortín-Ángel and Salas-Fumás (1998)). We therefore want to analyze the determinants and patterns of non-executive compensation using a large data set on individual compensation in the financial services industry of three European countries.

Additionally, in papers analyzing pay schemes of non-executive employees, often only fixed wages are analyzed (see e.g. Baker et al. (1994b) and Baker et al. (1994a)[5]). As a result, there is only a small number of empirical studies on both fixed and variable pay components for the mentioned group of employees (see e.g. Gerhart and Milkovich (1990), Abowd (1990), Leonard (1990), Stroh et al. (1996), Ortín-Ángel and Salas-Fumás (1998), Eriksson and Lausten (2000), Nash (2003), and Gibbs and Hendricks (2004)).[6] It is also important to analyze industry-specific and regional differences. Out of the small number of empirical studies for employees below top management level, there are only very few that analyze pay systems in the financial services industry.[7] The main reason is the restricted access to confidential

focus is on non-executive employees, we only concentrate on short-term bonus payments.

[5]Information on bonus payments is not used in this two studies as it is not available for all years.

[6]Furthermore, the majority of these studies uses data sets that have been collected about 10 to 20 years ago.

[7]Nash (2003) e.g. analyzes the determinants of financial incentives in the UK investment banking sector using a data set from a professional consultancy firm. See also Barro

personnel records in this very competitive market. But the banking and financial services industry seems to be very suitable especially for the analysis of variable payment schemes as employees' short-term bonus eligibility is above industry average.[8] Furthermore, almost all studies use data sets from the U.S. or UK, whereas data sets for continental European countries seem not to be present.[9]

We therefore contribute to the existing literature by addressing some of the major limitations in this field of research mentioned above. In a first step we study the determinants of compensation schemes for middle and lower-level employees using a comparatively large data set with up to 120,000 annual observations for the years 2004-2009. Our data set is owned by the management consultancy Towers Watson[10], where it is used for professional compensation benchmarking. We will shed some light on compensation patterns by using detailed job-specific information other studies often lack (e.g. Gerhart and Milkovich (1990)) like broader functional areas, detailed functions, career ladders and hierarchical levels. We are also able to distinguish between areas with standardized products and processes like retail banking and asset management and more client-specific fields like corporate banking. Our key variables include, besides base salary, annual short-term bonus payments and the ratio of variable payments to fixed salary. Second, we are among the first to introduce an international dimension into the research on the design of compensation systems by comparing data from Germany, Austria and one of the world's leading financial markets, Switzerland.[11] Third, we are able to analyze the results over time and also make use of new waves of the data set, which is very important as we can compare if the results are stable in different states of the economy. A major feature is that we can

and Barro (1990) and Treble et al. (2001).

[8] Stroh et al. (1996) e.g. find that in regressions with variable pay as proportion of total compensation as dependent variable, the coefficient for the financial services industry is the largest.

[9] Except Ortín-Ángel and Salas-Fumás (1998).

[10] In economics, Towers Watson (formerly Towers Perrin) data sets have also been used by Abowd and Kaplan (1999), Murphy (1999), and Murphy (2001).

[11] Abowd and Bognanno (1995) analyze executive and managerial compensation for twelve OECD countries. Grund (2005) compares personnel records of a U.S. and a German manufacturing firm.

also analyze the impact of one of the most severe financial crises starting in 2008 with the breakdown of Lehman Brothers. Investigating the effects of compensation packages on corporate performance for employees below top management is quite difficult, as the individual impact on corporate results diminishes at lower levels of the hierarchy. Therefore, this relationship is not being investigated in this study.

This chapter proceeds as follows. In section 2.2, the background and related literature is described. Section 2.3 explains the data set and the applied empirical strategy. Descriptive statistics of compensation practices between countries are shown in section 2.4, whereas section 2.5 econometrically analyzes the determinants of compensation schemes. Finally, section 2.6 concludes.

2.2 Background and Related Literature

Different theoretical approaches are used to formulate hypotheses on the determinants of compensation schemes. These determinants can typically be categorized into three different dimensions: job characteristics, employee characteristics, and firm/organizational characteristics (see e.g. Baker et al. (1988), Gerhart and Milkovich (1990), Milkovich and Newman (1996), Ortín-Ángel and Salas-Fumás (1998)). Job characteristics typically include the hierarchical position of the employee, functional area, detailed function, type of job (exempt vs. non-exempt, supervisory tasks vs. functional experts), and region. Employee characteristics include human capital variables like age, firm tenure, job tenure, labor market experience and years of education. Firm characteristics are often proxied by firm dummies or key indicators like e.g. firm size, sales, net income, profits, and the number of employees.

Agency theory predicts that performance-based compensation packages are helpful in aligning the agent's (manager, employee) interests with those of the principal (e.g. shareholders, boards of directors).[12] This is important

[12] Seminal papers include Holmström (1979) and Grossman and Hart (1983). For a comprehensive overview see e.g. Hart and Holmstrom (1987) or Milgrom and Roberts (1992).

because individual efforts may have, dependent on the hierarchical level, a strong influence on corporate performance like sales or financial results, and the principal is often unable to adequately monitor the agent's behavior. In incentive contracts a signal of the productivity of an agent is used that is composed of the non-observable effort of an employee and an error term measuring external influences on productivity that are not under the agent's control. The likelihood of performance-related pay is negatively correlated with the noise of the performance signal indicating that higher-powered incentives are less suitable in functional areas where the signal (the performance measure) is noisier. In these cases the agent has to be compensated for the additional risk in its income, what makes incentive systems more expensive. Therefore, the size of bonus payments and the probability of receiving a bonus should be higher in sales areas where indicators are less noisy and capture real performance more accurately. Nash (2003) indeed finds that performance-related pay is more prominent in areas where the observability of output is more easily measurable, e.g. retail banking and asset management with standardized products and transactions. In support and cross-divisional functions like marketing or human resources, individual output is, at best, observable after a longer time period and therefore often not measurable in the short run.

There are several reasons for a positive relationship between hierarchical level and the size of base salary and bonus payments. According to tournament theory (see e.g. Lazear and Rosen (1981) and Rosen (1986)), employees compete for higher-level positions in a promotion tournament. The related wage increase at the next level constitutes the winner prize. Ideally, to offer incentives, wage spreads should increase with the level in the hierarchy, with the largest difference moving from second-highest to the top level (empirically shown e.g. in Baker et al. (1994a), Baker et al. (1994b), Grund (2005), van Herpen et al. (2006)).[13] Other explanations refer to deferred compensation (Lazear (1979)) and decreasing career concerns when one moves up the hierarchy (Gibbons and Murphy (1992)). As promotion opportunities decrease at higher levels, additional variable payments have to be offered to employees.

[13] A recent study by Harbring and Irlenbusch (2011) shows that higher wage spreads also induce negative effects, but agents also act reciprocally to higher wages.

At lower levels, the whole set of future career opportunities should be a good motivator for employees, so that career concerns offer sufficient incentives for younger employees.[14] As a result, we expect the size of bonus payments and bonus eligibility rates to increase with the hierarchical level an employee is located at. Another argument deals with the leverage effect of individual efforts (see e.g. Gibbons and Waldman (1999)). At upper levels, employees have a higher impact on corporate results than lower-level employees, which makes them more productive for a company if their interests are in line with those of the firm. One possible reason is that higher-level employees with a wider span of control have a higher marginal revenue product than lower-level employees. Also tasks and jobs are less programmable, i.e. harder to monitor, at higher levels in the hierarchy, so we expect a negative relationship between task programmability and the importance of variable payments relative to total compensation as well as an increasing use of incentive contracts at upper levels. This is indeed confirmed e.g. by Abowd (1990), Stroh et al. (1996), and Ortín-Ángel and Salas-Fumás (1998).[15]

The theory of career concerns (Gibbons and Murphy (1992)) can also be applied to explain a positive relationship between age and the size and probability of receiving variable payments. With increasing age, career concerns and career opportunities tend to decrease and employees therefore have to be incentivized by variable payments. Ortín-Ángel and Salas-Fumás (1998) indeed find that bonus payments are more relevant for older managers with longer tenure. According to human capital theory (seminal contributions are Becker (1962), Becker (1964), and Mincer (1974)), base pay is determined to a large extent by human capital variables like education and job and labor market experience. With investments in education, training, and on-the-job learning employees accumulate general and firm-specific human capital that should lead to higher base salaries. Also high investments in human capital are more likely for jobs with low programmability and higher potential impact on corporate performance, so performance-based pay is more likely for more experienced employees (Gerhart and Milkovich (1990)).

[14] For a detailed discussion on the role of information see Dewatripont et al. (1999).

[15] See e.g. Eisenhardt (1989) for a detailed overview.

Previous research has shown that job grade or hierarchical level proves to be the most important single determinant of base salary and variable pay (Gerhart and Milkovich (1990), Nash (2003)).[16] After additionally controlling for job and individual characteristics, differences in fixed and variable pay schemes may remain between companies. These differences are then attributed to organizational characteristics, like e.g. industry affiliation, firm size, financial results, competitive position, or a diverse implementation of the corporate strategy. In studies that lack these indicators, firm dummies are often integrated into the regression model and a comparison of the increase in explained variance between the models with individual and job-specific characteristics as well as firm dummies is carried out. We follow this approach, as we also have no information on financial indicators, firm size and corporate strategy.

Empirical results for the differences in salary levels between companies after controlling for the whole set of characteristics are mixed so far. Some studies find large and persisting differences in salary levels over time (see Groshen (1991a) and Groshen (1991b) for early reviews), whereas diminishing differences are explained as a result of an increasing use of compensation benchmarking surveys by professional consulting firms as companies are forced to offer a market-based compensation to potential employees and also to assure the retaining of high performers. Others argue that these differences tend to be determined more randomly (Leonard (1990)). For variable payments, this is not so obvious as bonuses should ideally depend on individual efforts and the performance of the company. Gerhart and Milkovich (1990) e.g. indeed find that even similar companies differ to a large extent in their variable compensation policies.

[16] Leonard (1990) confirms this result for total pay (sum of base salary and bonus payments).

2.3 The Data

2.3.1 Data Set

We investigate a large data set on individual compensation in the German, Swiss and Austrian financial services industry. A major feature of the data set is the fact that the vast majority of companies in this industry is being included in the survey. For Germany, we have annual information on between 105,000 and 140,000 employees for the years 2005-2009, for Switzerland on between 50,000 and 70,000 employees for 2006-2009 and for Austria on around 20,000 employees between 2007 and 2009. It is important to note that we do not have information on CEO and top executive positions.[17] A crucial characteristic is the high validity of the data, because individual information on pay and job positions is used for professional compensation benchmarking.[18] A common problem with company data refers to a possible self-selection bias, because firms often voluntarily participate in compensation surveys. But the problem is mitigated in our study as firms are requested to report more than 2/3 of all employees of a certain job category and, additionally, the survey covers the vast majority of banks and financial companies in the respective market.[19]

In detail, the data set contains information on individual compensation like base salary and short-term bonus payments[20] and demographic informa-

[17] The data set is owned by the international management consultancy Towers Watson (formerly Towers Perrin). Due to reasons of confidentiality, the data sheets had to be anonymized.

[18] There is always a trade-off between national survey data sets including self-reported information on pay and data from professional compensation consultancy firms. The former method is typically characterized by a smaller number of observations accompanied with a more detailed set of demographic and personal information like e.g. gender, sex, and educational background. But self-reported compensation data often lack detailed firm-specific information and, perhaps more important, the reliability of the data has to be questioned. Compensation data sets from consultancy firms are characterized by a larger number of observations and detailed firm-specific information and are regarded much more reliable in terms of data consistency, as information is double-checked by company experts as well as consultants.

[19] Sparkassen (publicly owned savings banks), Volks- and Raiffeisenbanken (cooperative banks) and the Deutsche Bundesbank (German central bank) are not part of the sample.

[20] Swiss Francs are converted to Euros using ECB foreign exchange reference rates (see http://www.ecb.int/stats/exchange/eurofxref/html/index.en.html)

tion on employee's age, tenure, six hierarchical levels, eight main functional areas, and regional information. The hierarchical levels include entry level positions for apprentices and high school graduates up to divisional heads, the highest position in the data set. The functional areas reflect the eight main areas in the banking and financial services industry: retail banking (RB), private banking (PB), corporate banking (CB), investment banking (IB), asset management (AM), treasury and capital markets (TCM) as well as the support and service functions (corporate services (CS)) and the cross-divisional functions (corporate production (CP)). These functional areas are further subdivided into 70-80 specific functions that are used for more detailed compensation analyses. Retail banking, e.g., comprises the functions retail sales, business analysis, and retail product development. The cross-divisional functions include a.o. marketing, legal, HR, finance, and accounting.[21]

Towers Watson uses the standardized "career ladder methodology" to make career steps and job positions comparable between different companies in an industry and between countries. Therefore, typical career steps in an employee's career (starting with entry as university graduate or apprentice) in one of the career ladders management, professional, retail sales and support are defined using detailed job profiles of required knowledge, skills, and abilities for each possible position in the industry. Jobs in the management ladder are characterized by supervisory and general management tasks, whereas the professional ladder includes functional expert positions with no direct managerial responsibilities.[22] The retail sales ladder encompasses jobs in retail sales functions and back office and call center positions are included in the support ladder.

Tables 2.17 and 2.18 in the appendix show the distribution of employees by hierarchical level and year for the three countries. It is obvious that the distribution of employees by hierarchical level remains very stable throughout the years, despite an increasing number in total observations especially for Germany and Switzerland. In all countries, a slight increase in proportions at

[21] For an exemplary overview of the functions see Kampkötter and Sliwka (2010a).

[22] These are e.g. project managers, who coordinate project teams but typically have no managerial authority.

the top levels coincides with a small decrease at medium and bottom levels. Compared to Germany and Austria, top-level employees are overrepresented in the Swiss data set and middle-level employees are underrepresented. The distribution of employees by functional area is shown in table 2.19 for the years 2007-2009. The distribution *within countries* changes moderately over time, but larger differences appear if one looks at the distribution *between countries*. Germany and Austria are characterized by a domination of retail banking and corporate production positions with more than 60% of all employees working in these sectors, whereas capital market-based functions like investment banking and asset management as well as private banking only play a minor role. The Swiss banking sector is characterized by a similarly high proportion of employees working in the corporate production area, but the service functions play a more important role than in Germany or Austria. Furthermore, private banking positions are relatively more important in Switzerland, whereas retail banking is of minor importance in recent years. It is crucial to keep these structural differences in mind when it comes to the interpretation of the results.

2.3.2 Empirical Strategy

The empirical strategy is as follows. First we estimate the determinants of individual base salary for a given individual i in year t with OLS regressions using either cross sections for the three countries or the pooled data set.[23] Like in almost all studies, our compensation variables are positively skewed. We therefore use the logarithm of base pay and bonus payments. The baseline specification for individual i is given by

$$y_i = \alpha + \beta Z_i + \theta C_i + \lambda F_j + \varepsilon$$

for the cross sections and for individual i in year t in the pooled data set by

[23] For purposes of clarity, pooled cross section results for years before the financial crisis are compared with the cross sectional results for the year 2009.

$$y_{it} = \alpha + \beta Z_{it} + \theta C_{it} + \lambda F_j + \delta_t + \varepsilon$$

The dependent variable y_i is the logarithm of base salary for employee i in each of the cross sections. As it is important to account for differences in human capital and firm and job-specific influences, our controls include a vector of demographic variables Z_i (age, age squared, firm tenure, firm tenure squared) and a vector of job-related controls C_i (functional area, hierarchical level, career ladder and regional area). Organizational effects are captured by a dummy variable F_j for each firm_j in the data set. The constant is denoted by α and the error term by ε. The additional index t represents the time dimension in the pooled data set and δ_t is a vector of year dummies.

Prior to investigating the determinants of short-term bonus payments, we explore two interesting research questions: 1) What determines the likelihood of having a fixed compensation regime vs. a performance-based system. And 2) Is there a change in the probability of receiving positive (non-zero) bonus payments for *eligible* employees over time?

As we have information on the short-term bonus eligibility of employees in the banking sector, we estimate probit regressions with bonus eligibility as dependent variable. The baseline specification is given by

$$y_i = \alpha + \vartheta base_i + \beta Z_i + \theta C_i + \lambda F_j + \varepsilon$$

The dependent variable y_i is a dummy variable that is equal to 1 if employee i is eligible for short-term bonus payments in the given year, and 0 otherwise. As the level of base salary may have a positive impact on the eligibility and likelihood of bonus payments, we include $base_i$ into the model. The control vectors Z_i, C_i, the firm controls F_j and the error term ε are equal to those described above.[24]

We further observe employees that are principally eligible for short-term bonuses, but actually do not receive a variable payment at the end of the year. In companies with target achievement systems a straightforward reason is that the respective employee did not meet its targets. Another reason is that

[24] The regression equation for the pooled data set is also similar to that described above.

firms retain bonuses for potentially eligible employees, i.e. bonus pools are (completely) reduced, e.g. in the case of economic downturns. We therefore estimate the probability of receiving a positive, non-zero bonus payment for an actually eligible employee also with probit regressions. We construct a dummy variable that is equal to 1 if an eligible employee i receives a bonus payment that is strictly greater than zero, and 0 otherwise.

For the analysis of the determinants of short-term bonus payments we exclude employees that are principally eligible but receive no positive bonus payment in the respective year, as the determinants of zero bonus payments are already analyzed in the previous subsection. Similar to the regressions with base salary as dependent variable, we apply OLS regressions with the logarithm of bonus payments as dependent variable.[25] The set of independent variables in these regressions is equal to those used in the base salary estimates. Furthermore, robust standard errors are reported in all regressions.

2.4 Descriptive Statistics

The aim of this subchapter is to give a detailed, descriptive overview of the key compensation variables and their development over time and country. Table 2.1 reports mean values for base salary, bonus payments, the bonus to base ratio, and the bonus to total ratio.[26] This first overview shows that average salaries and bonuses are the highest in Switzerland, followed by Germany. It is interesting to note that although the differences in salary levels between Germany and Austria are relatively narrow, there are large differences in short-term bonus payments between countries. This is quite visible if one compares the bonus to base ratios. Whereas this ratio lies at about 23% in Switzerland and 17% in Germany before the financial crisis,

[25] As robustness check, we also apply tobit regressions including zero bonus payments and compare the results.

[26] The bonus to base ratio is defined as bonus payments divided by base salary and the bonus to total ratio as bonus payments divided by the sum of base salary and bonus payments (both multiplied by 100). Table 2.20 in the appendix shows results for median values.

variable payments play only a minor role in Austria with values ranging between 6% and 8%. The deep impact of the financial crisis on variable payments is also highly visible.

Country	Overview of pay variables (mean values)				
	2005	2006	2007	2008	2009
Germany					
Base salary	52,581	50,545	54,280	56,840	58,299
Bonus payments	9,487	11,995	12,548	13,961	8,121
Bonus to base ratio	13.5	17.2	17.3	17.7	11.2
Bonus to total ratio	10.3	12.7	12.5	12.4	8.9
Switzerland					
Base salary		65,620	63,853	69,431	72,399
Bonus payments		20,049	18,076	20,413	15,410
Bonus to base ratio		23.2	22.2	22.9	16.8
Bonus to total ratio		15.6	15.6	15.5	12.2
Austria					
Base salary			51,457	54,556	56,189
Bonus payments			4,196	5,542	3,699
Bonus to base ratio			6.5	8.2	5.4
Bonus to total ratio			5.5	6.8	4.6

Base salary and bonus payments expressed in Euros, ratios in %.

Table 2.1: Overview of pay variables (mean values)

But it is important to note that a cross-country comparison of average values is critical without considering the structural differences in the composition of the industry, mainly the proportion of functional areas and hierarchical levels. Higher average values in Switzerland may, besides a compensation for a higher price level, partly be an artefact of a strong focus on well-paid private banking activities, whereas in Austria the proportion of employees in the lower-paid retail banking sector is nearly triple as high as in Switzerland. We will take this heterogeneity into account and show descriptive statistics over hierarchical level and functional area in the following subsections. Within a certain area, practices and processes are very similar across countries, as banks offer highly standardized products e.g. to retail and corporate customers. In capital market-based functions like asset management the standardization of products is even higher as these products are

traded at the main stock exchanges in the world and are often regulated. Pay differences over countries are therefore quite well comparable if one looks at the same functional area.

2.4.1 Base Salary

Figure 2.1 shows the typical positive and convex relationship between average wages and hierarchical levels. The pattern looks very stable over time, even at the beginning of the financial crisis. According to tournament theory, pay spreads strictly increase in the hierarchical level with the highest gap between level 5 and top level 6. The average spreads for Germany are: 22% (between level 1 and 2), 23% (level 2 and 3), 24% (level 3 and 4), 26% (level 4 and 5), and 41% (level 5 and 6).

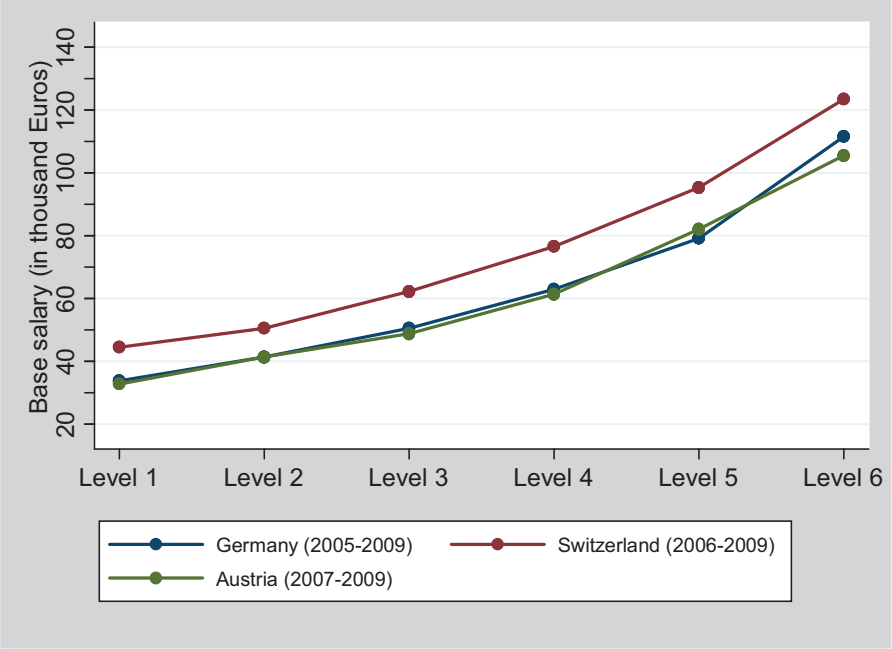

Figure 2.1: Average base salary over level

Figure 2.2 shows average base salaries over functional area and year for Germany. Employees in treasury and capital markets, investment banking, and asset management receive, on average, the highest wages, followed by

corporate and private banking. The lowest wages can be found in retail banking and the service functions.

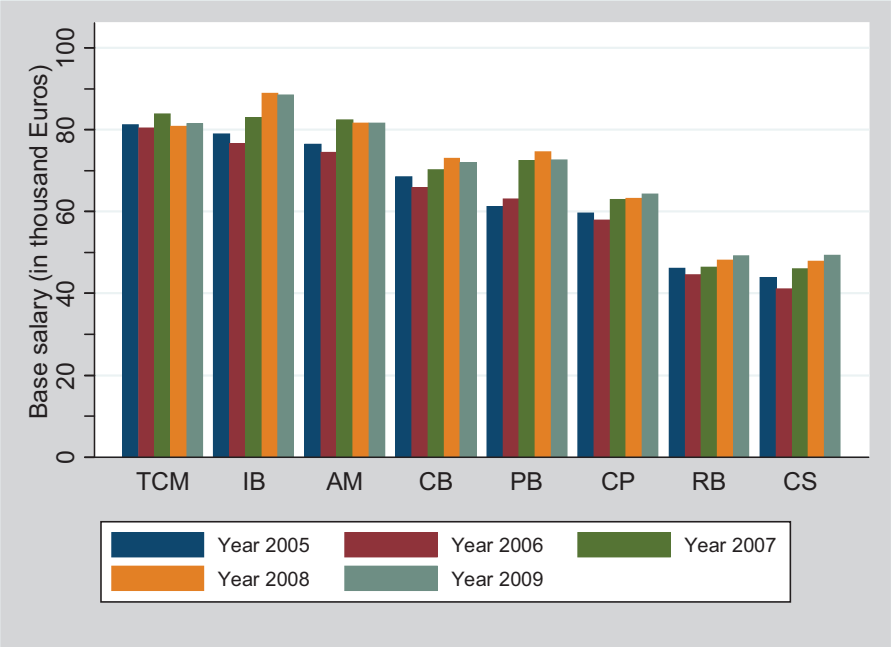

Figure 2.2: Average base salary over module (Germany)

As explained in the beginning of this chapter, a pay comparison is only meaningful if one compares the same functional areas between countries, which is shown in table 2.2. Comparing Germany and Switzerland, percentage differences in base salaries in IB, PB, and CS decreased by about 50% over time, with the highest decrease in IB from 34% in 2005 to 7% in 2009. In all other areas, differences in 2009 are close to the values in 2005, with frequent fluctuations during the years. Interestingly, differences in IB between Germany and Austria also decreased the most, followed by TCM and AM. To conclude, differences in base salaries are rather small nowadays.

2.4.2 Individual vs. Average Wage Increases

As we also have information on previous year's salaries for Austrian and German employees, we are able to compare *individual wage increases* with

	Percentage differences in base salary between Germany (reference) and						
	Switzerland				Austria		
	2006	2007	2008	2009	2007	2008	2009
TCM	12	1	9	14	-21	-17	-12
IB	34	16	10	7	-26	-26	-13
AM	16	3	11	13	-18	-16	-11
CB	11	3	8	12	-1	0	-2
PB	29	11	15	14	-1	-12	-10
CP	30	18	25	27	-3	-4	-3
RB	25	17	26	21	2	3	4
CS	27	12	12	15	-3	-2	-3

Table 2.2: Percentage differences in base salary between Germany (reference) and other countries

the development of *average wages* in the data set. Differences between both values may occur due to the recruitment policy of a bank. If the company hires many new employees for lower entry wages, this may cause a decrease in average wages of this firm. But at the same time, increases in individual wages of incumbent workers are typically not affected by this policy.

Figure 2.3 shows mean and median values of individual wage increases for Austria and Germany between 2007 and 2009. Whereas in Austria wage increases remain quite stable in the financial crisis, German bank employees face a large decrease, with growth rates less than or equal to zero for half of the German employees.[27] This may partially be explained by restructuring activities with reallocations of employees as a result of the crisis. Growth rates of average wages in Germany are 7.4% (median 10.3%) in 2007, 4.7% (2.7%) in 2008, and 2.6% (2.5%) in 2009. To conclude, many incumbents face wage decreases at the beginning of the crisis, whereas average wages increase by more than 2%.

Figures 2.10 and 2.11 in the appendix show median values of individual wage growth rates over functional area in Germany and Austria. Two main

[27] The 1st percentile is -5.4, the 5th percentile is -2.2, and the 10th percentile is 0. Hence, there are between 5% and 10% of German employees with individual wage decreases.

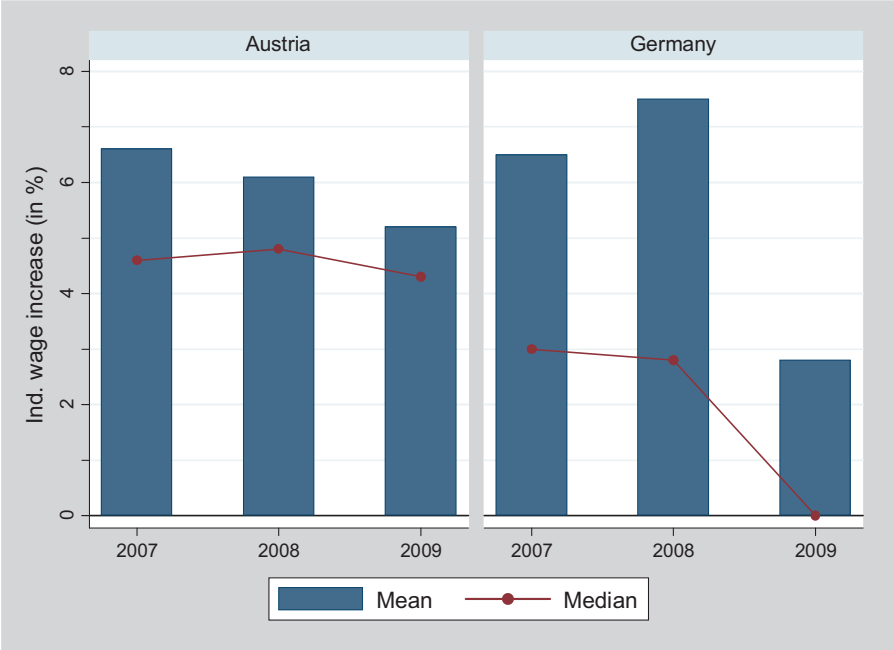

Figure 2.3: Individual wage increase (mean and median)

trends are observable: First, wage growth rates in Germany are lower and much more compressed compared to Austria. And second, median growth rates in all areas of Austrian banks are positive in 2009, whereas in Germany, half of the employees receive no wage increases or even face decreases in all areas except IB and CS.

2.4.3 Bonus Eligibility and Non-Zero Bonus Payments

Prior to investigating recent trends in short-term bonus payments, it is important to analyze the changes in bonus eligibility and the likelihood of receiving positive, i.e. non-zero bonus payments. Table 2.3 shows the proportion of employees that are eligible for short-term bonus payments by hierarchical level for Germany. Nearly all employees at the upper three levels in the data set are eligible. Rates at levels 2 and 3 show a slight downturn during the crisis but remain proportionately high, whereas the entry level is char-

acterized by lower eligibility rates at around 70% nowadays.[28] It seems that companies only slightly reduced the number of employees that are eligible for bonuses during the current recession. As can be seen in table 2.4, mainly lower-qualified employees working in service and cross-divisional functions are affected by this policy, whereas in IB, TCM, or CB eligibility rates remain at high pre-crisis levels.

Level	Bonus eligibility over level (Germany)				
	2005	2006	2007	2008	2009
Level 6	99.4	99.5	99.8	99.6	99.3
Level 5	97.9	98.9	99.0	99.0	98.9
Level 4	94.1	97.3	98.6	98.3	97.4
Level 3	83.1	85.4	88.9	89.8	86.5
Level 2	80.4	83.9	89.6	88.6	85.8
Level 1	83.7	64.9	84.1	72.2	71.4
Total	87.3	87.6	92.4	91.1	89.5

Table 2.3: Average short-term bonus eligibility over level (Germany)

Average eligibility rates in Switzerland and Austria are, compared to Germany, much higher in recent years with values between 97% and 99%. Even at lower levels, far more than 95% of all bank employees are eligible for bonus payments, even in service functions and retail banking. Similar to Germany, eligibility rates tend to fall during the financial crisis at the lowest levels, but the decrease is not that large. Eligibility rates at upper levels seem not to be affected by the economic downturn.

A further interesting analysis refers to the development of proportions of *eligible* employees receiving non-zero bonus payments. Although an employee is principally eligible for short-term bonus payments, the supervisor or the company can decide not to pay out a bonus at the end of the fiscal year. At higher levels, where bonus contracts typically consist of individual, divisional and company-specific targets, we expect zero bonus payments less likely to be observed in times of good economic condition. But in bad times like the current financial crisis, with company and divisional targets being

[28] The decline in bonus eligibility at level 1 in 2006 is driven by below-average eligibility rates in retail banking for this year.

Module	Bonus eligibility over module (Germany)				
	2005	2006	2007	2008	2009
AM	93.5	95.1	98.1	97.1	96.5
CB	94.3	96.4	96.9	97.0	98.2
CP	96.3	94.8	97.6	95.9	92.8
CS	81.0	81.1	88.6	84.3	80.9
IB	99.0	98.0	99.0	99.4	97.9
PB	98.4	98.9	97.6	99.3	98.6
RB	81.1	83.3	89.3	88.1	87.6
TCM	99.3	98.3	99.8	99.4	98.4

Table 2.4: Average short-term bonus eligibility over module (Germany)

hardly met, more companies may follow a strategy of bonus cuts. At lower levels, formula-based incentive contracts are rare and employees rather get a subjective performance evaluation that is payoff-relevant. Hence, zero bonus payments may be seen as an indicator that an employee did not meet her supervisor's expectations. But if the economy is in a bad shape, companies typically restrict financial budgets and, hence, bonus pools leading to a higher likelihood of zero bonus payments.

Tables 2.5 and 2.6 show the proportion of eligible employees receiving a positive, non-zero bonus payment by level and country. Before 2009, nearly all German employees at the top three levels received a positive bonus payment, at levels 3 and 2 the proportion is about 96% and for entry-level employees about 90%.

