Cross-sectional Earnings Risk and Occupational Sorting: The Role of Risk Attitudes

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Abstract

This paper investigates whether risk preferences explain how individuals are sorted into occupations with different earnings variability. We exploit data from the German Socio-Economic Panel, which contains a subjective assessment of willingness to take risks whose behavioral relevance has been validated in previous work. As a measure of earnings risk, we use the cross-sectional variation in earnings that is left unexplained by human capital in Mincerian wage regressions. By relating earnings risk to the measure of individual risk preference, our evidence shows that individuals with low willingness to take risks are more likely to be sorted into occupations with low earnings risk. This pattern is found regardless of the level of occupation categories, region, gender and labor market experience. We also find that risk preferences are significant determinant of wages in a Mincer regression, illustrating the importance of preferences and attitudes in addition to more standard regressors.

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1 Introduction

Certain occupations are riskier than others. Professions differ in terms of health risks, including risk of injury, fatality, and other health problems, but also in terms of economic risks, such as likelihood of unemployment and earnings variance. There is a large body of evidence suggesting that agents are rewarded for taking occupation-specific risks. Among others, Brown (1980) and Hwang *et al.* (1992) measure a wage premium for jobs with higher fatality and accident risks. Using individual level data, McGoldrick (1995) observes that women working in occupations with higher earnings variance tend to earn higher wages. Murphy and Topel (1987) and Moore (1995) show that wages are higher in jobs suffering from higher unemployment and earnings risk. More recently, Hartog *et al.* (2003) observe that occupations with higher earnings variance pay higher wages. While occupational choice is a risky decision, it is also strongly interrelated with educational choice. This is particularly true in economies with strict occupation-specific education requirements, such as in Germany with its dual education system. In this system educational choices or the choice of an apprenticeship occupation predetermines the subsequent career to a large extent. The decision to jointly sort into a specific education and occupation thus reflects irreversible human capital investments, particularly when occupational mobility is low.

The standard explanation for a positive correlation between market wages and occupational risk is the theory of compensating wage differentials with heterogeneous, risk averse agents. This theory also implies differential sorting into occupations: agents who are more willing to exchange wages for risk will choose to work in riskier occupations, compared to workers who are less inclined to trade off wages and risk.[1] So far, very little is known empirically

[1] Of course, there are other reasons why occupational segregation may occur. In partic-

about how individual attitudes towards risk affect sorting into occupations. The reason is that while risk attitudes play a crucial role in economic theory, they are difficult to measure in practice. DeLeire and Levy (2004) suggest family structure as a proxy for risk preferences. They show that agents in the role of primary care-givers, who are arguably less disposed to take risks, tend to work in occupations with lower risk of death. Ekelund *et al.* (2005) use a psychometric measure of harm avoidance as an indicator of propensity to take risks. Their estimates indicate that agents are more likely to become self-employed, which is considered a more risky occupation than being an employee, if they score high on the measure of harm avoidance.

This paper makes several important contributes to the literature. First, we use a new and direct measure of individual willingness to take risk. The measure is a subjective risk measure and is part of the German Socio-Economic Panel (GSOEP). It has been shown to be a valid predictor of actual risky behavior in an experimental validation study by Dohmen *et al.* (2005). Second, we use a direct measure of economic risk associated with each occupation. Occupational risk is defined as occupation-specific variance in earnings that cannot be explained by returns to human capital as estimated from Mincerian wage regressions.[2] This allows us to analyze sorting into several different occupations characterized by different degrees of economic risk. In contrast, previous work like that by Ekelund *et al.* (2005) focused on the choice between two occupational alternatives (dependent employment and self-employment) that are implicitly assumed to differ with respect to some sort of risk exposure.

Using our two direct measures we establish a positive and highly sig-

ular, willingness to trade off wages for occupational characteristics other than risk may be relevant, for example, flexibility in hours or effort. Occupational sorting might also be driven by demand factors.

[2] This approach follows earlier contributions including McGoldrick (1995).

nificant correlation between occupational risk and individual risk attitudes, controlling for individual characteristics and wages. In other words we find strong support for the hypothesis that individuals who are more inclined to take risks are sorted into occupations characterized by greater variance in earnings. Moreover, we find that this pattern is robust with respect to the level of occupation categories, region, gender and labor market experience.

Our findings have important labor market implications. First, they demonstrate that markets are capable of allocating risks relatively efficiently. Given the complexity of the decisions required to chart a course into an appropriate occupation, the costs of acquiring the necessary information, and the presence of constraints on mobility, it is striking that decentralized decision making in markets generates selection patterns where risk tolerant workers are selected into relatively risky occupations while relatively risk averse subjects are sorted into less risky occupations. Clearly this sorting improves the allocative efficiency compared to a situation without such sorting. Second, we show in our wage regressions that risk attitudes are positively correlated with wages. In our view labor economists have been overly preoccupied with explanations for wages such as education, age or tenure in Mincerian wage regressions. Our finding suggests that we should pay more attention to the importance of preferences, attitudes and personality as factors that determine wages, in addition to the standard factors. Third, the observed sorting pattern offers a potential explanation for the gender wage gap. Given the two facts that women are more risk averse than men (see, e.g., Dohmen *et al.*, 2005) and that wages are higher in more risky occupations, sorting predicts the occurrence of a gender wage gap. A fourth important implication has to do with the fact that pay structures in certain occupations attract individuals that are more or less risk tolerant, which in turn affects performance and

