Precautionary Savings and Self-Selection - Evidence from the German Reunification 'Experiment'

Nicola Fuchs-Schündeln and Matthias Schündeln*

June 25, 2003

Abstract

We combine particular features of the German civil service with the unique event of German reunification to test the theory of precautionary savings and to quantify the importance of self-selection into occupations due to differences in risk aversion. In the presence of self-selection, failing to control for risk aversion in empirical tests of the theory of precautionary savings will result in a bias that could lead to a false rejection of the theory. We exploit the fact that for individuals from the former German Democratic Republic (GDR) German reunification in 1990 caused an exogenous reassignment of income risks. Our findings suggest that self-selection of risk averse individuals into low-risk occupations is economically important and decreases the total amount of precautionary wealth holdings significantly. (JEL classification: D91, E21, J24)

1 Introduction

Three difficulties beset empirical studies of precautionary savings (Browning and Lusardi, 1996). The first and most important is the possible bias in precautionary savings regressions due to unobserved risk aversion[1] in the presence of self-selection.

---

[1]We use risk aversion and prudence as synonyms, as is often done in the literature. Strictly speaking, this is only correct in the case of a CRRA felicity function, as we explain in Section 2.

In the absence of complete insurance, expected future income shocks lead prudent individuals to build up precautionary savings in order to avoid wide fluctuations in the consumption path. The reaction of savings to expected future shocks is stronger, the more risk averse an individual is. Risk aversion might influence not only the savings behavior of an individual facing a stochastic income path, but it can also affect occupational choice in the first place. In particular, risk averse individuals might choose occupations that are associated with less risky income paths, while less risk averse individuals might prefer occupations with higher income risk. Assessing the importance of self-selection of individuals into occupations according to their risk aversion is difficult, since risk aversion is usually unobserved. Yet, failing to control for unobserved risk aversion in regressions of wealth on measures of labor income risk leads to a bias if self-selection takes place, since measures of labor income risk are negatively correlated with the error term, that is capturing the unobserved risk aversion. This could lead to a rejection of the theory of precautionary savings, even if individuals act according to the theory.

The second problem of precautionary savings tests Browning and Lusardi (1996) list is the difficulty of finding a measure of labor income risk that corresponds to the perceived risk of a household. Third, labor income risk must vary enough in the observed sample to identify precautionary savings. The results of existing tests for precautionary savings range from little or no evidence for precautionary savings (e.g., Skinner, 1988, and Dynan, 1993) to substantial evidence for precautionary savings (e.g., Carroll and Samwick, 1998, and Gourinchas and Parker, 2002).[2]

In this paper, we shed light on the empirical relevance of self-selection of risk averse individuals into low-risk occupations. Our approach deals with all three problems of empirical studies of precautionary savings stated above. We use data from the German Socio-economic Panel (GSOEP) and take advantage of specific institutional features in Germany to identify an occupation with observably low income risk that differs significantly from risk in other occupations. In our main contribution to the literature, we exploit the natural experiment of German reunification to demonstrate and quantify the effects of self-selection.

We test for the existence of precautionary savings by testing whether civil servants,

---

[2]Browning and Lusardi (1996) give an excellent overview of the existing empirical literature.

who face low labor income risk, have significantly lower wealth holdings than people in other occupations. The advantage of this approach is that we are able to address the last two challenges listed above. The coincidence of objective and subjective labor income risk is more likely if the risk is determined by the legal situation, as in the case of civil servants, than if the risk is identified by an econometric analysis of the ex post labor income process within an occupation. Further, the status of civil servant is associated with many occupations (e.g., teachers, people working in state or federal bureaucracy, judges and prosecution lawyers, the police corps), so that the subsample of civil servants is large enough to allow for empirical tests.

We are still confronted with the possibility that the choice of occupation might be endogenous. To address this problem, we exploit the event of German reunification. As we show below, in the former German Democratic Republic (GDR), labor income risk was almost completely absent in any occupation. Moreover, occupational choice was often restricted by political considerations. Finally, German reunification in 1990 was not anticipated by anybody until shortly before the event. Hence, we assume that there was no self-selection of risk averse individuals in the GDR into occupations that usually have the status of civil servant in the Federal Republic of Germany (FRG). Yet, after reunification, many people in the corresponding occupations were granted the status of civil servant. We conclude that for individuals who chose their occupation in the former GDR before 1990, occupation is independent of risk aversion. By comparing wealth holdings of the civil servants among these individuals with wealth holdings of individuals in other occupations after the reunification, we are able to identify the amount of precautionary savings in the absence of self-selection.[3]

We have two main findings. First, even without controlling for unobserved risk aversion, precautionary wealth seems to account for a significant part of total wealth: For the full German sample, we infer precautionary wealth in the order of 14% of total wealth. Second, self-selection seems to matter: The precautionary wealth that we infer from a subsample of former GDR households that chose their occupation before

---

[3]Some individuals might have changed their occupation after reunification, thereby introducing some self-selection into the East sample. However, this will make it more difficult for us to find differences between the East and the West samples. If we still find a difference between both samples, this will be a lower bound to the actual effect of self-selection. In Section 5.2 we discuss the consequences in some more detail.

reunification amounts to 22% of total wealth, while in the remaining subsample it accounts for 13% of total wealth. This suggests that risk aversion plays an important role in occupational choice. Self-selection of risk averse individuals into low-risk occupations is an economically important phenomenon, reducing the observed amount of precautionary wealth in our sample of German households by 42% in our most conservative estimates.

In the next section we provide a theoretical framework to demonstrate the empirical implications of the theory of precautionary savings in the presence of self-selection. We review the existing empirical evidence on precautionary savings and on self-selection in Section 3. Next, we describe the German institutional background. Section 5 provides information about the data and the construction of our sample. In the following section we present the results. Section 7 offers sensitivity analyses. The last section concludes.

2   A Theoretical Framework

To establish testable implications for our empirical analysis, we derive the consequences of self-selection in a model of precautionary savings. Following Carroll (1997), we consider an individual that faces a risky labor income path and maximizes the discounted value of future utility from consumption up to period T:

$$\max_{\{C_t\}_{t=0}^{T}} \sum_{t=0}^{T} \beta^t E_0 \left\{ u\left(C_t\right) \right\} \tag{1}$$

subject to the intertemporal budget constraint and a terminal condition:

$$X_{t+1} = R\left(X_t - C_t\right) + Y_{t+1} \qquad \text{and} \qquad X_{T+1} \geq 0 \tag{2}$$

where C_t is consumption, X_t is cash on hand at the beginning of the period, such that $X_t - C_t$ is wealth at the end of the period, Y_t is labor income, β is the subjective discount factor and R is the constant gross interest rate.

Labor income follows the stochastic path $Y_t = P_t \epsilon_t$ with $P_{t+1} = G P_t$ and

$$\log \epsilon_t = \begin{cases} -\infty & \text{with probability } p \\ \sim N\left(\frac{\sigma^2}{2}, \sigma^2\right) & \text{with probability } 1-p \end{cases}$$

4

where P_t is the permanent income component, G is the constant gross growth rate of permanent income, and ϵ_t is a transitory shock to income. Every period, the transitory shock takes on the value of 0 with a small probability p. The expected transitory shock is equal to 1 with probability $1 - p$.[4]

The one period felicity function is of the constant relative risk aversion form:

$$u\left(C_t\right) = \frac{C_t^{1-\gamma}}{1-\gamma} \tag{3}$$

where γ is the coefficient of relative risk aversion. Under this specific functional form, the degree of prudence is equal to $1 + \gamma$.