The pattern in Switzerland and Austria looks quite similar with average proportions that are only slightly below the values for Germany. The main difference is the impact of the financial crisis. In Germany and Austria, a sharp fall in average proportions for the year 2009 is observable with a decrease in average rates up to 15 percentage points at the majority of levels in both countries. This is mainly driven by a huge number of employees with zero bonus payments in investment banking (above proportion is about 75%), TCM (84%) and RB (88%). Contrary to that development, we observe only a slight decrease among hierarchical levels in Switzerland combined with a below-average number of zero bonuses in IB, TCM and RB (proportions

Level	% of employees with positive bonus (Germany)				
	2005	2006	2007	2008	2009
Level 6	97.7	99.3	98.8	99.2	89.0
Level 5	98.1	99.0	99.2	99.0	85.9
Level 4	96.1	99.1	98.4	98.3	89.7
Level 3	77.7	98.9	96.4	95.8	87.5
Level 2	74.3	98.4	95.8	95.6	84.9
Level 1	76.8	97.7	88.9	89.4	85.7
Total	85.0	98.8	96.4	96.4	87.2

Table 2.5: Average proportion of eligible employees receiving positive (non-zero) bonus payments over level (Germany)

above 95%). It seems that Swiss financial companies were afraid of bonus cuts, maybe to retain high-qualified employees, whereas in Germany and Austria a considerable part of employees at all levels faced zero bonus payments with the beginning of the financial crisis, although being principally eligible.

Level	% of employees with positive bonus					
	Switzerland			Austria		
	2007	2008	2009	2007	2008	2009
Level 6	99.6	98.6	96.9	98.0	96.4	87.9
Level 5	99.5	98.1	96.2	94.0	95.5	92.0
Level 4	98.8	96.7	95.6	91.1	93.8	94.3
Level 3	98.3	94.8	95.4	86.7	94.8	87.9
Level 2	97.4	91.0	90.9	73.5	95.3	83.7
Level 1	91.2	82.2	94.2	71.2	89.3	81.0
Total	97.5	94.1	94.6	84.0	94.4	88.6

Table 2.6: Average proportion of eligible employees receiving positive (non-zero) bonus payments over level (other countries)

2.4.4 Bonus Payments

In this subchapter, we investigate the development of short-term bonus payments over level and functional area for eligible employees in each of the three countries. The positive, convex relationship between average bonus payments

and level before the financial crisis is depicted in figure 2.4. Similarly to base salaries, the gaps between levels are increasing if an employee climbs up the corporate hierarchy, with the largest gap between the two highest levels in the data set. Average gaps in German banks before the financial crisis are: 49% (between level 1 and 2), 67% (level 2 and 3), 121% (level 3 and 4), 143% (level 4 and 5), and 175% (level 5 and 6). The most pronounced shape of the graph can be found for Switzerland, whereas for Austria, we observe a relatively flat curve. This is due to very large differences in bonus payments between countries, with average bonuses of more than 110,000 Euros in Switzerland, about 80,000 Euros in Germany and "only" about 25,000 Euros in Austria for top-level employees in the data set.

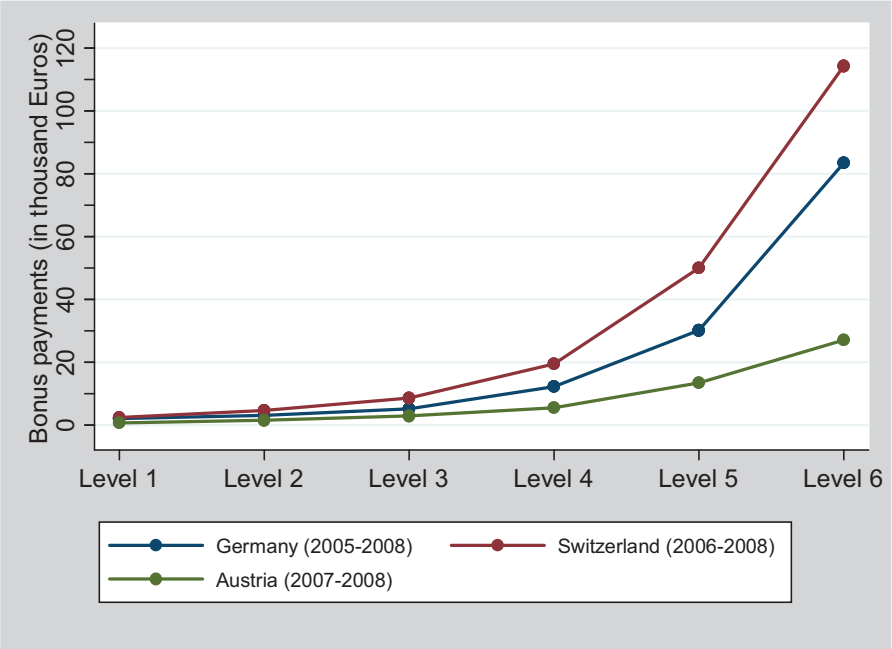

Figure 2.4: Average short-term bonus payments over level before financial crisis

The decrease in bonus payments following the bankruptcy of Lehman Brothers in September 2008 and the beginning of the financial crisis is currently of major interest. We therefore provide some interesting descriptive statistics that show what happened to bonuses in parts of the European fi-

nancial sector.[29] And these effects are dramatic. Figure 2.5 shows annual percentage changes in bonus payments over hierarchical level from 2008 to 2009. It is interesting to note that the pattern is quite similar for Germany and Switzerland, as all levels are hit by massive decreases in bonus payments, with increasing losses the higher the level. The reductions in Germany range between 16% and 25% at lower levels and even more than 50% at the top level. In Swiss banks, the decreases are slightly lower compared to Germany, especially at the lowest and highest level. This trend is somewhat contrary to what is frequently published mainly in the popular press claiming that managers at top levels faced below-average losses and employees at bottom levels are hit more severely by the crisis. In Austria, we observe no monotonic pattern, because employees at levels 2 and 3 face higher or similar decreases in bonuses than employees at upper levels.

But it is also important to analyze the development of bonus payments over the last years. Figure 2.6 shows annual percentage changes in bonus payments relative to the reference year 2005 for German banks.[30] This graph yields some interesting results. Before the crisis, employees at all hierarchical levels realized large increases in bonus payments over time. In 2008, employees at bottom levels received, on average, about 40% higher bonus payments compared to 2005, and top-level employees up to 60%, whereas increases for middle-level employees ranged between 20% and 30%. But though all employees face huge bonus cuts at the beginning of the crisis, bank employees at bottom levels 1 to 3 are nevertheless better off financially now than in 2005 (+10%). This is not the case for higher-level employees. For employees located at levels 4 to 6, crisis-related bonus cuts lead to a 20% *decline* in variable income compared to 2005.[31] To conclude, higher-level employees not only face the largest reductions in bonus payments in the first year of the

[29] As bonuses that are paid out in 2009 are based on the performance during the fiscal year 2008, the very first effects of the crisis (the first four months since the breakdown of Lehman Brothers) are investigated here.

[30] The first year in the data set is a good reference year, because there were no signs and warnings about an imminent financial crisis at that time.

[31] Even for total pay, lower-level employees are better off with a 10% to13% higher total income relative to 2005. Increases at level 5 are only 2%, whereas level 6 managers even face a 4% *decline* in total income.

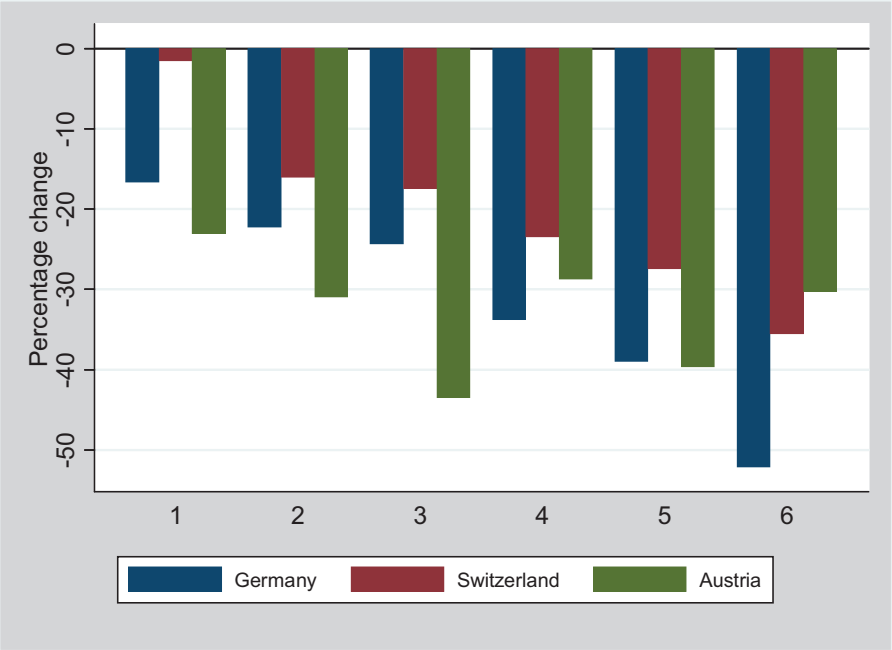

Figure 2.5: Percentage changes in bonus payments over level from 2008 to 2009

crisis, but also their average bonuses are below the level of 2005.[32] At lower levels, many employees are covered by collective wage agreements. This may be one explanation for the results, because these agreements may protect employees against high income losses.

Functional Areas

We now turn to a detailed analysis of the main functional areas in the financial services industry. Figure 2.13 in the appendix shows that there are large differences across areas between 2005 and 2009 in German banks. Average bonuses in TCM, IB, and AM are the highest by far, followed by PB and CB. The lowest variable payments can be found for RB and service function

[32] For Switzerland we use 2006 as reference year as this is the first year of the Swiss sample. Figure 2.12 in the appendix shows that 2006 was a good year for the Swiss financial services companies, because the vast majority of change rates is negative. It can be seen that all levels are affected by the financial crisis, but similar to Germany, relative losses are the highest at upper levels.

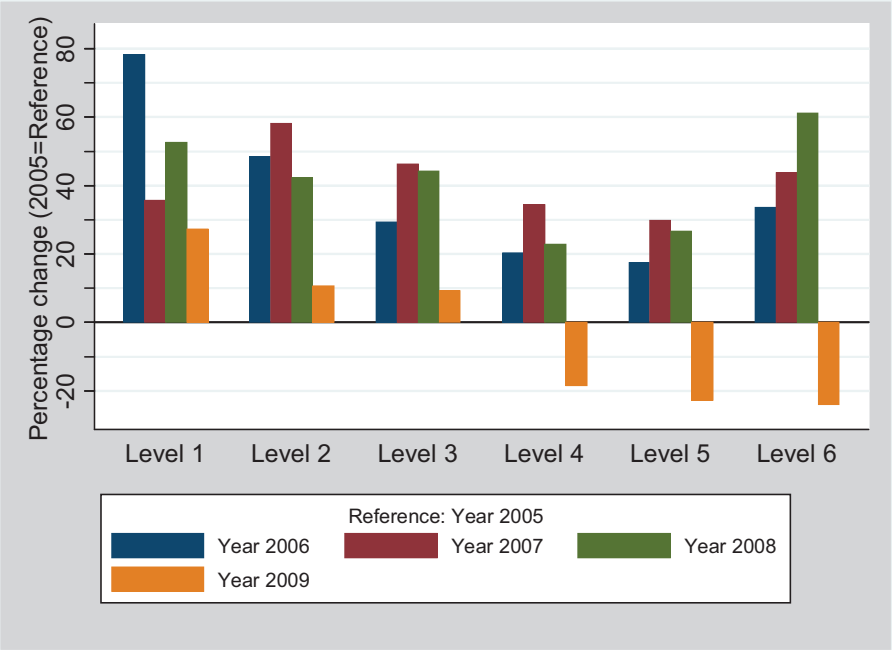

Figure 2.6: Annual percentage changes in bonus payments over level (Germany, reference: year 2005)

positions. Similar to the previous analyses, we are also interested in how bonus payments developed before and during the financial crisis. Figure 2.7 shows percentage changes in bonuses over functional area and country from year 2008 to 2009. For Germany, percentage losses are the highest in IB and TCM with a decrease of about 60% relative to the pre-crisis year 2008, followed by CB and AM with losses between 45% and 50% and RB with 31%. We further find a below-average decrease of bonuses in private banking with a reduction of "only" 16%.

In Swiss banks, investment banking employees also suffered the highest losses, but reductions in TCM are only half the size of those in Germany. Besides high reduction rates in retail banking, too, the relatively small decrease in the German private banking sector does not reflect the situation in Switzerland. Here, variable payments decrease by about 45%, nearly three times as much as in Germany. As private banking is one of the most important areas in Switzerland, the negative impact of the crisis on wealthy,

private clients explains this result. In Austria, change rates are more similar with highest reductions in CB, TCM and, as opposed to the other countries, in the lower-skilled service functions with more than 42%.

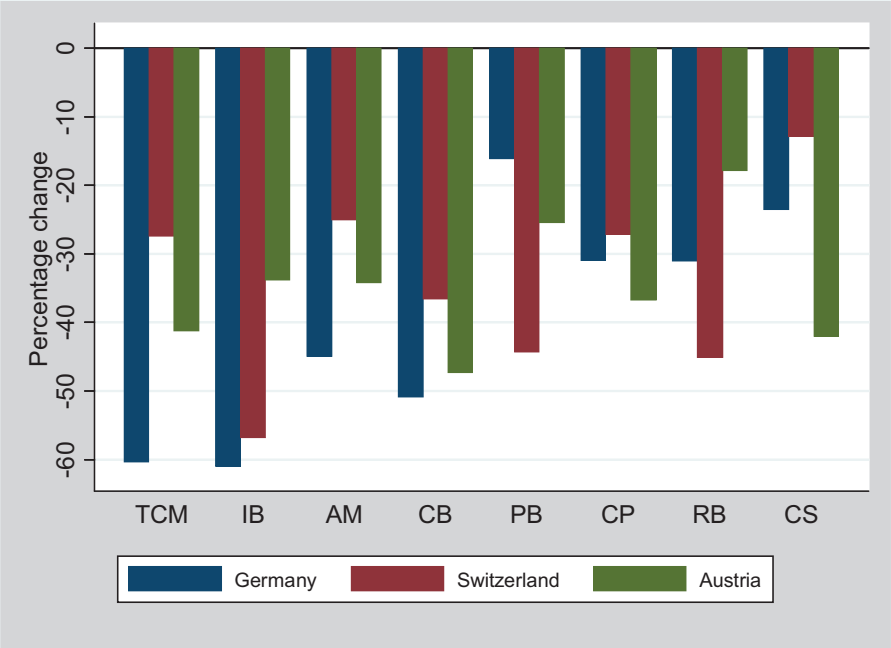

Figure 2.7: Percentage changes in bonus payments over functional area from 2008 to 2009

It is also interesting to note that German employees only in asset management and private banking are better off in the first year of the crisis than in 2005. Both areas are characterized by high levels of bonus payments during the last years and, despite the beginning crisis, average bonuses are about 20% higher in AM and even 60% higher in PB compared to 2005, as can be seen in figure 2.8. Large income losses can be found in capital market-based functions like TCM (55% lower in 2009 than in 2005), IB, CB and in retail banking. Figure 2.14 in the appendix shows the percentage changes for Switzerland with 2006 as reference year. Employees working in areas like IB, TCM and PB face the largest decreases in bonus payments compared to the year 2006, when Swiss companies paid out the highest amount of bonuses in recent years.

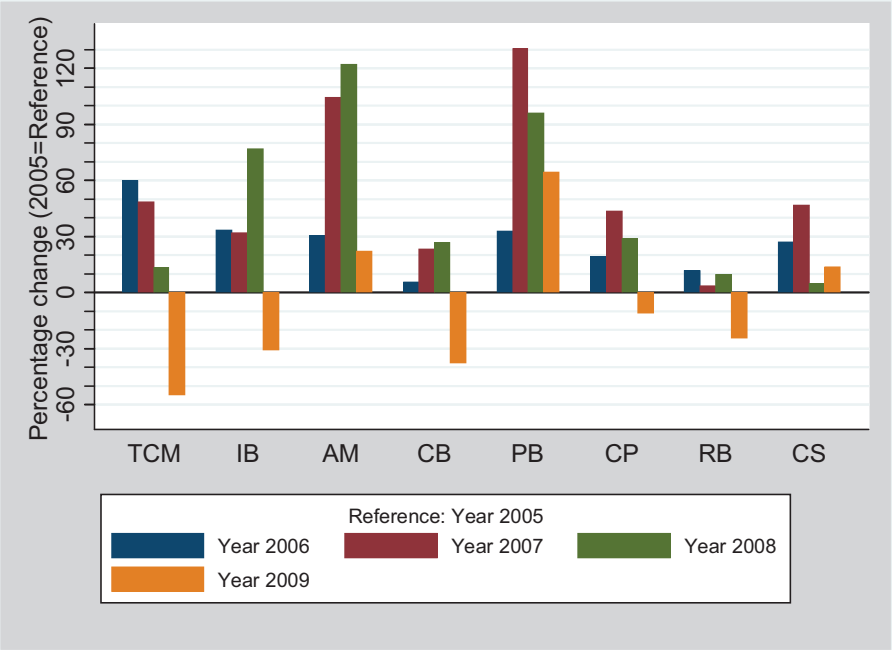

Figure 2.8: Annual percentage changes in bonus payments over module (Germany, reference: year 2005)

Country Comparison

After having analyzed the development of bonus payments over hierarchical level and functional area, it is further interesting to look at potential structural differences between countries *within the same functional area*. Table 2.7 shows annual percentage differences with Germany as reference unit. Interestingly, there are areas where the average gap in bonus levels between Germany and the other countries is continuously increasing or decreasing and areas where differences seem to be relatively constant over time. In TCM and CB, e.g., the difference between Switzerland and Germany is getting larger since 2007 with a huge increase in 2009, whereas the variable pay gap decreases over the same period between Germany and Austria. In CP, RB, and CS, percentage differences, though being volatile, are close to original levels in 2009.

Module	Percentage difference in bonus payments between Germany and						
	Switzerland				Austria		
	2006	2007	2008	2009	2007	2008	2009
TCM	14	-18	42	160	-79	-61	-43
IB	128	20	39	54	-71	-76	-60
AM	25	-30	-21	9	-65	-71	-65
CB	46	28	59	106	-51	-42	-38
PB	157	47	102	34	-56	-44	-50
CP	89	67	77	86	-54	-50	-54
RB	56	62	96	56	-60	-57	-49
CS	19	7	2	16	-65	-46	-59

Table 2.7: Percentage difference in bonus payments between Germany (reference) and other countries

Career Ladders

As we also have information whether a job is assigned to the management ladder (supervisory responsibilities) or to the professional ladder (functional expert in relevant field), we also investigate the differences in bonus payments between countries for these two groups of employees. As can be seen in figure 2.9, the percentage differences in bonus payments between Swiss and German managers increased dramatically from 17% in 2007 to more than 100% in 2009 indicating that Swiss managers are paid twice as much as their German counterparts. An increasing difference over time is also evident for functional experts in the professional ladder, from 70% in 2007 to about 90% in 2009. For Austrian managers, we find a decreasing difference compared to their German colleagues starting with -65% in 2007 up to -44% in 2009, whereas differences between functional experts in these two countries remain almost the same. The above-average decreases in bonuses for German managers from 2007 to 2008 (-25%) and from 2008 to 2009 (-41%) may explain these results, while in Austria and Switzerland crisis-related losses are much smaller.

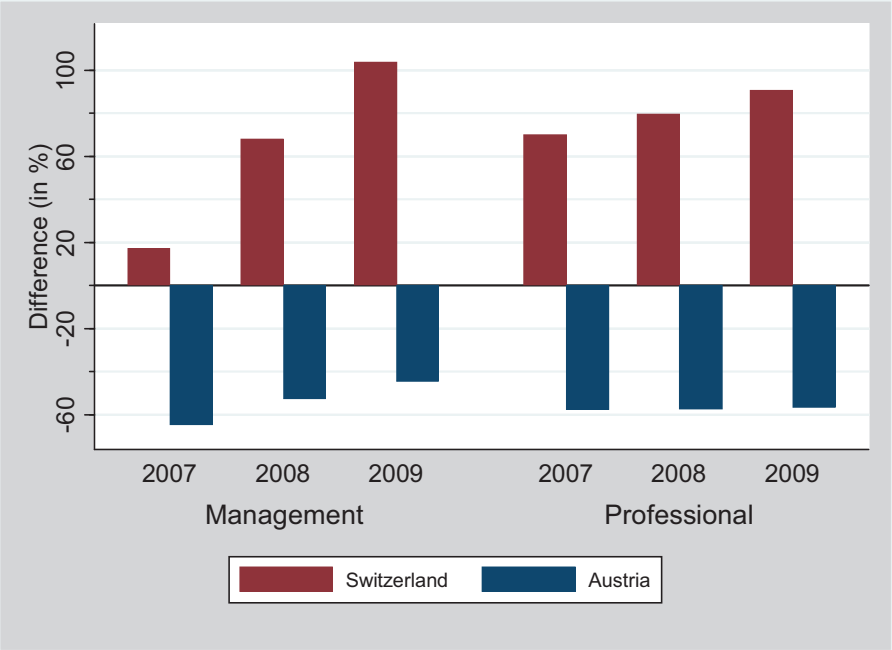

Figure 2.9: Differences in bonus payments between career ladders (reference: Germany)

2.4.5 Bonus to Base Ratio

After having analyzed base salary and bonus payments separately, we now want to give an overview on the pay mix of employees in the financial services sector. As a measure of pay mix we use the bonus to base ratio, i.e. bonus payments as a percentage of base salary.[33] Tables 2.8 and 2.9 show descriptive results over level and functional area for Germany. After an increase from 2005 to 2006, the average bonus to base ratio is relatively stable during recent years. Within levels, major increases can be found at the top, especially at level 6 with an increase from 52% in 2005 to 78% in 2008. At middle and bottom levels, ratios are overall constant. Similar to the previous section, the impact of the financial crisis on the individual pay mix is also evident at all levels. The average value decreases to 11.5%, what is mainly driven by

[33] The bonus to base ratio is given in percentages. We also use the bonus to total ratio leading to the same results.

huge declines at the highest levels.

Level	Mean bonus to base ratio (Germany)				
	2005	2006	2007	2008	2009
Level 6	52.4	66.2	69.6	78.3	39.6
Level 5	30.5	35.4	37.5	36.2	22.4
Level 4	16.2	19.0	20.3	18.3	12.4
Level 3	7.8	10.8	11.2	10.6	7.8
Level 2	5.7	8.9	8.8	7.6	5.8
Level 1	4.7	8.4	6.2	6.6	5.2
Total	13.5	17.2	17.3	17.7	11.5

Table 2.8: Average bonus to base ratio over level (Germany)

Table 2.9 shows that employees in all functional areas face a decrease in the proportion of variable payments over base salary, with the largest reductions in the capital market-based functions IB, AM, and TCM. Financial companies in Switzerland generally give a greater weight to variable payments compared to Germany. But the patterns described above can also be found in Swiss institutions, as is shown in table 2.21 in the appendix. Contrary to these results, variable pay plays only a minor role in Austria.

Module	Mean bonus to base ratio (Germany)				
	2005	2006	2007	2008	2009
TCM	53.9	80.9	74.7	57.1	24.3
IB	42.1	53.0	50.3	64.2	26.9
AM	30.2	40.7	57.4	59.9	34.8
CB	21.4	24.0	26.0	25.0	13.5
PB	17.0	22.7	33.1	27.0	23.6
CP	13.2	16.1	18.1	15.7	11.1
RB	10.9	13.0	11.6	12.0	8.3
CS	7.4	10.5	11.0	10.1	7.6

Table 2.9: Average bonus to base ratio over module (Germany)

2.4.6 Pay Dispersion

This last subchapter analyses the development of pay dispersion in the banking and financial services industry. We use two indicators of pay dispersion: First the level 6/level 1 pay ratio, i.e. average pay (base salary or bonus payments) at top level 6 divided by average pay at entry level 1, and the coefficient of variation, i.e. the standard deviation divided by the mean. Whereas the level 6/level 1 pay ratio shows the difference between highest and lowest average incomes, the coefficient of variation is a good indicator of within-level and within-function variation.

Table 2.10 shows level 6/level 1 pay ratios over year and country separately for base salary and bonus payments. Regarding base salary, the ratios are quite stable over time with values for Germany and Austria ranging between 3 and 3.5 and slightly smaller values for Swiss companies. But looking at bonus payments is much more interesting. Compared to base salary, the ratios in all countries are much higher, with a value of 55.1 for Swiss banks in 2008, meaning that an employee at top level 6 earns, on average, a 55 times higher short-term bonus than a colleague at the lowest level 1. For Germany, the ratio is about 45, whereas the lowest ratio can be found for Austria. In contrast to base salaries, the financial crisis has a large impact on the level 6/level 1 pay ratio resulting in a huge drop for Germany and Switzerland of about 20 units. But in Austrian banks, the ratio only slightly decreases.

With our second indicator, the coefficient of variation, we are able to analyze the variation in bonus payments *within* levels and areas, as can be seen in tables 2.22 and 2.23 in the appendix. It is interesting to note that differentiation at intermediate and top levels is the largest in Germany, followed by Austria and, with distance, Switzerland. In German banks, dispersion in bonus payments at the top levels has decreased over time, but is almost unchanged in the first year of the financial crisis. But at intermediate levels, we observe a huge fall in the coefficient of variation in 2009, indicating that the decrease in average bonuses is much stronger than the decrease in the standard deviation. Contrary to Germany, we find significant crisis-related increases in bonus dispersion at the top three levels for Switzerland and Aus-

Pay component	Level 6/Level 1 pay ratio				
	2005	2006	2007	2008	2009
Base salary					
Germany	3.3	3.4	3.5	3.2	3.1
Switzerland		2.8	2.8	2.9	2.7
Austria			3.2	3.1	3.3
Bonus payments					
Germany	42.8	32.1	45.4	45.2	26.0
Switzerland		45.4	43.8	55.1	36.0
Austria			38.7	36.2	32.8

Ratio of highest-level pay to entry-level pay is based on average values

Table 2.10: Ratio of highest-level pay to entry-level pay

tria. To conclude, Austrian and Swiss companies seem to differentiate more between employees with beginning of the financial crisis compared to German banks. But Swiss companies did not increase the number of employees with zero bonus payments at the same time.

2.5 Determinants of Base Salary and Bonus Payments

2.5.1 Base Salary

Table 2.11 reports OLS regression results for the determinants of base salary in Germany using annual cross sections for 2005 to 2009. The base model incorporates hierarchical level, age, age squared, firm tenure, firm tenure squared, and functional area as main independent variables. Further control variables in all specifications include career ladder, region, and company dummies. Heteroscedasticity-robust standard errors are reported for each regression.[34]

Overall, the coefficients in the base salary regressions are quite stable

[34]The decrease in observations in 2007 is due to missing information on regional areas. Excluding regional area as a control variable leads to the same results and a similar number of observations compared to previous years.

over time, with minor decreases in the first year of the financial crisis. The results support the positive and convex relationship between hierarchical level and base salary, with the largest gap between level 5 and top level 6. In 2008 e.g., employees at level 6 earn, on average, a 156%[35] higher base salary than colleagues at the entry level, all other factors constant. Consistent with tournament theory, gaps are increasing in the hierarchical level.[36] It is further interesting to note that standard errors also increase in the level. This supports the theory of internal labor markets which states that cross-firm variance is lowest at entry-level positions, as the strong competition for employees at these levels forces firms to focus more on market wages. We further find a statistically significant and very stable inversely U-shaped age-earnings-profile with an extremum between 49 and 51 years of age. This affects about 20% of all employees in the data set. All other factors constant, one additional year of age increases average wages between 2.4% and 3.5%, with decreasing marginal returns. The relationship between tenure and base salary shows no stable pattern, with only three of five years to be statistically significant and extrema between 13 and 22 years of firm tenure, which affects 20% to 40% of all employees.[37] But the coefficients are economically not significant.

Referring to functional areas, we also find relatively stable patterns in pre-crisis years. Compared to retail banking, employees in treasury and capital markets, investment banking and asset management receive, on average, between 35% and 47% higher salaries, followed by corporate and private banking with up to 25% in recent years. The salary of employees working in service functions of banks and financial institutions is quite comparable with average salary levels in retail banking. The financial crisis, already beginning in 2008, partly leads to a harmonization of salary levels, because coefficients are much smaller than in previous years. In some areas like corporate bank-

[35] Note that the wage increases by $\left(e^{\beta} - 1\right) * 100$ percent in case of dummy variables in semilogarithmic equations (see e.g. Halvorsen and Palmquist (1980)).

[36] These results are in line with previous studies like e.g. Baker et al. (1994b), Treble et al. (2001), and Grund (2005).

[37] The extremum for 2008 is negligible, as less than 0.5% have a tenure of 39 years or more.

ing, differences compared to retail banking even diminish.

Table 2.12 shows regression results for base pay in Swiss and Austrian banks and financial companies.[38] The results are similar to those presented in table 2.11. The largest coefficients for levels and functional areas can be found for German banks. Minor differences are visible with respect to the functional areas. In Switzerland, the differences between RB and AM, CB, CS and PB increase in 2009, whereas in Austria, similar to Germany, coefficients tend to decrease. Further, average wages in Austrian service areas are more than 5% lower than in retail banking. This is nowadays also true for private banking positions. The age-earnings-profile in Swiss banks is very similar to that in German firms, whereas in Austria, this relationship is more pronounced.

2.5.2 Bonus Eligibility and Non-Zero Bonus Payments

The first two columns of table 2.13 show marginal effects of probit regressions for bonus eligibility in German banks.[39] We observe a hump-shaped relationship between bonus eligibility and position in the hierarchy. Compared to entry positions, the likelihood of being eligible to short-term bonus payments increases with hierarchical level up to level 4, whereas coefficients are smaller at the highest levels in the hierarchy. This is in line with theoretical predictions, as short-term bonus payments are substituted by long-term rewards like e.g. option-based remuneration at higher levels (see e.g. Jensen and Murphy (1990b) and Murphy (1999)). The missing relationship between age and eligibility rates is probably explained by the level dummies, as older employees are typically located at higher levels. The analysis also reveals that eligibility rates in areas with standardized products like retail and corporate banking tend to be the highest, whereas the likelihood of being eligible is

[38] Columns 1 and 3 present results from pooled cross sections including year dummies. The decrease in observations in 2009 for Switzerland is due to missing information on age. Excluding age as a control variable leads to the same results and a similar number of observations compared to previous years.

[39] We show no results for Switzerland and Austria, as eligibility rates and proportions of non-zero bonus payments are close to 100%.