outcomes in these occupations. For example, consider fund managers whose occupation is characterized by a relatively high occupational risk. Given the observed sorting patterns we expect that relatively risk tolerant managers are attracted. As a result, risk tolerant managers determine the portfolio strategy and thus the performance of the fund. Likewise, introducing earnings variation into certain jobs, e.g., certain occupations in the public sector, can help changing the composition of the workforce in these jobs, and consequently the output produced by this workforce. Put differently, by choosing particular incentive schemes or organizational arrangements particular occupations or firms attract a specific portfolio of workers, which may or may not be in the interest of firms. These findings are supported by a complementary laboratory experimental study by Dohmen and Falk (2005) who find that relatively risk averse workers prefer fixed payments over variable payment schemes such as piece-rate or tournament contracts.

The remainder of the paper is organized as follows. Section 2 discusses the measures of individual risk preferences and earnings risk underlying the analysis. Section 3 presents our core results, estimated on a sample of full-time employed men. Section 4 presents results from plausibility and robustness checks based on alternative samples. The paper concludes with a discussion of the implications of our findings and topics for future research.

2 Measures of Risk Preferences and Earnings Risk

In this section, we briefly describe our measure of risk preference, which derives from a survey question in our data source, the German Socio-Economic Panel (SOEP). We then derive our measure of earnings risk from the cross-

sectional variation in earnings observed in the SOEP data.

2.1 Measuring Risk Preferences

The GSOEP is an annual panel survey of the German population representative for the residential German population aged 18 years and older.[3] It collects information on a wide range of personal and household characteristics, including information about employment status, occupation, monthly gross earnings, average weekly working time and overtime, educational attainment, experience, and tenure. In the 2004 wave, which covers 22,019 individuals in 11,803 different households, the survey asked for the first time about an individual's willingness to take risks in general, which subjects where asked to express on an eleven-point scale, with zero indicating complete unwillingness to take risks, and ten indicating complete willingness to take risks.[4]

One could challenge the view that this *self-reported* measure of risk preferences really reflects an underlying trait and is relevant for predicting behavior. There are, however, good reasons to expect that our measure does indeed reflect individuals' risk preferences in a behaviorally relevant manner. The consistency and validity of the responses for actual behavior has been documented by Dohmen *et al.* (2005) in a field experiment with a subject pool that has characteristics comparable to those of the SOEP respondents. In particular, their study shows that the subjective measure of risk attitudes is highly correlated with risk preferences elicited from lottery choices with

[3] For more details on the SOEP, see www.diw.de/english/.

[4] The exact wording of the general risk question (in translation from German) is as follows: "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 0 means: 'completely unwilling to take risks' and the value 10 means: 'fully prepared to take risks'." German versions of all risk questions are available online, at www.diw.de/deutsch/sop/service/fragen/personen/2004.pdf.

real money at stake. The study also provides evidence that risk preferences measured by the survey risk question better predict behavioral outcomes such as portfolio choice, smoking behavior, self-employment, mobility, and traffic offences than risk preferences elicited from hypothetical lotteries. Concerning the stability of preferences, other evidence suggests that risk preferences elicited from lottery choices are stable over time (see, e.g., Barsky *et al.*, 1997 and Harrison *et al.*, 2005).[5]

2.2 Measuring Earnings Risk

Our measure of earnings risk, which we use throughout the paper, is the cross-sectional variation in monthly wages that is not explained by observable differences in individuals' stock of human capital.[6] In particular, we estimate standard Mincer wage regressions, including as explanatory variables measures of human capital such as years of schooling, potential experience and tenure as well as a full set of occupation dummies constructed using the International Standard Classification of Occupations (ISCO) code that is available in our data.[7] We use the occupation-specific variance of the residuals as out measure of earnings risk. This measure reflects the uncertainty that is associated with a particular occupation from an *ex ante* perspective. Alternatively, one could construct individual earnings variability over time. But this variability is the result of past sequential choices and preferences of individuals, so that the derived risk measure would suffer from a severe

[5] See also Ekelund *et al.* (2005) for a discussion of the stability of psychometric measures of risk preferences.

[6] Within-occupation earnings variability that is driven by differences in human capital investments might affect educational choices but should not be perceived as earnings risk from the perspective of a person with a particular stock of human capital.

[7] To obtain reasonably large cell sizes, we group occupations on the broader 3-digit and 2-digit levels, using only the first three or the first two digits of the 4-digit ISCO code, respectively.

endogeneity problem. Our measure of earnings risk, which captures the unexplained cross-sectional earnings variability within an occupation, can be taken as given from an individual's perspective and is therefore a sensible measure for the purpose of this study.