Carroll (1997) shows that the optimal consumption rules based on this model converge as one goes back in the life cycle if the consumers are impatient. He defines an individual as impatient if in the absence of uncertainty consumption grows slower than income, implying that the individual would like to borrow at young age (see also Deaton, 1991). This is the case if $(R\beta)^{\frac{1}{\gamma}} < G$. Buffer stock behavior is well defined in the case of an impatient individual, since an impatient person would not want to accumulate any savings in the absence of income shocks and abstracting from a retirement period. All savings can therefore be attributed to precautionary behavior.

A closed-form solution of this problem does not exist, and hence we solve it numerically. In a Bellman equation formulation, the problem becomes:

$$V_t\left(X_t, P_t\right) = \max_{C_t}\left\{\frac{C_t^{1-\gamma}}{1-\gamma} + \beta E_t\left[V_{t+1}\left(X_{t+1}, P_{t+1}\right)\right]\right\}$$

subject to (2).

To solve the model, we represent one year as a model period and set the growth rate of permanent income equal to 2%, the interest rate equal to 4%, and the discount factor equal to $\beta = R^{-1} = 0.9615$, such that under perfect foresight the individual would opt for a smooth consumption path. Following Carroll (2001), the probability of a zero income event is set equal to 0.5%. The parameters we are most interested in for our empirical investigation are the coefficient of relative risk aversion and the variance of the income shock. We assume that the coefficient of risk aversion γ is equal

---

[4]The inclusion of an exogenous borrowing constraint would not influence the results. Behavior under an exogenous borrowing constraint mimics the behavior of an individual that instead faces a positive probability of a zero income event, since such an individual never chooses to borrow (Carroll, 2001).
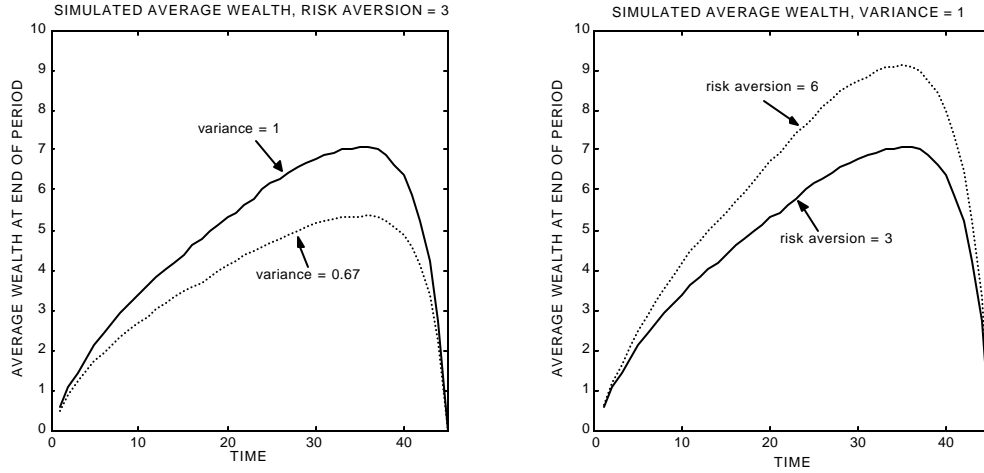
Figure 1: Average wealth holdings over the life cycle

to 3 in the baseline scenario and 6 in the alternative scenario, while the variance of the income shock σ^2 equals 1 in the baseline scenario and 0.67 in the alternative scenario. A life consists of 45 periods, symbolizing the working life from age 20 to age 65, and we abstract from a retirement period.

After having solved the model, we simulate 10,000 life cycle paths, assuming that all agents start life with zero wealth and permanent income equal to 1. The average wealth paths over the life cycle for different variances of the income shock and for different degrees of risk aversion are shown in Figure 1. The main features of the wealth paths are the same in both subplots. Agents accumulate wealth during the first 35 periods of the life cycle, and then start to decrease their wealth holdings. In the last period, wealth holdings reach zero. Since we use saving in some of our empirical estimates to confirm our results, we also depict the behavior of saving (Figure 2). Average saving is declining over the life cycle. Accordingly, consumption is increasing over the life cycle.

Next, we analyze the effects of variations in the parameter values on the optimal behavior. A higher variance of the income shock increases average wealth holdings in every period of the life cycle. In the first 35 periods of the life cycle, higher income risk also increases saving. From period 35 on, dissaving is larger in absolute values for an individual with higher income risk. A higher degree of relative risk aversion has
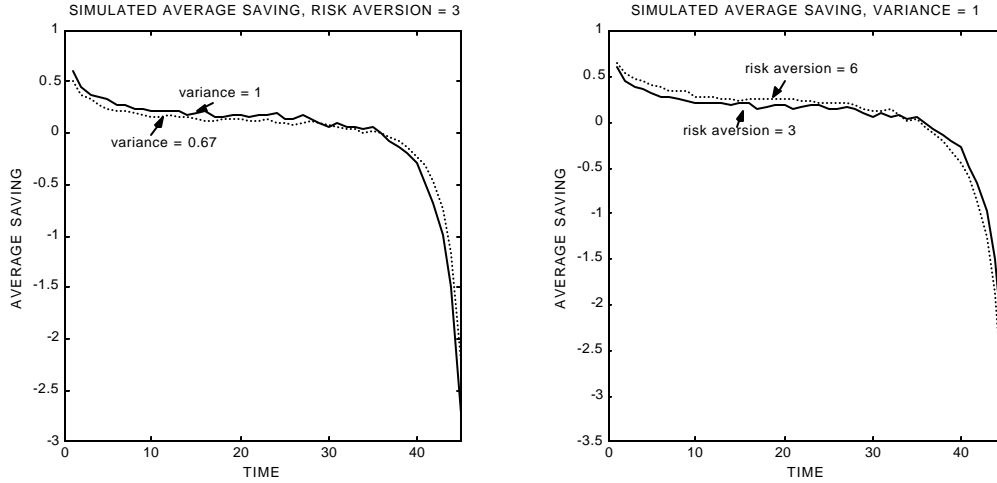
Figure 2: Average saving over the life cycle

the same qualitative effects on wealth and saving as a higher variance of the income shock. As the left panel of Figure 1 shows, the target level of wealth is increasing in income uncertainty. Carroll and Samwick (1998) show that the relationship between income uncertainty, as measured by the variance of the income shock, and the target level of wealth as a ratio to permanent income is close to linear.

Due to the countervailing effects of high risk aversion and low income risk, self-selection of more risk averse individuals into jobs with lower risk and vice versa could make it very difficult for an econometrician to observe precautionary savings. Consider the simulations in Figures 3 and 4, showing average wealth holdings and average saving over the life cycle of two types of individuals in two different types of jobs. One agent type has a high risk aversion of 6 and works in a low risk job with variance 0.67, while the other agent type has a lower risk aversion of 3 but works in a job with the higher variance of 1. The saving and wealth paths displayed for agents in both types of jobs are almost indistinguishable.