Dependent variable:	Logarithm of Base Salary (Germany)				
	2005	2006	2007	2008	2009
Level 6[a]	0.9402***	0.9007***	0.9249***	0.9409***	0.9038***
	(0.0053)	(0.0047)	(0.0061)	(0.0044)	(0.0047)
Level 5	0.6674***	0.6382***	0.6591***	0.6764***	0.6329***
	(0.0028)	(0.0025)	(0.0030)	(0.0026)	(0.0026)
Level 4	0.4913***	0.4783***	0.5069***	0.5052***	0.4359***
	(0.0020)	(0.0018)	(0.0023)	(0.0021)	(0.0019)
Level 3	0.3251***	0.3046***	0.3491***	0.3248***	0.2731***
	(0.00188)	(0.0015)	(0.0020)	(0.0019)	(0.0016)
Level 2	0.1650***	0.1403***	0.1916***	0.1716***	0.1270***
	(0.0015)	(0.0013)	(0.0020)	(0.0017)	(0.0015)
Age	0.0339***	0.0345***	0.0292***	0.0245***	0.0347***
	(0.0004)	(0.0004)	(0.0006)	(0.0005)	(0.0005)
$\text{Age}^2 * 100$	-0.0346***	-0.0351***	-0.0290***	-0.0250***	-0.0350***
	(0.0006)	(0.0006)	(0.0007)	(0.0006)	(0.0006)
Tenure	-0.0006***	-0.0009***	-0.0001	0.0020***	-0.0015***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$\text{Tenure}^2 * 100$	0.0024***	0.0021***	0.0001	-0.0026***	0.0054***
	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0005)
Asset Management[b]	0.2578***	0.2761***	0.3246***	0.2228***	0.1292***
	(0.0077)	(0.0069)	(0.0078)	(0.0052)	(0.0055)
Corporate Banking	0.1791***	0.1841***	0.2209***	0.1483***	-0.0092**
	(0.0044)	(0.0039)	(0.0052)	(0.0037)	(0.0042)
Corporate Prod.	0.1468***	0.1514***	0.2095***	0.1085***	0.0534***
	(0.0040)	(0.0036)	(0.0047)	(0.0020)	(0.0021)
Corporate Services	0.0401***	0.0488***	0.0847***	0.0497***	0.0017
	(0.0048)	(0.0049)	(0.0063)	(0.0023)	(0.0024)
Investment Bank.	0.2694***	0.2750***	0.3036***	0.1567***	0.1255***
	(0.0071)	(0.0060)	(0.0079)	(0.0073)	(0.0077)
Private Banking	0.1482***	0.1665***	0.2263***	0.1503***	0.1098***
	(0.0043)	(0.0044)	(0.0060)	(0.0039)	(0.0036)
Treas. and Cap. M.	0.2362***	0.3442***	0.3845***	0.1610***	0.1104***
	(0.0053)	(0.0055)	(0.0063)	(0.0059)	(0.0042)
Observations	94,058	90,957	65,435	96,572	101,596
Adj. R^2	0.83	0.86	0.83	0.83	0.81

[a] Reference category: Level 1, [b] Reference category: Retail Banking
Additional controls include career ladder, region, year and company
*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors in parentheses

Table 2.11: Regression results for determinants of base salary (Germany)

Dependent variable:	Logarithm of Base Salary			
	Switzerland		Austria	
	2006-2008	2009	2007-2008	2009
Level 6[a]	0.7677***	0.7432***	0.7059***	0.7625***
	(0.0025)	(0.0097)	(0.0086)	(0.0114)
Level 5	0.5560***	0.5271***	0.5342***	0.5517***
	(0.0016)	(0.0071)	(0.0055)	(0.0080)
Level 4	0.3798***	0.3613***	0.3262***	0.3659***
	(0.0013)	(0.0062)	(0.0044)	(0.0066)
Level 3	0.2274***	0.1757***	0.2012***	0.2339***
	(0.0012)	(0.0057)	(0.0037)	(0.0058)
Level 2	0.0932***	0.0511***	0.0831***	0.1164***
	(0.0010)	(0.0050)	(0.0033)	(0.0053)
Age	0.0340***	0.0324***	0.0507***	0.0443***
	(0.0003)	(0.0011)	(0.0010)	(0.0013)
$\text{Age}^2 * 100$	-0.0317***	-0.0304***	-0.0428***	-0.0354***
	(0.0003)	(0.0013)	(0.0012)	(0.0016)
Tenure	-0.0072***	-0.0081***	-0.0045***	-0.0071***
	(0.0001)	(0.0005)	(0.0004)	(0.0006)
$\text{Tenure}^2 * 100$	0.0191***	0.0211***	0.0217***	0.0260***
	(0.0003)	(0.0013)	(0.0011)	(0.0015)
Asset Management[b]	0.0873***	0.1701***	0.1495***	0.1825***
	(0.0034)	(0.0093)	(0.0113)	(0.0165)
Corporate Banking	0.0183***	0.1105***	0.0933***	0.0073
	(0.0028)	(0.0070)	(0.0076)	(0.0086)
Corporate Prod.	0.0448***		0.0545***	0.0170***
	(0.0024)		(0.0049)	(0.0053)
Corporate Services	-0.0182***	0.1143***	-0.0356***	-0.0537***
	(0.0027)	(0.0160)	(0.0053)	(0.0057)
Investment Bank.	0.1292***	0.0662***	0.0883***	0.0233
	(0.0117)	(0.0182)	(0.0114)	(0.0257)
Private Banking	0.0436***	0.1605***	0.0748***	-0.0252*
	(0.0025)	(0.0070)	(0.0107)	(0.0144)
Treas. and Cap. M.	0.1137***	0.1177***	0.1568***	0.0125
	(0.0043)	(0.0117)	(0.0091)	(0.0116)
Observations	158,480	12,142	39,151	19,419
Adj. R^2	0.85	0.83	0.78	0.78

[a] Reference category: Level 1, [b] Reference category: Retail Banking
Additional controls include career ladder, region, year and company
*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors in parentheses

Table 2.12: Regression results for determinants of base salary (Switzerland and Austria)

significantly lower for employees in lower-skilled service and support as well as cross-divisional functions. This is in line with theoretical predictions stating that eligibility rates should be higher in areas where output is more accurately measurable (Milgrom and Roberts (1992)).[40]

Columns 3 and 4 indicate that the likelihood for eligible employees to receive a positive, i.e. non-zero bonus payment also increases up to level 4 and decreases again for higher-level employees. But the economic significance of the coefficients especially for age, tenure and the functional areas is very low indicating that firms base the decision whether to pay out a bonus or not primarily on individual efforts of employees rather than on systematic workplace or demographic characteristics. This is also supported by the small value of pseudo R-squared of 37% in column 3. In 2009, the value is much higher, but the coefficients are very small. Regressions with company dummies as sole independent variable revealed that the higher proportion of explained variation in the data is mainly attributable to differences between companies in the course of the crisis and not to systematic differences in job or individual characteristics. This shows that decisions on compensation policies like bonus cuts have been handled quite differently across companies in the current economic crisis.

2.5.3 Short-term Bonus Payments

In this subsection we investigate the determinants of short-term bonus payments. Table 2.14 shows OLS regression results with the logarithm of positive bonus payments as dependent variable for German cross sections from 2005 to 2009. Compared to base salaries, the coefficients are much more volatile over time, especially for the functional areas. We also find different patterns of the effects of the financial crisis for the three analyzed countries.

As indicated in the descriptive analyses, we find strongly increasing coefficients for bonus payments when moving up the hierarchy. Before 2009, a German top-level employee receives, on average, between 8 to 12 times

[40] In 2009, the financial crisis leads to significantly lower eligibility rates in capital market-based functions, as these functions were primarily hit by the breakdown of the financial system.

Dependent variable:	Bonus Eligibility (Probit)		Positive Bonus (Probit)	
	2005-2008	2009	2005-2008	2009
Level 6[a]	0.0044***	0.0435***	0.0110***	0.0068***
	(0.0004)	(0.0032)	(0.0010)	(0.0022)
Level 5	0.0062***	0.0557***	0.0134***	0.0100***
	(0.0005)	(0.0043)	(0.0008)	(0.0032)
Level 4	0.0087***	0.1142***	0.0213***	0.0254***
	(0.0007)	(0.0079)	(0.0009)	(0.0074)
Level 3	0.0033***	0.0652***	0.0029***	0.0058***
	(0.0003)	(0.0049)	(0.0008)	(0.0019)
Level 2	-0.0022***	0.0368***	0.0027***	-0.0018***
	(0.0003)	(0.0030)	(0.0006)	(0.0007)
Age	0.0001	-0.0010	-0.0015***	0.0005***
	(0.0001)	(0.0010)	(0.0002)	(0.0002)
$\text{Age}^2 * 100$	-0.0002	0.0003	0.0016***	-0.0004**
	(0.0001)	(0.00001)	(0.0002)	(0.0002)
Tenure	0.0003***	-0.0022***	0.0018***	0.0002***
	(0.00005)	(0.0004)	(0.0001)	(0.0001)
$\text{Tenure}^2 * 100$	-0.0008***	0.0041	-0.0046***	-0.0006***
	(0.0001)	(0.0010)	(0.0002)	(0.0002)
Asset Management[b]	-0.0080***	-0.1012***	-0.0152***	0.0029**
	(0.0030)	(0.0225)	(0.0046)	(0.0012)
Corporate Banking	0.0029***	0.0283***	-0.0059***	0.0026***
	(0.0004)	(0.0031)	(0.0025)	(0.0010)
Corporate Prod.	-0.0016*	-0.0429***	-0.0068***	0.0042***
	(0.0009)	(0.0040)	(0.0018)	(0.0013)
Corporate Services	-0.0078***	-0.1525***	0.0045**	0.0063***
	(0.0014)	(0.0077)	(0.0019)	(0.0018)
Investment Bank.	0.0012	-0.3150***	-0.0137***	0.0037***
	(0.0012)	(0.0554)	(0.0046)	(0.0014)
Private Banking	0.0027***	-0.0003	0.0048***	0.0038***
	(0.0006)	(0.0094)	(0.0014)	(0.0013)
Treas. and Cap. M.	-0.0027	-0.0781***	-0.0061**	0.0030***
	(0.0024)	(0.0186)	(0.0029)	(0.0011)
Observations	235,403	57,509	279,211	76,510
Log likelihood	-28239.55	-11182.740	-47107.39	-11129.52
Pseudo R^2	0.73	0.62	0.37	0.66

[a] Ref. category: Level 1, [b] Ref. category: Retail Banking. Add. controls include ln base salary, career ladder, region, year and company. Marg. effects reported. *** p<0.01, ** p<0.05, * p<0.1, Robust standard errors in parentheses

Table 2.13: Probit regression results for determinants of bonus eligibility and positive bonus payments (Germany) 47

higher bonus payments than a colleague at the lowest level, all other factors constant. Table 2.15 shows results for (pooled) cross sections of Swiss and Austrian banks. It can be seen that the coefficients are much larger in magnitude, with this difference lying between 12 and 21 times. These results are in line with incentive theory stating that variable payments should be more important at levels where tasks are more complex and where the individual impact on firm performance is stronger (Milgrom and Roberts (1992)).

The above-average losses in variable payments in the financial crisis lead to decreasing coefficients for all levels in German and Swiss banks, whereas coefficients increase for all levels in Austria in the year 2009. This leads to growing differences between entry-level and especially top-level positions due to the crisis with average bonuses at top levels more than 14 times higher compared to lowest-level payments.

Compared to base salaries, age plays a minor role in bonus determination as the coefficients are smaller in the regressions for each country. It is interesting to note that differences in age-earnings-profiles are more pronounced between countries than in age-tenure profiles. In all countries, we find an inversely U-shaped relationship between age and variable payments, but the extrema are quite different. Whereas in Germany, average bonus payments increase (with a decreasing marginal rate) up to 46-49 years of age (around 25% of all employees are aged 48 years and older), the value for Austria is 38 years and the extremum in Swiss companies is at 27 years, all other factors constant. But as 90% of all Swiss employees are older than 27, bonus payments decrease with age for the vast majority of employees. This negative relationship, i.e. the decrease in variable payments for older employees, is confirmed by estimates with age class dummies as independent variables. All else equal, an employee that is between 51 and 60 (61 years and older) receives, on average, a 19% (35%) lower bonus payment compared to an employee that is around 30 years of age. Note that we found no significant impact of age on bonus eligibility in the previous subsection, what stands in contrast to predictions of the career concerns theory. The same is true for the decrease in bonuses for older employees (and in Swiss banks already for much younger employees). It may therefore be possible that banks rather use

Dependent variable:	Logarithm of Bonus Payments (Germany)				
	2005	2006	2007	2008	2009
Level 6[a]	2.5074***	2.0402***	2.0737***	2.3323***	1.8599***
	(0.0219)	(0.0241)	(0.0270)	(0.0179)	(0.0198)
Level 5	1.7523***	1.3833***	1.4165***	1.5985***	1.2627***
	(0.0155)	(0.0156)	(0.0171)	(0.0122)	(0.0133)
Level 4	1.2045***	0.8616***	1.0664***	1.0470***	0.7397***
	(0.0131)	(0.0134)	(0.0141)	(0.0102)	(0.0109)
Level 3	0.5783***	0.4151***	0.5681***	0.4849***	0.4007***
	(0.0119)	(0.0124)	(0.0130)	(0.0092)	(0.0098)
Level 2	0.1980***	0.1209***	0.2395***	0.1836***	0.1328***
	(0.0106)	(0.0115)	(0.0117)	(0.0084)	(0.0087)
Age	0.0336***	0.0272***	0.0235***	0.0216***	0.0605***
	(0.0025)	(0.0026)	(0.0029)	(0.0021)	(0.0024)
$\text{Age}^2 * 100$	-0.0368***	-0.0306***	-0.0250***	-0.0239***	-0.0623***
	(0.0031)	(0.0031)	(0.0035)	(0.0026)	(0.0028)
Tenure	0.0015	0.0056***	0.0051***	0.0059***	-0.0021**
	(0.0012)	(0.0011)	(0.0012)	(0.0010)	(0.0010)
$\text{Tenure}^2 * 100$	-0.0041	-0.0167***	-0.0182***	-0.0182***	0.0019
	(0.0030)	(0.002)	(0.0030)	(0.0024)	(0.0023)
Asset Management[b]	0.8849***	1.0808***	1.1415***	1.0058***	0.7680***
	(0.0342)	(0.0315)	(0.0335)	(0.0239)	(0.0231)
Corporate Banking	0.5445***	0.5947***	0.7811***	0.4804***	-0.1187***
	(0.0202)	(0.0187)	(0.0210)	(0.0181)	(0.0202)
Corporate Prod.	0.2742***	0.4146***	0.5401***	0.2875***	0.2273***
	(0.0185)	(0.0171)	(0.0197)	(0.0087)	(0.0102)
Corporate Services	0.0859***	0.1774***	0.1990***	0.1770***	0.1273***
	(0.0208)	(0.0236)	(0.0263)	(0.0097)	(0.0111)
Investment Bank.	1.0851***	1.2225***	1.2584***	0.7513***	0.4878***
	(0.0358)	(0.0321)	(0.0378)	(0.0357)	(0.0374)
Private Banking	0.4291***	0.5860***	0.8543***	0.5957***	0.2439***
	(0.0205)	(0.0120)	(0.0274)	(0.0185)	(0.0166)
Treas. and Cap. M.	1.0448***	1.6914***	1.8702***	0.7240***	0.4047***
	(0.0263)	(0.0293)	(0.0336)	(0.0313)	(0.0198)
Observations	64,319	71,692	52,691	86,108	72,628
Adj. R^2	0.70	0.67	0.69	0.69	0.62

[a] Reference category: Level 1, [b] Reference category: Retail Banking.

Additional controls include career ladder, region, year and company

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

Table 2.14: Regression results for determinants of bonus payments (Germany)

promotions as incentive device than absolute bonus payments, with the large gap between levels as incentive device.[41] Another explanation may refer to a decrease in individual productivity levels with increasing years of age. Looking at firm tenure, we also find a hump-shaped relationship for Germany and Switzerland, with extrema between 14 and 17 years for Germany and around 23 for Swiss companies. But in the first year of the crisis, the relationship shows the opposite sign or gets statistically insignificant in all countries.

The comparison between functional areas and countries yields some interesting results. Compared to levels, the results for the main functional areas are much more volatile. This seems to be rational, as bonuses ideally depend on individual efforts as well as divisional and company outcomes. These are typically influenced by external factors like the economic situation or the competitive position in the market or division. Second, differences between functional areas are much larger compared to base salaries. Before the crisis, we find a similar pattern in all countries with average bonuses in retail banking and the service functions being the lowest in the industry. The largest coefficients, however, can be found for TCM, IB, and AM, followed by PB and CB. All other factors constant, employees in TCM e.g. earn average bonuses that are between 175% and 550% higher than in retail banking.

It is further interesting to compare the impact of the crisis on functional area regression coefficients between countries, which is quite different. For German banks, we find decreasing coefficients for *all* functional areas leading to shrinking differences between RB and all other areas. The largest decreases are visible for the capital market-based functions IB, AM and TCM as well as CB, where average bonuses are significantly lower than in RB nowadays. In Switzerland, differences between retail banking and the majority of areas are getting larger including a massive increase in PB. But also in TCM and IB, a negative impact of the crisis is visible with bonuses in IB that are no longer statistically different from those in retail banking. For Austria, the most striking result is the huge increase in investment banking, leading to a difference in average variable payments between retail and investment

[41] Note that we have no information on promotion probabilities of employees in the data set.

Dependent variable:	Logarithm of Bonus Payments (Switzerland)			
	Switzerland		Austria	
	2006-2008	2009	2007-2008	2009
Level 6[a]	3.0488***	2.8903***	2.4556***	2.6495***
	(0.0118)	(0.0514)	(0.0371)	(0.0533)
Level 5	2.3394***	2.2058***	1.9484***	1.9716***
	(0.0092)	(0.0364)	(0.0277)	(0.0419)
Level 4	1.5730***	1.5472***	1.4020***	1.5069***
	(0.0081)	(0.0314)	(0.0242)	(0.0366)
Level 3	0.9484***	0.7238***	0.9976***	1.1172***
	(0.0074)	(0.0296)	(0.0226)	(0.0343)
Level 2	0.4438***	0.2510***	0.5813***	0.6359***
	(0.0067)	(0.0278)	(0.0222)	(0.0331)
Age	0.0174***	0.0117*	0.0264***	0.0055
	(0.0016)	(0.0060)	(0.0048)	(0.0068)
$\text{Age}^2 * 100$	-0.0332***	-0.0220***	-0.0356***	-0.0152*
	(0.0019)	(0.0071)	(0.0059)	(0.0083)
Tenure	0.0305***	-0.0013	0.0075***	-0.0096***
	(0.0007)	(0.0025)	(0.0021)	(0.0028)
$\text{Tenure}^2 * 100$	-0.0664***	0.0043	-0.0214***	0.0176**
	(0.0019)	(0.0071)	(0.0051)	(0.0071)
Asset Management[b]	0.3399***	0.6078***	0.5830***	0.6117***
	(0.0165)	(0.0441)	(0.0442)	(0.0731)
Corporate Banking	0.0355***	0.3007***	0.5087***	0.2521***
	(0.0136)	(0.0365)	(0.0307)	(0.0380)
Corporate Prod.	0.0659***		0.1375***	-0.0869***
	(0.0105)		(0.0191)	(0.0243)
Corporate Services	-0.2379***	0.1294	0.1156***	0.0594**
	(0.0127)	(0.0849)	(0.0195)	(0.0240)
Investment Bank.	0.6307***	0.1179	0.4758***	0.9035***
	(0.0688)	(0.1107)	(0.0484)	(0.1705)
Private Banking	0.3442***	0.8326***	0.4571***	0.4581***
	(0.0114)	(0.0355)	(0.0477)	(0.0789)
Treas. and Cap. M.	0.9384***	0.7891***	1.0068***	0.6738***
	(0.0235)	(0.0650)	(0.0445)	(0.0668)
Observations	141,342	10,912	30,279	14,950
Adj. R^2	0.72	0.75	0.63	0.53

[a] Reference category: Level 1, [b] Reference category: Retail Banking
Additional controls include career ladder, region, year and company
*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors in parentheses

Table 2.15: Regression results for determinants of bonus payments (Switzerland and Austria)

banking of more than 150%. Major decreases can be found for TCM, CB and CP.

To conclude, the financial crisis leads to shrinking differences between hierarchical levels in Germany and Switzerland, whereas the results for functional areas are quite mixed between countries. Hence, further discussions with financial company representatives are necessary to derive explanations for the different patterns between countries even in the same functional area like e.g. investment banking. Especially in capital market-based areas, it seems that financial companies differed with respect to their portfolio strategies and investments in risky products. But empirical evidence is almost absent yet.

2.5.4 Differences in Explanatory Power

After having investigated the partial effects of the determinants of compensation schemes in the previous subsections, we now analyze if there are any structural differences in the explanatory power of the regression models. The measure we apply is R-squared, i.e. the ratio of explained variance by the regressors in the model to the total variance in the dependent variable.[42]

Regarding base salary, hierarchical level is the single variable with the highest explanatory power, as can be seen in table 2.16. Estimating a model, where the logarithm of base salary is solely explained by the level the employee is located at, leads to values of R-squared between 0.71 and 0.76 for Germany and Switzerland and values around 0.53 to 0.55 for Austria. The estimates in the second row also include controls for human capital variables (age and firm tenure) and job characteristics (functional area, career ladder and region). The incremental changes in R-squared show structural differences between the analyzed countries, as the additional explanatory power of human capital and job characteristics is only of minor importance for Germany (between 0.05 and 0.08) and Switzerland (0.10 to 0.12), whereas these additional controls increase R-squared in the regressions for Austria even by

[42] Our results show almost no difference between the values of R-squared and adjusted R-squared.

0.22 to 0.23. Human capital characteristics seem to be of high importance for the determination of base salary in Austrian banks, as those variables solely account for around 40% of total variation, whereas for German banks these values are only half the size. The third row shows changes in R-squared when firm controls are additionally included into the model. The incremental changes are very small, especially for Switzerland and Austria with negligible 0.01 to 0.02, but also for Germany we find small and decreasing changes in R-squared in the last years between 0.02 and 0.06. As a result, fixed compensation packages are standardized to a very high extent between companies in all three countries. One explanation is that firms have less discretion in fixed salary decisions, because the labor market is highly transparent and competitive for many job positions in the financial industry. This again leads to an increasing use of professional compensation benchmarking surveys by consultancies and therefore diminishing differences between companies.[43] Salaries are further tied to hierarchical/career levels to a very high extent in Germany and Switzerland, whereas human capital plays only a minor role in salary determination. This seems to be rational, because tying pay to job positions reduces bargaining costs, especially for larger firms, and is a prerequisite for the use of industry-wide benchmarking surveys. In Austria, career levels are also the main determinant, but explain "only" about 55% of total variation, whereas age and tenure profiles seem to be much more relevant for fixed salary determination indicating that compensation policies like e.g. seniority wages play a more important role in Austrian banks.

It is further interesting to note that there are pronounced differences for bonus payments between countries. Similar to fixed wages, the position in the corporate hierarchy is the main single determinant in the regressions with the logarithm of bonus payments as dependent variable, as can be seen in the second part of table 2.16. But the values of R-squared are much smaller than in estimates for base salary, indicating that bonuses are stronger related to individual efforts rather than to career levels.[44] In Austria, levels explain

[43] Murphy (1999) speaks of a "near-universal use of surveys in determining base salaries".

[44] Attaching bonuses to levels induces no efficiency gains, as they have to be determined individually for each employee.

between 36% and 42% of the total variation, in Germany between 48% and 53% and in Switzerland between 61% and 64%. Additionally controlling for human capital and job characteristics leads to an increase in R-squared that is very similar in all countries with values between 0.03 and 0.14, again with human capital variables playing a stronger role in Austrian banks.

The most notable difference between countries is visible when firm controls are included. In Germany, bonus payments vary to a high extent between companies, because company controls lead to an increase in R-squared of 9% to 11%[45], even in the beginning of the financial crisis. Contrary to that result, firm controls only account for a marginal increase in Switzerland of 1% to 2%. This is very similar to the 3% increase for Austrian banks in 2009, where a sharp decrease from 13% in 2007 up to now is visible. To conclude, the explanatory power of the regression models for variable payments is, compared to fixed salaries, much lower in all of the three countries. This is in line with previous theoretical and empirical research stating that variable payments should more strongly depend on the individual performance of employees. We have shown that German banks and financial institutions follow very different variable compensation strategies, even with beginning of the financial crisis. In Switzerland and Austria however, bonus payments are, just like fixed salaries, very standardized today, what seems to be a surprising result.

[45] Leonard (1990) shows that company effects account for an increase of 8% in total pay, which is quite similar to our results.

	R-squared											
	Germany					Switzerland				Austria		
	2005	2006	2007	2008	2009	2006	2007	2008	2009	2007	2008	2009
Ln Base pay												
Hierarchical level (1)	0.73	0.76	0.72	0.71	0.71	0.72	0.75	0.73	0.71	0.55	0.53	0.55
(1), job characteristics[a]												
and human capital[b] (2)	0.81	0.82	0.77	0.78	0.78	0.84	0.85	0.84	0.81	0.78	0.76	0.77
(1), (2), and firm dummies	0.83	0.86	0.83	0.83	0.81	0.85	0.86	0.85	0.83	0.79	0.77	0.78
Ln Bonus payments												
Hierarchical level (1)	0.53	0.49	0.52	0.53	0.48	0.63	0.64	0.63	0.61	0.36	0.42	0.39
(1), job characteristics[a]												
and human capital[b] (2)	0.61	0.57	0.59	0.59	0.51	0.71	0.71	0.70	0.74	0.50	0.55	0.50
(1), (2), and firm dummies	0.70	0.67	0.69	0.69	0.62	0.73	0.73	0.72	0.75	0.62	0.64	0.53

[a] Functional area, career ladder and region; [b] Age and tenure

Table 2.16: Changes in R-squared over year and country

But if wages are highly standardized between companies, how can firms offer attractive pay packages to potential employees or guarantee the retaining of high-performing incumbents? First, bonus payments may play a more important role in pay packages rather than fixed salaries. But it is also important to analyze the *within-level* variation in wages. The largest coefficients of variation for base salaries can be found for entry level 1 and for levels 5 and 6. This shows that although average wages are highly standardized between companies, banks differentiate between employees at entry and top levels to be able to offer attractive pay packages to current and future employees.[46]

2.6 Conclusion

In this chapter, we provide a detailed descriptive overview on the development of base salaries and bonus payments over time in the banking and financial services industry. We find the typical positive and convex relationship between hierarchical level and base salaries as well as bonus payments. Furthermore, the majority of employees is eligible for short-term bonus payments and only a small number of those employees receives no positive bonus payment at the end of the year. In a next step we show that the financial crisis has a large impact on these figures resulting in massive reductions of bonus payments and an increasing number of eligible employees not receiving a bonus for the year 2008. These relationships are then tested econometrically using OLS regressions, which broadly confirm the descriptive evidence. Regression coefficients in estimates with base salary as dependent variable are relatively stable over time, whereas estimates with variable payments are much more volatile and different between countries. This is especially true for the functional areas. We also show that fixed compensation packages are highly standardized between companies in all of the three countries. Bonuses, however, are much stronger related to individual efforts with large differences between companies for German banks and negligible differences for Austria and Switzerland.

[46] Baker et al. (1994b) find a similar result.

This study has several limitations. First, further research should try to collect more information on business strategies of banks to be able to better explain the different results across countries even in the same functional areas. Due to a lack of information on company performance in this study, further research is needed to explore the consequences of compensation schemes for non-executive employees, i.e. if there is a positive relationship between variable payments and company performance. Finally, data sets that include other industries than the banking and financial services sector might provide interesting insights, especially whether the results presented here can also be confirmed for other industries.

2.7 Appendix to Chapter 2

Level	Germany				
	2005	2006	2007	2008	2009
6 (highest)	2.6	2.4	2.5	3.5	3.3
5	11.1	11.2	11.6	12.8	11.3
4	25.6	24.9	24.2	23.7	26.1
3	24.3	24.7	23.9	23.7	25.0
2	26.5	26.0	26.3	25.5	24.3
1 (lowest)	10.0	10.8	11.5	10.8	10.0
Total obs	105,209	107,587	107,913	121,645	139,429

Table 2.17: Distribution by hierarchical level and year (Germany)

Level	Switzerland				Austria		
	2006	2007	2008	2009	2007	2008	2009
6 (highest)	3.5	3.7	5.0	5.4	2.1	3.0	3.4
5	12.3	12.8	13.7	15.2	9.2	10.5	12.3
4	22.6	23.0	22.9	22.3	26.1	25.5	27.0
3	24.2	24.0	27.7	24.5	28.2	25.3	25.9
2	23.3	23.2	23.8	21.5	26.4	27.6	24.9
1 (lowest)	14.2	13.4	7.0	11.1	8.0	8.1	6.5
Total obs	53,104	50,633	65,327	68,723	19,282	20,502	20,237

Table 2.18: Distribution by hierarchical level and year (Switzerland and Austria)

Module	Germany			Switzerland			Austria		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
Asset Management	1.5	2.4	1.8	2.4	2.4	1.7	1.0	1.9	1.8
Corporate Banking	4.9	3.6	4.9	3.5	3.2	2.7	4.0	3.9	4.5
Corporate Production	26.3	29.4	31.6	26.4	35.6	31.6	21.9	28.4	28.2
Corporate Services	23.5	20.1	19.1	30.9	33.8	28.6	31.4	23.3	21.5
Investment Banking	1.2	1.9	1.4	0.1	0.2	0.3	1.6	1.1	0.5
Private Banking	2.3	2.2	3.5	13.4	11.2	21.2	0.6	2.0	3.0
Retail Banking	38.0	36.5	34.1	22.2	11.7	12.1	36.8	36.2	36.8
Treasury & Cap. Mark.	2.3	3.9	3.6	1.1	1.9	1.8	2.7	3.2	3.7

Table 2.19: Distribution by functional area

Country	Overview of pay variables (median values)				
	2005	2006	2007	2008	2009
Germany					
Base salary	49,916	46,980	51,800	53,196	54,522
Bonus payments	4,000	5,000	5,150	5,000	4,048
Bonus to base ratio	8.6	11.0	11.0	10.4	7.6
Bonus to total ratio	7.9	9.9	9.9	9.4	7.0
Switzerland					
Base salary		60,433	59,081	65,035	68,272
Bonus payments		7,618	8,011	8,098	6,571
Bonus to base ratio		12.7	13.4	12.8	9.5
Bonus to total ratio		11.3	11.8	11.4	8.6
Austria					
Base salary			46,912	49,474	51,183
Bonus payments			1,800	2,480	1,600
Bonus to base ratio			3.8	5.0	3.3
Bonus to total ratio			3.6	4.8	3.2

Table 2.20: Overview of pay variables (median values)

Level	Mean bonus to base ratio						
	Switzerland				Austria		
	2006	2007	2008	2009	2007	2008	2009
Level 6	99.9	85.4	90.0	55.6	22.8	25.6	17.1
Level 5	54.1	50.7	49.8	34.6	14.7	15.5	9.4
Level 4	26.3	25.1	24.0	17.7	8.2	9.4	6.6
Level 3	14.1	14.4	13.1	10.4	4.9	6.7	3.8
Level 2	9.2	9.8	8.6	6.8	3.5	4.2	2.9
Level 1	6.3	5.4	4.7	4.2	2.0	2.4	2.0
Total	23.2	22.8	22.9	16.8	6.5	8.2	5.4

Table 2.21: Average bonus to base ratio over level (Switzerland and Austria)

Level	Coefficient of variation bonus (GER)			
	2006	2007	2008	2009
Level 6	2.38	1.87	1.37	1.33
Level 5	2.15	1.86	1.50	1.50
Level 4	2.10	1.79	1.52	1.36
Level 3	0.83	1.42	1.55	1.28
Level 2	0.93	1.16	1.12	1.17
Level 1	1.03	1.31	0.92	0.82
Total	1.38	1.49	1.35	1.26

Table 2.22: Average coefficient of variation of bonus payments over level (Germany)

Level	Coefficient of variation bonus payments						
	Switzerland				Austria		
	2006	2007	2008	2009	2007	2008	2009
Level 6	1.01	0.70	0.77	1.18	1.01	1.23	1.59
Level 5	1.04	0.72	0.85	1.35	1.33	1.45	1.72
Level 4	1.10	0.88	1.06	1.14	1.45	1.41	1.77
Level 3	1.08	0.81	0.97	0.97	1.43	1.47	1.52
Level 2	0.90	0.83	1.02	1.79	1.52	1.04	1.14
Level 1	0.71	0.73	1.43	0.78	1.80	1.17	1.28
Total	0.98	0.81	1.01	1.23	1.47	1.30	1.50

Table 2.23: Average coefficient of variation of bonus payments over level (Switzerland and Austria)

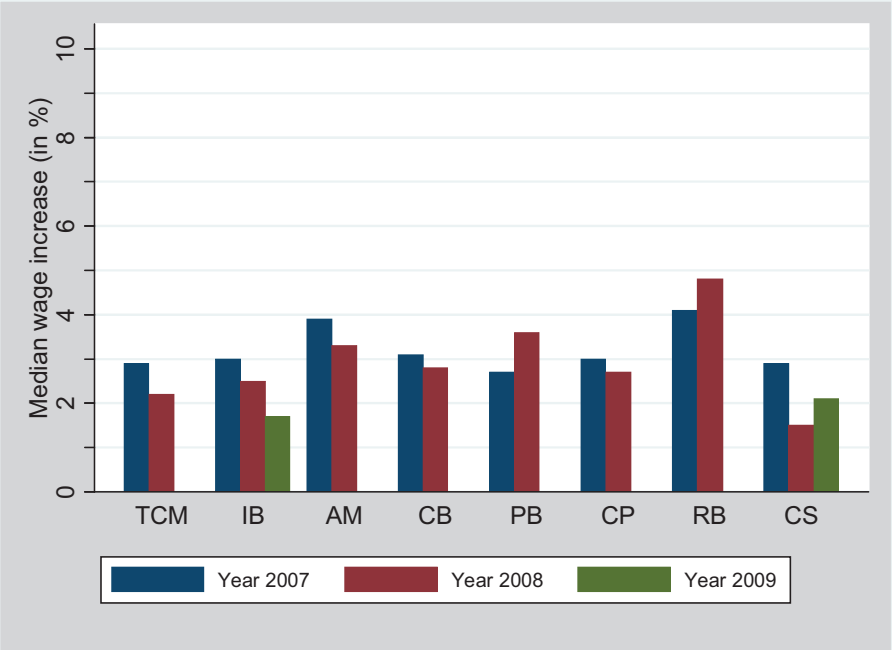

Figure 2.10: Individual median wage increase over module (Germany)