We restrict our sample to prime-age men[8] between 25 and 55 years of age who are full-time employed, and consider monthly earnings only. Since we also want to discard observations of full-time employed men whose wage information is extremely implausible, we drop observations of those in the top 1-percentile and bottom 1-percentile of the wage distribution.[9] We do not consider part-time workers, apprentices, or workers in retirement, as well as those employed in military service or alternative civilian service. We also exclude the self-employed from our sample, because it is unclear whether the earnings definition is appropriate for the self-employed and whether earnings from self-employment and dependent employment are comparable. Moreover, the reported earnings for self-employed are likely to be measured with more error.[10]

Column (1) of Table 1 contains coefficient estimates for a specification of the wage equation, in which the log of monthly net earnings is regressed on a cubed experience term, a squared tenure term, years of schooling, a dummy taking the value 1 if the individual worked in East Germany, a dummy for public sector employment, and on dummies for 2-digit occupations. As one would expect, experience and tenure have a positive but concave effect on

[8] Women are analyzed separately in section 4.

[9] This means that we eliminate subjects with monthly wages for full-time employment of less than 155 Euro (1-percentile), or more than 10,000 Euro (99th percentile). The average monthly wage in our sample is 2440.19 Euro with a standard deviation of 1695.32 Euro.

[10] In fact, we replicated all our analysis including the self-employed, who make up only a small proportion of the sample. We found even stronger results on risk sorting, which are available upon request.

wages. The return to education is around 5 percent; East Germans earn around 30 percent less than West Germans, and employees in the public sector earn around 9 percent less than employees in the private sector.

Insert Table 1 about here.

Since our earnings risk measure depends on the specification of the wage regression, we conduct our analysis with different specifications of the wage equation, which are all presented in Table 1. In general, we find that the coefficient estimates for the variables from specification (1) remain virtually the same. We obtain our first alternative earnings risk measure by augmenting the Mincer wage equation from Column (1) with the survey measure of the individual willingness to take risks. The statistically significant positive effect of willingness to take risks on the level of wages, reported in Column (2), might reflect the fact that more risk tolerant individuals accept riskier jobs within the 2-digit occupation cluster, for which they receive a risk premium. The coefficient estimate does, however, not reflect a compensating wage differential on the occupation level, which would be captured by the occupation fixed effects. Rather it can be viewed to reflect the compensation for an individual's productive trait that is captured by the measure of willingness to take risks. Without a measure of the riskiness of an individual's jobs, one cannot unambiguously ascribe this wage premium to a compensating wage differential. In that sense, this approach is complementary to the findings by Hartog *et al.* (2003). Columns (3) and (4) report estimates of the same specifications as in Columns (1) and (2), but on the 3-digit level of occupations rather than on the 2-digit level. All results are qualitatively and quantitatively the same.[11] From the residuals of these four specifications we

[11] We also estimated all specifications with a measure of log hourly wages instead of

construct our different measures of earnings risk for the 2-digit or the 3-digit occupation categories by calculating the variance of residuals for individuals in a particular 2-digit or 3-digit occupation cell. There are sizable differences in the amount of earnings risks across occupations. The values of our earnings risk measure range from around 0.2 to 0.8 with a mode of around 0.35 and a mean of about 0.4.

The theory of compensating wage differentials would imply that individuals in occupations with higher earnings risk should receive a higher average wage as compensation for bearing more risk. Figure 1 presents a plot of the average earnings risk obtained from specification (2) in Table 1 against the mean residual earnings across 2-digit occupations. There is clearly a positive association between average earnings mark-ups in the 2-digit occupations and earnings variability.[12] This finding complements earlier results (e.g., Hartog *et al.*, 2003).

Insert Figure 1 about here.

However, we do not explore this issue further in this paper. Instead, we analyze in the next section whether more risk tolerant individuals are sorted into occupations with higher earnings variability.

monthly wages as the dependent variable. Again, the results are practically identical, qualitatively as well as quantitatively. Hourly wages are calculated based on self-reported information about regular hours worked per week, including paid overtime, however. This measure is more noisy than monthly earnings since hours are measured with error, and so we concentrate attention to monthly wages as our preferred variable of interest. Detailed results are available upon request.

[12] The plots for risk measures obtained from other specifications of the wage equation, or for a finer definition of occupations, are comparable.

3 Risk Sorting and Occupational Earnings Variability

The key question addressed in our analysis is whether individuals who express a low willingness to take risks are sorted into occupations that exhibit lower earnings risk. To investigate this issue, we proceed in two steps. First we investigate whether a correlation between occupation-specific earnings risk and willingness to take risk exists on the aggregate level, which would be the case if occupational risk sorting actually exists. However, since this approach does not allow us to take individual specific factors into account, we adopt, in a second step, a more disaggregate view and regress occupational earnings risk on individual characteristics of workers who are sorted into their particular occupations. Note that analogous to earlier contributions we assume that the occupational choice decision is motivated by one factor only, namely earnings risk. This risk is assumed to be separable from other factors that might determine occupational choice, like fatality risk, or even certain abilities or preferences. In this respect, our paper complements earlier contributions in the literature that concentrated on other determinants of occupational choice.

The results of the first step of our analysis are summarized by Figure 2, which plots the 2-digit occupation earnings risk, measured by the standard deviation of the residuals from the Mincer regression that was specified in Column (2) of Table 1, against the average willingness to take risks of individuals employed in the respective occupation. The observations are not weighted by cell-size. Evidently, higher average willingness to take risks in a particular occupation is associated with higher earnings risk in that occupation. Such a positive relationship is also found for all our alternative

measures of earnings risk derived from the other three Mincer wage equation specifications of Table 1.

Insert Figure 2 about here.