So far, we have concentrated on depicting average behavior of individuals over the life cycle. There are two variables in addition to the period of the life cycle that jointly influence the saving rate of the agent in a given period: these are the size of the actual income shock experienced in that period, and the current wealth holdings. To understand the joint influence of wealth holdings and labor income on the saving rate,
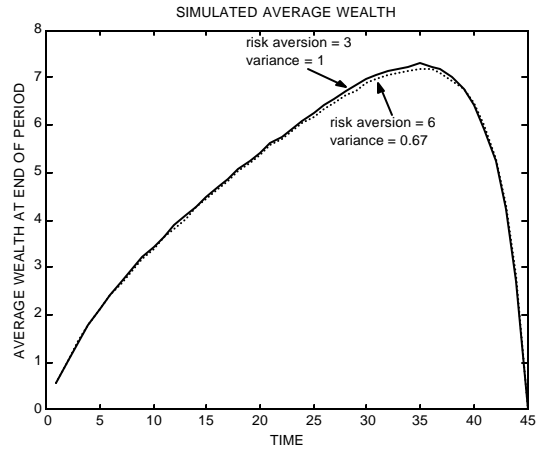
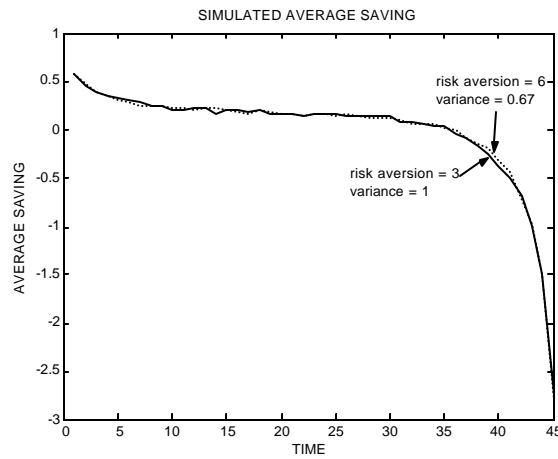7

Figure 3: Average wealth under self-selection

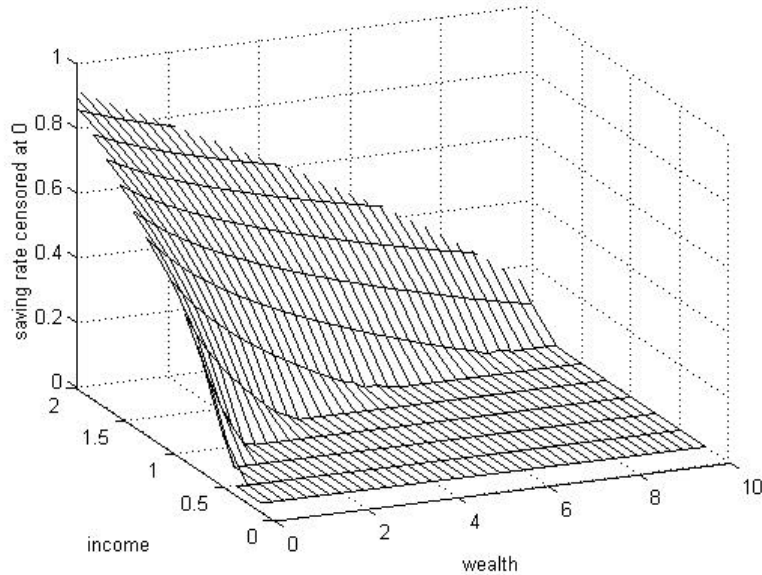Figure 4: Average saving under self-selection

Figure 5: Income, wealth and the saving rate left-censored at 0

in Figure 5 we hold the period of the life cycle constant at 20, and show the average saving rate out of labor income left-censored at 0 as a function of wealth holdings and current income for a given variance of the income shock (here equal to 1) and a given level of permanent income (here equal to 1 in period 1 of the life cycle). The saving rate is increasing in the income shock and decreasing in the wealth level. For a very small income shock, the agent decides to consume everything. If an agent has accumulated considerable wealth, she only starts to save out of a temporary income shock at a higher level of the shock than an agent with less wealth.

We conclude that the theoretical model has the following implications for our empirical work. First, the theory of precautionary savings predicts that, *ceteris paribus*, agents in low risk occupations have lower wealth holdings and lower saving than agents in high risk occupations.

Second, the theory predicts that the effects of risk on wealth and saving are increasing in prudence. If self-selection of agents into occupations according to the unobserved risk aversion takes place, agents in jobs with different risks might show similar wealth paths and saving behavior.

9

Third, we note that the effects of precautionary behavior on wealth holdings are less pronounced at the end of the life cycle, when agents are reducing their assets. Due to the dissaving, the effects of risk on saving are even reversed. Therefore, we should omit the last periods of the life cycle in the empirical analysis of the theory of precautionary savings.

Fourth, in explaining wealth holdings we include permanent income as an explanatory variable, while, as shown in Figure 5, saving depends on actual cash on hand

3 Existing empirical evidence for precautionary savings and self-selection

The very mixed and contradictory empirical evidence on precautionary savings might at least partly be attributable to the challenge of identifying observable and exogenous sources of risk.

Skinner (1988) uses occupation dummies to proxy for risk. However, he does not explicitly assign a specific risk to different occupations. He finds evidence against precautionary savings in the sense that the regression coefficients indicate that self-employed and sales workers save less than craftsmen, although it is commonly assumed that both occupations face a higher income risk. Carroll and Samwick (1998) carefully construct appropriate empirical measures of income uncertainty that correspond to the underlying theory. They conclude that the precautionary motive explains up to 50% of the aggregate wealth accumulation in the US. Similarly, Kazarosian (1997) constructs risk measures from panel data and finds significant evidence for precautionary savings. He estimates that a doubling of income uncertainty would increase the ratio of wealth to permanent income by 29%. Guiso et al. (1992) specifically address the issue that the explanatory variable should ideally be the subjective income risk of each individual. They use self reported measures of earnings uncertainty over a one year horizon from the 1989 Italian Survey of Household Income and Wealth as the measure of income risk. The disadvantage of this measure is that one year ahead forecasts might be too narrow to proxy for lifetime labor income risk. They conclude that precautionary savings account for 2% of overall savings. Lusardi (1998)

finds evidence for the importance of precautionary savings based on subjective risk measures provided in the University of Michigan Health and Retirement Survey. Engen and Gruber (2001) use the fact that unemployment insurance programs differ between the US states and conclude that this helps to explain significant differences in wealth holdings. Reducing unemployment insurance replacements by 50% would increase gross asset holdings by 14%. Moreover, they find that the negative effects of unemployment insurance on asset accumulation are larger for younger workers and those who face a higher unemployment risk, which is consistent with the precautionary savings theory. Gourinchas and Parker (2002) use a structural estimation to find that around 65% of liquid wealth is due to precautionary reasons.

In one of the few studies that try to assess the importance of the self-selection bias while testing for precautionary savings, Lusardi (1997) employs years of experience and regional unemployment rates as instruments for subjective income risk. While a simple OLS-regression suggests that precautionary savings account for only 2% of overall savings, the instrumental variable regressions rather point towards 20-24%. Lusardi concludes that while part of this difference might be attributed to measurement error, part is probably due to the self-selection bias. Dynan (1993) estimates a very small degree of prudence in a consumption growth estimation. She tests the overidentifying restrictions to assess whether self-selection drives this result, but she cannot reject the restrictions, concluding that self-selection does not play an important role.

In the only study that we are aware of that directly tests whether risk aversion influences occupational choice, Cramer et al. (2002) determine the degree of risk aversion of a sample of individuals based on a lottery question. They analyze whether this measure of risk aversion helps to explain the occupational status of the individuals, namely being an employee versus self-employed. They find that the average degree of risk aversion of self-employed is significantly lower than the average degree of risk aversion of employed.

4 Institutional background

Our analysis relies crucially on two identification assumptions. First, we argue that civil servants face significantly lower labor income risk than non civil servants. Second, we reason that self-selection into occupations according to risk aversion can be excluded to a large extent for people who chose their jobs in the former GDR. In this section, we describe the institutional environments on which we base our claims.