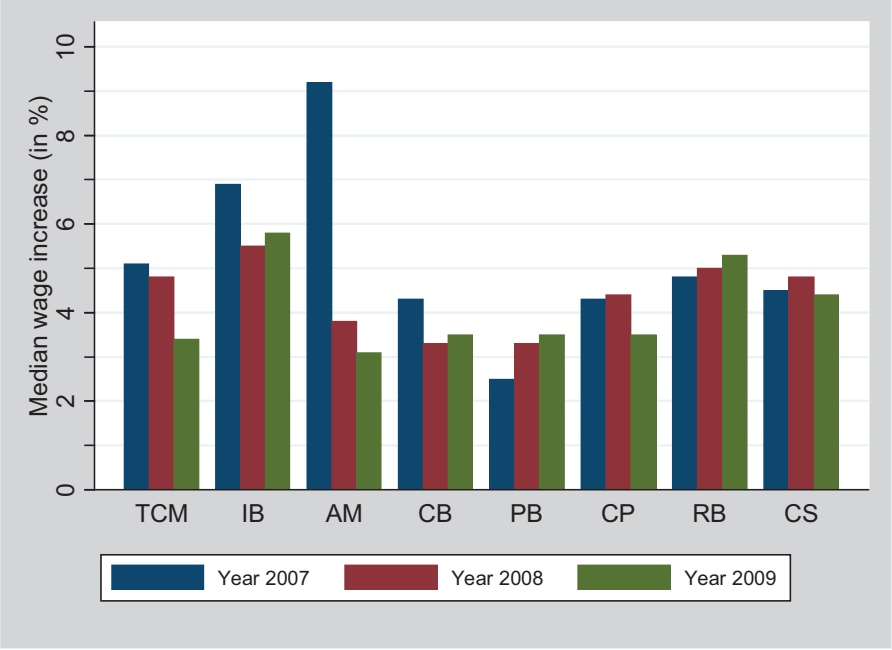

Figure 2.11: Individual median wage increase over module (Austria)

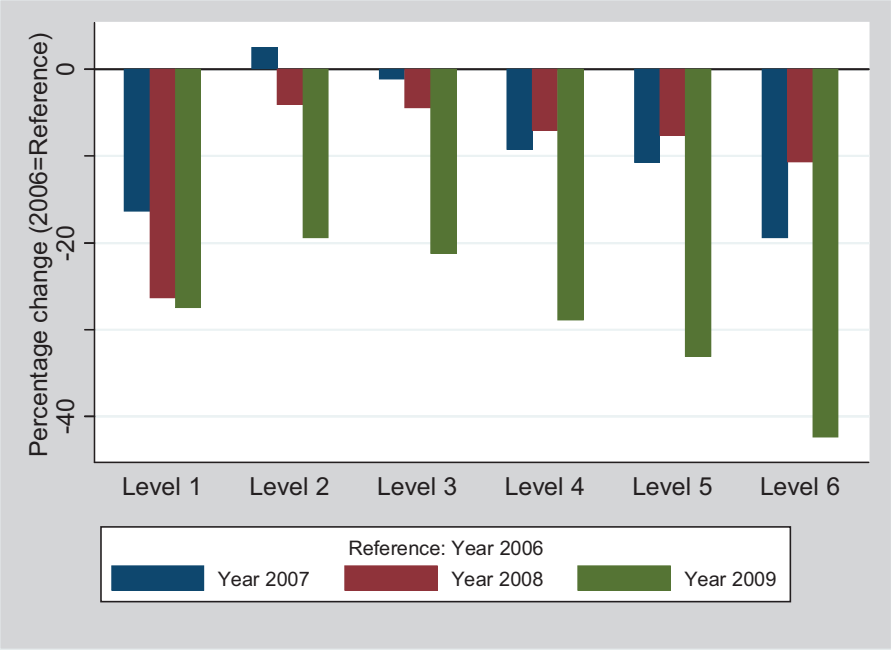

Figure 2.12: Annual percentage changes in bonus payments over level (Switzerland, reference: year 2006)

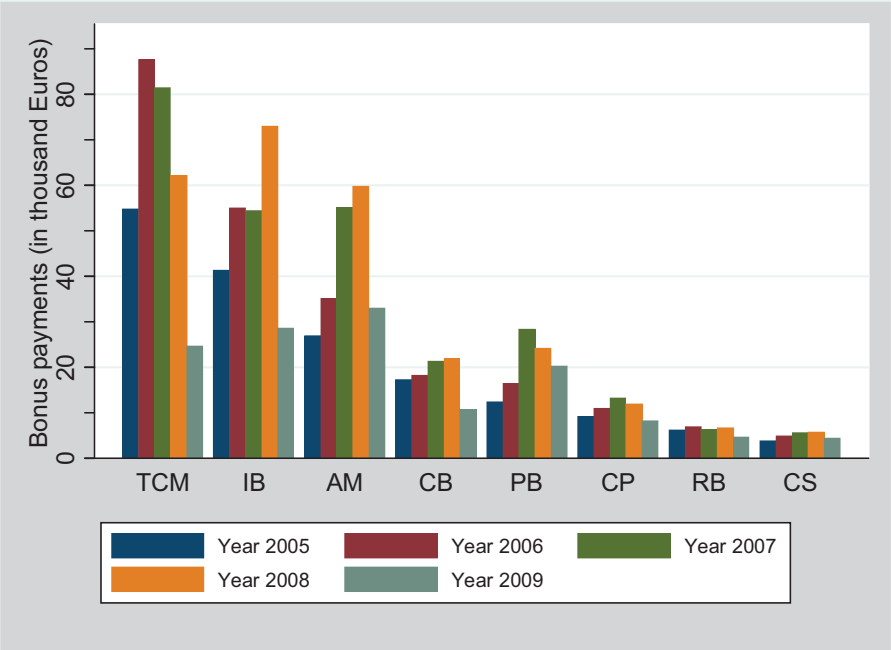

Figure 2.13: Average bonus payments over module (Germany)

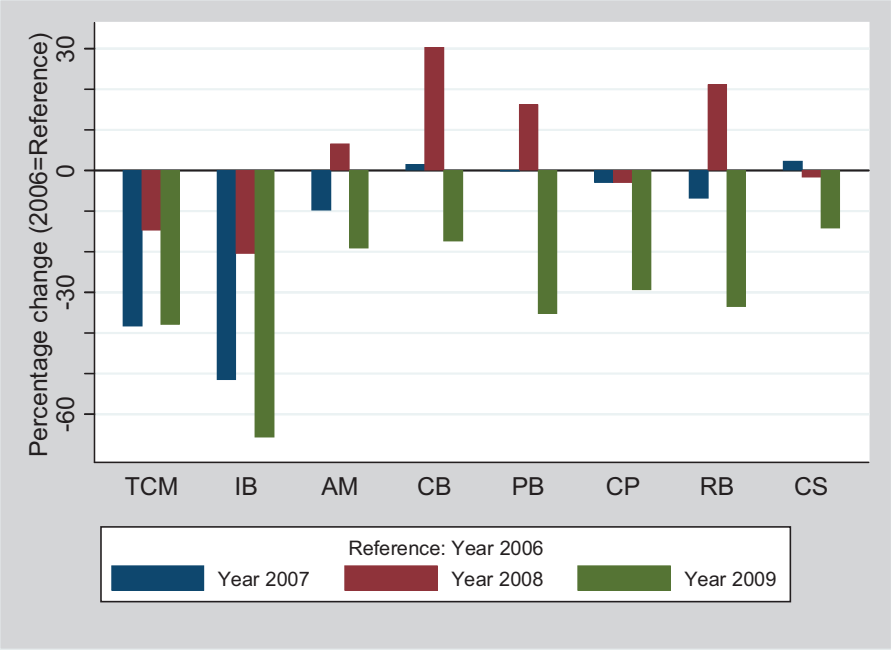

Figure 2.14: Annual percentage changes in bonus payments over module (Switzerland, reference: year 2006)

Chapter 3

Wage Premia for Newly Hired Employees[1]

3.1 Introduction

It is often claimed by practitioners that employers tend to pay more to employees hired from the outside than to their incumbent colleagues even when they do the same job. But whereas the wage effects of individual job moves across firms have often been studied, much less work has been done on comparing the wages of incumbents and newly hired employees at the same job. The key reason for this lack of evidence is that the typically used individual data sets have only crude information on the job characteristics of an employee. Even the matched employer-employee data sets that came available in the last few years[2] often contain only proxies for the hierarchical level of the employees and often have no detailed information on the departments and functional areas in which they are working.

More specific details on the jobs studied are known in the literature on internal labor markets when single-firm case studies are investigated (see Baker et al. (1994a), Baker et al. (1994b) and more recently e.g. Treble et al. (2001), Gibbs and Hendricks (2004), Dohmen et al. (2004), Lin (2005)).

[1] This chapter is based upon Kampkötter and Sliwka (2010b).

[2] See, for instance, Lima and Pereira (2003), Lazear and Oyer (2004a), Lazear and Oyer (2004b), von Wachter and Bender (2006).

However, these papers do not systematically compare wages of incumbents and new recruits and as these studies work with personnel data from single firms the evidence may be idiosyncratic to the specific firm studied. We now make use of a unique data set spanning a whole sector and providing detailed information on the jobs, hierarchical levels, company, region as well as information on the individual employees such as wages, bonus payments, age, and firm tenure.

We study the question raised in the above theoretically as well as empirically.[3] First, we analyze a simple model to develop hypotheses on the determinants of sign and size of wage differentials between incumbents and new recruits. Firms in an industry compete against each other for the service of employees who can fill a certain position and are already employed in one of the firms. An employee's utility is affected by his wage as well as by the personal well-being in his current job (for instance his fit to the corporate culture, his satisfaction with the work environment, supervisor or colleagues). The risk averse employee has private information about these personal preferences. However, while he receives wage offers from other firms, he is uncertain about his personal well-being at a potential new employer. We show that the current employer will always offer a lower wage to the employee than competing firms when the employee's human capital is not too firm-specific. The reason is that risk averse agents are reluctant to move to new employers even when wages are higher. Hence, firms earn rents in a competitive labor market even when human capital is mainly general. Nonetheless, turnover occurs as employees move to different firms when they are less satisfied with the work environment. When comparing the wages of employees staying with their firm with those who have been newly recruited by their employer we should therefore indeed observe that wages are higher for the new recruits. However, when human capital is very firm-specific current employers may outbid potential rivals to ascertain that the employee stays with the firm with a sufficiently high probability and these specific skills are not lost.

To test our theoretical results we then analyze the wage premia paid

[3]Note that this paper focusses on wage premia for newly hired employees, so we do not analyze variable bonus payments.

to newly hired employees empirically. We investigate a large data set on compensation in the German banking and financial services sector provided by the management consultancy Towers Perrin. In the years 2004-2007, around 50 banks and financial service companies of every size participated in the survey covering a vast majority of all relevant job positions in this industry. Including all of the largest banks in Germany, the survey covers around 100,000 employees each year between 2004 and 2007.

We find that, on average, newly hired employees earn significantly higher wages than incumbents at the same job, holding all others factors constant. We then study the influence of the hierarchical level and functional area on these wage premia. The results show that wage premia are *negative* for lower levels but are *positive* and *very substantial* at higher levels where general managerial skills are of increasing importance. Moreover, wage premia differ significantly between functional areas. Wage premia are highest in investment banking and corporate banking where client-specific human capital is of high importance which is general human capital in the sense that it is very valuable for other firms. Hence, firms indeed seem to pay high wage premia for new recruits to poach them from competitors.

The focus of our empirical study is a within-firm comparison of the wages of employees doing the same job. But earnings differentials between employees have also been investigated in the theoretical and empirical literature on job search (see for instance Rogerson et al. (2005) and Eckstein and van den Berg (2007) for a recent overview). Postel-Vinay and Robin (2002), for instance, show that earnings differentials can arise across identical workers employed at identical firms. In their paper this is due to sequential sampling of alternative random job offers. In our simple model, differentials occur due to a combination of differences in match-specific utility driving employee turnover and differences in the importance of firm-specific human capital on the job under consideration. Hassink and Russo (2008) investigated the wage difference between incumbents and externally hired workers with matched employer-employee data of Dutch firms. They find no wage difference between incumbent workers and employees hired from other firms but do not

distinguish between hierarchical levels or types of the job.[4]

3.2 A Simple Model

3.2.1 Description of the Model

We first analyze a very simple model of an industry consisting of n firms indexed by k with $n \geq 3$ and a number of employees indexed by i. We consider only employees who gained some labor market experience and therefore are already employed in one of the firms. Each employee is qualified for exactly one type of job J. Initially being employed in one of the firms, an employee can in principle fill the same job in all firms in the industry. Hence, for each job all firms in the industry compete for the service of all employees who are qualified for the job. Consider a certain employee i working at a firm k. When staying with firm k the employee generates revenue $s_J \cdot a_i$ for his current employer. When moving to the same job in another firm in the industry, the new employer earns revenues of a_i. Hence, a_i can be interpreted as the employee's job-specific ability and human capital and $s_J \geq 1$ measures the importance of firm-specific human capital for the considered job J. For instance, when the job mainly consists of managerial tasks and managerial competencies are rather general, s_J will be relatively small. But when it is for instance important for the job to know firm-specific software or specific procedures, s_J will be large. We assume that the job-specific ability a_i is measurable by all potential employers. We further assume that a firm always benefits from employing an employee when the revenue generated by the employee exceeds the wage costs.

An employee i's utility does not only depend on the wage he earns but also on other aspects of the job. We denote this match-specific utility when staying with firm k by u_{ik}. Of course, the employee knows this match-specific utility when staying with the firm but we assume that u_{ik} is private

[4] Note that this is not inconsistent with our results as they only consider average wage premia. In our data, wage premia are negative for lower hierarchical levels but positive for higher levels.

information of the employee and is unknown to the current employer as well as to other employers on the labor market. When she moves to a different firm $l \neq k$ it is drawn from a normal distribution with mean 0 and variance σ_u^2 and is unknown by the employee before his decision on whether to accept an external offer.[5] The employee's utility is additively separable in the wage and the match-specific utility and he is risk averse with constant absolute risk aversion. His Arrow-Pratt measure of absolute risk aversion is r.

The timing is as follows: First the current employer makes a wage offer to the employee, then other firms in the industry simultaneously make wage offers to the same employee. Finally, the employee decides on whether to stay with the initial employer or to move to a competing firm.

3.2.2 Equilibrium Analysis

Due to the competitive labor market, in equilibrium each employer makes a wage offer of $w_i^E = a_i$ to each external employee i. We now investigate the optimal wage offer made to an employee by his initial employer. Note that the certainty equivalent of the employee's utility when moving to a new employer is $a_i - \frac{1}{2} r \sigma_u^2$. Employee i stays with his current employer k at a wage w_{ik} whenever

$$u_{ik} + w_{ik} \geq a_i - \frac{1}{2} r \sigma_u^2.$$

Hence, the employee stays with probability

$$P(w_{ik}) = 1 - F\left(a_i - \frac{1}{2} r \sigma_u^2 - w_{ik}\right).$$

Note that there always will be employee turnover between the firms in the industry. When considering the optimal wage paid to an incumbent employee firms now trade-off wage costs against the risk to lose the employee to a competitor. Although moving to a different firm is risky, employees will do so when they are very dissatisfied with the current working conditions, i.e.

[5] Hence, the match-specific utility is an experience good such as for instance in Jovanovic (1979).

u_{ik} is relatively small. The firm maximizes

$$\max_{w_{ik}} (s_J \cdot a_i - w_{ik}) \left(1 - F\left(a_i - w_{ik} - \frac{1}{2} r\sigma_u^2\right)\right). \tag{3.1}$$

The first order condition is equivalent to

$$(-1)\left(1 - F\left(a_i - w_{ik} - \frac{1}{2} r\sigma_u^2\right)\right) + (s_J \cdot a_i - w_{ik})\, f\left(a_i - w_{ik} - \frac{1}{2} r\sigma_u^2\right) = 0. \tag{3.2}$$

From this condition we can derive the following result:

Proposition 1 *The wage w_i^I offered to an employee by his current employer is characterized by*

$$w_i^I + \frac{1 - F\left(a_i - w_i^I - \frac{1}{2} r\sigma_u^2\right)}{f\left(a_i - w_i^I - \frac{1}{2} r\sigma_u^2\right)} = s_J \cdot a_i. \tag{3.3}$$

The wage paid to an incumbent employee w_i^I will be lower than that paid to a new hire of the same ability $w_i^E = a_i$ if and only if human capital is not too firm-specific, i.e. when

$$s_J \leq 1 + \frac{1 - F\left(-\frac{1}{2} r\sigma_u^2\right)}{a_i f\left(-\frac{1}{2} r\sigma_u^2\right)}.$$

Proof:

Condition (3.2) can be directly rearranged to obtain (3.3). The normal distribution satisfies the monotone hazard rate condition, hence, $\frac{d}{dx}\left(\frac{f(x)}{1-F(x)}\right) > 0$ which implies that

$$\frac{1 - F\left(a_i - w_{ik} - \frac{1}{2} r\sigma_u^2\right)}{f\left(a_i - w_{ik} - \frac{1}{2} r\sigma_u^2\right)}$$

is strictly increasing in w_{ik}. Therefore, (3.3) has a unique solution w_i^I. Moreover, the first derivative of (3.1) is strictly positive for $w_{ik} < w_i^I$ and strictly negative for $w_{ik} > w_i^I$. Hence, a necessary and sufficient condition for a positive wage premium paid to newly hired employees is that the first derivative of the objective function (3.1) with respect to w_{ik} is negative at $w_{ik} = a_i$.

This is the case when

$$-1 + F\left(-\frac{1}{2}r\sigma_u^2\right) + (s_J \cdot a_i - a_i)\, f\left(-\frac{1}{2}r\sigma_u^2\right) < 0 \Leftrightarrow$$
$$(s_J - 1)\, a_i f\left(-\frac{1}{2}r\sigma_u^2\right) \leq 1 - F\left(-\frac{1}{2}r\sigma_u^2\right) \Leftrightarrow$$
$$s_J \leq 1 + \frac{1 - F\left(-\frac{1}{2}r\sigma_u^2\right)}{a_i f\left(-\frac{1}{2}r\sigma_u^2\right)}.$$

■

Hence, when the competencies relevant for a certain job type are purely general human capital, i.e. employee's can switch between firms without productivity losses, incumbents always earn less in equilibrium than newly hired employees. The reason is the following: In the competitive labor market employees who leave their employer will be paid according to their productivity. When the current employer matches this outside offer he makes zero profits. A lower wage of course increases the probability that the incumbent leaves the firm. But if he stays, profits will be strictly positive. Hence, expected profits are only positive when incumbents are paid at a wage below the market level. It is interesting to note that this effect even arises when agents are risk neutral. However, the more risk averse the employee the lower can be the incumbent's wage as the switching costs due to the uncertainty about the new job are higher.

But when firm-specific human capital is more important, market wages will be below the productivity of the employee in the current firm. Hence, the firm makes positive profits even at market wages. When firm-specific skills are very important, paying less than market wages becomes too risky as agents with below-average levels of job satisfaction will be tempted to leave the firm. In equilibrium, the firm will then pay wages that exceed the market level to assure the employee's retention.

3.3 The Data

We investigate a large data set on compensation in the German banking and financial services sector[6] for the years 2004-2007 owned by the management consultancy Towers Perrin. In 2004 we have information about 43 firms and more than 95,000 employees, in the years 2005 to 2007, more than 50 banks and financial service companies of every size located in Germany participated in the compensation survey covering around 105,000 employees each year. The survey participants report information for a variety of job positions in all relevant functional areas of the financial services sector.[7]

We have individual information on base salary, age, firm tenure with the current employer, hierarchical level (6 levels), functional area (8 areas), function (60-80 functions), and region (15 regions) for selected employees of each participating company. The functional areas represent a broad classification of the main sectors in the banking and financial services industry: Retail banking (RB), asset management (AM), corporate banking (CB), investment banking (IB), private banking (PB), treasury and capital markets (TCM), the typically lower-skilled service functions (corporate services (CS)) as well as the cross-divisional functions (corporate production (CP)). A unique feature of the data set is that information on the functional area, function[8] and hierarchical level is quite precisely comparable across firms in the sample as Towers Perrin uses a so-called career level methodology. This standardized evaluation method defines a number of career levels that are described through detailed job descriptions and profiles of e.g. skills and knowledge required for the relevant job position in an employee's career path. These career levels therefore reflect different career steps for individuals from entry levels to senior expert positions for each function and job family. In a next step these career levels are matched to the huge number of functions and disciplines that can be identified in the financial services sector resulting in four different career ladders: one for management positions and three for

[6] Sparkassen (publicly owned savings banks), Volks- and Raiffeisenbanken (cooperative banks) and the Deutsche Bundesbank (German central bank) are not part of the sample.

[7] Executive and senior management positions are excluded.

[8] A functional area comprises a large number of specific functions.

individual expert positions (professional, sales and support).

We can distinguish six hierarchical levels in the data set, where level 1 denotes the lowest level, typically the entry positions of apprentices and university graduates, and level 6 the highest level, typically divisional heads. Most of the employees belong to levels 2, 3, and 4. Only 2.5% hold the highest positions in the data set. The average proportion of newly hired employees ranges from 1.5% in 2004 to 2.1% in 2007, as can be seen in table 3.9 in the appendix. The mean age of incumbents (new hires) in the sample is about 40 years (33 years). About 34% of all employees work in the retail banking area, followed by about 25% in both the cross-divisional support functions like e.g. HR, legal, finance and accounting (corporate production) and the lower-skilled service functions including mostly back-office positions (corporate services). About 2% can be assigned to asset management and investment banking positions.[9]

3.4 Results

3.4.1 The Aggregate Effect

As a starting point consider the OLS baseline regression results reported in table 3.1. The dependent variable is the logarithm of wage (base salary) and the dummy variable *Newly hired* indicates that an employee has been hired in the relevant year. We control for age, age squared, hierarchical level, functional area, geographic region and company and run separate regressions for the years 2004 to 2007. Recall that our model made a prediction on the difference between the wages of new recruits and incumbents with a *similar previous experience* on the labor market. Hence, we restrict the data set to levels 3 to 6 as we can rule out that there are new recruits without prior professional experience on these levels.[10] The employees' age then serves

[9] As we exclude levels 1 and 2 (entry levels) in the following regressions, descriptive statistics for levels 3 to 6 are provided in table 3.8 in the appendix.

[10] Levels 1 and 2 are typical entry levels, so there is a large proportion of young graduates among the newly hired employees. In that case we should expect lower wages for new recruits as a new recruit should not only have less firm-specific human capital but also less

as a proxy for labor market experience. Further, heteroskedasticity-robust standard errors are reported in each regression.

Dependent variable:	Logarithm of Base Salary			
	2007	2006	2005	2004
Newly hired	0.0491***	0.0165***	0.0298***	0.0282***
	(0.0062)	(0.0055)	(0.0065)	(0.0082)
Age	0.0258***	0.0273***	0.0279***	0.0202***
	(0.0009)	(0.0007)	(0.0007)	(0.0007)
Age^2*100	-0.0241***	-0.0256***	-0.0259***	-0.0173***
	(0.0010)	(0.0009)	(0.0009)	(0.0008)
Level 6[a]	0.654***	0.690***	0.670***	0.673***
	(0.0052)	(0.0041)	(0.0045)	(0.0043)
Level 5	0.338***	0.374***	0.364***	0.395***
	(0.0024)	(0.0021)	(0.0021)	(0.0021)
Level 4	0.160***	0.184***	0.171***	0.179***
	(0.0015)	(0.0013)	(0.0012)	(0.0012)
Observations	40248	57021	59724	54147
R-squared	0.71	0.74	0.70	0.73

Additional control variables include functional area, region and company

[a] Reference category: Level 3

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

Table 3.1: Baseline regressions

On average, newly hired employees earn between 1.7% and 4.9% more than incumbents and these wage premia are highly significant. The results also show the typical inversely U-shaped age-earnings profile as well as a wage structure which is convex in the hierarchical level.

It is also interesting to investigate the size of wage premia of new recruits in comparison with employees on the same job with different levels of seniority. Therefore we classify firm tenure into four groups: The first includes only newly hired employees, the second includes incumbents with firm tenure from 1 to 5 years, the third employees with 6 to 10 years of firm tenure and the last group comprises employees who work more than 10 years for their current firm. The results of the regression including variables for different

general human capital. This is indeed confirmed by table 3.10 in the appendix showing regression results for the two lowest levels.

tenure classes are shown in table 3.2, with newly hired employees as reference category. It can be seen that employees with the longest firm tenure face the strongest disadvantage relative to the new recruits in the same job. In 2007 for example, a newly hired employee earns on average 4% more than an incumbent with 1 to 5 years of tenure. This premia increases up to 5.7% when comparing to incumbents with more than 10 years of firm tenure. Note that we control for age, job, and firm characteristics. Hence, each job move leads to a wage premium for the mover providing him with a persistent advantage relative to his colleagues on the same job who have stayed with the firm for longer periods of time. These results are robust over the years.

Dependent variable:	Logarithm of Base Salary			
	2007	2006	2005	2004
1-5 years of tenure[a]	-0.0400***	-0.0053	-0.0246***	-0.0186***
	(0.0064)	(0.0056)	(0.0066)	(0.0083)
6-10 years of tenure	-0.0524***	-0.0210***	-0.0313***	-0.0275***
	(0.0063)	(0.0056)	(0.0066)	(0.0083)
11-max years of tenure	-0.0572***	-0.0308***	-0.0370***	-0.0415***
	(0.0063)	(0.0056)	(0.0066)	(0.0083)
Observations	40248	57019	59526	54147
R^2	0.71	0.74	0.71	0.74

Additional control variables include age, hierarchical level, functional area, region and company. [a] Reference category: Newly hired employees
*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors in parentheses

Table 3.2: OLS wage regressions with tenure classes

3.4.2 Hierarchical Levels

Given the prediction of our model, these results seem to indicate that firm-specific human capital is on average not too important in the banking industry. However, we expect differences between the hierarchical levels and functional areas with respect to the importance of firm-specific human capital. We can use these expected differences to provide a better test of the theoretical predictions.

First of all, managerial skills and talent will become more important

the higher the hierarchical level. But managerial talent is mostly general human capital. As qualifications for managerial positions become more and more similar between firms when an employee climbs up the hierarchy, our simple model therefore suggests that wage premia for new recruits should be increasing in the hierarchical level. To test this prediction we add interaction terms between each hierarchical level and the *Newly hired* dummy to the baseline regression model.

Dependent variable:	Logarithm of Base Salary			
	2007	2006	2005	2004
Newly hired	0.0010	-0.0337***	-0.0535***	-0.0064
	(0.0091)	(0.0075)	(0.0100)	(0.011)
Newly hired × Level 4	0.0486***	0.0775***	0.110***	0.0138
	(0.0122)	(0.0110)	(0.013)	(0.015)
Newly hired × Level 5	0.122***	0.115***	0.171***	0.131***
	(0.0197)	(0.0178)	(0.020)	(0.027)
Newly hired × Level 6	0.147***	0.157***	0.193***	0.187***
	(0.0407)	(0.0425)	(0.034)	(0.061)
Age	0.0255***	0.0271***	0.0275***	0.0201***
	(0.0009)	(0.0007)	(0.0007)	(0.0007)
Age^2*100	-0.0238***	-0.0253***	-0.0254***	-0.0171***
	(0.0010)	(0.0009)	(0.0009)	(0.0008)
Level 6[a]	0.651***	0.687***	0.666***	0.671***
	(0.0053)	(0.0041)	(0.0046)	(0.0043)
Level 5	0.336***	0.372***	0.361***	0.394***
	(0.0024)	(0.0021)	(0.0021)	(0.0021)
Level 4	0.160***	0.183***	0.169***	0.179***
	(0.0015)	(0.0013)	(0.0012)	(0.0012)
Observations	40248	57021	59724	54147
R-squared	0.71	0.74	0.71	0.73

Additional control variables include functional area, region and company

[a] Reference category: Level 3

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

Table 3.3: Interaction with hierarchical level

As level 3 is the reference category, the coefficients for the interaction terms measure the difference in the new recruits' wage premia relative to that premium at level 3. Our hypothesis concerning the effect of the hierarchical

level on the wage premia is indeed confirmed by the results reported in table 3.3: First note that the coefficient for *Newly hired* is negative and statistically highly significant in 2005 and 2006 when the interaction terms are included. That is on level 3, the lowest level in the data set, newly hired employees earn less than their incumbent counterparts. This difference is sizeable at about -3.4% in 2006 and -5.4% in 2005, but not significantly different from zero in 2004 and 2007. However, already on level 4 new recruits receive a positive wage premium relative to incumbents in all years except 2004. This premium increases up to 13% at level 5 and further up to 13%-20% at the highest level.[11] For divisional heads, the average premium amounts to 18,000 Euros.

Hence, at the lowest level considered in the data set firm-specific human capital such as the knowledge of firm-specific software systems, specific banking products and administrative processes seems quite important such that firms pay less to employees hired from the outside. But at higher levels wage premia become positive and are increasing with the level which is well in line with our hypothesis that firm-specific human capital becomes less important at upper levels in hierarchy.

As in German banks many employees at lower levels are covered by collective wage agreements, which impose restrictions on market wages, it is important to check whether some of the observed effects are due to such agreements. In the regressions reported in table 3.11 in the appendix we therefore exclude all employees covered by a collective wage agreement from the data set. It is interesting to note that, at the lowest level, the wage discount for new hires even becomes more negative, indicating that the minimum wage character of a collective wage agreement seems to favor new recruits relative to the outcomes of a market-based wage-setting process as analyzed in our model. At higher levels the results remain unchanged.

[11] Recall that the wage increases by $\left(e^{\beta}-1\right)*100$ percent in case of dummy variables in semilogarithmic equations (see e.g. Halvorsen and Palmquist (1980)).

3.4.3 Functional Areas

Another test of our theoretical prediction makes use of a comparison of wage premia between the different functional areas in the considered banks and financial services companies. Table 3.4 shows the results of a wage regression where we interact the *Newly hired* dummy with the different functional areas. As reference group we have chosen retail banking as this is the largest functional area covering more than 30% of all employees. It is quite interesting to note that there are substantial differences between the functional areas.

The results show that wage premia are negative and significant in retail banking (up to -5.3%). Positive and economically significant wage premia can be found in treasury and capital markets in all years, with average premia that are up to 16% higher than in retail banking. We also find large and economically significant wage premia in three of the four years in corporate banking and investment banking.

Of course, the data must be interpreted carefully in this respect, but it seems as if the observations may quite well be understood by the reasoning suggested in our model. In capital market-based functions like treasury and capital markets, employees mainly deal with trading in debt, equity, foreign exchange, derivative and money market products that are highly standardized and therefore very similar or even identical across banks. Hence, acquired human capital should be rather general than firm-specific. Jobs in investment banking and corporate banking are often characterized by human capital that is much more *client-specific* than firm-specific. But client-specific human capital is general human capital in the sense that it is very valuable for a competitor. Hence, firms will be willing to pay high wages to lure investment and corporate bankers away from their competitors.[12] However, retail banking is concerned with the day-to-day business with less wealthy private customers where it is important for an employee to be more familiar with firm-specific products and procedures.[13] This has been confirmed in

[12] This is indeed the case, as e.g. Merrill Lynch recruited two teams of financial advisors from UBS in 2009, both managing in total around $500 million in client assets. Furthermore, Deutsche Bank lured away a group of more than 15 investment bankers from Merrill Lynch and Lehman Brothers.

[13] Note that new recruits earn relatively more in private banking than in retail banking.

Dependent variable:	Logarithm of Base Salary			
	2007	2006	2005	2004
Asset Management[a]	0.158***	0.141***	0.143***	0.138***
	(0.0072)	(0.0064)	(0.0071)	(0.0078)
Corporate Banking	0.0689***	0.0565***	0.0589***	0.0342***
	(0.0030)	(0.0023)	(0.0023)	(0.0023)
Corporate Production	0.0418***	0.0200***	0.0214***	0.0181***
	(0.0020)	(0.0017)	(0.0016)	(0.0014)
Corporate Services	-0.0148***	-0.0452***	-0.0236***	-0.0274***
	(0.0025)	(0.0021)	(0.0020)	(0.0019)
Investment Banking	0.130***	0.141***	0.142***	0.118***
	(0.0073)	(0.0057)	(0.0066)	(0.0067)
Private Banking	0.0694***	0.0424***	0.0226***	0.0103***
	(0.0041)	(0.0030)	(0.0020)	(0.0018)
Treasury and Capital Markets	0.210***	0.206***	0.143***	0.179***
	(0.0052)	(0.0048)	(0.0046)	(0.005)
Newly hired	-0.0254***	-0.0346***	-0.0528***	-0.0448**
	(0.0097)	(0.013)	(0.0177)	(0.0161)
Newly hired × Asset Man.	0.0105	0.0777***	0.0438	0.0564
	(0.0238)	(0.0276)	(0.0346)	(0.0429)
Newly hired × Corp. Banking	0.0387	0.0979***	0.158***	0.222***
	(0.0311)	(0.0250)	(0.0295)	(0.0552)
Newly hired × Corp. Prod.	0.0058	0.0690***	0.0991***	0.0707***
	(0.0130)	(0.0145)	(0.0195)	(0.0193)
Newly hired × Corp. Services	-0.0461**	0.0019	0.0619**	0.0470
	(0.0230)	(0.0220)	(0.0300)	(0.0313)
Newly hired × Inv. Banking	0.0779**	-0.0008	0.169***	0.207***
	(0.0342)	(0.0315)	(0.0401)	(0.0493)
Newly hired × Priv. Banking	0.129***	0.0173	0.0853***	0.0282
	(0.0242)	(0.0265)	(0.0297)	(0.0326)
Newly hired × TCM	0.0543**	0.148***	0.111***	0.162***
	(0.0265)	(0.0301)	(0.0294)	(0.0384)
Age	0.0257***	0.0273***	0.0279***	0.0201***
	(0.0009)	(0.00074)	(0.00073)	(0.00069)
$\text{Age}^2 * 100$	-0.0240***	-0.0256***	-0.0259***	-0.0172***
	(0.0010)	(0.00087)	(0.00086)	(0.00082)
Observations	40248	57021	59724	54147
R^2	0.71	0.74	0.71	0.73

Additional control variables include hierarchical level, region and company

[a] Reference category: Retail Banking

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

Table 3.4: Interaction with functional area

discussions with company representatives and consultants.