Since the analysis of unweighted observations in the scatter plot can potentially be misleading, we repeat the analysis in a regression framework in which the observations on the occupation level are weighted by the size of the particular occupation cell. The results from such weighted regressions, reported in Table 2, confirm our first visual impression that average willingness to take risk is higher in occupations that exhibit higher earnings risk. The earnings risk measure that is used as dependent variable in a particular column is based on the residuals from the Mincer wage regression in the respective column of Table 1. The results are strikingly robust across all specifications: the higher the average willingness to take risks expressed by individuals of a given occupation, the higher is the earnings risk in that occupation. The respective estimated coefficients are always highly significant and positive.[13] Moreover, the estimates are somewhat smaller when using information on the 3-digit occupation level rather than the 2-digit level. These results provide first evidence that individuals are sorted into occupations based on their individual attitudes towards risk and the expected earnings variability.

Insert Table 2 about here.

In order to investigate this issue further, we regress our measures of occupational earnings risk on individual risk attitudes, rather than on occupation-specific averages, and vary the specification in terms of other individual or

[13] The coefficients obtained using monthly earnings are larger than those obtained with hourly wages, which might reflect measurement error in reported hours.

job-specific characteristics. To focus the discussion, we report the results for one of our earnings risk measures only, namely the measure that we constructed based on the residuals of the Mincer wage regression specified in column (2) of Table 1.[14] Table 3 contains the results. Columns (1) to (3) of the table present OLS estimates of different specifications. The main result of the analysis is already evident from the coefficient estimate of the general risk attitude in Column (1), which makes clear that an individual's willingness to take risks in general are highly significant and positively associated with the unexplained within-occupation wage variability. The more a person is willing to take risks in general the more likely this person works in an occupation that exhibits higher earnings risk.

A potential problem with the estimate in Column (1) is that we do not control for other factors that determine occupational sorting and might also be related to risk attitudes. In order to see whether the coefficient estimate on risk attitude from Column (1) is robust to controls for observable individual and job-specific characteristics, we add potential experience, tenure, years of education, marital cohabitation, body height[15], a dummy for living in East Germany, and a public sector dummy as explanatory variables in the specification in Column (2). The key result is that the coefficient estimate for willingness to take risk is unaffected. The other coefficient estimates indicate that highly educated individuals are more prevalent in occupations with higher earnings risk; taller and more experienced workers are also significantly more prevalent, but the coefficient estimates are negligibly small.

[14] Results for all other risk measures based on the different specifications in Table 1 are very similar and available upon request. The results are also robust — but somewhat smaller — when the risk measure is based on hourly wages rather than on monthly earnings.

[15] In Dohmen *et al.* (2005) we have shown that height is positively related to willingness to take risks.

East German workers are less likely to be sorted into occupations with high earnings risks, holding constant individual risk attitudes. Moreover, being employed in the public sector is associated with lower occupation-specific earnings risk. This might imply that occupation-specific earnings risk is lower the larger the share of public sector employment. The sectoral choice, public versus private, adds another dimension to occupational sorting if individuals make a joint decision concerning their occupation and whether to work in the public or the private sector. This issue is addressed in detail in section 4 below.

In Column (3), we include log individual monthly earnings as an additional control. Individuals' actual earnings might capture some unobserved characteristics that are also related to occupational choice and willingness to take risk. Irrespective of such a relation, we clearly expect earnings to have a positive effect due to the fact that earnings are on average higher in occupations with greater earnings risk, which has been established above. We are of course aware of the potential endogeneity problem with respect to including monthly earnings as a control variable but think that the potential importance of this variable justifies reporting the results anyway. Not surprisingly, the inclusion of individual earnings takes away some explanatory power from the other controls, and reveals a positive and significant coefficient of the on the earnings variability in a given occupation. The main coefficient of interest, however, remains highly significant.

Insert Table 3 about here.

Given our interpretation of the correlation between individual risk attitudes and occupational earnings risk as the outcome of occupational sorting, a choice model seems a more appropriate estimation framework. Since individuals can, in our context, choose between 28 2-digit occupations, which

can be ordered according to their degree of earnings risk, we also estimate Ordered Probit models for this choice set using the same explanatory variables as in the OLS specifications of Columns (1) to (3). The coefficient estimates, reported in Columns (4) to (6), tell exactly the same story as the OLS regressions. In particular, individual risk attitudes have a strong and significant positive effect on the likelihood of being employed in an occupation with high earnings risk. Higher levels of educational investments and higher earnings both have a significant positive association with employment in occupations with higher earnings risk.[16]

So far, we have assumed that all individuals are employed in their preferred occupation, i.e., implicitly we have treated occupational sorting as an instantaneous effect and assumed that occupations can be changed at no cost. In reality, however, occupational choice is a crucial decision that is not easily modified and change in occupations is not free of charge. Moreover, individuals are typically not fully informed about their career and earnings potential, or even about work conditions when choosing a particular occupation. Hence, it might take time until the process of occupational sorting is completed. It might even be the case that earnings risk is a desirable feature early during this process for given risk preferences. Jovanovic and Nyarko (1997), for example, suggest a so-called bandit model in which workers prefer occupations with high earnings risk early during their career when they still face uncertainty about their talents. Such a model implies job shopping, but also suggests a weaker relationship between risk preference and occupational earnings risk for workers with little labor market experience. Before we address this issue empirically, we also note that a weaker relationship

[16] These findings support occupational sorting according to risk preferences. Given that there is no sorting on other unobservable characteristics like ability or individual earnings risk, OLS estimates of the risk premium are unbiased, see Jacobs *et al.* (2005).

between risk preferences and earnings risk of the chosen occupation would also be weaker if risk preferences were endogenously determined. Our estimates would reflect reverse causality if individuals' stated risk attitudes were determined by exposure to occupational risk. This could occur, for example, from the reduction of cognitive dissonance (Festinger, 1957). Being exposed to high risks causes dissonance for risk averse workers. As a response, workers can either try to find a less risky job or reduce cognitive dissonance by adjusting their preferences and perceptions.