4.1 Civil service

The privileges and duties of German civil servants are regulated in federal and state laws on civil servants (*Beamtengesetz*), while categories for salaries are defined in another law (*Besoldungsgesetze*). The actual salaries are determined by the states or the federal government respectively. Salaries depend on the category of the position that a civil servant occupies, on her age and family situation. The federal law (paragraph 26) states that a civil servant can only be transferred into a new position if her wage does not decline due to the transfer. A civil servant can only be dismissed if she is convicted to at least one year in prison for any criminal charge, or if she is convicted to six months in prison for charges associated with homeland security (paragraph 48). Unemployment has become a fairly severe problem in Germany since the 1990s. From 1992 to 2001, average unemployment rates amounted to 8.2 percent in the west and 16.4 percent in the east, leading to an overall average unemployment rate of 9.8 percent.[5] The average duration of unemployment spells in the years 1992 to 2001 was around 11 months. One third of all unemployed were unemployed for more than a year during this period. From 1997 to 2001, of those unemployed for more than a year, 50% were 50 years or older. Although unemployment insurance payments are more generous in amounts and duration in Germany than for example in the US, long unemployment spells still lead to significant income reductions.[6] For

---

[5]In West Germany, average unemployment rates amounted to 7.9% in the 1980s, 2.8% in the 1970s, 1.0% in the 1960s, and 6.7% in the 1950s.

[6]An unemployed fulfilling certain requirements receives "*Arbeitslosengeld*" ("unemployment money"), currently amounting to 60% of the last net income (67% with children). "*Arbeitslosengeld*" is paid for a certain amount of time from at least 180 days up to 960 days, depending on age and contribution history. After this time, an unemployed can receive "*Arbeitslosenhilfe*" ("unemployment support"), which pays lower amounts (currently 53% of the last net income or 57% with children) and requires an eligibility check, incorporating wealth and incomes of other households members. In

older unemployed, it is especially hard to reenter into employment after long spells of unemployment, and they often end up entering early retirement. The foregone income due to unemployment does in these cases not only exist in the difference between labor income and unemployment insurance payments, but also in the lost retirement income due to a much shortened employment spell. The yearly unemployment incidence averaged 24.6 percent from 1993 to 2001. One can conclude that unemployment risk constitutes a significant labor income risk in Germany. Consequently, due to life tenure, the labor income risk of a civil servant is much smaller than the labor income risk in other professions.

The nominal salary of a civil servant is completely sticky downward. Yet, also the variations of the base salaries of civil servants (disregarding variations based on the family situation) are narrow. All positions belong to one of four categories (called *unterer, mittlerer, gehobener,* and *höherer Dienst*) and the crossing into a higher category is difficult, often requiring further formal education (e.g., obtaining a university degree). Within the categories, there are subcategories for which the upper and lower salaries are defined by decree. Since an individual can assess from the beginning of her civil servant career which categories she can hope to achieve in her life given a certain educational level, and because she can check the according current salaries in public tables, a civil servant can predict her future income path better than people in other professions. Nominal salaries of civil servants rise on average at a similar rate as nominal salaries of non civil servants, and hence low nominal wage risk translates into low real wage risk.[7] In appendix B, we show that, in addition to being able to predict their future incomes better than non civil servants due to institutional reasons, civil servants also face lower income variations than non civil servants.

Indirect evidence for lower labor income risk of civil servants can be derived from their choices. Civil servants are more likely than any other occupational group to own a house, except for self-employed. In western Germany, this difference is far more pronounced than in the East, and civil servants are even slightly more likely to own a house than self-employed excluding farmers. In western Germany, 65.1%

September 2001, 44% of the unemployed received "*Arbeitslosengeld*", and 40% "*Arbeitslosenhilfe*".

[7]In our sample, the average nominal salaries of non civil servants rose by 26% from 1992-2000, while the average nominal salaries of civil servants rose by 27%.

of all civil servants owned a house in 1998, while the number was 64.6% for self-employed excluding farmers, 49.1% for white collar workers, 45.8% for blue colllar workers, 28.2% for unemployed and 44.1% for people not in the labor force (Münnich 1999).[8] Compared to other European countries, home ownership is less frequent in Germany, and as a result the housing market is not very liquid. As a consequence, most people tend to buy houses only if they forecast that they won't have to sell in the medium future. We argue that the comparatively high home ownership rate of civil servant households gives further evidence that their job security is significantly higher than for the rest of the population. In appendix C, we show probit estimates that corroborate this interpretation.

Our conclusion that civil servants face lower income risk than people in other occupations is only valid if civil servants do not opt out of the civil service frequently. While they cannot be dismissed, civil servants can still choose to end their contract and enter another occupation. Since they do so voluntarily, this decision might be anticipated, and hence the individual income risk that a civil servant who contemplates to leave civil service faces is not necessarily lower than the individual income risk of a person in another occupation. In our data set, we estimate that 9.2 % of civil servants leave civil service during the years 1992 to 2000. This number is lower than for any other occupation. 16.7% of white collar workers, 24.3% of blue collar workers, and 14.3% of self employed change occupation during the years 1992 to 2000 in our data set. Of those civil servants leaving civil service, 34% are younger than 30 years old.[9] Most of these probably did an apprenticeship in the civil service, but were not offered a permanent position afterwards.[10] An apprentice is granted the status of "civil servant on probation", which is valid only during the years of the apprenticeship, i.e. usually two to three years. Since we focus in our main empirical analysis on

---

[8]This information is taken from the Income- and Expenditure Survey 1998 (see appendix A.4 for a detailed description), but is also reflected in the GSOEP data. In the East, the numbers were 52.9% for self-employed excluding farmers, 41.1% for civil servants, 40.2% for white collar workers, 39.8% for blue collar workers, 24.8% for unemployed, and 23.4% for people not in the labor force. The differences are presumably much smaller due to housing choices and allocation before reunification.

[9]Of the white collar workers changing occupations, only 18.6% are younger than 30 years old, while for blue collar workers this number is 23%, and for self-employed 15.4%.

[10]This is especially frequent for teachers, who after their university education get 2 years of practical training as civil servants on probation. While anyone is guaranteed a position for the practical training, many graduates of the program are not offered a permanent position afterwards.

people older than 30 years, these apprentices do not enter our sample. We conclude that only a small percentage of civil servants opt out of civil service, and hence our identifying assumption that civil servants face lower individual lifetime income risk is valid.[11]

4.2 Occupational choice and occupational characeristics in the former GDR

Occupational choice in the former GDR was to a certain extent restricted. In practice, the most obvious intervention in occupational choice occurred in university admittance. Only a certain quota of students was allowed to complete the last two years of high school which were necessary to attend university. Additional criteria besides qualification were the membership in the official GDR youth organization (FDJ), the political opinion in accordance with official government positions, and the family background. Children from working class families were given priority in attending university (Hille, 1991). The income disparity in the GDR was very small compared to the Federal Republic of Germany (FRG). In 1988, the average net income of people with a university degree was only 15% higher than that of blue collar workers, compared to 70% in the FRG. Also, intersectoral differences in net incomes were minimal, on average amounting only to 150 Mark per month with an average monthly income of around 1100 Mark in 1988 (Stephan and Wiedemann, 1990, Schäfgen, 1998). From 1960 on, official labor market statistics of the GDR do not show any unemployment. It appears that the government quickly found a new job for anybody who might have been displaced in order to achieve its goal of full employment written down in the constitution (Rytlewski and Opp de Hipt, 1982). We draw three conclusions that corroborate our hypothesis that self-selection due to risk aversion was absent in the GDR and that we can therefore treat occupation as an exogenous variable. First, the income path was very predictable and income shocks were small in all occupations. Second, job security was constitutionally guaranteed, and third, occupational choice in the GDR was limited.