3.4.4 Managers and Functional Experts

Our data set offers an additional feature that allows another test of the predictions of the simple model. The consultancy Towers Perrin distinguishes between four different career ladders. Here we investigate the *managerial* and the *professional* ladder. The managerial ladder includes employees in supervisory roles with mainly managerial tasks whereas the professional ladder encompasses functional experts. As argued already above, managerial skills should mostly be general human capital. On the other hand, among the functional experts in the professional ladder, firm-specific knowledge should be more important for individual productivity. Hence, we expect that wage premia for external recruits are higher when we consider jobs in the managerial ladder as compared to the professional ladder. To investigate this claim empirically we interact the *Newly hired* dummy with the dummy variable for the managerial ladder.[14]

The results are reported in table 3.5. A newly hired employee in the professional ladder receives a wage premium of about 3-5% across the levels 3 to 6. We indeed find that average wage premia are higher in the managerial ladder as the interaction term is significantly positive in all four years. Hence, an employee in the managerial ladder receives a 4-7% higher premium than a comparable employee in the professional ladder, holding all other factors constant. These results are significant and stable over time, as can be seen in table 3.5.

Private banking deals with wealthy private clients. In this case hiring employees from competitors should be more attractive as they may bring more valuable client relations with them.

[14] The reference category is the professional ladder.

Dependent variable:	Logarithm of Base Salary			
	2007	2006	2005	2004
Newly hired	0.0469***	0.0322***	0.0357***	0.0353***
	(0.0068)	(0.0062)	(0.0071)	(0.0094)
Newly hired × Management	0.0568***	0.0413**	0.0666***	0.0499*
	(0.0213)	(0.0181)	(0.0207)	(0.030)
Management	0.1402***	0.1353***	0.1341***	0.1109***
	(0.0033)	(0.0027)	(0.0032)	(0.0033)
Age	0.0228***	0.0227***	0.0244***	0.0216***
	(0.0012)	(0.0009)	(0.0009)	(0.0009)
$Age^2 * 100$	-0.0202***	-0.0197***	-0.0214***	-0.0183***
	(0.0014)	(0.0011)	(0.0011)	(0.0010)
Level 6[a]	0.573***	0.601***	0.598***	0.609***
	(0.0056)	(0.0045)	(0.0049)	(0.0047)
Level 5	0.317***	0.346***	0.340***	0.369***
	(0.0027)	(0.0023)	(0.0025)	(0.0026)
Level 4	0.159***	0.183***	0.170***	0.178***
	(0.0020)	(0.0016)	(0.0016)	(0.0018)
Observations	28098	39962	41776	37782
R-squared	0.72	0.74	0.71	0.73

Additional control variables include functional area, region and company

[a] Reference category: Level 3

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

Table 3.5: Interaction with career ladder

3.4.5 Measuring the Importance of Firm-Specific Human Capital

So far we have tested our key hypothesis only indirectly and argued that firm-specific human capital should be less important at higher levels, for certain functional areas and less important for managerial as compared to expert positions. Indeed, we found strong evidence based on these conjectures. In this section we develop a more direct test for our key hypothesis derived from the theoretical model by generating a measure for the importance of firm-specific human capital. We then investigate whether the size of this measure in fact determines the difference between the wages of incumbents and newly hired employees.

For about 1/3 of all employees in our sample we can construct a panel data set by matching individuals in the cross sections over the period 2004-2007.[15] This panel data set contains identical information to that used in the cross sections and the distribution of employees across hierarchical levels and functional areas is very similar. The human capital measure is defined as follows. We first generate cells as unique combinations of the specific function, hierarchical level and career ladder for each year in the data set. This detailed combination reflects that the importance of human capital is rather function- and job-specific than company-specific, i.e. in many areas firm-specific human capital is of the same importance across different companies. As a result, we obtain between 380 and 435 unique cells per year. In a next step we conduct separate regressions for the years 2004 to 2007 for each of these cells with the individual performance measure (logarithm of bonus payments) as dependent variable and firm tenure and age as explanatory variables.[16] The coefficient of firm tenure in each regression now gives a measure for the importance of firm-specific human capital in a cell: The more important firm-specific human capital in a certain area the more the performance of an employee should depend upon his tenure at the firm

[15] Note that not all companies report a *time-invariant* unique (anonymous) personal ID number for each employee in the data set.

[16] In line with our previous analyses we do not make use of entry levels 1 and 2. We also exclude cells with insufficient observations to run OLS regressions.

controlling for overall experience (proxied by age).

We then standardize this measure by generating a variable containing the distribution function of this measure for each cell, i.e. the fraction of all cells in which the impact of tenure on performance is smaller. Hence, for the cell with the lowest tenure coefficient this specificity measure takes on the value 0, for that with the highest coefficient it is close to 1 and for the median cell it is 0.5.

Table 3.6 shows estimation results where the dummy for newly hired employees is interacted with our specificity measure. According to our theoretical model we expect the sign of the interaction term to be negative, because wage premia for newly hired employees should be lower in areas where human capital is more firm-specific. We indeed find that our measure for the importance of firm-specific human capital is the highest in retail banking, whereas lowest values can be found for capital market-based functions like investment banking and treasury and capital markets. The regression results seem to be very robust over the years, as can be seen in table 3.6. We indeed find a significant negative interaction effect for all years, i.e. the wage premium for newly hired employees is economically as well as statistically significant when firm-specific human capital is not important. In these areas, new hires receive an average premium between 8% and 12%, all other factors constant. But this premium decreases in those areas where specific human capital is of high importance. In 2007 for example, the wage premium gets close to zero for new employees entering a company in areas with the highest degree of firm-specific human capital.[17] In 2006 and 2004 we even observe negative premia for new hires.

A further robustness check is done by comparing the wage premia for newly hired employees between areas with above- and below-median values for the specificity of human capital. To test the differences between these both groups, we use a dummy variable equal to one if the standardized measure is greater than the median and zero otherwise. As we would have expected, in all years average wage premia for the below-median group

[17] A one standard deviation increase in the human capital measure reduces average wage premia for new hires by 1.9% to 3.5%.

Dependent variable:	Logarithm of Base Salary			
	2007	2006	2005	2004
Newly hired	0.0851***	0.0816***	0.1141***	0.0913***
	(0.0231)	(0.0277)	(0.0211)	(0.0145)
Newly hired × HC Specificity[a]	-0.0815**	-0.0990**	-0.0642*	-0.1191***
	(0.0395)	(0.0478)	(0.0370)	(0.0271)
Human Capital Specificity[a]	-0.0154***	-0.0248***	-0.0498***	-0.0188***
	(0.0033)	(0.0031)	(0.0027)	(0.0028)
Observations	35718	49486	51683	50542
R-squared	0.72	0.74	0.72	0.73

[a] Standardized measure (distribution function). Additional control variables include hierarchical level, age, region, functional area and company

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

Table 3.6: Interaction with measure for specificity of human capital

are highly significant and larger than those for the above-median group. The wage premia range from 6.6% to 9.0% in areas reflecting below-median specificity, and from 1.0% to 6% otherwise.

3.4.6 Differences in Ability?

In the regressions presented above we compared a newly hired employee with an incumbent at the same age, hierarchical level, functional area, region and company. But there might be still unobservable differences in individual ability between employees. For instance, if firms would systematically recruit employees from the outside that are of higher ability than incumbent employees in the same jobs, wage premia may to a certain extent simply reflect productivity premia. Hence it is important to know whether the wage premia are affected by a potential omitted variable bias as individual ability is unobserved.

Our data set provides a natural proxy for ability as we can observe individual annual bonus payments for almost all employees. But newly hired employees will typically not receive a full bonus in the year in which they moved to a new employer and therefore the bonus paid in the year of hire is not a suitable proxy.

Dependent variable:	Logarithm of Base Salary	
	(1)	(2)
Newly hired in 2005	0.0273***	-0.0520***
	(0.0094)	(0.0165)
Newly hired × Level 4		0.0964***
		(0.0202)
Newly hired × Level 5		0.1638***
		(0.0268)
Newly hired × Level 6		0.1874***
		(0.0425)
Ln Bonus 2006	0.0688***	0.0687***
	(0.0018)	(0.0018)
Level 6[a]	0.559***	0.556***
	(0.0070)	(0.0070)
Level 5	0.293***	0.291***
	(0.0035)	(0.0035)
Level 4	0.136***	0.134***
	(0.0020)	(0.0021)
Observations	21519	21519
R-squared (within)	0.77	0.77

Additional control variables include functional area, age, region and company. [a] Reference category: Level 3.

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

Table 3.7: Bonus payments in subsequent year as proxy for ability

Hence, we now use the actual bonus in 2006 as a proxy for productivity when comparing the wages of new hires and incumbents in 2005. We replicate the baseline regressions for 2005 additionally controlling for bonus payments in 2006 as a productivity measure. The results are given in table 3.7. Note that the coefficients are very close to those reported in tables 3.1 and 3.3. These results are also confirmed for newly hired employees in the year 2004 and 2006, also controlling for bonus payments in the subsequent year. Hence, the wage premia seem not to be driven by systematic differences in ability between incumbents and new recruits.[18]

3.5 Conclusion

First, we analyzed a simple model in which firms compete for the service of employees. An employee's decision to stay with his current employer or to move to a different firm depends on the wages offered as well as his personal current job satisfaction. The uncertainty about the job satisfaction in a new firm leads to switching costs. We have shown that when firm-specific human capital is mainly general, firms will offer higher wages to new recruits than they pay to comparable incumbents.

When firm-specific human capital is more important, however, this is no longer clear. In that case a competitor's willingness to pay is lower than the value of the employee for the current employer. But paying only this market wage to an incumbent agent is too risky as agents with lower levels of current job satisfaction may well leave the firm and move to a different employer. Hence, incumbent employees may earn more than new recruits at the same position.

We then examined these predictions empirically using a large data set on wages in German banks and financial services companies. We found that newly hired employees earn more than incumbents at higher levels of the hierarchy where managerial skills, which are rather general, are more important.

[18] Even controlling for bonus payments in 2006 *and* 2007 leads to the same results. As a further robustness check, we use future promotions as proxy for ability, what also confirms the results.

These premia are economically highly significant. Moreover, we found that these hiring premia are larger in functional areas where human capital is often client-specific rather than firm-specific as well as in managerial positions. We also apply a direct test of the model by including a generated measure for the specificity of human capital into the regressions, which supports the theoretical predictions empirically. A further robustness check shows that wage premia are not driven by systematic differences in individual abilities between incumbents and newly hired employees.

Our study thus shows that firms (have to) pay more when poaching employees from competitors. In turn, new hires typically earn more than equally able incumbents on the same job. An important implication of the result is that firms must earn rents from working with incumbents. This supports the claim put forward in the literature on internal labor markets that firms are indeed able to shield their incumbent employees from external market forces. But the extent to which this happens differs strongly between different types of jobs.

3.6 Appendix to Chapter 3

	2007		2006		2005		2004	
Variables	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Ln Base Salary	11.025	0.261	10.948	0.264	10.980	0.254	10.966	0.248
Age	41.88	7.94	41.21	7.95	40.82	8.03	40.66	8.21
Age squared	1816.72	681.92	1761.40	677.13	1730.39	680.27	1721.22	698.75
Newly Hired	0.016	0.125	0.016	0.127	0.017	0.130	0.015	0.122
Hierarchical level:								
Level 6 (highest)	0.040	0.195	0.039	0.193	0.040	0.197	0.040	0.197
Level 5	0.187	0.390	0.177	0.382	0.174	0.379	0.161	0.368
Level 4	0.389	0.488	0.393	0.489	0.403	0.491	0.421	0.494
Level 3	0.384	0.486	0.391	0.488	0.382	0.486	0.377	0.485
Functional area:								
Asset Management	0.024	0.152	0.018	0.131	0.017	0.131	0.019	0.137
Corporate Banking	0.075	0.264	0.085	0.279	0.082	0.275	0.096	0.295
Corp. Production	0.370	0.483	0.366	0.482	0.362	0.481	0.353	0.478
Corporate Services	0.146	0.353	0.150	0.357	0.139	0.346	0.138	0.345
Investment Banking	0.019	0.136	0.021	0.145	0.019	0.135	0.016	0.124
Private Banking	0.032	0.174	0.037	0.188	0.061	0.239	0.093	0.291
Retail Banking	0.299	0.458	0.285	0.451	0.283	0.450	0.246	0.431
Tr. & Cap. Mkts.	0.036	0.185	0.039	0.193	0.037	0.189	0.039	0.193

Table 3.8: Descriptive statistics (levels 3 to 6)

Level	2007				2006				2005				2004			
	Employees[a]		Age[b]		Employees[a]		Age[b]		Employees[a]		Age[b]		Employees[a]		Age[b]	
	Inc.	New	Inc.	New	Inc.	New	Inc.	New	Inc.	New	Inc.	New	Inc.	New	Inc.	New
6	2583	54	46.8	41.8	2594	29	46.1	41.1	2640	63	46.0	40.9	2261	24	46.5	40.0
	(97.95%)	(2.05%)			(98.89%)	(1.11%)			(97.67%)	(2.33%)			(98.95%)	(1.05%)		
5	12146	187	44.2	39.4	11896	151	43.5	38.9	11432	203	43.3	38.0	9283	99	43.7	39.0
	(98.48%)	(1.52%)			(98.75%)	(1.25%)			(98.26%)	(1.74%)			(98.94%)	(1.06%)		
4	25248	430	42.1	37.5	26308	431	41.7	36.4	26511	440	41.5	35.3	24392	256	41.1	36.1
	(98.33%)	(1.67%)			(98.39%)	(1.61%)			(98.37%)	(1.63%)			(98.96%)	(1.04%)		
3	24648	373	40.2	34.6	26069	500	39.4	33.5	25114	446	38.8	33.3	21706	233	38.5	32.7
	(98.51%)	(1.49%)			(98.12%)	(1.88%)			(98.26%)	(1.74%)			(98.94%)	(1.06%)		
2	26321	503	38.6	30.0	27404	525	38.0	30.0	27534	381	38.3	30.4	26763	368	37.5	30.6
	(98.12%)	(1.88%)			(98.12%)	(1.88%)			(98.64%)	(1.36%)			(98.64%)	(1.36%)		
1	9670	571	38.0	28.7	11221	417	36.7	27.1	10080	360	36.1	25.8	10345	479	36.7	25.9
	(94.42%)	(5.58%)			(96.42%)	(3.58%)			(96.55%)	(3.45%)			(95.57%)	(4.43%)		
Total	100616	2118	40.7	33.1	105492	2053	40.0	32.8	103311	1893	39.7	32.5	94750	1459	39.4	31.1
	(97.94%)	(2.06%)			(98.09%)	(1.91%)			(98.20%)	(1.80%)			(98.48%)	(1.52%)		

[a] Absolute and in % of respective level (in brackets); [b] Mean

Table 3.9: Proportion of newly hired and incumbent employees and distribution of age over hierarchical level (all levels)

Dependent variable:	Logarithm of Base Salary			
	2007	2006	2005	2004
Newly hired	-0.0469***	-0.0394***	-0.0243***	-0.0235***
	(0.0059)	(0.0051)	(0.0066)	(0.0053)
Age	0.0319***	0.0427***	0.0412***	0.0405***
	(0.0006)	(0.00043)	(0.00046)	(0.00047)
$Age^2 * 100$	-0.0341***	-0.0470***	-0.0452***	-0.0443***
	(0.0008)	(0.00056)	(0.00059)	(0.00061)
Level 2[a]	0.198***	0.141***	0.163***	0.178***
	(0.0019)	(0.0013)	(0.0015)	(0.0015)
Observations	25187	33938	34588	33738
R^2	0.70	0.70	0.69	0.67

Additional control variables include functional area, region and company

[a] Reference category Level 1

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

Table 3.10: OLS wage regressions regarding only entry levels 1 and 2

Dependent variable:	Logarithm of Base Salary			
	2007	2006	2005	2004
Newly hired	0.0081	-0.0558***	-0.0854***	-0.0234
	(0.0133)	(0.0125)	(0.019)	(0.018)
Newly hired × Level 4	0.0571***	0.0963***	0.143***	0.0400*
	(0.0201)	(0.0145)	(0.020)	(0.021)
Newly hired × Level 5	0.155***	0.140***	0.194***	0.133***
	(0.0324)	(0.0203)	(0.026)	(0.031)
Newly hired × Level 6	0.115**	0.190***	0.230***	0.210***
	(0.0576)	(0.0457)	(0.037)	(0.067)
Age	0.0330***	0.0204***	0.0234***	0.0164***
	(0.0016)	(0.0010)	(0.0012)	(0.00078)
Age^2*100	-0.0316***	-0.0066***	-0.0195***	-0.0128***
	(0.0019)	(0.0012)	(0.0013)	(0.00091)
Level 6[a]	0.635***	0.603***	0.624***	0.634***
	(0.0089)	(0.0045)	(0.0051)	(0.0043)
Level 5	0.305***	0.297***	0.331***	0.360***
	(0.0042)	(0.0028)	(0.0031)	(0.0022)
Level 4	0.136***	0.127***	0.158***	0.146***
	(0.0032)	(0.0024)	(0.0026)	(0.0015)
Observations	13933	37715	38851	44172
R-squared	0.72	0.68	0.65	0.74

Additional control variables include functional area, region and company in all specifications. [a] Reference category: Level 3

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

Table 3.11: OLS wage regressions excluding employees covered by a collective wage agreement

Chapter 4

The Effects of Intra-Firm Training on Earnings and Job Performance[1]

4.1 Introduction

Human capital as an intangible asset has become increasingly important for the competitiveness and performance of organizations (Lev (2001)). As a result, organizational investments in intra-firm trainings are significant. In 2005, total costs of continuing vocational training (CVT) amount to 1.6% of total labour costs in the EU-27, according to a recent study by the European Union[2] (Cedefop (2010)). Almost 70% of all German companies provide CVT and about 30% of the workforce participate in training courses. In companies with more than 500 employees, like the firm analyzed here, even 90% provide intra-firm trainings.[3] Companies investing in trainings expect that these trainings enhance employee performance by improving general and firm-specific skills, knowledge and abilities. The overall goal is to make

[1] This chapter is based upon Breuer and Kampkötter (2010).

[2] Figures for training courses. Other forms of vocational training like on-the-job trainings or job rotation excluded.

[3] Furthermore, in large companies, training provision is formalized to a large extent, as more than 70% of these companies have a specific person/unit responsible for training, pursue training plans, prepare a training budget and measure participant satisfaction.

human capital as an asset even harder to imitate what should result in a competitive advantage in the market. If such an investment is made, the returns should be systematically evaluated.

Former research has mainly focused on the effects of training participation at the organizational level (e.g. Bartel (1994), Black and Lynch (1996), Barrett and O'Connell (2001), Dearden et al. (2006), Zwick (2006)). At the individual level, empirical research on the effects of training participation on performance is mainly based on national survey data sets (e.g. Barron et al. (1989), Lynch (1992), Barron et al. (1993), Veum (1995), Parent (1999)). Although these data sets are valuable by covering detailed information about individual characteristics and wages, major drawbacks are the respondents difficulty to reliably report the details retrospectively (Barron et al. (1997)) and, more importantly, heterogenous definitions about intra-firm trainings between companies. Personnel records from a single company can overcome these problems (see e.g. Bartel (1995), Tharenou et al. (2007)) and therefore offer the possibility to more reliably analyze the effects of trainings, as all employees are exposed to the same corporate training policy and participation details are often tracked in a database.

We contribute to the literature in several aspects. First, only a few studies have analyzed the performance effects of intra-firm training participation based on company data sets so far (Bartel (1995), Krueger and Rouse (1998), Fahr et al. (2010)). Therefore we follow the recommendation of Bartel (1995) to "focus on collecting more comprehensive data from companies" in order to analyze determinants and effects of firm-sponsored vocational trainings, as the empirical results are mixed so far. Our study contributes by using a unique data set consisting of personnel records from a large, multinational German firm which is representative for that kind of companies. Second, we make use of several monetary as well as non-monetary performance indicators, as in the literature only fixed salaries have been used in the vast majority of studies so far. We use annual (short-term) bonus payments as a further individual performance measure, as they are well suited to reflect individual performance of employees. Additionally, we look at absenteeism and overtime hours as well as turnover rates. Third, using bonus payments

as performance indicator, we are also able to offer a different explanation for the rather weak performance effects that have been manifested in previous studies.

We can confirm only some of the previous findings for the determinants and performance effects of trainings which may be explained by varying training policies of firms operating in different industries or countries. Using similar estimation techniques accounting for endogeneity in training participation, we do not find a long-term effect of training on performance measured by monetary indicators. We argue that this result may partially be attributed to the anchoring of training participation in individual target agreements or performance appraisals. Also, employees may act reciprocally and increase effort during a training period if training is perceived as an employer's investment in skills and abilities of its employees. But for non-monetary indicators like turnover rates and overtime work, a significant effect of classroom trainings can be confirmed. A further feature of our data set allows us to differentiate between several training categories including a.o. leadership, language, business administration, and project management trainings. Therefore, we can closely analyze the impact of different training categories, which only few studies have analyzed before.[4]

The remainder of this chapter is organized as follows. In section 4.2, the background and related literature is described. Section 4.3 explains the data set and the applied methods for the empirical analysis. Descriptive statistics of training participation are shown in section 4.4, whereas section 4.5 analyzes the determinants of training participation in general and for different training categories using probit regressions. Section 4.6 investigates the performance effects of training participation and section 4.7 concludes.

4.2 Background and Related Literature

The overall objective of intra-firm training is the accumulation of human capital. Ideally, employees are provided with knowledge, skills and competencies

[4] Only Bartel (1995) uses information on different training categories yet.

that are needed for their actual as well as for future jobs and assignments. It is obvious that investments in trainings require a cost-benefit-analysis: There is a need to investigate if training positively affects future employee performance and therewith organizational, mainly financial, results.[5]

Several studies focused on the effects of training participation on organizational level outcomes based on firm-level surveys. In these studies, productivity, measured by accounting figures like sales per year (Bartel (1994), Black and Lynch (1996), Barrett and O'Connell (2001)) or value added (Dearden et al. (2006), Zwick (2006)), ss predicted with a Cobb-Douglas production function. However, the results differ widely which can be partly explained by the high level of aggregation, but may also be caused by differences in estimation techniques (Zwick (2006)). Other studies focused on the combination of human resource management practices arguing that a bundle of high performance work practices may lead to improved performance (Arthur (1994), Huselid (1995), Delaney and Huselid (1996), Huselid et al. (1997), and Ichniowski et al. (1997)). But as company training is only one component of these practices, disentangling these effects seems to be quite difficult. Most studies have reported a positive relationship between firm performance and human resource practices using firm-level data sets. Ichniowski et al. (1997) even stress that the complementarity between different human resource practices leads to further productivity effects. These studies, however, rely on survey responses of firm representatives that were asked about general training opportunities. But the content of the trainings and the connection between training needs and the current job remains unclear. To get a deeper insight into training practices, we use individual-level data from company records that provide detailed information on both the type of training and the trained employees.

Before these investments may result in organizational-level outcomes, trainings have to increase general and job-specific skills of the individual employee. Given that the acquired skills are useful for the job, individual job performance should improve (Salas et al. (1999)). So far, a broad literature on intra-firm training participation and the effects of training on individual

[5] For a prominent approach to evaluate trainings see Kirkpatrick (1979).

performance exists. But most of the empirical research in this field analyzes the effect of training participation on individual wage growth using national survey data sets (compare e.g. Barron et al. (1989), Lynch (1992), Barron et al. (1993), Veum (1995), and Parent (1999)). But there are potential drawbacks of these studies.

First, productivity is mainly measured by wage or wage growth, whereas variable bonus payments are almost neglected. Although wage has proven to be a good proxy for performance, some problems remain as a divergency between wages and productivity may still occur. Possible explanations comprise seniority wages, i.e. wages above individual productivity levels in later years of firm tenure (Lazear (1981)), and human capital theory predicting that training in firm-specific human capital may not equivalently result in higher wages although there might be a productivity increase. Also, labor market frictions may lead to lower wages if employees that invested in general human capital are not paid their full marginal product when they change jobs (Acemoglu and Pischke (1999)). Therefore, other productivity measures on an individual level are needed. We try to solve this problem by additionally using information on annual bonus payments of employees that seem to be a good proxy for individual productivity.

Second, survey data sets are often concerned with measurement problems (Bartel (1995)). These include e.g. the respondents' difficulty to reliably recall their training participation and the existence of various definitions of training policies across different firms. Using personnel records from one company, we can avoid these measurement problems, because a more homogenous understanding of training patterns is guaranteed. But access to company data remains difficult which might be one reason why only few studies have investigated training effects based on personnel records so far.

In one of the few exceptions, Bartel (1995) investigates the determinants and effects of on-the-job training using a five-year panel data set of a large US manufacturing company. She is able to divide the offered trainings into three categories: core trainings, developmental trainings and technical trainings. The results show that employees with a higher position in the salary distribution of their department (i.e. comparable employees performing the

same job), are less likely to participate in a developmental training, but are more likely to participate in the other trainings. This result indicates employee selection into training programs and gives a reason to control for ability in the performance regressions. Using a fixed effects and instrumental variable approach Bartel finds a significantly positive wage effect for the participation in developmental and technical trainings while controlling for a person´s relative position in the salary distribution. As a robustness check she includes a multinomial logit estimation using individual performance ratings as additional productivity measure. She can confirm the productivity effects by showing that training participation increases the likelihood of a better performance rating in the subsequent year.

Krueger and Rouse (1998) examine the impact of on-site trainings on a range of outcome variables using two US company data sets for the years 1992 and 1994. The outcome variables include wage, turnover, performance awards, job attendance and the self-assessment of productivity. Besides investigating the determinants of training participation, they find a positive wage effect for only one of the companies applying fixed effects regressions. But only a small fraction of employees receive a performance award which leads to a low variation in the dependant variable.[6]

Fahr et al. (2010) evaluate a training program of a single retail sales company. They can identify both a treatment group of branch managers taking part in a 6-month sales training program and a control group. The objective performance measure they use are monthly sales figures. Controlling for seasonal influences and store manager and store fixed effects, they find no performance effect of trainings on firm productivity after the 6-month training period or even a negative effect in some specifications.

[6] Also, it may be unlikely to receive a performance award in two consecutive years, as political reasons might play a role which will then be interpreted as a performance decrease.

4.3 The Data

4.3.1 Data Set

We investigate personnel records from a multinational company headquartered in Germany for the years $2006 - 2008$.[7] The records comprise data on about $15,000$ German full-time employees each year resulting in a total of about $46,300$ employee-year-observations. In detail, the panel data set contains information on individual compensation like base salary and short-term bonus payments[8] as well as on individual overtime and absenteeism hours and turnover rates. Demographic information includes employee's age, years of firm tenure, highest educational level and sex. Information on training participation, the number of attended trainings and the content of training is also available for each employee and year.

According to the company's training policy, there are three main reasons for training participation: First, there are mandatory trainings that have to be completed by all employees in the company. As these trainings are only used to provide information on legal requirements (e.g. Anti-discrimination law or workplace safety trainings), they are excluded from further analyses. Second, employees can independently choose to participate in "Open Enrollment" trainings, which do not depend on a supervisor´s advice or directive. And third, employees can be registered for trainings by their direct supervisor.

Additionally, detailed information on employee status, strategic business unit and subdivision is available. The variable *employee status* (which is based on the hierarchical level an employee is located at) comprises four groups: Non-exempt employees (levels 1 to 12) and three groups of exempt employees. These cover junior managers (levels 13 to 15), which include the typical entry positions for university graduates, senior managers (levels 16 to 17) and senior executives (levels 18 to 22).[9] Table 4.1 shows that about

[7] Due to confidentiality reasons, the data sheets and the company name had to be anonymized.

[8] Note that only exempt employees are eligible for bonus payments.

[9] Top executives are not part of the sample.

2/3 of all employees in this firm are non-exempt employees, about 30% are working as junior or senior managers and about 3% are senior executives.

Employee status	2006		2007		2008	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Non-exempt	9,969	68.05	10,674	67.63	10,377	65.47
Junior manager	2,558	17.46	2,708	17.16	2,988	18.85
Senior manager	1,778	12.14	1,989	12.60	2,044	12.90
Senior executive	345	2.35	412	2.61	442	2.79
Total	14,650	100.00	15,783	100.00	15,851	100.00

Table 4.1: Distribution of employees by employee status and year

Average firm tenure (age) is 22 years (42) for non-exempt employees and it ranges between 15 and 20 years (43 and 50) for exempt employees. We further observe three main subdivisions: The holding, the service units, and the operational/industrial units. About 4% of all employees work in the holding, 22% in the service units and about 74% in the operational units.

4.3.2 Empirical Strategy

The empirical strategy is as follows. First we estimate the determinants of training participation for a given individual i in year t with a probit regression using the pooled data set. The baseline specification is given by:

$$y_{it} = \alpha + \beta Z_{it} + \theta C_{it} + \lambda promoted_{it} + \vartheta move_{it} + \delta q_{it-1} + \varepsilon$$

The dependent variable y_{it} is a dummy variable that is equal to 1 if employee i has participated in at least one training in year t. Our demographic control variables include employee status, sex, age, firm tenure, and level of education (vector Z_{it}). Controls for subdivision and year are given by the vector C_{it}. When moving to a new job or after being promoted, a higher training participation may be expected. We therefore include control variables identifying promoted employees ($promoted_{it}$) and employees who moved between subdivisions ($move_{it}$).[10]

[10] Due to collinearity problems, we cannot include a separate dummy for newly hired

In the literature much attention is paid to the selection problem stating that the likelihood of participating in a training will be higher for more able and productive employees. To test for possible effects of employee selection into trainings, we follow Bartel (1995) and include a proxy variable q_{it-1} for ability in the probit regressions. This variable is defined as the percentile rank of an employee's base salary in period $t-1$ in her salary class and work unit, i.e. it shows how much salary an employee earns relative to her colleagues. The relevant work unit is defined as a unique combination of year, subdivision, strategic business unit and hierarchical level. As a result, we obtain 2,745 unique values for work units with a median size of 58 employees. The error term is denoted by ε.

In a further specification we additionally include work unit size and the number of attended trainings of the direct supervisor in period $t-1$. The department size could have a positive impact on training participation as it is easier to replace an absent employee who is participating in training courses in a larger department (Krueger and Rouse (1998)). We also include the number of trainings of the direct supervisor, as a more intensive training behavior of the supervisor may have a positive influence on subordinates' participation rates. As there are many observations with the value zero for the number of training hours, we apply tobit regressions for robustness reasons.[11]

In a second step we conduct fixed effects regressions to estimate the effects of training participation in period t and $t-1$ on individual outcome variables p_{it}, i.e. base salary, short-term bonus payments, absenteeism and turnover rates. The fixed effects approach allows us to control for individual heterogeneity. We use the same set of demographic control variables and include subdivision and year fixed effects. Individual, time-constant heterogeneity like e.g. ability is captured by the parameter α_i, whereas ε_{it} is the individual, time-variant error term.

employees.

[11] The probit regressions have also been used in studies by Bartel (1995) and Krueger and Rouse (1998). Bartel (1995) also investigates the number of trainings.

$$p_{it} = \alpha + \beta Z_{it} + \theta C_{it} + \alpha_i + \varepsilon_{it}$$

It is important to note that some employees move to a new position throughout the year. But bonus payments are not a good performance indicator for employees in the year of the job change, as it is very difficult for their supervisors to evaluate their performance.[12] We further expect these employees to take more training courses which might also influence the results. Therefore we exclude newly hired employees, promoted employees and subdivision movers in the fixed effects regressions.[13]

4.4 Descriptive Statistics

4.4.1 Training Participation

Classroom trainings are usually offered to a group of employees and are instructed by an internal or external trainer. For employees who attain at least one training in a respective year, we observe 15,109 training-year observations during the time span $2006 - 2008$, i.e. for about one third of all observations in the sample. This indicates that classroom trainings are a widely used personnel development instrument in the analyzed company.[14] Overall training participation decreased from 36% in 2006 to 30% in 2008. The rate of training participation may depend on the economic situation of a company as in growth periods employees may have fewer days left to participate in training programs. We indeed find evidence for this relationship as the observed firm increased net sales significantly between 2006 and 2008. Figure 4.1 shows the average training participation (in at least one training) by employee status and year. Junior managers show the highest rates with a three-year average of about 52%.

[12] Regressions indeed confirm that movers earn significantly lower bonus payments in the year of the job change than stayers.

[13] Note that Bartel (1995) follows a similar approach.