In order to shed light on the question whether a time consuming sorting process, learning, or problems of reversed causality contaminate our previous results, we rerun our analysis separately for sub-samples with different levels of labor market experience (computed as age minus years of education minus 6). In particular, we consider three different samples: Individuals in the bottom quartile of the distribution of potential labor market experience, workers in the upper quartile of the potential labor market experience distribution and, those in the intermediate two quartiles. The respective experience thresholds are less than or equal to 15 years of potential experience (1st quartile), more than 15 but less than or equal to 22 years (2nd quartile), more than 22 but less than or equal to 28 years (3rd quartile), and more than 28 years of potential labor market experience (4th quartile).[17] We construct our earnings risk measure based on the specification of the wage regression in column (2) of Table 1 for 2-digit occupations. Earnings risk can arguably be measured in two different ways, namely either by considering earnings risk for all workers on the occupation level, i.e., using the residuals from the wage regression on the entire sample, or by defining earnings risk specifically for the respective experience category, i.e., by using residuals from separate

[17] Since individuals with the same years of labor market experience are assigned to the same group, these sub-samples differ slightly in size.

wage regressions for the sub-samples. The first measure represents earnings risk in a life cycle context, while the second measure reflects earnings risk for the particular current period in life, which might be more relevant for individuals' actual decisions. We estimate ordered Probit models separately, using both measures as dependent variable, and controlling for individual risk attitudes as well as other explanatory variables as in the last section.

The results of Ordered Probit models in which the dependent variable reflects occupation-specific lifetime earnings risk are displayed in Columns (1) to (3) of Table 4, while the results with earnings risk computed for each experience group separately as dependent variable are tabled in Columns (4) to (6). Irrespective of the earnings risk definition we find only a weak positive but statistically insignificant relationship between risk attitudes and the earnings variability for individuals in the bottom quartile (see Columns (1) and (4)). Such a weak relationship could result from an occupational sorting process as predicted by a bandit model of occupational mobility. But the results also cast doubts on the sorting explanation, suggesting that stated risk preferences might be endogenous. But if risk preferences were endogenously determined, we would expect to find the strongest positive correlation between willingness to take risk and occupational earnings risk for workers in the top quartile of the experience distribution since these workers have been exposed to the respective occupational hazards for the longest period. However, the estimates in Columns (3) and (6) clearly show that this is not the case. In fact, a significant positive relationship between risk attitudes and occupational earnings risk is not found for those who have spent the longest time on the labor market. Instead, the correlation is strongest for the intermediate range of the experience distribution, i.e., for workers with

intermediate levels of labor market experience, see Columns (2) and (5).[18] These findings suggest that occupational sorting according to risk preferences and earnings risk is weak for labor market entrants. But after having collected enough information about their talents and the labor market, individuals seem to sort themselves into occupations (and sectors) that exhibit earnings risk, which they deem adequate given their individual willingness to take risks. A reverse causality explanation seems less adequate given that the correlation appears to be hump-shaped and becomes weaker (and eventually disappears) for larger levels of labor market experience. In order to further examine the robustness of our results, we replicate our analysis on other sub-samples in the next section.

4 Extensions

In order to assess whether our results on occupational sorting according to risk attitudes are robust, we estimate our econometric models for various subsamples, which we construct along three dimensions: public versus private sector employment, region, and gender.

4.1 Public versus Private Sector Employment

The choice between becoming self-employed or working in the private vs. the public sector represents another dimension that might be relevant for risk sorting and that affect earnings risk. Risk attitudes have already been shown to have an impact on the decision to become self-employed in the studies of Ekelund *et al.* (2005) and Dohmen *et al.* (2005). In this paper, we

[18] When conducting the estimation separately for the two intermediate quartiles, we find a weaker relationship between risk attitudes and occupational earnings risk for the third quartile than for the second quartile.

therefore concentrate on the decision between working as a public employee versus working in the private sector.

As a first step, we interpret occupational and sectoral choice as a joint decision, and therefore define occupation-sector cells. We then estimate a Mincer wage equation as specified in Column (2) of Table 1 with dummies for each of the 50 2-digit occupation-sector cells.[19] Based on the residuals from this regression we construct our occupation-specific earnings risk measure. As expected, earnings risk is higher in private sector occupations than in public sector occupations. This measure is then related to risk attitudes in the same way as in section 3. The first column of Table 5 reports results from Ordered Probit regressions, using the same specification as in column (6) of Table 3. The main result is the same as in Table 3: A higher willingness to take risks makes an individual more likely to work in occupations with higher earnings variability. The results also make clear that working in the public sector implies a significantly lower earnings risk than working in the private sector. Additionally, individuals living together with a spouse are significantly more likely to work in an occupation with lower earnings variability. Similar results hold for individuals with less education and longer tenure. Note also that the coefficient estimates for individual willingness to take risk is larger if we do not control for earnings.