The German Unification Treaty of 1990 established that the FRG system of civil

---

[11]In section 7.2, we talk about differences in pension regulations for civil servants and non civil servants.

service was extended into East Germany without major changes. It was acknowledged that it would be infeasible to dismiss all former GDR public employees (i.e., individuals working in positions that were typically taken by civil servants in the FRG) and replace them by new personnel. On the other hand, the GDR public system was oversized, and it seemed necessary to replace some people due to lack of qualification or due to their past involvement in oppressive political acts. The treaty allowed for dismissal of a public employee if there was no longer a need for the employee's services. Moreover, it was possible to close entire administrative divisions and dismiss their personnel. Last, an employee could be laid off if she had violated the principles of humanity or rule of law as defined under the provisions of the Universal Declaration of Human Rights, or if she had been active on behalf of the Ministry of State Security ("*Stasi*"). People who remained in their position had to undergo an individual review after a three-year probationary period before achieving the lifetime status of civil servant. If the review was positive, the person was granted the full status of civil servant including all privileges (Quint, 1997).

5 The data

5.1 The German Socio-Economic Panel

We use data from the German Socio-Economic Panel (GSOEP).[12] This annual panel survey was started in 1984 and initially included only West German households. From 1990 on, the survey covers also the territory of the former German Democratic Republic. We use the survey rounds from 1992 to 2000 to construct our measure of permanent income, and the survey rounds from 1998 to 2000 for the main analysis. We start only in 1998 for several reasons. First, in 1998 a refreshment sample was added that significantly increased the number of observations. Second, in the East sample, wealth effects that differ between civil servants and other occupational groups can only be expected some time after reunification. Third, the review process before granting the civil servant status to an East German took several years.

The wealth and saving data in the survey is recorded at the level of the household.

---

[12] We use the 95% research sample of the GSOEP. A detailed description of the survey can be found in SOEP Group (2001).

Therefore it is critical for our analysis to define the occupation of a household. For households where more than one person is earning an income, we determine who is the main income earner in the household (i.e., who has the highest gross monthly income), and take the information about her occupation. We also take personal characteristics that we control for (e.g., age) from this person.[13]

We restrict our sample as follows: We drop the subsamples that focus exclusively on foreigners and migrants[14], since these groups might have different savings motives (e.g., due to return migration or transfers home). Further, we focus on labor force participants, and exclude households whose main income earner is retired, but include households whose main income earner is unemployed. We eliminate households whose main income earner is self-employed from the sample. The self-employed are not required to contribute to the compulsory pension system and might choose to accumulate retirement savings in private funds. The survey is also not clear on whether accumulation of business capital should be included into the saving and wealth measures. To validate the results, we include self-employed in one of the sensitivity analyses in section 7.4. Further, we also drop households whose main income earner is serving an apprenticeship. Finally, we focus on households whose main income earner is 55 years or younger at the time of the survey. In addition to the theoretical reasons provided above, this avoids possible selection problems that arise once people approach the age where they can enter early retirement.

We identify the household net monthly income and saving from direct questions regarding these items. Further we construct a measure of financial wealth. The exact wording of the questions, as well as the calculation of the financial wealth measure, are described in the appendices A.1 and A.2. Appendix A.4 confirms the validity of the data constructed from GSOEP by comparing it with data from other sources. The financial wealth measure represents financial wealth excluding wealth related to home ownership, and it is left-censored at zero. GSOEP does not provide measures

---

[13]As it turns out, in 77% of all observations the main income earner is also recorded as the "head of the household" and in 95% she is either the "head of the household" or the "spouse of the head" (including the "life partner"). The results do not change significantly in any important aspect if the household characteristics are taken from the "head of household" as defined by the survey instead of the main income earner. We think that it is more reasonable to take characteristics from the main income earner in the present context, so we present these results.

[14]The eliminated subsamples are the samples B, D, and F2.

of home equity – just information on home ownership. It can be argued that housing wealth serves purposes of retirement wealth more than purposes of precautionary wealth, since it cannot be liquidated easily. Many empirical tests of precautionary savings concentrate exclusively on financial wealth (e.g., Kazarosian, 1997, Engen and Gruber, 2001) or use financial wealth as well as total net worth as dependent variables (e.g., Lusardi, 1998, Carroll and Samwick, 1998). We construct a measure of housing wealth (see appendix A.3) and confirm our results with a more comprehensive wealth measure in the robustness checks in section 7.3.

We inflate nominal variables to year 2000 values. Tables 9 and 10 in appendix D show summary statistics for the variables of interest.[15]

5.2 Construction of the "East" and "West" samples

For our self-selection test, we split the sample into an "East" sample and a "West" sample, where East and West refer to the place where people lived *before* the reunification and in particular where they made their occupational choices. To be included into the East sample, individuals have to fulfill one of two criteria. First, we include people from the "GDR-sample" that was added to the GSOEP in 1990 if they are more than 30 years old in 2000. These individuals were at least 20 years old at the time of reunification, and we argue that they had already made their occupational choice at this time. People in the GDR graduated from high school between the age of 16 and 18, depending on their final schooling level. Although some of these individuals might have shifted their occupational choice after reunification, this should not be the case for too many. Moreover, if individuals shifted their occupational choice after reunification, this would induce self-selection in the East sample, which should work against finding a stronger effect of risk on wealth holdings in the East sample.[16]

---

[15] Due to different approaches towards wealth observations of value zero (as will be explained in the next section) we work with different samples. Here we report summary statistics for the sample as it is used in the first set of wealth regressions (tables 1 and 2).

[16] Self-selection within the East sample *after* reunification would lead risk averse individuals to stay in occupations that turn out to be associated with lower risk (i.e. the occupations that are associated with civil service status after a transition period). Theory predicts that those who switched to occupations with larger income risks will be less risk averse. This would decrease the difference that we find between the East and West samples. Therefore, any difference we might find will rather underestimate the true effect of self-selection. Our results can hence be seen as a lower bound for the true effect.

Second, we include people from the refreshment samples taken in 1998 and 2000 if they have a GDR education and are older than 30 years. These refreshment samples do not report the place of residence before reunification, and hence we can only infer it indirectly. We impose this lower age limit for the same reasons as for the "GDR-sample". We also need an upper age limit. It is possible that people finished their education in the GDR before the Berlin Wall was built in 1961 and still emigrated to the West. These individuals should not be included in the East sample. Until the Berlin Wall was built in 1961, many people still emigrated from the East to the West, while after the construction of the Wall, emigration was almost impossible. If the emigrants already had a GDR school degree before 1961, they should now be older than 55 years. Hence, since we restrict our sample to main income earners of age 55 and below, we can assume that the individuals in our sample that have a GDR education indeed lived in the GDR until reunification. To make results comparable, we also exclude people younger than 30 from the West sample. There are 713 civil servant observations in the remaining sample "West", and 94 civil servant observations in the sample "East". We report the summary statistics in Table 11 in appendix D.