[14] We also have information on so-called webbased trainings, which are completed by employees on their own via an online platform. But as these trainings are only very rarely used we exclude them from further analyses.

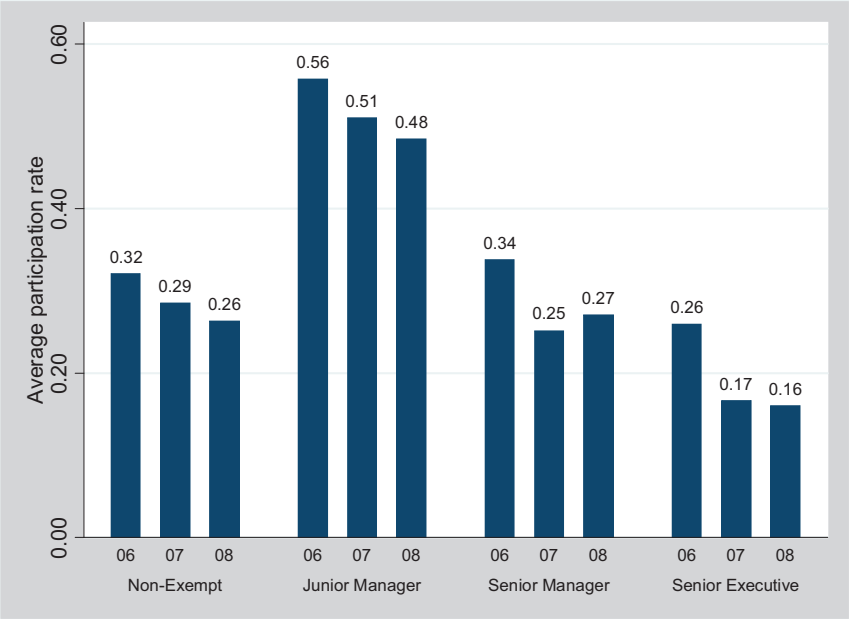

Figure 4.1: Average training participation by employee status and year

Additionally, it is interesting to consider the different training categories, as can be seen in figures 4.2 and 4.3. Overall, participation rates for language, leadership and communication as well as IT trainings are the highest in the company followed by trainings in business administration. Figure 4.3 shows that junior managers are the group with the highest participation rates in each of the six categories.[15] It is notable that the participation rate of junior managers in leadership and communication trainings is the highest compared to the other training categories. One could assume that especially *promoted* junior managers drive this result, but that is not the case as training participation in leadership and communication trainings for promoted junior managers is 23% and 21% for non-promoted junior managers. This shows that the focus of personnel development instruments like classroom trainings is on junior managers which are supposed to be the future leaders of the company. Interestingly, promoted senior managers are trained more in lead-

[15] Table 4.13 in the appendix shows the same statistics but only for trained employees (contrary to all employees in figure 4.3).

ership and communication skills (15%) than non-promoted senior managers (9%).[16]

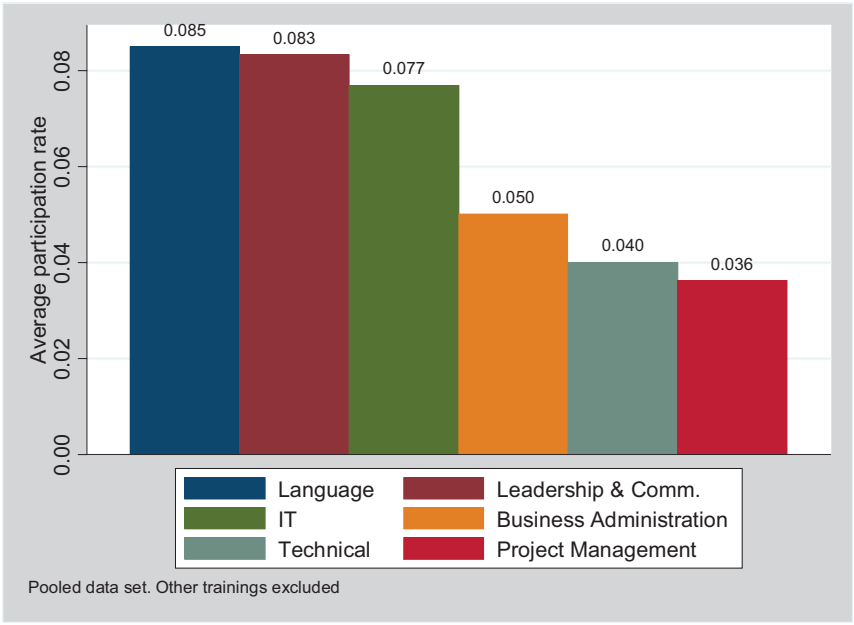

Figure 4.2: Average training participation by training category

4.4.2 Training Hours and Numbers of Training

Besides participation rates, the data set covers information on training hours and the number of attended trainings. On average, a training takes 19.5 hours in this company, which is equivalent to about 2.5 training days. The first three columns of table 4.2 show the average number of training hours per employee, i.e. the total number of training hours divided by the number of full-time employees. It can be seen that this number decreases from 12.4 in 2006 to 11.6 in 2008. The last three columns show the average number of training hours for the group of *trained* employees, i.e. who participate in at least one classroom training in the relevant year. Here, we find an increase

[16] Note that some employees participate in more than one training each year. Therefore, the total participation rate for each employee group in figure 4.3 may be higher than the average training particpation rate in at least one training in figure 4.1.

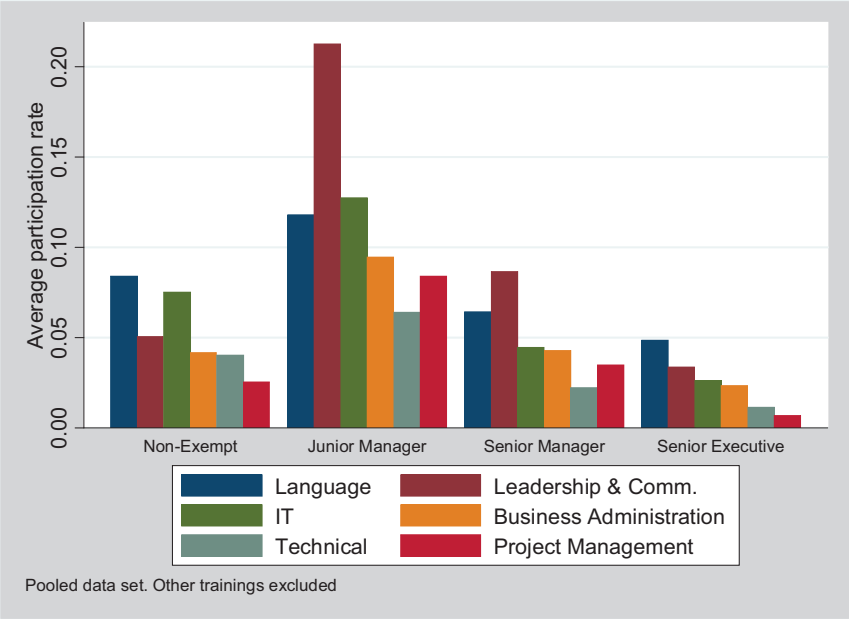

Figure 4.3: Average classroom training participation by employee status and training category

from 34.9 to 38.2 hours indicating that the average training duration for *trained* employees in the company has been rising over the years.[17] For exempt employees, we find a negative correlation between the position in the hierarchy and all of these indicators, i.e. training hours and number of trainings are lowest at the top levels of the hierarchy.

4.4.3 Training Behavior of Employees in New Job Positions

As already mentioned, we expect employees working in a new position to be trained more frequently in order to acquire the needed job-relevant skills. We can differentiate between newly hired employees, promoted employees and employees who moved to a different subgroup. In fact, these employees show, on average, higher training participation rates as can be seen in the

[17] The average number of classroom trainings per full-time employee decreases from 0.8 in 2006 to 0.6 in 2008 (per *trained* employee from 2.1 in 2006 to 1.9 in 2008 respectively).

	Average number of training hours					
	per employee			per *trained* employee		
Employee status	2006	2007	2008	2006	2007	2008
Non-exempt	10.0	10.8	9.5	32.2	38.1	36.1
Junior manager	24.7	23.2	22.0	44.7	45.5	45.5
Senior manager	9.6	7.6	8.7	29.1	30.3	32.2
Senior executive	3.5	4.3	2.4	13.6	25.6	15.0
Total	12.4	12.4	11.6	34.9	39.2	38.2

Table 4.2: Average number of classroom training hours by employee status and year

first column of table 4.3. Compared to job stayers, the participation rate of new hires is, on average, about 13 percentage points higher, for employees that moved between subgroups 11.5 and for promoted employees 7 percentage points. The same pattern is visible for training hours, which can be seen in the second column of table 4.3. These results indicate that the different training behavior of job movers has to be to taken into account in the following regressions, which we will do so.

Job status	Train. participation (in %)	Training hours
No job change	30.7	11.8
Newly hired	43.9	15.9
Promoted	37.9	16.2
Subgroup move	42.2	15.5

Note: Averages reported. Data source: Pooled data set 2006-2008.

Table 4.3: Training statistics by type of job change

4.5 Determinants of Training Participation

4.5.1 Overall Training Participation

Columns 1 to 4 of table 4.4 show marginal effects[18] for different specifications of probit regressions for the determinants of participation in at least one

[18] Marginal effects are evaluated at the mean of the independent variables and, for dummy variables, report the discrete change from 0 to 1.

classroom training. The base model in column 1 incorporates the percentile rank of individual $i's$ base salary in her work unit in period $t-1$, age, age squared, tenure, tenure squared, sex, employee status, and subdivision as main independent variables. The results of model 1 for the subgroup of non-exempt employees are shown in column 2 and for exempt employees in column 3. Model 4 additionally controls for department size as well as the number of trainings of the direct supervisor in period $t-1$. Column 5 reports tobit regression results for the number of training hours as dependent variable. Further control variables in all specifications include the level of education and year dummies. Robust standard errors are reported for each regression.

As can be seen in column 1 of Table 4.4, we find an inversely U-shaped pattern for the relationship between classroom training participation and age, with a maximum at 40 years of age. This seems to be in line with predictions of the human capital theory (Becker (1962)) as the return on investment in employee training for older employees may be lower due to their shorter remaining time in the firm. The tenure coefficients show the opposite result, i.e. a U-shaped relationship for the likelihood of participating in company trainings. Employees with lower levels of firm tenure seem to be trained more intensively to enable them for their jobs and provide them with firm-specific knowledge, whereas longer-tenured employees might have lost recent trends and developments in the market and their skills and knowledge have to be refreshed. However, the economic size of the effect is quite small.

As already shown in the descriptive section, the likelihood of training participation is significantly higher for managers that are at the bottom management levels (+13%) and lower for senior executives at the top levels, compared to non-exempt employees. The group of junior managers comprises both the entry positions for university graduates, which are typically between 25 and 35 years of age, as well as more experienced employees. Regressions show that within this group, training participation rates are steadily declining with age.[19] This pattern shows that especially younger employees with less work and labor market experience need to accumulate general and firm-specific human capital, which seems to be the driver of the results here.

[19] The results are available upon request.

Dependent variable:	Training participation$_t$				Hours$_t$
	(All)	(Non-ex.)	(Exempt)	(All)	(All)
	(1)	(2)	(3)	(4)	(5)
Percentile salary$_{t-1}$	-0.0921***	-0.0983***	-0.0719***	-0.0948***	-12.003***
	(0.0132)	(0.0162)	(0.0242)	(0.0198)	(2.002)
Age	0.0397***	0.0338***	0.0338***	0.0308***	6.899***
	(0.0037)	(0.0053)	(0.0096)	(0.0052)	(0.5774)
Age squared	-0.0005***	-0.0005***	-0.0005***	-0.0004***	-0.092***
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0068)
Female	0.0440***	0.0527***	0.0007	0.0380***	8.281***
	(0.0084)	(0.0094)	(0.0178)	(0.0124)	(1.2602)
Tenure	-0.0069***	-0.0021	-0.0108***	-0.0069***	-1.563***
	(0.0017)	(0.0027)	(0.0028)	(0.0023)	(0.2621)
Tenure squared	0.0002***	0.0001*	0.0003***	0.0002***	0.041***
	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0068)
Junior manager[a]	0.1336***			0.1229***	19.603***
	(0.0113)			(0.0156)	(1.6384)
Senior manager	-0.0162		-0.1247***	-0.0012	-4.616**
	(0.0138)		(0.0139)	(0.0208)	(2.1366)
Senior executive	-0.1248***		-0.2167***	-0.0805**	-25.770***
	(0.0203)		(0.0196)	(0.0381)	(3.9705)
Promoted$_t$	0.0448***	0.0702***	-0.0076	0.0452***	8.208***
	(0.0101)	(0.0127)	(0.0166)	(0.0117)	(1.5117)
Subdivision move$_t$	0.1074***	0.0844***	0.1376***	0.1218***	13.377***
	(0.0247)	(0.0326)	(0.0377)	(0.0381)	(3.3098)
No. of trainings of direct supervisor$_{t-1}$				0.0493***	
				(0.0055)	
Department size$_t$				-0.0452***	
				(0.0118)	
Observations	23292	15908	7384	19651	23283
Pseudo R^2	0.07	0.05	0.11	0.09	0.02

Marginal effects reported in columns 1 to 4. Reference category: [a] Non-exempt employees. Additional control variables include education, subdivision, and year.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Column 4: Clustered standard errors (2,246 supervisor/department clusters)

Table 4.4: Probit regression results for determinants of classroom training participation

We further find a significantly higher likelihood of training participation for female employees (+4.4%). This seems to be driven by non-exempt employees, as the coefficient for female managers in column 3 is neither statistically nor economically significant. Especially in lower-skilled positions, the career tracks of females may be characterized by more interruptions than those of male employees, often due to maternity and parental leaves.[20] These career breaks result in a higher demand for trainings to compensate missed on-the-job and classroom learning during periods of maternity leave.[21] Some may argue that the overall positive effect for females is only attributed to larger functional units with a high proportion of female employees. As robustness check, we replicated the baseline regressions for smaller business units (especially production units) and in the majority of estimates the female dummy remains positive.

But the most striking result is the negative coefficient of our proxy variable for previous performance indicating that less productive employees are significantly more likely to participate in trainings. In detail, compared to an employee whose salary is the lowest in a given department in period $t-1$, the probability that an employee with the highest salary participates in at least one training in period t is about 9% lower. For exempt employees this "reversed selection effect" seems to be less intense with a coefficient of 7% (column 3). To facilitate the interpretation of the negative selection effect, we subdivided the proxy variable into quintiles and reran the baselines regressions.[22] The results show that the negative effect is mainly driven by best-paid employees, i.e. employees that belong to the $4th$ and $5th$ quintile of previous year's salary distribution in a given work unit. This is quite plausible as opportunity costs for these employees are much higher than for peers in the lower quintiles. We therefore find no evidence for the usual positive selection effect in this company.

[20] See e.g. Altonji and Blank (1999) and Kunze (2008) for a discussion on gender differences in job mobility and training.

[21] Another possible explanation is the decreasing proportion of female employees at higher hierarchical levels. For non-exempt employees, the share of female employees is about 23%, for junior managers 19% and it decreases down to 7% for senior executives.

[22] These results are available upon request.

As a specific feature of the data set, we also have information on short-term bonus payments and performance grades for exempt employees. To test if the negative selection into trainings is robust for this subgroup, we reran the baseline regression for classroom trainings with two new proxy variables for previous performance: the percentile rank of the annual bonus payments an employee receives in a given department and the individual performance grade of the annual performance management process both in period $t-1$.[23] The results of table 4.5 confirm the previous results, as employees that are higher in the bonus distribution or that receive better performance grades show a significantly lower likelihood of training participation.

Dependent variable:	Training participation$_t$	
	(1)	(2)
Percentile bonus$_{t-1}$	-0.0634***	
	(0.0216)	
Grade 1 $_{t-1}$ [a]		-0.1278**
		(0.0599)
Grade 2 $_{t-1}$		-0.0284*
		(0.0145)
Grade 4 $_{t-1}$		0.0468
		(0.0381)
Observations	7301	6994
Pseudo R^2	0.11	0.11

Marginal effects reported. Reference category: [a] Grade 3 $_{t-1}$.
Control variables: see table 4.4. Robust standard
errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4.5: Robustness checks for selection into training participation

In specification 4 of table 4.4 the logarithm of department size is incorporated into the baseline model. We find that the likelihood of training participation decreases in larger departments which is the opposite of what has been expected. In detail, if department size increases by 1%, the likelihood of training participation decreases by 4.5%, all other factors constant. Additionally, we include the number of trainings of the direct supervisor in

[23] The grades are from 1 to 5, with 1 being the highest grade and 5 the worst, respectively.

period $t-1$ into the model.[24] One could expect that an increasing number of trainings of the direct supervisor in the previous year should have a positive effect on subordinates' training behavior. And indeed, we find a positive and economically significant effect of about 4.9%. Also, as predicted, employees in a new job position show a significantly higher likelihood of training participation in the baseline specification.[25] Finally, the tobit regression results in column 5 for the number of training hours per employee broadly confirm the results discussed above.

4.5.2 Training Categories

As mentioned earlier, we are able to distinguish between different types of classroom trainings. Table 4.6 shows some interesting estimation results for each of these categories. In this company, less productive employees (with lower relative base salaries) are more likely to participate in trainings of each category. This stands in contrast to Bartel (1995) who founds that high performers are awarded with leadership and project management trainings.[26] For language trainings, we find no significant results.

It is further interesting to note that job movers are more likely to attend language, business administration and leadership trainings. For leadership trainings this is not surprising, as especially promoted employees are trained for future leadership tasks, whereas lateral moves between subdivisions are typically not characterized with an increase in managerial authority. Compared to non-exempt employees, the likelihood of participating in leadership trainings is the highest for junior managers (+8.7%), followed by senior managers (+4.4%). This indicates that leadership skills are very important for managers at the bottom levels.

Sex has a significant influence on training participation in all specifications. Female employees are more likely to participate in all categories of

[24] Standard errors in this specification are clustered on supervisor-level, as we are able to identify 2,246 unique supervisors.

[25] Holding all factors constant, promoted workers (subdivision movers) show, on average, a 4.5% (10.7%) higher likelihood of training participation than stayers.

[26] It is important to note that the definition of the various training categories in the study by Bartel (1995) and our study cannot be compared exactly.

classroom trainings except technical trainings than male employees, with the highest likelihood for language trainings. As mentioned above, the loss of human capital during out-of-job periods like maternal leaves might be one reason, whereas the lower share of women among technicians might drive the results for technical trainings.

Dependent variable:	Classroom training participation$_t$					
	(1)	(2)	(3)	(4)	(5)	(6)
	(Lead.&Com.)	(Language)	(Bus. Adm.)	(Project)	(IT)	(Techn.)
Percentile salary$_{t-1}$	-0.0236***	-0.0017	-0.0103*	-0.0146***	-0.0369***	-0.0139***
	(0.0067)	(0.0077)	(0.0060)	(0.0043)	(0.0073)	(0.0053)
Age	0.0189***	0.0153***	0.0110***	0.0027**	0.0112***	-0.0009
	(0.0019)	(0.0022)	(0.0017)	(0.0011)	(0.0020)	(0.0015)
Age squared $*100$	-0.0003***	-0.0002***	-0.0001***	-0.0000***	-0.0001***	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Female	0.0151***	0.0577***	0.0072*	0.0069**	0.0248***	-0.0267***
	(0.0045)	(0.0056)	(0.0039)	(0.0029)	(0.0050)	(0.0026)
Junior manager^a	0.0867***	0.0202***	0.0323***	0.0288***	0.0339***	0.0048
	(0.0079)	(0.0068)	(0.0061)	(0.0050)	(0.0067)	(0.0044)
Senior manager	0.0444***	-0.0110	0.0171**	0.0033	-0.0026	-0.0201***
	(0.0091)	(0.0077)	(0.0077)	(0.0049)	(0.0076)	(0.0046)
Senior executive	0.0201	-0.0410***	-0.0078	-0.0180***	-0.0303***	-0.0268***
	(0.0153)	(0.0099)	(0.0109)	(0.0050)	(0.0113)	(0.0060)
Promoted$_t$	0.0213***	0.0121**	0.0168***	0.0050	-0.0024	-0.0018
	(0.0055)	(0.0058)	(0.0049)	(0.0034)	(0.0054)	(0.0041)
Subdivisional move$_t$	0.0116	0.0455***	0.0474***	-0.0011	0.0244	-0.0025
	(0.0125)	(0.0162)	(0.0145)	(0.0071)	(0.0162)	(0.0099)
Observations	23292	23292	23292	23292	23292	22606
Pseudo R^2	0.12	0.04	0.04	0.10	0.08	0.06

Marginal effects reported. Reference category: ^{a} Non-exempt employees.

Additional control variables include education, tenure, and year. Robust standard errors in parentheses.

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

Table 4.6: Probit regression results for training categories

4.6 Performance Effects of Training Participation

To analyze the performance effects of classroom training participation on monetary outcomes, we conduct fixed effects regressions with the logarithm of the compensation variables as dependent variable. Our key independent variable is a dummy for training participation in the same or in the previous year. The control variables are identical to those used in the probit and tobit regressions. It is important to note that we exclude job movers in the year of the job change from all regressions.[27]

As previous studies on the effects of intra-firm trainings used fixed wages as productivity measure, we present fixed effects regression results with base salary as dependent variable in table 4.7. Classroom training participation significantly increases individual base salary only in the same year, holding all other factors constant. But the economic effect is very small. An employee who participated in at least one training in year t, attains, on average, a 0.2% higher wage in the same year compared to an employee with the same occupational characteristics that did not participate.[28] To test the robustness of our results, we also estimate the baseline regressions using individual wage growth rates and the percentile rank of base salary as dependent variable. We find no statistically significant effect of training participation in period t and $t-1$ both for wage growth and the percentile rank[29], so that the economically weak effects of training attendance on base salary are confirmed.

For exempt employees, we additionally run fixed effects regressions with the logarithm of short-term bonus payments as proxy of individual performance and find an economically significant short-term effect. As can be seen in column 1 of table 4.8, training participation leads to an average increase

[27] As shown in section 4.5, these employees tend to participate in more trainings compared to job stayers. Promoted employees e.g. receive significantly lower bonus payments and higher base salaries in their first year in the new job. This would bias the outcome of the regressions.

[28] This is equivalent to 120 Euros (based on an annual mean salary of about 58,000 Euros).

[29] These results are available upon request.

Dependent variable:	Ln base salary$_t$		Ind. wage growth$_t$	
	(1)	(2)		
Training participation$_t$	0.0013**		0.0278	
	(0.0005)		(0.0830)	
Training participation$_{t-1}$		0.0000		-0.1036
		(0.0006)		(0.0850)
Observations	31973	21536	19937	21536
R^2 within	0.738	0.726	0.077	0.201

Additional control variables include employee status, age, age squared, tenure, tenure squared, subdivision, education and year. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.7: Fixed effects regression results for base salary and wage growth

in bonus payments in the same year of 3.3%. However, the effect of training participation in period $t-1$ disappears as the coefficient in column 2 is both statistically and economically far from significance. We additionally use the individual growth rate in bonus payments as dependent variable, as shown in columns 3 to 4. Actual training participation results, on average, in an about 7 percentage points higher individual bonus growth rate, compared to employees that did not attend at least one training in the respective year.[30] But having participated in at least one training in the previous year leads to an average decrease in the bonus growth rate of about 9 percentage points, all other factors constant.

To analyze the drivers of the aggregate effects we also include interaction terms between training participation and employee status in the baseline regressions. The results in table 4.14 in the appendix show that the short-term performance effect is not different for the three groups of exempt employees, as the interaction terms are not significantly different from zero at conventional levels.

All these results indicate that training participation has a significant performance effect *only in the short run* and *only for variable payments*. These findings are in contrast to the outcomes of previous studies like Bartel (1995), but support the results by Fahr et al. (2010). We try to give a new explana-

[30] The median bonus growth rate in the data set is 10%.

Dependent variable:	Ln bonus payment$_t$		Ind. bonus increase$_t$	
	(1)	(2)	(3)	(4)
Tr. participation$_t$	0.0329***		0.0660*	
	(0.0076)		(0.0396)	
Tr. participation$_{t-1}$		0.0051		-0.0865**
		(0.0051)		(0.0397)
Ln Salary$_t$	0.8972***	0.4456***	-2.5144	-0.7599
	(0.2567)	(0.1479)	(1.5422)	(0.5674)
Age$_t$	-0.0843	-0.0310	-0.5500**	-0.3253
	(0.0952)	(0.0707)	(0.2298)	(0.2102)
Tenure$_t$	0.1114	-0.0287	0.2864	0.0487
	(0.0938)	(0.0701)	(0.2198)	(0.2073)
Observations	9327	6376	5846	6179
R^2 within	0.17	0.11	0.11	0.12

Additional control variables include employee status, subdivision, education, and year. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4.8: Fixed effects regression results for bonus payments and bonus increase (baseline)

tion for the considerable short-term effect that has not been addressed in the literature so far. As already mentioned, training needs are often integrated into the annual target agreements between a supervisor and its employees. This is especially true for large, international companies. If our company follows a similar personnel development strategy, we would expect that only the *incidence* of training participation matters and not the *number* of attended trainings or the training *composition*. As we have information on different training categories and the number of trainings an employee attended a year, we can directly test the "target achievement" explanation for the short-term performance effects.

Project and leadership trainings are typically most important for junior managers at the beginning of a management career and may therefore be part of an individual target agreement for these group of employees. Hence, we would expect the dummy variables for these training categories to have the largest coefficients in magnitude. The results in table 4.9 indeed show the highest effects of training participation on bonus payments at the end of the

same year for project management (+4%) and leadership trainings (+3.7%), followed by IT (+2.7%) and business administration trainings (+2.2%). Language and technical trainings, however, seem to have no significant effect in the short run.

Dependent variable:	Ln bonus payment$_t$
Leadership$_t$	0.0328***
	(0.0075)
Business Adm.$_t$	0.0256***
	(0.0096)
Project$_t$	0.0369**
	(0.0147)
Language$_t$	-0.0147
	(0.0118)
IT$_t$	0.0289***
	(0.0083)
Technical$_t$	0.0031
	(0.0113)
Number of trainings$_t$	-0.0053**
	(0.0025)
Ln salary$_{t-1}$	0.9295***
	(0.2578)
Observations	9327
R^2 within	0.17

Additional control variables include employee status, subdivision, education, age, tenure, and year.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.9: Fixed effects regression results for logarithm of bonus payments by training category

4.6.1 Number of Trainings and Training Diversity

In a next step we investigate whether an increasing number of trainings or a more diversified training composition have a positive effect on individual

bonus payments in the current year.[31] As can be seen in column 1 of table 4.10, the coefficients for one, two or three attended trainings are very similar.[32] Compared to employees that did not attend any training in a given year, having participated in one, two or three trainings leads to an average increase in bonus payments of 3.2% to 4.3% in the same year, with a peak for participation in two trainings. Hence, a larger number of trainings seems to have no significant effect on performance, rather economically nor statistically. In column 2, the number of training hours is additionally included in the regression model. Comparing two employees with the same number of trainings in a given year, an additional training hour has no significant performance effect, all other factors constant.

These two interesting results support our previous explanation. Having participated in the *first* training in year t leads to a significant increase in bonus payments, whereas one or more additional trainings seem to have nearly the same effect. This suggests, that only the *incidence* of participation matters and not the *number* of attended trainings.

But one may argue that not the number of attended trainings is an important driver for actual performance, but rather the training *composition* may be much more relevant. There are several arguments supporting this hypothesis. Especially for junior managers, who are supposed to lead a project team in the near future, there may be a complementary relationship between different types of trainings as e.g. the benefit of a project management training may be higher if one additionally participates in a leadership training. Also, when participating in more than one training of the same category, a decreasing marginal learning effect can be expected. A more diversified training program would therefore lead to the highest effect.

We are able to test this hypothesis by using the information on the different training categories. Therefore, a variable is generated that counts in how many *different* training categories an employee has attended at least one

[31] We focus on the effect of training participation on bonus payments in the same year, as we found no effects of lagged training participation on performance before.

[32] The hypothesis, that the coefficients for one, two and three trainings are equal, cannot be rejected at conventional levels (Wald test, p=0.4455).

Dependent variable:	Ln bonus payment$_t$	
	(1)	(2)
One training$_t^a$	0.0321***	0.0336***
	(0.0079)	(0.0082)
Two trainings$_t$	0.0432***	0.0439***
	(0.0111)	(0.0120)
Three trainings$_t$	0.0302***	0.0316**
	(0.0114)	(0.0128)
Four or more trainings$_t$	0.0003	0.0040
	(0.0116)	(0.0148)
Training hours$_t$		-0.0001
		(0.0001)
Ln salary$_{t-1}$	0.8989***	0.8972***
	(0.2557)	(0.2577)
Observations	9327	9286
R^2 within	0.17	0.17

Reference category: ^{a} No training. Additional control variables include employee status, subdivision, education, age, tenure, and year. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4.10: Fixed effects regression results for number of trainings

training in a given year.[33] The distribution of this variable is shown in table 4.15 in the appendix. It can be seen that the majority of trained employees participates in trainings of the same category followed by trainings of two different categories, whereas individual training compositions with more than two different categories are not very prominent.

Table 4.11 reports fixed effects regression results with the diversity measure as key independent variable. But again, the coefficients are very similar in magnitude indicating that a more diversified training portfolio has no significant performance effect in the same year.[34]

Discussions with company representatives of the training department revealed that supervisors are generally requested to consider training needs in the annual performance management process and to reach agreements with their subordinates. Therefore, training participation is likely to be one of the individual goals in the target agreement process and thus linked to annual bonus payments.[35] The main focus is on junior manager positions, as these are typical ports of entry for university graduates. Out of this group of employees, successors for higher-skilled management positions are being recruited. These high performers therefore serve as talent pool for the company. As most of them have gained almost no job experience and leadership skills, the average training participation in this group is very high. Therefore, the observed positive effects of trainings in the current year may be attributable to this policy to a high extent. But one year later, the effect disappears, so that trainings do not seem to have a long-term performance effect. This argumentation also fits to the significant reduction in individual growth rates of bonus payments. Employees benefit from successful training participation in the current year, but a year later, the growth rates tend to go back to original levels. A possible reason might be that supervisors increase individual target values after successful training participation. An-

[33] We therefore only include employees who participate either in no or in at least two trainings in a given year.

[34] The hypothesis, that the coefficients on training diversity are equal, cannot be rejected at conventional levels (Wald test, p=0.9483).

[35] Besides individual targets, subdivisional- and company-specific targets are typically included in a target agreement. The weights of these elements depend on the hierarchical level.

other plausible explanation may refer to social preferences. Particularly in the case of "open enrollment" trainings, employees may show reciprocal behavior if they perceive the offer of company-sponsored trainings as a special benefit (Tzafrir (2005)). The reciprocal behavior then may lead to higher efforts in the year of the training, but employees seem to adapt to former productivity level afterwards.

Dependent variable:	Ln bonus payment$_t$
Same category$_t^a$	0.0487***
	(0.0171)
Two different$_t$	0.0482***
	(0.0167)
More than three different$_t$	0.0526**
	(0.0207)
Training hours$_t$	-0.0003***
	(0.0001)
Ln salary$_{t-1}$	0.8799**
	(0.3784)
Observations	7345
R^2 within	0.15

Reference cat.: ^{a} No training. Additional control variables include employee status, subdivision, tenure, age, education, and year. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4.11: Fixed effects regression results for training composition

4.6.2 Absenteeism, Overtime Work and Turnover

As we also have individual information on annual overtime work, absenteeism and turnover, we can further analyze the effects of training participation on these non-monetary job indicators. Information on overtime and absenteeism (both measured in hours per year) is only available for non-exempt employees. An employee works, on average, 11 hours overtime and is absent from work for about 89 hours each year.[36] The variable *turnover probability*, which takes

[36] Absenteeism is defined as absence through illness and other unpaid absence days (exluding absence for holidays).

on the value 1 if the respective employee leaves the company in the following year, is available for all employee groups with an average annual turnover rate of 6%.

Intra-firm training normally takes place during the regular working time which partly reduces the effective working hours of an employee. We therefore expect a positive relationship between training participation and overtime hours. Furthermore, we expect training participation to be negatively correlated with absenteeism, if employees value the participation in training courses more than their day-to-day business. Krueger and Rouse (1998) empirically investigate this relationship on a weekly basis and found a negative effect of training hours on absence time.

Classical human capital theory predicts that, if training increases general human capital, trained employees become more valuable for competitors.[37] We should therefore expect a positive relationship between training participation and turnover, if wages are not increased after training participation. If only firm-specific human capital is acquired, the employee is only valuable to the current employer and the relation with turnover remains unclear. Unfortunately, we are not able to distinguish between general and specific human capital as well as voluntary and involuntary turnover, which would be necessary to closely analyze these mechanisms. When investigating the determinants of training, we found that less productive employees are more likely to participate in training. If training participation improves the performance of these employees, we should expect them less likely to be discharged by the company implying a negative relationship of participation and turnover. Thus, the direction of the hypothesis is not clear.