The estimates in Columns (2) and (3) are based on separate analyses for public and private sector employment, respectively. In other words, we check whether individuals who have decided to work in a particular sector sort into occupations with different earnings risk within that sector based on their risk attitude. Interestingly the results in Column (2) suggest that

[19] Hence, we treated a 2-digit occupation in the private sector as a different category than the same occupation in the public sector. We end up with 50 non-empty cells since we do not have observations for all occupation-sector cells.

neither risk attitudes nor education play a role for occupational sorting with different earnings risk within the public sector. This could reflect the fact that earnings risks are generally small in all occupations within the public sector. In contrast, the estimates in Column (3) reveal that these attributes have a significant impact on occupational choice within the private sector. These results indicate that risk sorting apparently affects both occupational sorting as well as the choice to work in the private or public sector.

Insert Table 5 about here.

4.2 Regional Variation: East vs. West Germany

In our second extension we investigate whether individuals from East and West Germany exhibit similar patterns of risk preferences and occupational choice with respect to earnings variability in different occupations. This distinction is of particular relevance given the different historical and economic environments in East and West Germany. As was shown by Dohmen *et al.* (2005), individuals who had lived in East Germany prior to the fall of the Berlin wall in 1989 report a slightly higher willingness to take risks than their countrymen who had lived in West Germany.

Wage regressions for individuals who had lived in West Germany prior to 1989 deliver qualitatively and quantitatively extremely similar results to those obtained in the previous section for the pooled sample. If anything, the effects of experience, tenure and years of education are slightly stronger.[20] On the contrary, wage regressions for individuals with East German socialization show slightly smaller wage effects through experience and years of education, but slightly larger tenure effects. Overall, however, the results for

[20] Detailed results are available upon request.

the two sub-samples are qualitatively identical. Constructing an occupation-specific earnings risk measure in the same way as described in section 2, we replicate the analysis from section 4 for these two sub-samples, regressing the occupation-specific earnings risk measure on average risk attitudes of individuals in that respective occupation. For both sub-samples, we find a significant positive association between willingness to take risks and earnings variability, indicating that risk tolerant individuals are sorted into riskier occupations. The effects are somewhat weaker than those obtained for the entire sample, particularly when using hourly wages for the sub-sample of West Germans and monthly wages for the sub-sample of East Germans.

Regressing earnings risk of the chosen occupation on individual risk attitudes, we find virtually identical effects as those reported in Table 3 for both sub-samples. If anything, the results are even stronger for the East German sub-sample compared to our previous results for the pooled sample. In contrast to our earlier findings, the experience effects are smaller and not always statistically significant.

4.3 Gender Differences

All results so far have been obtained with data for prime-age men. A legitimate question is therefore whether similar patterns are found for women as well. As in the analysis using men, we restrict the female sample to women who are between 25 and 55 years of age and full-time employed, and we discard part-time female employment or minor employment. The wage regressions for these women reveal qualitatively identical results as for our male sample. The effect of experience on wages is slightly lower for women than for men, while the effect of years of education is slightly larger. The wage effects of tenure are identical in both samples. Moreover, the Mincerian

framework explains less of the variation in wages than for men, as indicated by the slightly smaller R^2 in the regressions for women.[21]

When regressing the earnings risk measure constructed from the residuals of the wage equation for women on average risk attitudes of women, we find no effect of risk attitudes on the 2-digit occupation level. On the 3-digit level, however, we find a significant positive effect of risk attitudes, which is considerably smaller than what we found for men. Overall, the effects in the female sample are somewhat weaker. They exhibit smaller coefficient estimates and less explanatory power, particularly if hourly wages are used as the earnings measure. Regressions of earnings risk on individual risk attitudes, however, reveal virtually identical effects compared to the male sample, although the effects are slightly smaller.

5 Conclusion

This paper provides evidence that individuals are sorted according to their risk preferences into occupations that differ with regard to earnings risk. We measure risk preferences by self-reported, behaviorally relevant statements about risk attitudes of individuals, and construct an earnings risk measure that reflects the cross-sectional variation in wages that is not explained by observable heterogeneity in human capital investments. The more willing individuals are to take risk in general, the more likely they end up working in an occupation with high earnings risk. As a result of this sorting process, prime-age men employed in a particular sector are on average more willing to take risk the higher the earnings risk of that occupation is.

These results hold regardless whether occupations are defined on the 2-

[21] Detailed results are available upon request.

digit level or on the 3-digit level. They also hold for women. Moreover, we find similar results for East Germans and West Germans. Since the occupational distribution of earnings is reasonably stable over time in Germany, and since it can be taken as given from an individual's perspective, the results strongly suggest that earnings risk is a relevant sorting criterion when individuals with heterogeneous risk preferences make their occupational choice.

Showing the relevance of earnings risks does not mean, of course, that other factors such as fatality risk, various abilities, or preferences are irrelevant for occupational sorting. A more holistic investigation of occupational choice, that takes several relevant dimensions of risk as well as other determinants into account is desirable but beyond the scope of this paper.