6 Results

6.1 Baseline results

We start our estimation from the following specification, as in Carroll and Samwick (1998),

$$\log(W) = \beta_0 + \beta_1 risk + \beta_2 \log(P) + \delta' Z + \varepsilon \tag{4}$$

where W is wealth, P is permanent income, and Z is a vector of household characteristics. A civil servant dummy, that is equal to one if the main income earner is a civil servant, is included to capture differences in risk. To increase the number of observations in which the main income earner is a civil servant, we pool the data for the three sample years 1998-2000. In a sensitivity analysis we will also use data for 2000 (the single year for which we have most observations) alone. Following Carroll and Samwick (1998) and Guiso et al. (1992), we eliminate in a first approach house-

holds with zero or negative wealth holdings from the sample.[17] While this procedure is commonly used in the empirical literature, it may bias the results if observations with zero or negative wealth are not just due to measurement error. Hence, in an additional analysis at the end of this section, we include all observations with zero wealth and estimate Tobit models left-censored at zero.

We calculate permanent income for every observation using net income data from 1992 to 2000.[18] Permanent income represents the component of income that the household would earn in the absence of idiosyncratic shocks. Splitting observed income into permanent and temporary income obviously introduces measurement error, especially for households that we only observe for a few years. Therefore, we instrument permanent income, using education dummies and interaction terms of education with age and age squared as instruments.[19] We then estimate 2SLS models. Overidentification tests confirm the validity of the instruments and are reported in the tables.

We control for other wealth accumulation motives, especially saving for retirement, saving for bequests, and saving for children's education. Therefore, we include age, age squared, sex, and the marital status of the main income earner as explanatory variables. Further, we include the number of individuals above age 16 in the household, and the number of children (less than or equal to age 16) living in the household. We also employ a control for residence in western Germany in the observation year ('west'). The omitted marital status is single or widowed. We include year dummies, which are not reported.

The results of the 2SLS estimates, excluding households who report zero wealth holdings, are shown in Table 1. Most controls exhibit the expected signs and are significant. The coefficient on permanent income is positive and highly significant. Households with a divorced or married main income earner have significantly lower

---

[17]Specifically, Carroll and Samwick (1998) and Guiso et al. (1992) exclude households with negative wealth. Our data does not allow us to distinguish between zero and negative wealth holdings.

[18]We calculate permanent income as follows: We detrend total non-capital family income by dividing it through the average income of all households in the corresponding survey year. Next, we calculate the average detrended household income for every household over all availabe observation years starting in 1992. Permanent income equals the product of this average detrended household income with the average income of all households within each survey year.

[19]Included educational variables are college, vocational training, secondary schooling, and intermediate or technical degree with less or equal to 10 years of schooling.

| Full Sample | | |
Dep. variable: log(W)	(i)	(ii)
log(P)	1.879	1.886
	(0.140)	(0.143)
age	-0.029	-0.031
	(0.015)	(0.015)
age squared ($\cdot 10^2$)	0.044	0.046
	(0.019)	(0.019)
sex (1=male)	0.064	0.061
	(0.032)	(0.032)
married	-0.248	-0.256
	(0.048)	(0.047)
divorced	-0.219	-0.212
	(0.055)	(0.055)
adults (age>16)	-0.229	-0.238
	(0.027)	(0.026)
children	-0.105	-0.108
	(0.017)	(0.017)
west	0.004	-0.003
	(0.040)	(0.039)
home ownership		0.074
		(0.037)
civil servant	-0.145	-0.154
	(0.055)	(0.055)
constant	-5.054	-5.062
	(1.040)	(1.067)
year dummies	yes	yes
# observations	10007	10007
R-squared	0.117	0.117
p-value of overidentification test	0.300	0.248

Notes: Results from 2SLS regressions. Instruments used: education dummies
and interaction terms of education with age and age squared.
Standard errors are in parentheses and are corrected for pooling.

Table 1: Wealth regressions, full sample

wealth than those with an unmarried or widowed main income earner. The number of adults in the household decreases the wealth holdings, as does the number of children in the household to a lesser extent. The latter might indicate that expenditure for current consumption of children is larger than the saving motives for children's education or bequests. Note that German universities are public and do not charge tuition. Wealth holdings of households living in eastern or western Germany at the time of the survey are not significantly different.

In the second specification we include an indicator variable for home ownership. If financial wealth and housing wealth are substitutes for retirement or precautionary wealth, then home ownership should have a negative effect on financial wealth. Yet, the coefficient on the home ownership dummy is positive and significant. It could therefore be the case that financial wealth serves mainly precautionary purposes, while housing wealth serves as retirement savings or has mainly a consumption value (see Engen and Gruber, 2001). The inclusion of the home ownership dummy does not alter the other coefficients in a significant way.

Now we turn to the main variable of interest. The coefficient on the civil servant dummy is negative and significant at the 1% significance level. This result is robust to the inclusion of the indicator for home ownership. We discuss the economic importance of the coefficient in Section 6.3 below. For now we note that, after controlling for other savings motives, civil servants hold significantly less wealth than the rest of the population. This is evidence in favor of the precautionary savings motive.[20] Potential self-selection of risk averse individuals into the civil servant profession would bias the coefficient on the civil servant dummy upwards. Hence, it could be that, after controlling for risk aversion, the coefficient on the civil servant dummy would be even more negative. We use the reunification 'experiment' to find out whether self-selection biases the results.

---

[20]It may be objected that pension regulations differ in some aspects between civil servants and non civil servants, potentially influencing their savings behavior. In section 7.2, we describe differences in the pension systems and perform a robustness check. In any event, these differences between civil servants' pensions and other pensions are the same in eastern and western Germany and hence should not matter for our reunification 'experiment'.

6.2 Demonstrating the self-selection bias: Using the reunification 'experiment'

As argued above, self-selection in occupational choice should be absent for people from the former GDR. Hence, we redo the analysis above separately for the East and West samples.

For both subsamples, we present the same specifications as above (Table 2). Permanent income, number of adults, and number of children have the same signs and are significant in all specifications in both subsamples. Yet, there are differences in other controls. In the East sample, households with a male main income earner hold significantly more wealth than households with a female main income earner, while the coefficient is not significant in the West sample. Being married or divorced leads to significantly lower wealth accumulation in the West sample, but has less significant effects in the East sample. The dummy for residence in western Germany is positive and significant in the West sample, but negative and significant in the East sample, consistent with an interpretation that for both subsamples the migrants from east to west or vice versa have lower wealth holdings.

We turn to the results for the civil servant dummy. The coefficient on the civil servant dummy in the East sample is negative and significant (at the 8% significance level). In the West sample, the coefficient is also negative and significant, but only slightly more than half the size in absolute terms of the coefficient in the East sample. The difference in wealth holdings between civil servants and the rest of the population is much larger in the East sample than in the West sample. Again, this result holds even after controlling for an important source of wealth not captured in our wealth proxy by including a home ownership indicator. The results suggest that a self-selection bias is present in the West sample.[21] Endogeneity of occupational choice based on risk aversion in the West sample can lead to a higher average risk aversion among civil servants than among the rest of the population. This leads to an upward bias in the coefficient on the civil servant dummy.

---

[21] We conduct a Chow test of equality of the coefficients on the civil servant dummy in the East and West sample, but it does not reject equality of the coefficients.