Fixed effects regression results in columns 1 and 2 of table 4.12 show that actual training participation significantly increases overtime working hours and decreases absenteeism of employees, therefore confirming our hypotheses. Participation in at least one training per year increases overtime work of a non-exempt employee by about 2 hours and leads to a decrease of about 15 absence hours per year (excluding holidays), holding all other factors

[37] According to the theory, training in general human capital will not be financed by the employer. For contrary results see Acemoglu and Pischke (1999).

constant. Note that the size of the coefficient on absenteeism is economically significant. Given that a non-exempt employee earns 24 Euros per hour on average[38] in this company, this effect produces a "recovered value" of about 360 Euros. This result is in line with Krueger and Rouse (1998).

The last two columns report marginal effects of a probit regression with turnover probability as dependent variable. Column 3 reports regression results for all employees, whereas additional controls for bonus payments in column 4 are only possible for exempt employees. The results indicate that employees who participate in at least one classroom training in the current year show a significantly lower turnover probability compared to non-trained employees. This pattern is robust in both specifications and the effects are quite large. Regressions with lagged training participation also confirm these results. The results therefore fit to the hypotheses mentioned above.

Dependent variable:	Overtime work$_t$	Absenteeism$_t$	Turnover probability$_t$	
	(1) FE	(2) FE	(3) Probit	(4) Probit
Train. participation$_t$	1.995***	-15.3956***	-0.0724***	-0.114***
	(0.627)	(2.6541)	(0.0038)	(0.0122)
Ln Salary$_t$	-1.508	14.2949	-0.203***	-0.218***
	(5.340)	(43.0314)	(0.0092)	(0.0698)
Ln Bonus$_t$				0.0402
				(0.0256)
Observations	22481	22481	22892	7470
(Pseudo) R^2 within	0.02	0.01	0.53	0.80

Additional control variables include education, sex, age, tenure, employee status, subdivision and year. Columns 3 and 4: Marginal effects reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4.12: Regression results for overtime work, absenteeism and turnover

4.7 Conclusion

Analyzing the effects of intra-firm training on employee's performance based on company records of a multinational company, we find that the productiv-

[38] This was calculated based on the average annual salary of non-exempt employees divided by 1,776 working hours (222 working days per year*8 hours a day).

ity effects shown by other studies have to be interpreted with caution. There seems to be no clear evidence that training sustainably improves the performance of employees. The data set we use is unique because we have information on monetary performance indicators like individual bonus payments and fixed wages, but also on non-monetary job indicators like absenteeism, overtime work and turnover rates. Additionally, we use information on the relative position of employees in the income distribution to control for possible selection effects and find that less productive employees are more likely to participate in trainings. We show that managers at lower management levels are most likely to participate in classroom trainings. Also, participation is significantly higher for female employees which might indicate a higher necessity of training for women who face interruptions in their professional career mainly due to maternity leaves.

Applying fixed effects regressions to eliminate unobserved heterogeneity between employees we find a positive effect of training participation on fixed wages only in the same year. But this effect is economically insignificant. Using bonus payments as productivity measure, our results show that trainings only have a considerable effect on employee performance in the short run. We argue that this result may be driven by the annual performance management process, as training requirements are typically integrated into target agreements between employees and supervisors especially for junior managers. Further analyses investigating the effects of an increasing number of trainings or a more diversified training composition confirm this explanation as only the incidence seems to be a driver of the short-term performance effect. Another explanation refers to short-term reciprocity behavior of employees.

Besides the unique data set we use, this study has several limitations. First, further research should try to collect more years of company records in order to better evaluate potential long-term performance effects. Also, objective performance measures like sales figures would be helpful to overcome a possible bias in subjective performance evaluations.

Of course, our results may only partly be generalizable because we use a single firm data set. But still, there is a need for analyzing the structure and

benefits of training programs in companies to get a closer understanding of the relevant mechanisms and the mixed empirical results. Future research should focus mainly on personnel records when investigating the effects of training to mitigate possible measurement problems of survey studies.

4.8 Appendix to Chapter 4

Employee status	Lead./Comm.	Language	Bus. Adm.	Project	IT	Tech./Research
Non-exempt	17.52	29.00	14.40	8.82	26.00	13.90
Junior Manager	41.22	22.87	18.35	16.31	24.70	12.41
Senior manager	32.43	20.15	16.70	9.62	17.91	8.17
Senior executive	21.88	20.54	13.84	4.02	15.18	8.48
Total	25.89	26.18	15.76	10.95	24.59	12.77

Other trainings excluded. Numbers are given in percentages.

Table 4.13: Av. training participation (in at least one training) by employee status and category

Dependent variable:	Ln bonus payment$_t$
Training participation$_t$	0.0329***
	(0.0120)
Ln Salary$_{t-1}$	0.8984***
	(0.2566)
Tr. part.$_t$* Sen. manager^a	-0.0031
	(0.0139)
Tr. part.$_t$* Sen. executive	0.0193
	(0.0191)
Observations	9327
R^2 within	0.17

Reference cat.: ^{a} Junior managers. Additional control variables include status, subdivision, education, age, tenure, and year. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.14: Fixed effects regression results for logarithm of bonus payments (interactions with employee status)

Diversity	Freq.	Percent
No training	31,151	82.08
Same category	3,321	8.75
Two different categories	2,664	7.02
More than three categories	818	2.16
Total	37,954	100.00

Table 4.15: Composition of individual trainings

Chapter 5

The Effects of Differentiation on Performance[1]

5.1 Introduction

Most bonus contracts for employees in practice are not based on objective measures of performance but rather on a subjective performance assessment by a supervisor. But it is often stressed (compare e.g. Prendergast and Topel (1993), Murphy and Cleveland (1995)) that supervisors tend to give performance ratings that are too compressed relative to the true performance of their employees. In that case bonus payments presumably will not reward high performance or sanction low performance adequately.[2]

Simple economic reasoning suggests that rating compression should lead to a lower performance as the subordinates' marginal return to effort is reduced. But on the other hand it is sometimes claimed by practitioners that differentiated ratings may destroy employee motivation or "crowd-out" intrinsic motivation. However, there is surprisingly little empirical evidence on this issue so far. In this chapter we therefore study the performance effects of differentiated ratings empirically in a unique large data set spanning different companies from one industry.

[1] This chapter is based upon Kampkötter and Sliwka (2010a).

[2] In the recent Global Workforce Study 2010 by Towers Watson, only 41% of the respondents agree that supervisors differentiate enough between low and high performers.

The question of whether more differentiated ratings increase or reduce employee performance is of high practical importance, as for instance many firms quite controversially discuss methods to increase differentiation in performance appraisals such as so called forced distribution systems.[3] Moreover, as differentiated ratings lead to higher powered incentives this study also adds to the still rather scarce empirical literature investigating the effects of incentive schemes on productivity (Lazear (2000), Knez and Simester (2001), Bandiera et al. (2007), Casas-Arce and Martinez-Jerez (2009)).

The data set we study contains information on individual compensation in the German banking and financial services sector for the years 2005-2007 and is owned by the management consultancy Towers Watson[4]. On average, around 50 companies participated in the survey each year. We use individual information on salary, annual bonus payments, age, firm tenure, functional area, specific function, career ladder and hierarchical level. For a substantial part of the employees in the survey unique personal identifiers are reported such that we can construct a panel data set.

Empirically we observe large differences between various departments (in the same firm or across firms) with respect to the differentiation in bonus payments. In some departments all employees receive the same bonus, in others there are huge differences in the bonus payments made to individual employees at the same job. These differences will of course be driven to some extent simply by differences in ability between the individual employees. But they will also be driven by the personal preferences of the supervisor[5], by characteristics of the appraisal system or by the specific corporate culture of the firm. There are companies that prefer an egalitarian approach paying mainly fixed wages or team bonuses without a strong emphasis on individual performance. Others consider differentiation a key part of their culture. As for instance Jack Welch, who has put a large emphasis on establishing a

[3] For discussions on the controversial issues in the popular press see for instance "Performance Reviews: Many Neeed Improvement" in the *New York Times*, September 10, 2006 or "The Struggle to Measure Performance" in *Business Week*, January 9, 2006.

[4] Formerly known as Towers Perrin.

[5] Kane et al. (1995) for instance show that there are substantial differences between the ratings given by different supervisors to the same employees.

culture of differentiation as CEO of General Electric, puts it "*Differentiation comes down to sorting out the A, B, and C players. [..] Managers who can't differentiate soon find themselves in the C category" (pp. 195).*[6]

The key idea of the paper is the following. The effective power of individual incentives is mainly driven by the extent to which there is differentiation in bonus payments. We therefore measure this power of individual incentives for each organizational unit by computing the coefficient of variation (or alternatively the ratio of the 90th and 10th percentile or the standard deviation of the logs) of the bonus payments. A unit is identified by a unique combination of year, company, module, function, career ladder and hierarchical level. Our key hypothesis is that a higher variation in bonus payments in a certain unit in the previous year should lead to higher bonus payments for an employee in this unit in the subsequent year, holding all other factors constant. Of course, unobserved individual heterogeneity will be an important issue as differentiation will also be driven by the specific amount of heterogeneity in abilities in the different units. To control for this unobserved heterogeneity, we investigate regression models with individual fixed effects.

We indeed find that differentiation on average has a substantial positive effect on individual performance. The effect is also of economic significance: When ranking units by their degree of differentiation the overall model predicts that units in the highest quintile pay about 31% to 36% higher bonuses in the subsequent year than units in the lowest quintile, holding all other factors constant. We also analyze whether the influence of differentiation on individual performance differs between hierarchical levels and functional areas. We find very strong positive effects of differentiation at the highest and intermediate levels. Regarding only those levels, employees in the most strongly differentiating units have an about 30% higher performance than employees in the unit with the weakest differentiation. But surprisingly, we find a reversed or diminishing performance effect of differentiation for the top quintiles at the lowest hierarchical levels. Additionally, differentiation

[6] He also admits "*Differentiation isn't easy. Finding a way to differentiate people across a large company has been one of the hardest things to do." (p. 153) and "[..] we spent over a decade building a performance culture with candid feedback at every level*" (Straight from the gut, p.199).

has the strongest effect in retail banking, where objective performance measures are rather widely available. We also find that differentiation has a much stronger effect on performance for managers than for experts controlling for the level of responsibility.

The chapter proceeds as follows. Section 5.2 provides an overview on the related literature, whereas in section 5.3 the data set and the empirical strategy are described in detail. Sections 5.4 and 5.5 then investigate the performance effects of bonus dispersion for the whole data set as well as for separate subsamples. In section 5.6, robustness checks are presented as well as a first indication on the relationship between differentiation and firm performance. Finally, section 5.7 concludes.

5.2 Related Literature

The design of compensation schemes in companies is always characterized by a potential trade-off between fairness considerations and the provision of incentives. The key question is whether to treat employees equally, i.e. to pay equal wages to all workers, or to reward higher levels of efforts adequately leading to more differentiated pay schemes. Many theoretical and empirical studies only consider dispersion or differentiation in wages, mainly focussing on pay spreads between hierarchical levels. According to the tournament theory (e.g. Lazear and Rosen (1981)), a higher differentiation in agents' income enhances individual performance and that again leads to increased firm performance. Also, large pay gaps are required to motivate employees. But also fairness considerations seem to play a role, as workers compare their own wage with the average wage of a comparable reference group. If their own wage is lower than the perceived fair wage they will decrease effort (see e.g. Akerlof and Yellen (1990)). Wage equity, i.e. a more compressed wage structure, may therefore be beneficial for the organization. Additionally, high levels of intra-firm wage dispersion may induce competition and lead to sabotage efforts (if possible) that negatively affect current or future firm performance (Lazear (1989)). Hence, the question which of these effects will dominate is an empirical one.

Differentiation strategies may be useful as recent studies show the importance of income comparisons between workers and co-workers. Equally-skilled employees care more about their position in the salary distribution of the reference group than about the average reference group income, i.e. a higher rank induces higher effort levels and an individual's rank is the more important determinant of effort (Clark et al. (2010)). Abeler et al. (2010) show in a laboratory experiment that agents who receive the same wage exert significantly lower levels of effort, that are also declining over time, than those who are paid individually by their supervisor. One explanation is the adjustment of effort levels by high performers to the levels of the low-performers in their group as a response to the violation of the equity principle. In contrast, Charness and Kuhn (2007) only find very weak effects of coworker wages on effort levels. But productivity differences between workers in their experiment may have justified a more differentiated pattern of income from an employee's perspective.

There are several empirical studies investigating the relationship between intra-firm wage dispersion and firm performance using company data sets. But these studies report quite mixed results, as some find a positive and others no or even a negative relationship. They all differ in the use of applied dispersion measures (e.g. coefficient of variation, standard deviation,...), indicators of firm performance (e.g. return on equity, sales,...), country, and employee group. Winter-Ebmer and Zweimüller (1999) find a positive relationship between wage dispersion and *firm* performance for Austrian blue-collar workers, while there seems to be a hump-shaped relationship for white-collars. This is in line with the results of Lallemand et al. (2004) and Mahy et al. (2010) for Belgian private firm employees and for most of the industries in the UK manufacturing sector (Beaumont and Harris (2003)). For German manufacturing companies, Jirjahn and Kraft (2007) report a positive relationship, but it decreases in establishments covered by collective wage agreements or with installed works councils. Braakmann (2008), however, finds no significant effect using a linked employer-employee data set for Germany. A negative effect of pay dispersion on total sales per worker is found in a recent study by Martins (2008) after applying worker and com-

pany fixed effects estimates on a sample of Portuguese employees. Grund and Westergaard-Nielsen (2008) follow a different approach and find a negative impact of the dispersion in wage *growth* on firm performance for a sample of Danish firms. Instead of analyzing data on company employees, Pfeffer and Langton (1993) show that wage dispersion in UK academic departments negatively effects research performance output. Using data on professional baseball players, Bloom (1999) finds a positive effect of differentiation on individual performance for higher-ranked team members, but a negative effect of differentiated pay schemes on team performance.[7]

A different strand of literature also takes executive and managerial employees into account. Studies by Main et al. (1993) and more recently by Lee et al. (2008) show a positive influence of greater variation in top executive team salary on company performance in the US. This result is supported by Eriksson (1999) for Denmark as well as by Heyman (2005) using data on Swedish managers and white collar employees. In contrast, Leonard (1990) finds no significant relationship between an increasing variance in total pay and subsequent return on equity for top executive and managerial employees in the US. Also Conyon et al. (2001) show for a cross sectional sample of UK directors that the coefficient of variation in short- and long-term board member compensation has no significant impact on firm performance.

As reported above, these firm-level studies show no clear pattern of the relationship between wage dispersion and *firm* performance. Pay dispersion is often defined as the size of the pay spread between hierarchical (pay) levels in most of the studies or the gap between the CEO and the top management team. Additionally, there are only a few studies that investigate the effect of pay dispersion on *individual* productivity, which is often approximated by alternative measures as indicators of individual performance are rarely available. Drago and Garvey (1998), for example, find a positive relationship

[7] Other studies using sports data are a.o. Mondello and Maxcy (2009) for NFL teams, Richards and Guell (1998), Depken II (2000) and DeBrock et al. (2004) for MLB baseball teams, Frick et al. (2003) for all US major leagues and Becker and Huselid (1992) for professional racing car drivers. The mixed results described above can also be found in these studies.

between pay spread and individual productivity approximated by worker absenteeism for Australian non-managerial employees. Bingley and Eriksson (2001) support this result for Danish managers and non-managerial white collars, whereas no significant effects can be found for blue collar employees. For a sample of US top managers, Bloom and Michel (2002) find a positive correlation between pay dispersion and turnover probability. But many of these studies only use cross sectional instead of panel data sets, so heterogeneity between individuals and firms is not taken into account.

Our study is also very closely related to field and experimental studies analyzing the relationship between subjective performance evaluation, especially supervisor ratings, and individual productivity. Bol (2009) shows that rating compression, here the centrality bias[8], negatively affects the incentives of both above-average and below-average performers in a large Dutch financial services company. This result is supported by Ahn et al. (2010) and Engellandt and Riphahn (2011), who find a positive incentive effect of a higher variability in ratings on future individual performance. In a recent experimental study Berger et al. (2010) analyze the impact of a forced distribution system on individual performance and show that productivity is significantly higher if supervisors are forced to differentiate between employees.

We contribute to the literature by addressing some of the shortcomings of previous studies. Using a unique panel data set, we are able to analyze the performance effects of differentiation for a large sample of non-executive employees in various job positions. We also concentrate on individual bonus payments instead of fixed salaries and compute dispersion measures for a large number of comparable work units rather using only between-level comparisons.

[8] For an overview on rating distortions see e.g. Murphy and Cleveland (1995), Prendergast (1999), or Moers (2005).

5.3 The Data

We investigate a panel data set on compensation in the German banking and financial services sector for the years 2005-2007. The data set is owned by the management consultancy Towers Watson and is used for professional compensation benchmarking.[9] It covers all the largest German banks and financial services companies and contains detailed individual information on base salary, bonus payments, age, firm tenure, hierarchical level (6 levels), functional area, and specific function.[10]

The functional areas represent a broad classification of the main sectors in the banking and financial services industry: Retail banking (RB), asset management (AM), corporate banking (CB), investment banking (IB), private banking (PB), treasury and capital markets (TCM), the typically lower-skilled service functions (corporate services (CS)) as well as the cross-divisional functions (corporate production (CP)). Most of the employees in the data set are working in retail banking and in the service and corporate functions, followed by corporate banking. But we make also use of a much more detailed classification of industry-specific jobs, as these functional areas are subdivided into about 60 specific functions.[11] The distribution of employee-year observations by hierarchical level is shown in table 5.1.

Level	Panel 2005/07	
	Frequency	Percent
6 (highest)	514	1.18
5	6,007	13.78
4	11,150	25.58
3	11,275	25.86
2	12,619	28.95
1 (lowest)	2,029	4.65
Total	43,594	100.00

Table 5.1: Distribution by hierarchical level

[9] Towers Watson (formerly Towers Perrin) data sets have in economics also been used by Abowd and Kaplan (1999), Murphy (1999), and Murphy (2001).

[10] Due to confidentiality reasons, company names had to be anonymized.

[11] A list of exemplary functions is given in table 5.12 in the appendix.

A very useful feature of this data set is the systematic comparability of employee positions across different firms. As the consultancy offers compensation benchmarking services, it applies a standardized job evaluation method to determine the specific function and hierarchical level of a job. Therefore career levels are defined that reflect typical career steps in an individual's career, i.e. they depend on the career progression for the considered job. Each career level is described through detailed profiles of the skills, knowledge and behaviors that are required for that task or position. These levels are then integrated into four career ladders for managerial positions and functional experts (i.e. professional, sales and support). In our sample, about 48% of all employee-year observations belong to the sales ladder, more than 20% to the professional ladder and about 10% are managerial positions.

The empirical strategy is as follows. In the baseline specification we analyze a balanced panel data set to investigate the effects of differentiation within a department on individual performance in the subsequent year. In a first step, we generate cells capturing the organizational units of a company. A unit is characterized by a unique combination of year, company, functional area, function, career ladder and hierarchical level. We restrict our analysis to cells with a minimum number of three observations. Then we compute different measures of bonus dispersion within each unit and for each year: the coefficient of variation, i.e. the ratio of the standard deviation to the mean, the P90/P10 ratio, i.e. the ratio of the 90th to the 10th percentile and the standard deviation of the logs. We include only observations with non-missing and positive actual bonus payments to capture only positions which are eligible for a bonus payment.

The sample is restricted to employees staying at the same hierarchical level, in the same functional area, the same specific function and the same career ladder in their initial company throughout all the years. We therefore obtain a balanced panel data set. This is important to exclude variability in bonus payments due to employee movements like promotion, functional rotation, entry, or exit. Hence, the results of the estimates can not be attributed to changes in an employee's career. In the 2005-2007 panel, about 12,000 individuals can be observed over a three-year period with 1,455 unique

cell-year combinations and a median size of 244 observations per cell.

We then run regressions with employee fixed effects where the log of the individual bonus payment of a person i in a year t is the dependent variable. Our key independent variable is the measure of dispersion (coefficient of variation, P90/P10 ratio, and standard deviation of logs) of bonus payments in year $t-1$ in the relevant cell. Additional control variables include the log of base salary, age, functional area, career ladder and year. In the baseline regressions, we use two specifications to analyze the effects of differentiation: In the first specification, the dispersion measures are included as independent variable in the regression models. To allow for nonlinear effects of differentiation, these measures are further categorized into quintiles and we include dummy variables for each quintile in the second specification.

5.4 Performance Effects of Differentiation

5.4.1 How much Differentiation?

There is substantial variation in the degree of differentiation between the organizational units. Descriptive statistics of the dispersion measures for the balanced panel are shown in table 5.2.

Level	Balanced Panel 2005/07				
	Mean	Median	SD	Min	Max
CV	0.33	0.27	0.20	0	2.06
P90/P10	2.59	1.93	2.76	1	77.28
SD of logs	0.33	0.29	0.18	0	1.90

Table 5.2: Descriptive statistics for measures of dispersion

The lowest coefficient of variation, for example, is 0 and the highest 2.06, with a mean value of 0.33 (median 0.27). Regarding the P90/P10 ratio, we obtain values between 1 and 77.28 with a mean ratio of 2.59 and a median of 1.93. The deciles of the coefficient of variation are displayed in figure 5.1.[12]

[12] Figure 5.5 in the appendix shows the deciles of the P90/P10 ratio.

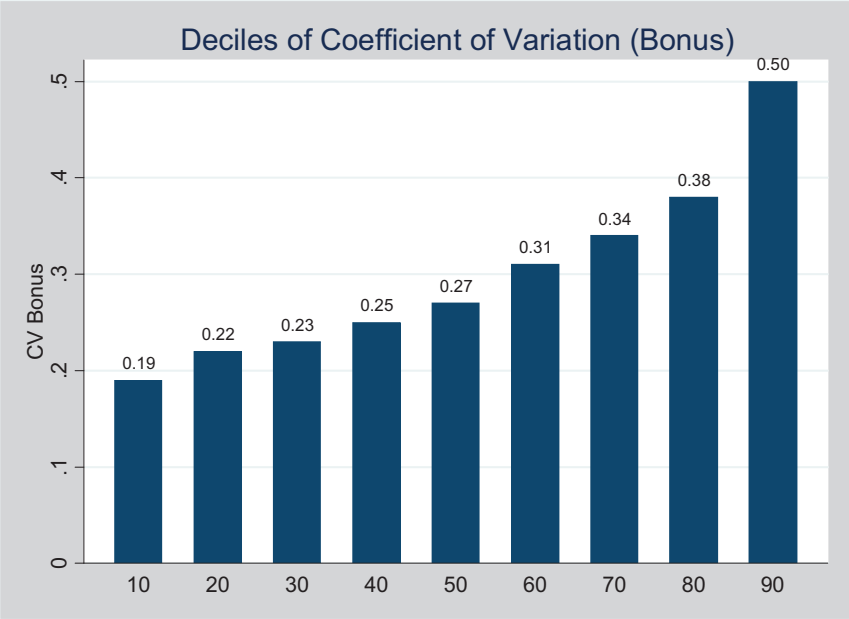

Figure 5.1: Deciles of coefficient of variation for bonus payments

Table 5.3 reports median values of the coefficient of variation and the P90/P10 ratio in bonus payments for the years 2005 to 2007 by hierarchical level. There is a slight tendency that the degree of variation increases with the hierarchical level.

Level	Median Coeff. of Variation			Median P90/P10 ratio		
	2007	2006	2005	2007	2006	2005
6	0.27	0.29	0.33	2.40	2.12	2.24
5	0.34	0.34	0.36	2.32	2.35	2.29
4	0.33	0.30	0.35	2.27	2.17	2.33
3	0.23	0.22	0.21	1.85	1.80	1.76
2	0.26	0.25	0.23	1.91	1.82	1.77
1	0.20	0.25	0.22	1.47	1.93	1.77
Total	0.27	0.27	0.27	1.91	1.90	1.98

Table 5.3: Differentiation over year and hierarchical level

It is interesting to note that there are also differences in the degree of

variation between the broader functional areas as reported in table 5.4.[13] The highest rates of variation in bonus payments can be found in the capital market-based functions treasury and capital markets as well as investment banking and asset management. These areas are also characterized by very high absolute bonus payments. In retail banking, however, we observe the lowest levels of differentiation combined with below-average bonus payments.

Funct. Area	Median Coef. of Variation			Median P90/P10 ratio		
	2007	2006	2005	2007	2006	2005
CP	0.33	0.40	0.38	2.30	2.57	2.48
CS	0.28	0.32	0.30	2.16	2.07	2.21
IB / AM	0.40	0.47	0.49	2.75	2.89	3.33
PB / CB	0.32	0.33	0.33	2.22	2.20	2.24
RB	0.26	0.25	0.23	1.91	1.82	1.77
TCM	0.57	0.54	0.51	4.47	4.49	3.52

Table 5.4: Differentiation over year and functional area

But we also find large differences in the coefficient of variation even within the more detailed specific functions. The coefficient of variation in Human Resources, for example, ranges from 0 to 1.40 between companies, in Marketing from 0.01 to 0.76, in Sales Assistance from 0.02 to 0.92, in Corporate Finance from 0.65 to 0.86, and in IT Generalist functions from 0.03 to 0.44. Similar differences can be found for the other dispersion measures.

Figure 5.2 shows a kernel density plot of bonus payments for the lagged quintiles of differentiation measured by the coefficient of variation.[14] It can be seen that the distribution of bonuses in the lowest quintiles is much more compressed with average values between 3,000 and 6,000 Euros, whereas values above 10,000 Euros are almost not observable. Contrary to that, employees in departments that belong to the upper quintiles are more likely to receive higher bonuses, which are also less compressed.

[13] Due to a small number of observations, the modules investment banking and asset management are pooled.

[14] For reasons of clarity, the figure is censored at a cut-off value of 22,000 Euros, as this is the 90th percentile of bonus payments.

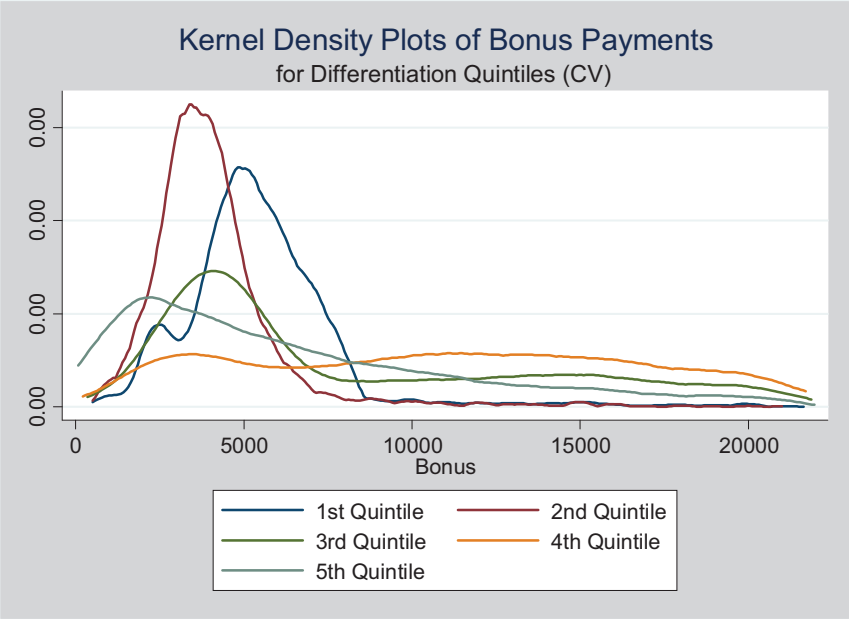

Figure 5.2: Kernel density plot of bonus payments for lagged quintiles of CV bonus

5.4.2 The Aggregate Effect

Table 5.5 reports estimation results of the baseline regressions with individual fixed effects and the logarithm of bonus payments as dependent variable using the balanced panel data set for the years 2005-2007. Key independent variable is the respective measure of dispersion for the relevant cell in the previous year. To account for potential within-cell correlation in the error terms we report robust standard errors clustered on cell-level. All models include the log of base salary, age, firm tenure, level, functional area, function, career ladder, company, and year as further control variables. Recall that our panel includes only employees that did not change the employer, hierarchical level, functional area, function and career ladder throughout the whole period 2005-2007.

The results in table 5.5 show that there is a highly significant positive relationship between differentiation and performance, i.e. an increase in the degree of differentiation in a departments' bonus payments in one year leads

to significantly higher individual bonus payments in the subsequent year for all three indicators. A one standard deviation increase in the coefficient of variation (P90/P10 ratio) leads to an increase in bonus payments of about 10% (7%), all other factors constant. To give some indication about the economic significance of this effect, we ranked all cells by the degree of differentiation and then created dummy variables for each quintile in the distribution of the measures of dispersion. Therefore, additionally to the direct measure of dispersion, the table also reports the results when these dummy variables are included. The coefficient for the $5th$ quintile now gives an estimate of the percentage change in performance when a supervisor who is among the 20% of weakest differentiators moves to the degree of differentiation applied by the 20% strongest differentiators. Note that these effects are quite sizeable. For the coefficient of variation the model in table 5.5 predicts a 31% increase[15] in performance when moving from rather undifferentiated incentives to highly differentiated bonus payments. The coefficients for the P90/P10 ratio and the standard deviation of logs are even slightly higher with a predicted 33% respectively 36% increase in subsequent performance. It is interesting to note that the effects are roughly monotonic in all specifications, i.e. the effects increase when moving from the lowest quintile to the highest one.

We also check whether the results are robust even in years with different economic conditions by using a balanced panel for the years 2006-2008. Due to the first influences of the financial crisis on bonus pools and individual bonus payments, these results may be biased as bonus payments may be reduced in the majority of companies. Additionally in 2008, the consultancy changed the job evaluation method and introduced new functional areas which cannot be perfectly mapped to the older methodology. Therefore, the 2006-2008 balanced panel is characterized by a smaller number of observations, because we have to drop all employees belonging to the new areas. But the main results are basically robust, as can be seen in table 5.13 in the appendix. All dispersion indicators have a positive coefficient and are significant in two of three specifications. The same is true if we include quintiles into the regression model.

[15] Note that $e^{0.2693} = 1.31$. See e.g. Halvorsen and Palmquist (1980) for details.

Dependent variable:	Logarithm of bonus payments					
	Balanced panel 2005-2007					
	Coef. of variation		P90/P10 ratio		Std. dev. of logs	
Differentiation$_{t-1}$	0.5036**		0.0239***		0.6588***	
	(0.2167)		(0.0093)		(0.2009)	
2nd Quintile$_{t-1}$		0.2053***		-0.0541		-0.0548
		(0.0693)		(0.0413)		(0.1443)
3rd Quintile$_{t-1}$		0.1554**		0.1944		0.0564
		(0.0661)		(0.1267)		(0.0636)
4th Quintile$_{t-1}$		0.2271***		0.2525**		0.1673**
		(0.0752)		(0.1200)		(0.0743)
5th Quintile$_{t-1}$		0.2693***		0.2882***		0.3080***
		(0.0959)		(0.1101)		(0.0902)
Ln Base salary$_t$	-0.4566	-0.3418	-0.3394	-0.3740	-0.3886	-0.6278**
	(0.3114)	(0.3387)	(0.2930)	(0.2936)	(0.2927)	(0.2553)
Age	0.0147***	0.0104***	0.0128***	0.0142***	0.0135***	0.0170***
	(0.0030)	(0.0032)	(0.0028)	(0.0007)	(0.0029)	(0.0024)
Observations	25587	25587	25587	25587	25587	25587
R^2 within	0.091	0.064	0.079	0.078	0.092	0.084

Additional control variables are tenure, level, functional area, function, career ladder,company and year

*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors clustered for cells in parentheses

Table 5.5: Fixed effects regression results with measures of dispersion for balanced panel 2005-2007

5.5 Levels, Functional Areas, and Career Ladders

It is important to investigate whether this effect holds when the sample is restricted to different subgroups of employees as the effect of differentiation may depend on the type of job. In some areas it may be rather simple to give differentiated performance ratings, for instance, as objective measures of individual performance are widely available (such as financial performance indicators). But in other areas it is quite difficult to assess the individual performance of employees. In addition, differentiated ratings often automatically lead to relative performance evaluation of employees.[16] As has for instance been pointed out by Lazear (1989), this may even generate incentives to sabotage colleagues and reduce cooperation and teamwork. Hence, it is conceivable that differentiation may even be harmful in certain areas of an organization.

5.5.1 Hierarchical Levels

We start by investigating the effects of the hierarchical level. To do this we first included interaction terms between the measures of differentiation and each of the six hierarchical levels in the baseline regression model. The reference category is level 1, the lowest level in the data set.

These regressions yield some surprising results, which are shown in table 5.6. First of all, the effects of differentiation on subsequent bonus payments are increasing in the hierarchical level an employee is located at. From level 3 upwards, we find a highly significant positive relationship between differentiation and future performance. But the effects seem to be reversed at the lowest levels: differentiation here seems to have a negative overall effect on subsequent performance, even if not all coefficients are significantly different from zero.