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A Tables

Table 1: Results of Mincerian Wage Regressions

	Dependent Variable: log of Monthly Earnings			
	(1)	(2)	(3)	(4)
Experience	0.094***	0.095***	0.093***	0.094***
	(0.009)	(0.009)	(0.008)	(0.008)
Experience^2/100	-0.363***	-0.367***	-0.355***	-0.360***
	(0.045)	(0.044)	(0.044)	(0.044)
Experience^3/1000	0.045***	0.046***	0.044***	0.045***
	(0.007)	(0.007)	(0.007)	(0.007)
Tenure	0.023***	0.023***	0.022***	0.022***
	(0.002)	(0.002)	(0.002)	(0.002)
Tenure^2/100	-0.046***	-0.046***	-0.045***	-0.045***
	(0.006)	(0.006)	(0.006)	(0.006)
Years of Education	0.052***	0.052***	0.048***	0.049***
	(0.003)	(0.003)	(0.003)	(0.003)
East Germany	-0.277***	-0.279***	-0.274***	-0.276***
	(0.013)	(0.013)	(0.013)	(0.013)
Public Sector Employment	-0.087***	-0.086***	-0.095***	-0.093***
	(0.015)	(0.015)	(0.017)	(0.017)
General Risk Attitude		0.012***		0.013***
		(0.002)		(0.002)
Constant	6.435***	6.346***	6.486***	6.392***
	(0.080)	(0.082)	(0.080)	(0.082)
Occupation Dummies				
2-Digit ISCO	Yes	Yes	No	No
3-Digit ISCO	No	No	Yes	Yes
Observations	3621	3612	3621	3612
R-squared	0.55	0.55	0.57	0.58

OLS estimates. Robust standard errors in parentheses; ***, **, * indicate significance at 1-, 5-, and 10-percent level, respectively.

Table 2: Earnings Risk and Average Individual Risk Attitudes

Dependent Variable: Standard Deviation of Occupational Wage Residuals				
	2-digit ISCO Classification		3-digit ISCO Classification	
	(1)	(2)	(3)	(4)
Mean Risk Attitude by Occupation	0.051**	0.047**	0.035**	0.033**
	(0.019)	(0.018)	(0.014)	(0.014)
Constant	0.044	0.065	0.113	0.126*
	(0.095)	(0.093)	(0.075)	(0.073)
Observations	28	28	102	102
R-squared	0.22	0.20	0.06	0.05

OLS estimates. Robust standard errors, allowing for clustering at the 2-digit occupation level, in parentheses;***, **, * indicate significance at 1-, 5-, and 10-percent level, respectively. Dependent Variable in specifications in columns (1)-(2) is standard deviation of wage residuals on 2-digit occupation level, in specifications in columns (3)-(4) on 3-digit occupation level.

Table 3: Earnings Risk and Individual Risk Attitudes

	Dependent Variable: Standard Deviation of Occupational Wage Residuals					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	Ordered Probit	Ordered Probit	Ordered Probit
General Risk Attitude	0.001***	0.001***	0.001**	0.032***	0.030***	0.021**
	(0.000)	(0.000)	(0.000)	(0.011)	(0.010)	(0.009)
Experience		0.000	0.000		0.008*	0.004
		(0.000)	(0.000)		(0.004)	(0.004)
Tenure		0.000	-0.000		0.003	-0.002
		(0.000)	(0.000)		(0.005)	(0.005)
Years of Education		0.004***	0.002***		0.156***	0.110***
		(0.001)	(0.001)		(0.034)	(0.033)
Married living together		-0.001	-0.002		-0.042	-0.100
		(0.002)	(0.002)		(0.069)	(0.071)
Body height		0.000*	0.000		0.007*	0.004
		(0.000)	(0.000)		(0.004)	(0.003)
East Germany		-0.003	0.002		-0.154**	0.040
		(0.001)	(0.002)		(0.074)	(0.079)
Public Sector Employment		-0.004	-0.002		-0.072	0.035
		(0.007)	(0.007)		(0.285)	(0.289)
Log Monthly Income			0.014**			0.548***
			(0.006)			(0.208)
Constant	0.299***	0.219***	0.143**			
	(0.001)	(0.013)	(0.058)			
Observations	4094	3985	3605	4094	3985	3605
R-squared	0.004	0.11	0.13			
Log-Likelihood				-11,895	-11,238	-10,102

Robust standard errors of coefficient estimates, allowing for clustering at the 2-digit occupation level, in parentheses; ***, **, * indicate significance at 1-, 5-, and 10-percent level, respectively. Estimation Method is OLS in columns (1)-(3), and Ordered Probit in columns (4)-(6). Dependent Variable is the standard deviation of occupational wage residuals as obtained from wage regressions of specification (2) in Table 1 on 2-digit ISCO Classification level.