Dep. variable: log(W)	West Sample		East Sample	
	(i)	(ii)	(iii)	(iv)
log(P)	1.958	1.946	1.819	1.821
	(0.181)	(0.187)	(0.239)	(0.239)
age	-0.059	-0.061	-0.087	-0.090
	(0.039)	(0.039)	(0.049)	(0.049)
age squared ($\cdot 10^2$)	0.074	0.075	0.111	0.114
	(0.046)	(0.046)	(0.057)	(0.057)
sex (1=male)	0.040	0.035	0.172	0.171
	(0.051)	(0.051)	(0.054)	(0.054)
married	-0.306	-0.316	-0.199	-0.209
	(0.069)	(0.068)	(0.095)	(0.094)
divorced	-0.335	-0.324	-0.052	-0.051
	(0.076)	(0.077)	(0.095)	(0.095)
adults (age>16)	-0.220	-0.226	-0.233	-0.238
	(0.034)	(0.033)	(0.042)	(0.042)
children	-0.100	-0.104	-0.168	-0.170
	(0.022)	(0.022)	(0.035)	(0.035)
west	0.413	0.407	-0.209	-0.201
	(0.158)	(0.157)	(0.095)	(0.096)
home ownership		0.096		0.059
		(0.052)		(0.054)
civil servant	-0.128	-0.138	-0.248	-0.249
	(0.069)	(0.068)	(0.143)	(0.143)
constant	-5.395	-5.262	-3.356	-3.310
	(1.653)	(1.704)	(2.120)	(2.121)
year dummies	yes	yes	yes	yes
# observations	5532	5532	2510	2510
R-squared	0.100	0.103	0.130	0.131
p-value of overidentification test	0.509	0.465	0.480	0.498

Notes: Results from 2SLS regressions. Instruments used: education dummies
and interaction terms of education with age and age squared;
Standard errors are in parentheses and are corrected for pooling.

Table 2: Wealth regressions, West and East samples

6.3 Quantifying the size of precautionary wealth and the importance of self-selection

We go through a simulation to approximate the amount of precautionary wealth as a percentage of overall wealth holdings. Based on the estimated parameters of the regressions above, we construct the mean predicted wealth of all non civil servants for the full, the East and the West sample.[22] In a next step, we assume everyone faces the same labor income risk as a civil servant by setting the civil servant dummy equal to one for every household, keeping everything else unchanged. Again using the same estimated coefficients as before, we predict how much wealth non civil servants would have accumulated in this counterfactual economy. The difference between predicted wealth and counterfactual wealth divided by predicted wealth is our measure of precautionary wealth. If the main income earner of every non civil servant household faced the same low income risk as civil servants do, *ceteris paribus*, overall wealth of non civil servant households would be smaller by the percentage identified as 'precautionary wealth'. The full sample also excludes households whose main income earner is younger than 30 years to make it comparable with the West and East samples.

Under this measure, precautionary wealth for the full sample amounts to 14.2% of all wealth. We conclude that precautionary wealth is economically important. For the East sample, precautionary wealth accounts for 22.1% of all wealth, while for the West sample it accounts for only 12.9%. These numbers show that the economic implications of self-selection are large. Without self-selection, we would observe almost twice the size of precautionary wealth in the West sample.

6.4 Including zero wealth observations

In the regression analysis above we have followed the common approach in the literature and have eliminated observations with zero wealth, which corresponds to zero or negative actual wealth holdings. This sample selection potentially biases our results. We now keep all observations with zero wealth and estimate instrumental variable

---

[22] We use specification (ii) from Table 1, and specifications (ii) and (iv) from Table 2.

Tobit models (Newey, 1987).[23] As above, we instrument permanent income by education dummies and interactions with age and age squared. We report bootstrap standard errors that are corrected for pooling.[24]

Most of the Tobit estimates have the same sign as the 2SLS estimates. Concentrating on the civil servant dummy, we get even stronger evidence for self-selection than in the 2SLS estimations. In the full sample, the coefficient on the civil servant dummy is negative, but only significant at the 13% significance level in specification (i) and at the 10% significance level in specification (ii). Splitting the sample into East and West samples, the coefficient becomes positive but insignificant in the West sample, but negative and significant at the 1% significance level in the East sample. Self-selection seems to counterbalance the precautionary savings motive in the West sample, and self-selection in the West sample makes it hard to detect precautionary savings in the full sample. Yet, in the East sample we can detect a strong precautionary savings motive.

Based on the Tobit estimations, the quantitative importance of the bias is even more striking. We redo the quantification exercise in Section 6.3 with the results from these parameter estimates. While in the full sample we detect precautionary savings in the order of 18% of overall wealth holdings, in the West sample none of the wealth holdings are due to precautionary reasons. In the East sample, precautionary savings account for 68% of overall wealth holdings.

A Chow test rejects the equality of the coefficients on the civil servant dummies in the East and West samples at a significance level of 1%. Hence, the difference between East and West is not only economically significant, but also statistically significant.

---

[23]Since our dependent variable is the logarithm of wealth, we add one Deutsche Mark to zero wealth observations and estimate Tobit models left-censored at zero. There are 1382 observations with zero wealth.

[24]We use 250 repetitions to calculate the bootstrap standard errors. On average, the standard errors that are calculated based on Newey (1987) but are not corrected for pooling are about 20% smaller than the standard errors obtained from the bootstrap corrected for pooling.

Dep. variable: log(W)	Full Sample		West Sample		East Sample	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
log(P)	5.721	5.674	4.924	4.780	5.711	5.665
	(0.322)	(0.328)	(0.415)	(0.422)	(0.992)	(0.671)
age	-0.003	-0.006	-0.128	-0.134	-0.408	-0.430
	(0.044)	(0.044)	(0.091)	(0.089)	(0.156)	(0.157)
age squared ($\cdot 10^2$)	-0.018	-0.016	0.120	0.124	0.459	0.484
	(0.056)	(0.055)	(0.109)	(0.107)	(0.164)	(0.163)
sex (1=male)	0.036	0.030	0.090	0.078	0.399	0.384
	(0.088)	(0.088)	(0.142)	(0.141)	(0.171)	(0.161)
married	-0.374	-0.384	-0.372	-0.393	-0.496	-0.557
	(0.123)	(0.121)	(0.166)	(0.161)	(0.436)	(0.344)
divorced	-1.043	-1.026	-1.178	-1.139	-0.667	-0.649
	(0.182)	(0.182)	(0.197)	(0.197)	(0.354)	(0.354)
adults (age>16)	-0.741	-0.753	-0.531	-0.541	-0.636	-0.666
	(0.077)	(0.074)	(0.090)	(0.087)	(0.195)	(0.139)
children	-0.346	-0.352	-0.265	-0.276	-0.491	-0.500
	(0.048)	(0.048)	(0.056)	(0.056)	(0.109)	(0.113)
west	-0.765	-0.767	1.675	1.649	-0.779	-0.720
	(0.112)	(0.111)	(0.510)	(0.504)	(0.308)	(0.298)
home ownership		0.173		0.345		0.434
		(0.100)		(0.141)		(0.196)
civil servant	-0.203	-0.214	0.049	0.028	-1.152	-1.147
	(0.127)	(0.125)	(0.156)	(0.150)	(0.375)	(0.360)
constant	-36.319	-35.879	-29.875	-28.569	-28.138	-27.338
	(2.362)	(2.439)	(3.872)	(3.923)	(9.180)	(6.534)
year dummies	yes	yes	yes	yes	yes	yes
# observations	11389	11389	6230	6230	2820	2820
log likelihood	-14380.3	-14649.6	-5394.2	-5414.1	-3264.1	-3305.4

Notes: Results from instrumental variable Tobit regressions. Instruments used: education dummies and interaction terms of education with age and age squared. Standard errors are in parentheses and are corrected for pooling.