We also reran the baseline regressions for subsamples each containing only

[16] This is automatically the case when the supervisors are forced to follow a given distribution of performance grades.

Dependent variable:	Logarithm of bonus payments		
	Balanced panel 2005-2007		
	Coef. of variation	P90/P10 ratio	Std. dev. of logs
Differentiation $_{t-1}$	-0.3756	-0.0221**	-0.1053
	(0.3245)	(0.0109)	(0.3189)
Differentiation$_{t-1}$ × Hier 2	-0.5222	-0.0350	0.7724
	(0.4130)	(0.0573)	(1.0129)
Differentiation$_{t-1}$ × Hier 3	0.2552	0.0295*	0.1716
	(0.4763)	(0.0166)	(0.3657)
Differentiation$_{t-1}$ × Hier 4	1.1694***	0.0426***	0.9289**
	(0.3961)	(0.0153)	(0.4501)
Differentiation$_{t-1}$ × Hier 5	1.2021***	0.0803***	1.0401**
	(0.3677)	(0.0182)	(0.5297)
Differentiation$_{t-1}$ × Hier 6	2.2351***	0.1212***	1.6390***
	(0.7135)	(0.0242)	(0.5761)
Ln Base salary$_t$	-0.1754	-0.2949	-0.3474*
	(0.2707)	(0.2823)	(0.2051)
Observations	25587	25587	25587
R^2 within	0.149	0.095	0.107

Additional control variables are age, tenure, level, functional area, function, career ladder, company and year. [a] Reference category: Level 1

*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors clustered for cells in parentheses

Table 5.6: Interactions between measures of dispersion and hierarchical levels

two adjacent hierarchical levels. The results for the coefficient of variation and the P90/P10 ratio are reported in tables 5.14 and 5.15 in the appendix.[17] The first two columns contain the results for the two highest levels in the sample, columns 3 and 4 for the levels in the middle of the hierarchy and the last two columns for the lowest levels (typical entry levels). These estimates confirm our results because the coefficients for the direct measures of dispersion are the larger the higher the hierarchical level an employee is located at. Analyzing the quintiles of dispersion for the intermediate and upper levels, there is a strong tendency that more differentiation is beneficial for individual performance. For instance, at the highest levels, the 20% strongest differentiators attain subsequent bonus payments which are, on average, more than 30% higher than those of the weakest differentiators. Due to the higher number of observations the results are much more robust for levels 3 and 4. We also can confirm the reversed effects at the lowest levels: differentiation here is harmful, as can be seen in column 5 of tables 5.14 and 5.15. But the effects are non-linear and there is no clear pattern visible: Intermediate levels of differentiation seem to have a positive effect on future performance, as indicated by the positive and significant coefficients of the $2nd$ and $3rd$ quintile in the estimates with the P90/P10 ratio as measure of dispersion. But it is quite interesting to note that the performance effects of the strongest differentiators are negative or almost disappear. The opposite is true for the middle and upper hierarchical levels, where the coefficient for the $2nd$ quintile is significantly negative in estimates with the P90/P10 ratio, as can be seen in columns 2 and 4 of table 5.15. A small increase in the difference between the $90th$ and the $10th$ percentile seems to have a negative effect on subsequent bonus payments. Hence, we may conclude in the spirit of Gneezy and Rustichini (2000) that firms should either "differentiate enough or do not differentiate at all".

Of course it is important to understand why differentiation seems to be harmful or does not show strong beneficial effects at the lowest hierarchical levels respectively. One possible explanation builds on the observation that

[17] Estimates with the standard deviation of logs as dispersion indicator confirm the results presented here.

for jobs at lower levels objective measures of individual performance are very rarely available. As it is well known from the empirical personnel psychology literature (see e.g. Murphy and Cleveland (1995)), subjective performance assessments are often very strongly biased. In that case the incentive effects of differentiated ratings may be weak as those ratings may be very noisy indicators of individual performance and the drawbacks of differentiated ratings may outweigh the benefits. At higher hierarchical levels financial indicators more closely capture the performance of employees. In addition, managers and high-level functional experts are more visible in the organization which makes assessing their performance easier. In that case a higher degree of differentiation indeed may capture differences in true performance and therefore should have stronger incentive effects.

Furthermore, employees within a certain unit typically work closely together at lower levels in the hierarchy. Strong differentiation may then cause within-team competition and therefore can have detrimental effects when cooperation is very important. But managers at higher levels lead separate teams of lower level employees and such detrimental effects of differentiation should be less severe.

5.5.2 Functional Areas

Given the sizeable differences in the effects at the various hierarchical levels we should also expect differences between the functional areas. Recall that most of the employees in our data set are working in the *retail banking* area. This area is, as opposed to the other areas, characterized by a high level of standardized, direct sales activities. Hence, objective measures of individual performance are more readily available making differentiated ratings easier. Furthermore, the structure of the retail banking departments is different as we observe only a small number of cells in this area comprising a large number of employees.

To test if the aggregate results are driven by certain characteristics of the retail banking area, we reran the baseline regressions for a subsample where retail banking is excluded. The results are shown in table 5.7. It can be seen

that the baseline results remain qualitatively unchanged, as each coefficient of the direct measures of dispersion is positive and significantly different from zero. The coefficients of the highest quintiles are even larger than those in the baseline regressions.[18]

Dependent variable:	Logarithm of bonus payments					
	Balanced panel 2005-2007 (retail banking excluded)					
	Coef. of variation		P90/P10 ratio		Std. dev. of logs	
Differentiation$_{t-1}$	0.3923**		0.0196**		0.5943***	
	(0.1898)		(0.0077)		(0.1724)	
2nd Quintile$_{t-1}$		0.1911**		0.0943		-0.0918
		(0.0931)		(0.1133)		(0.1387)
3rd Quintile$_{t-1}$		0.2408***		0.3014**		0.1744*
		(0.0862)		(0.1181)		(0.0907)
4th Quintile$_{t-1}$		0.2252***		0.3034**		0.2623***
		(0.0795)		(0.1221)		(0.0949)
5th Quintile$_{t-1}$		0.2811***		0.4256***		0.3732***
		(0.0818)		(0.1007)		(0.1008)
Ln Base salary$_t$	-0.5152	-0.3884	-0.3400	-0.5868***	-0.3891	-0.6952**
	(0.3983)	(0.3856)	(0.0092)	(0.3023)	(0.2926)	(0.2689)
Age	0.2015***	0.2054***	0.0088***	0.2441***	0.0097***	0.2533***
	(0.0721)	(0.0701)	(0.0033)	(0.0499)	(0.0034)	(0.0477)
Observations	11343	11343	11343	11343	11343	11343
R^2 within	0.115	0.099	0.109	0.147	0.125	0.136

Additional control variables are tenure, level, functional area, function, career ladder, company and year

*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors clustered for cells in parentheses

Table 5.7: Fixed effects regression results with measures of dispersion (retail banking excluded)

In a second step we estimate the performance effects of differentiation for subsamples of the functional areas. Besides *retail banking*, the other analyzed areas include *corporate and private banking* and *corporate services*, which comprise lower-skilled customer support and administration jobs like secretaries and reception desks. We further include *corporate production* containing typical (cross-divisional) support functions such as human resources,

[18] Table 5.16 shows results for the balanced panel 2006-2008 with retail banking employees excluded, which confirm the results presented here.

finance/accounting, marketing, legal, and economics as we expect that in this area it is relatively hard to make differentiated performance ratings and, hence, the effect of differentiation on performance should be weak or even negative. Additional subsamples include *investment banking and asset management* as well as *treasury and capital markets*.

Note that there are substantial differences among the functional areas, as can be seen in tables 5.8 and 5.9. Differentiation has the strongest effect in *private and corporate banking* and *retail banking*, with a one standard deviation increase in differentiation levels leading to about 20% higher bonus payments, all other factors constant. This may not be surprising as these are areas with direct sales activities and objective measures of performance are more readily available making differentiated ratings easier.

Dependent variable:	Logarithm of bonus payments (Panel 2005-2007)					
	CP	CS	IB/AM	PB/CB	RB	TCM
	(1)	(2)	(3)	(4)	(5)	(6)
CV Bonus$_{t-1}$	0.6134***	-0.7232**	0.5870	0.6408***	1.8414***	0.4182
	(0.2246)	(0.3549)	(0.3539)	(0.1598)	(0.6559)	(0.2756)
Ln Base salary$_t$	-0.5745**	-0.2747	-0.3149	-0.1672	-0.3390	-0.4854
	(0.2695)	(0.6715)	(0.2850)	(0.3098)	(0.4344)	(0.2891)
Age	0.2819***	0.0430	0.3874***	0.1866***	0.0075*	0.3134***
	(0.0582)	(0.1127)	(0.0700)	(0.0284)	(0.0039)	(0.0549)
Observations	4041	5131	481	1169	14244	521
R^2 within	0.210	0.099	0.327	0.282	0.173	0.140
1 Std. dev. increase	16%	-14%	20%^{a}	20%	19%	8%^{a}

Additional control variables are tenure, level, function, career ladder, company and year. ^{a} Statistically not significant from zero. *** p<0.01, ** p<0.05, * p<0.1, Robust stand. errors clustered for cells in parentheses

Table 5.8: Fixed effects results for subgroups of functional areas (coefficient of variation)

It is further quite interesting that the effects are positive and sizeable in *corporate production* where we would have expected weaker positive effects as objective performance measures are rather hard to find. We also find a positive relationship between differentiation and performance in *investment banking and asset management* and *treasury and capital markets.* But these results are insignificant in some of the specifications, most likely due to the

small number of observations. Note that we observe a negative coefficient for *corporate services* which includes customer support and administration jobs, again areas in which performance seems very rarely objectively measurable. This effect may partly be explained by the fact that the majority of positions in the service area are low-skilled jobs located at the bottom of the hierarchy.

Dependent variable:	Logarithm of bonus payments (Panel 2005-2007)					
	CP	CS	IB/AM	PB/CB	RB	TCM
	(1)	(2)	(3)	(4)	(5)	(6)
P90/P10 Bonus$_{t-1}$	0.0162	-0.0173**	-0.0123	0.0304***	0.1873**	0.0129***
	(0.0106)	(0.0079)	(0.0194)	(0.0094)	(0.0904)	(0.0041)
Ln Base salary$_t$	-0.5369*	-0.5268	-0.4076	-0.0171	-0.0394	-0.4389
	(0.2750)	(0.7529)	(0.2909)	(0.3890)	(0.3636)	(0.2846)
Age	0.2929	0.0863	0.3617***	0.2115***	-0.0090	0.2741***
	(0.0640)	(0.1232)	(0.0784)	(0.0390)	(0.0069)	(0.0585)
Observations	4041	5131	481	1169	14244	521
R^2 within	0.164	0.029	0.286	0.244	0.155	0.149

Additional control variables are tenure, level, function, career ladder, company and year

*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors clustered for cells in parentheses

Table 5.9: Fixed effects results for subgroups of functional areas (P90/P10 ratio)

Further analyses show that the effect of differentiation varies strongly across hierarchical levels within and between the functional areas. While differentiation in the retail banking area is harmful at the lowest levels in the hierarchy, it has a strong positive effect at intermediate levels. At the top levels the coefficient is negative but not statistically significant. At lower levels, cooperation is important and team incentive schemes are very common, so that higher levels of differentiation are harmful and induce counterproductive effects. This may also explain the negative coefficient in the services area. In corporate banking and private banking, we find very strong positive effects at the top levels of the hierarchy, compared to intermediate levels.

5.5.3 Managers or Professionals

The argument that differentiation is more beneficial for managerial jobs can also be tested differently by making use of an additional feature of the data set: The jobs considered are separated into four different career ladders: one management ladder and three expert/professional ladders (sales, support and professional). Each ladder spans different hierarchical levels. Note that there are experts even at higher hierarchical levels. These are typically employees with a high functional expertise but without general managerial responsibilities. Given the above explanation we expect that differentiation should have the strongest effect on performance in the managerial ladder. To analyze this effects we include interaction terms between the different measures of dispersion and the career ladders into the baseline regression model.

This is indeed confirmed by the results reported in table 5.10, where the professional ladder has been chosen as reference group. Column 1 reports regressions results for all hierarchical levels in the data set. But as some of the career ladders are not present at each level, we also report results for the intermediate levels 3 and 4, where all four ladders can be found.

Dependent variable:	Logarithm of bonus payments		
	Balanced panel 2005-2007		
	All levels	Level 3	Level 4
CV Bonus$_{t-1}$	0.5349***	0.4670*	0.3934***
	(0.1003)	(0.2589)	(0.0781)
CV Bonus$_{t-1}$ × Management^a	1.9988***	1.9296**	2.0963***
	(0.2355)	(0.9695)	(0.1978)
CV Bonus$_{t-1}$ × Sales	-0.5941	-1.5756	2.0067***
	(0.5918)	(1.1532)	(0.6063)
CV Bonus$_{t-1}$ × Support	-1.2788***	-0.9733***	-0.1078
	(0.2760)	(0.3545)	(0.4285)
Observations	25587	6793	6362
R^2 within	0.206	0.158	0.357

Additional control variables are base salary, age, tenure, level, functional area, function, career ladder, company and year. ^{a} Reference category: career ladder professional

*** p<0.01, ** p<0.05, * p<0.1, Robust stand. errors clustered for cells in parentheses

Table 5.10: Interactions with career ladders (coefficient of variation)

The effect of differentiation on individual bonus payments in the subsequent year has, on average, a positive and significant effect for employees in the professional ladder. But this effect is much stronger for managerial employees, as the interaction term is very large. The result seems to be robust in all specifications and both with the coefficient of variation and the P90/P10 ratio as measure of differentiation.[19] The negative effect for employees in support functions is in line with the previous results for the entry positions, as the majority of employees in this career ladder is working at the lowest levels.

To get a deeper understanding of the effects of differentiation on performance *within* the main career ladders, we replicate the baseline model for a subsample of the two largest career ladders, the management and professional ladder. This yields some interesting results. In the management ladder, the highest levels of differentiation result in large increases of bonus payments in the following year, compared to the weakest differentiators. But for functional expert positions, the pattern is quite different. First, the coefficients are much smaller than in the regressions for management employees. And, more interestingly, for professional employees the interaction terms of the $3rd$, $4th$ and $5th$ quintile are very similar. This indicates that higher degrees of differentiation do have a positive effect on performance for expert positions, but not an *increasing* effect at higher levels as compared to the management ladder.

5.6 Robustness of Results and the Effects of Differentiation on Firm Performance

To check the robustness of our results, we replicate the baseline estimates for the coefficient of variation using a panel data set with the organizational unit as panel variable. As explained above, a unit is identified by a unique combination of year, company, module, function, career ladder and hierarchical

[19] The results for the P90/P10 ratio are shown in table 5.17 in the appendix.

level.[20] As the results in table 5.11 show, the positive performance effects of higher differentiation levels can be confirmed, as the values of the quintiles are quite comparable to the results in table 5.5.

Dependent variable:	Log. of average bonus payments Unit-level panel 2005-2007	
CV Bonus$_{t-1}$	0.0805	
	(0.0982)	
2nd Quintile$_{t-1}$		0.0211
		(0.0742)
3rd Quintile$_{t-1}$		0.1360*
		(0.0787)
4th Quintile$_{t-1}$		0.2224***
		(0.0841)
5th Quintile$_{t-1}$		0.2283**
		(0.0921)
Observations	850	850
R^2 within	0.130	0.153

Additional control variables are tenure, function, module, career ladder, ln base salary, age, tenure and year.

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

Table 5.11: Robustness check with collapsed data set

Finally, to rule out that there is a problem of reverse causality we did a simple falsification exercise by running fixed effects regressions with the coefficient of variation as dependent variable and the lagged logarithm of bonus payments as independent variable in the collapsed data set. We use the same set of control variables like in the regressions in table 5.5. The coefficient of the lagged logarithm of bonus payments is insignificant (coefficient 0.0227, p-value>0.1), which supports the idea that differentiation indeed drives performance and not vice versa.

In the previous sections, we focused on the effects of differentiation on *individual* rather than *firm* performance. In a next step we provide first indications on the effect of increasing variation in bonus payments within organizational units on the long-term performance of companies. We therefore

[20] Note that a company comprises several units.

convert our individual-level data set into a firm panel data set[21] and merge it with company information from the BankScope data set, a leading global database of banks' financial statements.[22] For each company, we finally have information on average bonus payments and base salaries, the average value of the coefficient of variation in bonus payments (the mean of all organizational units in a company) as well as firm indicators like the return on average equity (ROE), the return on average assets (ROA) and net income.

In the aftermath of the financial crisis it is often proposed that incentive schemes, mainly in the financial services sector, encouraged excessive risk-taking behavior of employees. This indicates that employees only focussed on short-term goals that were (immediately) payoff-relevant rather than on the long-term performance of the firm. Figure 5.3 shows a scatter plot that depicts the relationship between the return on equity in time t and the coefficient of variation in bonus payments in $t-1$ for the years before the financial crisis.[23] Each marker represents a firm-year observation in the period 2004-2007. It can be seen that there is a positive, linear relationship between firm performance and previous differentiation levels.

We now turn to the first year of the financial crisis and analyze average changes in ROE and ROA from year 2007 to 2008. Figure 5.4 gives a first indication of a negative relationship between average differentiation levels in the pre-crisis period. i.e. average values of the coefficient of variation from 2004-2007, and the growth rate of the return on equity from year 2007 to 2008.[24] Hence, firms that differentiated more between employees in the past show, on average, higher reductions in the ROE change rate with beginning of the crisis, what supports the notion that increased differentiation may have enforced risk-taking behavior. But it is important to note that much more data have to be collected to make robust and statistically significant predictions, as these analyses are only based on a small number of observations.

[21] An observation unit is a company-year combination.
[22] See http://www.bvdinfo.com/Products/Company-Information/International/BANKSCOPE.aspx.
[23] Due to confidentiality reasons, axis labels are not shown here.
[24] Figure 5.6 in the appendix confirms this result for the ROA.

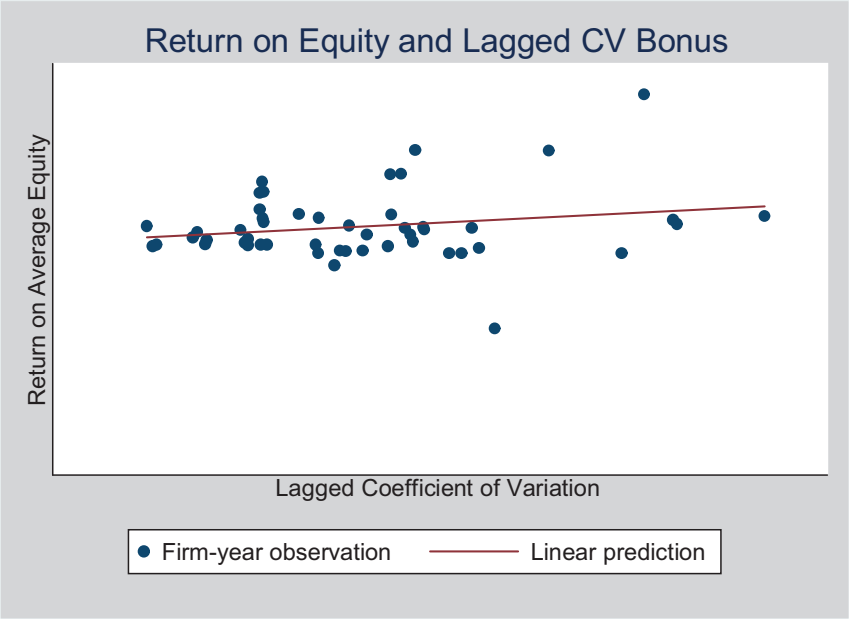

Figure 5.3: Return on equity and lagged CV Bonus (2004-2007)

5.7 Conclusion

We have analyzed the effects of differentiation in bonus payments among employees within organizational units. Standard economic reasoning suggests that differentiation should increase performance, as it implies higher powered incentives. We indeed find a highly significant and economically substantial average effect of differentiation on performance.

However, a more differentiated picture arises when we look at subsamples. The effect is even stronger at higher hierarchical levels. The most striking observation however is that differentiation seems to be harmful at the lowest levels.

The results give some indications for the design of compensation schemes in practice. One implication is that the higher a position in the corporate hierarchy the more firms should strive to enforce differentiated performance ratings, maybe through the introduction of recommended performance distributions or management panels. However, at lower levels it may even be

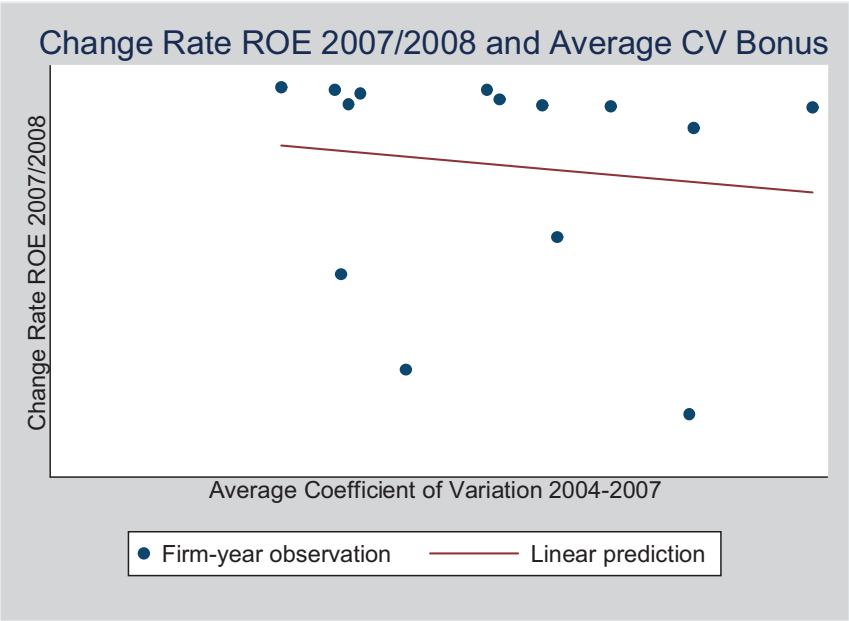

Figure 5.4: Change in ROE from 2007 to 2008 and average CV Bonus (2004-2007)

worthwhile to abandon differentiated bonus payments. For instance, at those levels, team bonus payments that treat employees equally may be an attractive alternative to generate incentives. But of course further research is necessary to explore these questions in more detail.

5.8 Appendix to Chapter 5

Functions	Functions
Asset Allocation	Human Resources
IT Administration / Support	Credit & Approval
IT Applications Development	Corporate/Institutional Relationship
IT Architecture	Legal
Asset Management Support	Middle Market Account Management
Audit	Marketing
Securities & Settlements	Money Markets
Administration / Support	Money Transfers
Cash Management & Custody Service	Strategic Planning & Corp.Development
Corporate Finance	Purchasing
Client Relationship Management	Performance Measurement
Compliance	Project Management
Corporate Affairs	Portfolio Management
Contact Centre	Corporate Banking Product Developm.
Customer Service	IT Project Management
IT Database Analysis & Development	Sales & Marketing
Asset Management Product Development	Corporate Treasury
Dealing	Retail Banking Product Development
Economics	Quality
Equity	Trading Analytics/Modelling
Financial Advice	Risk Management
Fixed Income	Retail Sales
Fund Management	Structured Finance
Finance / Accounting	Sales Assistance
Foreign Operations	Structured Products
IT Business Analysis	Commodity Trading
IT Generalist / Miscellaneous	Technical / Product Specialists
General Management	Training

Table 5.12: Examples of specific functions

Dependent variable:	Logarithm of bonus payments					
	Balanced panel 2006-2008					
	Coef. of variation		P90/P10 ratio		SD of logs	
Differentiation$_{t-1}$	0.6302		0.0445**		0.7972**	
	(0.4650)		(0.0214)		(0.3208)	
2nd Quintile$_{t-1}$		0.1683		0.1417		0.1665
		(0.1320)		(0.0999)		(0.1326)
3rd Quintile$_{t-1}$		0.1408		0.2976**		0.2000
		(0.1691)		(0.1199)		(0.1563)
4th Quintile$_{t-1}$		0.0137		0.1530		0.1120
		(0.2133)		(0.1364)		(0.1923)
5th Quintile$_{t-1}$		0.1931		0.3647***		0.3130**
		(0.1771)		(0.1374)		(0.1572)
Observations	15249	15249	15249	15249	15249	15249
R^2 within	0.025	0.048	0.017	0.079	0.036	0.047

Additional control variables are base salary, age, tenure, level, functional area, function, career ladder company and year. *** p<0.01, ** p<0.05, * p<0.1, Robust std. errors clustered for cells in parentheses

Table 5.13: Fixed effects regression results with measures of dispersion for balanced panel 2006-2008

Dependent variable:	Logarithm of bonus payments (Panel 2005-2007)					
	Level 5+6		Level 3+4		Level 1+2	
CV Bonus$_{t-1}$	0.8956***		0.6496***		-1.0727***	
	(0.1288)		(0.2006)		(0.4025)	
2nd Quintile$_{t-1}$		0.1888		0.0543		0.1366
		(0.1347)		(0.1057)		(0.1509)
3rd Quintile$_{t-1}$		0.1907		0.0630		0.1553
		(0.1633)		(0.1038)		(0.1363)
4th Quintile$_{t-1}$		0.2441		0.2232**		0.1769
		(0.1752)		(0.0930)		(0.2869)
5th Quintile$_{t-1}$		0.3075		0.3235***		-0.0289
		(0.2235)		(0.1032)		(0.2847)
Observations	3540	3540	13155	13155	8892	8892
R^2 within	0.239	0.117	0.165	0.120	0.098	0.027

Additional control variables are base salary, age, tenure, functional area, function, career ladder, company and year. *** p<0.01, ** p<0.05, * p<0.1, Robust std. errors clustered for cells in parentheses

Table 5.14: Fixed effects regression results for hierarchical levels (coefficient of variation)

Dependent variable:	Logarithm of bonus payments (Panel 2005-2007)					
	Level 5+6		Level 3+4		Level 1+2	
P90/P10 Bonus $_{t-1}$	0.0630***		0.0180**		-0.0186	
	(0.0119)		(0.0086)		(0.0221)	
2nd Quintile$_{t-1}$		-0.2027***		-0.1647***		0.0837*
		(0.0420)		(0.0411)		(0.0458)
3rd Quintile$_{t-1}$		0.1926		0.0835		0.3117***
		(0.1666)		(0.0650)		(0.1070)
4th Quintile$_{t-1}$		0.2514		0.2864***		-0.1345
		(0.1563)		(0.0696)		(0.1980)
5th Quintile$_{t-1}$		0.3132*		0.2573***		0.0138
		(0.1697)		(0.0726)		(0.1254)
Observations	3540	3540	13155	13155	8892	8892
R^2 within	0.269	0.118	0.110	0.137	0.008	0.098

Additional control variables are base salary, age, tenure, functional area, function, career ladder, company and year. *** p<0.01, ** p<0.05, * p<0.1, Robust std. errors clustered for cells in parentheses

Table 5.15: Fixed effects regression results for hierarchical levels (P90/P10 ratio)

Dependent variable:	Logarithm of bonus payments					
	Balanced panel 2006-2008 (retail banking excluded)					
	Coef. of variation		P90/10 ratio		SD of logs	
Differentiation Bonus$_{t-1}$	0.7772*		0.0529*		0.8002***	
	(0.4041)		(0.0283)		(0.3065)	
2nd Quintile$_{t-1}$		0.0976		0.1172		0.1704*
		(0.0823)		(0.0826)		(0.1022)
3rd Quintile$_{t-1}$		0.1491		0.1383		0.1433
		(0.1001)		(0.0954)		(0.1104)
4th Quintile$_{t-1}$		0.2372		0.2173*		0.2950**
		(0.1669)		(0.1183)		(0.1431)
5th Quintile$_{t-1}$		0.3151**		0.2946***		0.2817**
		(0.1380)		(0.1100)		(0.1246)
Observations	11483	11483	11483	11483	11483	11483
R^2 within	0.109	0.111	0.088	0.116	0.111	0.123

Additional control variables are base salary, age, tenure, level, functional area, function, career ladder company and year. *** p<0.01, ** p<0.05, * p<0.1, Robust std. errors clustered for cells in parentheses

Table 5.16: Fixed effects regression results with measures of dispersion for balanced panel 2006-2008 (retail banking excluded)

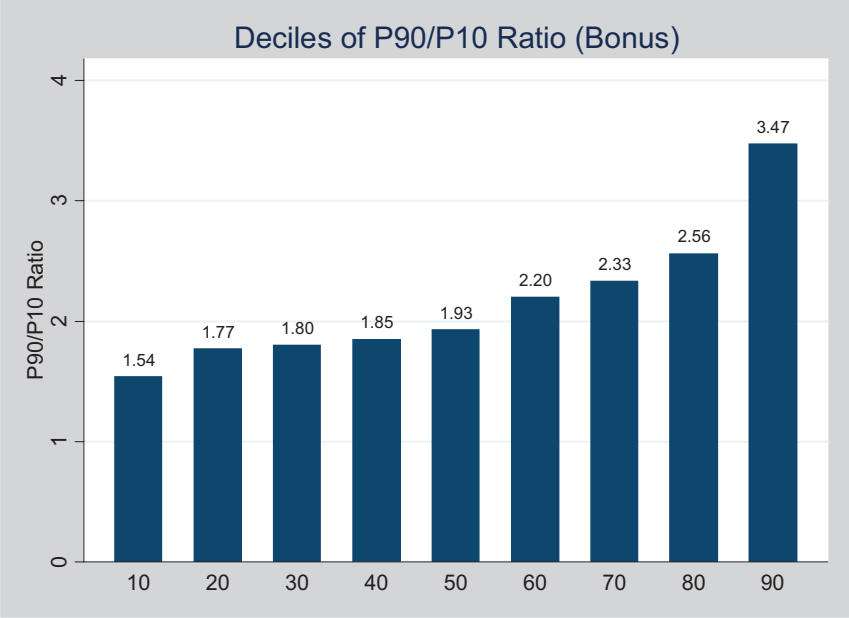

Figure 5.5: Deciles of P90/P10 ratio for bonus payments

Dependent variable:	Logarithm of bonus payments (Panel 2005-2007)		
	Overall	Level 3	Level 4
P90/P10 Bonus$_{t-1}$	0.3627*	0.0109	0.0115*
	(0.1967)	(0.0132)	(0.0062)
P90/P10 Bonus$_{t-1}$ × Management	0.1768***	0.3194***	0.2689***
	(0.0680)	(0.0192)	(0.0746)
P90/P10 Bonus$_{t-1}$ × Sales	0.0091	-0.0109	0.5550***
	(0.0515)	(0.0310)	(0.1593)
P90/P10 Bonus$_{t-1}$ × Support	-0.0431**	-0.0523**	0.0048
	(0.0187)	(0.0245)	(0.0697)
Observations	25587	6793	6362
R^2 within	0.146	0.144	0.298

Additional control variables are age, tenure, level, functional area, function, career ladder, company and year. [a] Reference category: career ladder professional

*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors clustered for cells in parentheses

Table 5.17: Interactions with career ladders (P90/P10 ratio)

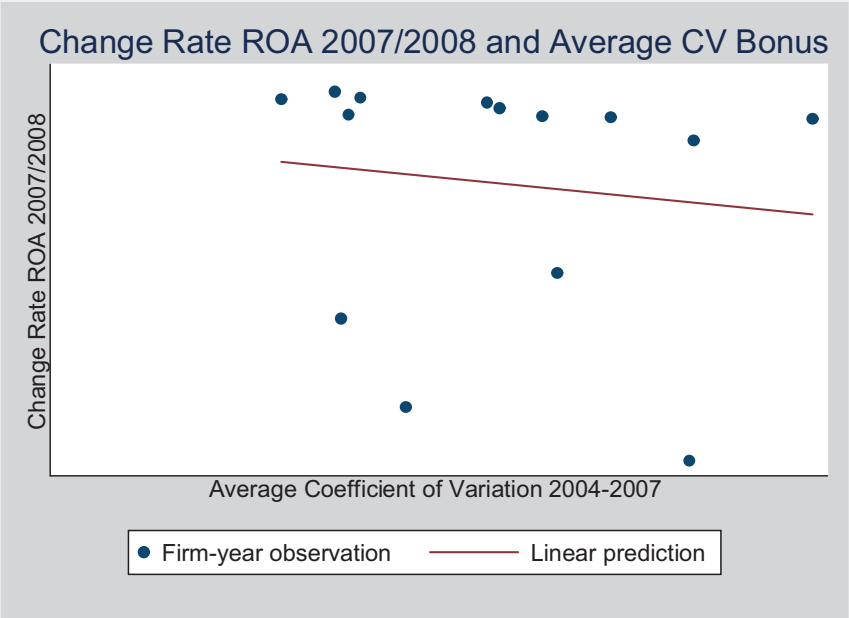

Figure 5.6: Change in ROA from 2007 to 2008 and average CV Bonus (2004-2007)

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