Table 4: Earnings Risk and Individual Risk Attitudes of Different Experience Cohorts

	Dependent Variable: Standard Deviation of Occupational Wage Residuals					
	all experience groups pooled			all experience groups separately		
	1. quartile	2. and 3. quartile	4. quartile	1. quartile	2. and 3. quartile	4. quartile
	(1)	(2)	(3)	(4)	(5)	(6)
General Risk Attitude	0.008	0.033***	0.005	-0.024	0.023**	-0.01
	(0.022)	(0.011)	(0.017)	(0.019)	(0.011)	(0.015)
Experience	0.001	-0.005	0.002	-0.012	0.000	0.014
	(0.017)	(0.007)	(0.016)	(0.020)	(0.006)	(0.012)
Tenure	-0.008	-0.007	0.001	-0.014	-0.008	0.002
	(0.016)	(0.006)	(0.003)	(0.021)	(0.007)	(0.004)
Years of Education	0.150***	0.093***	0.097**	0.112*	0.003	-0.027
	(0.037)	(0.033)	(0.039)	(0.063)	(0.038)	(0.055)
Married living together	-0.046	-0.107	-0.157	0.133	-0.114	0.121
	(0.120)	(0.074)	(0.109)	(0.101)	(0.080)	(0.131)
Body height	-0.001	0.005	0.008	-0.001	0.003	0.01
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.007)
East Germany	-0.170*	0.125	0.178	-0.126	0.124*	0.228
	(0.095)	(0.088)	(0.138)	(0.088)	(0.068)	(0.145)
Public Sector Employment	-0.181	0.081	0.092	0.042	0.126	-0.336
	(0.336)	(0.310)	(0.278)	(0.314)	(0.263)	(0.287)
Log Monthly Income	0.224	0.728***	0.605**	0.091	0.288	0.675***
	(0.213)	(0.227)	(0.255)	(0.164)	(0.232)	(0.260)
Observations	805	1936	864	804	1936	864
Log-Likelihood	-2,216	-5,364	-2,426	-2,238	-5,564	-2,456

Ordered Probit coefficient estimates. Robust standard errors, allowing for clustering at the 2-digit occupation level, in parentheses; ***, **, * indicate significance at 1-, 5-, and 10-percent level, respectively. Dependent Variable is the standard deviation of occupational wage residuals as obtained from wage regressions analog to specification (2) in Table 1 for the respective sample.

Table 5: Earnings Risk and Individual Risk Attitudes

Dependent Variable: Standard Deviation of Occupational Wage Residuals			
	(1)	(2)	(3)
	Public and Private	Public	Private
General Risk Attitude	0.024***	-0.002	0.035***
	(0.009)	(0.018)	(0.008)
Experience	0.002	0.011	0.005*
	(0.004)	(0.007)	(0.003)
Tenure	-0.007*	-0.007	-0.008*
	(0.004)	(0.009)	(0.004)
Years of Education	0.123***	0.146***	0.113***
	(0.022)	(0.046)	(0.032)
Married living together	-0.121*	0.085	-0.191**
	(0.068)	(0.089)	(0.078)
Body height	0.002	0.004	0.003
	(0.003)	(0.005)	(0.004)
East Germany	0.060	0.232	-0.019
	(0.077)	(0.146)	(0.084)
Public Sector Employment	-1.977***		
	(0.408)		
Log Monthly Income	0.451**	0.205	0.437**
	(0.178)	(0.256)	(0.206)
Observations	3601	812	2789
Log-Likelihood	-10,808	-2,151	-7,408

Ordered Probit coefficient estimates. Robust standard errors, allowing for clustering at the 2-digit occupation level, in parentheses; ***, **, * indicate significance at 1-, 5-, and 10-percent level, respectively. Dependent Variable is the standard deviation of occupational wage residuals as obtained from wage regressions on 2-digit ISCO Classification level analog to specification (2) in Table 1 for the respective sample.

B Figures

Figure 1: Earnings Risk and Mean Wage Premium

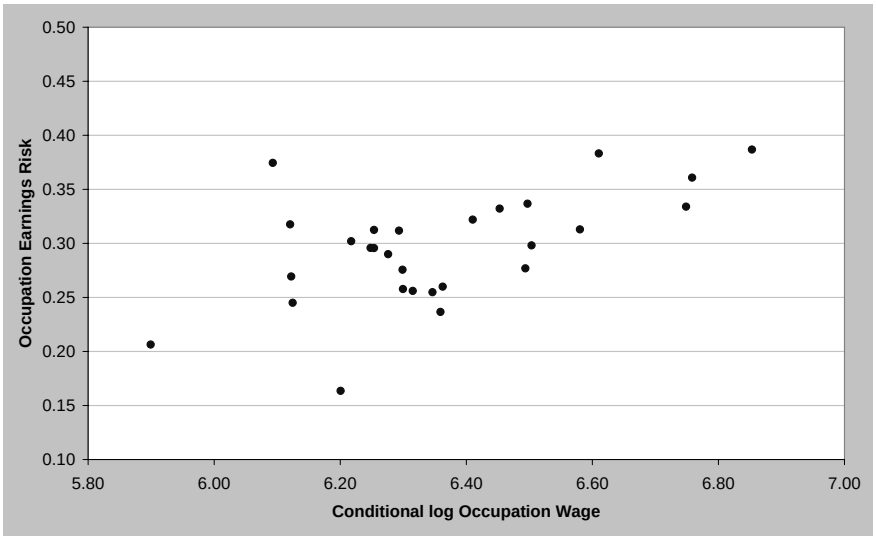

Figure 2: Earnings Risk and Average Risk Attitudes Across Occupations