Table 3: Tobit wealth regressions

7 Sensitivity Analyses

7.1 Saving regressions

Using wealth as the dependent variable may make comparisons between the East and the West samples difficult, due to the shorter time period of significant wealth

accumulation for people from the former GDR. In observing saving, which is a jump variable, it might be easier to detect statistically significant differences between the East and West samples. Since we only observe positive saving, we estimate Tobit models of the logarithm of saving left-censored at 0.[25] We start from the following equation

$$\log\left(\frac{S}{Y}\right) = \beta_0 + \beta_1 risk + \beta_2 \log(Y) + \beta_3 W + \delta' Z + \varepsilon \tag{5}$$

and estimate

$$\log(S) = \beta_0 + \beta_1 risk + (1 + \beta_2) \log(Y) + \beta_3 W + \delta' Z + \varepsilon \tag{6}$$

where S is saving, and Y is disposable income. The other included controls are the same as in the wealth regressions. Again, we pool the data for the three sample years and calculate robust standard errors.

All controls except the age variables are significant in the saving regressions of the full sample (Table 4). Households with higher income and households with a male main income earner save more, while an increase in the number of adults or number of children in the household is associated with lower saving. Households whose main income earner is married or divorced save less than those whose main income earner is unmarried or widowed.[26]

The coefficient on the civil servant dummy is positive, contrary to the theory of precautionary savings, yet insignificant in both specifications (i) and (ii) for the full sample. In contrast to our results from the wealth regressions, using the full sample we cannot find that civil servants save significantly less than the rest of the population. Again, to see whether this is due to self-selection, we split the sample in the East and West samples.

The logarithm of income, the age variables, the sex and divorced indicator variables, and the number of adults and children have the same sign and are significant in the East and West samples. The marriage dummy is still negative but is now

---

[25] As in the wealth Tobit models above, we add 1 Deutsche Mark of saving for people who report 0 saving, which makes our dependent variable left-censored at 0.

[26] Both positive coefficients on the wealth proxy and on the home ownership dummy are inconsistent with the theory of precautionary savings, yet the puzzle of a very skewed wealth distribution and high saving rates of the rich is well documented (e.g. Carroll, 2000).

Dep. variable:	Full Sample		West Sample		East Sample	
log(S)	(i)	(ii)	(iii)	(iv)	(v)	(vi)
log(Y)	4.305	4.243	3.930	3.824	5.108	5.048
	(0.130)	(0.131)	(0.169)	(0.170)	(0.289)	(0.289)
age	-0.045	-0.050	-0.414	-0.424	-0.653	-0.682
	(0.048)	(0.048)	(0.109)	(0.109)	(0.174)	(0.175)
age squared ($\cdot 10^2$)	0.055	0.058	0.477	0.482	0.750	0.783
	(0.060)	(0.060)	(0.128)	(0.128)	(0.202)	(0.202)
sex (1=male)	0.213	0.203	0.271	0.254	0.403	0.389
	(0.105)	(0.105)	(0.145)	(0.145)	(0.200)	(0.199)
married	-0.190	-0.210	-0.099	-0.139	-0.210	-0.275
	(0.130)	(0.130)	(0.171)	(0.171)	(0.300)	(0.298)
divorced	-1.379	-1.353	-1.384	-1.339	-0.935	-0.918
	(0.189)	(0.189)	(0.232)	(0.232)	(0.390)	(0.388)
adults (age>16)	-0.684	-0.706	-0.657	-0.679	-0.563	-0.596
	(0.063)	(0.064)	(0.085)	(0.085)	(0.132)	(0.133)
children	-0.548	-0.559	-0.496	-0.513	-0.717	-0.730
	(0.055)	(0.055)	(0.067)	(0.067)	(0.128)	(0.128)
west	-0.717	-0.726	1.275	1.235	-0.863	-0.794
	(0.108)	(0.108)	(0.570)	(0.566)	(0.330)	(0.332)
wealth ($\cdot 10^5$)	0.281	0.276	0.230	0.224	0.887	0.878
	(0.077)	(0.076)	(0.074)	(0.073)	(0.212)	(0.211)
home ownership		0.298		0.444		0.487
		(0.102)		(0.132)		(0.192)
civil servant	0.194	0.175	0.360	0.323	-0.683	-0.665
	(0.149)	(0.150)	(0.171)	(0.171)	(0.443)	(0.453)
constant	-29.374	-28.760	-20.436	-19.339	-23.374	-22.330
	(1.279)	(1.290)	(2.585)	(2.591)	(4.323)	(4.347)
year dummies	yes	yes	yes	yes	yes	yes
# observations	11389	11389	6230	6230	2820	2820
log likelihood	-24169.5	-24163.4	-13412.9	-13404.6	-5869.4	-5864.8

Notes: Results from Tobit regressions. Standard errors are in parentheses
and are corrected for pooling.

Table 4: Saving regressions

insignificant in both subsamples. Wealth and home ownership are associated with
higher saving in both subsamples. As in the wealth regressions, the only control that
changes signs from the West to the East sample is the dummy for residence in western
Germany, again indicating that people who migrated save less than those who stayed

in west or east after the reunification respectively.

The results for the civil servant dummy are similar to the results from the Tobit wealth regressions. In the East sample, the coefficients on the civil servant dummy are negative and borderline significant - at the 12% significance level in specification (v) and at the 14% significance level in specification (vi) - while in the West sample they are positive and significant, at the 4% and 6% significance level respectively. Hence, based on the saving regressions we cannot detect precautionary savings in the West sample, but we find evidence for precautionary savings in the East sample. A Chow test rejects the equality of the coefficients on the civil servant dummies in the East and West samples at a significance level of 8%.

7.2   Pension differences

Pension differences between civil servants and non civil servants could induce additional differences in the savings motives of both groups, and could hence complicate our analysis. In this chapter, we briefly describe the German pension system, and perform an additional robustness check. Since any differences between pensions of civil servants and non civil servants are the same in East and West, our main self-selection test is still valid even if part of the lower savings of civil servants might be caused by pension differences.

The German pension system offers relatively high replacement ratios. For example, for an average worker with 45 years contribution history the replacement ratio amounts to 70.5% (Börsch-Supan et al., 2002). Thus, additional private retirement savings play a less important role in Germany than for example in the US.[27] Yet, pension regulations have been frequently reformed in the last decade and, given the unfavorable demographic development, the need for additional reforms is constantly stressed in the political debate. As a result, the amount of retirement income is perceived as uncertain especially by younger generations. Retirement regulations from the West have been adopted in East Germany immediately after reunification. Retirement incomes between eastern and western Germany differ only in as much as

---

[27] Given the increase in leisure time and discounts after retirement, and the decrease in work related expenditure, it is unclear whether any retirement savings motive in addition to public pensions exists. However, the public debate in Germany points heavily toward the need for additional retirement savings.

labor incomes still differ. The average household pension income in the East is even higher than in the West due to higher female labor market participation rates in the GDR (Sinn 2002).

The German pension regulations for civil servants and non civil servants differ in many aspects, making general comparisons virtually impossible.[28] There exist especially three important differences.[29] First, civil servants do not pay explicit pension contributions during their working life. Instead, their pensions are paid by the government, and their gross income is lower than gross incomes of other public sector employees with comparable education. Second, civil servant pensions are taxable, while only a very small portion of non civil servant pensions is taxable. Third, and probably most important, pensions of civil servants are calculated based on the last income, while pensions of non civil servants are calculated based on the average income over the life cycle. Comparing retirement behavior, Börsch-Supan et al. (2002) report that civil servants retire on average one year earlier than non civil servants. The German Supreme Court ruled the differential tax treatment of civil servant and non civil servant pensions unconstitutional in March 2002, and demanded the legislation to issue new rules until 2005. It acknowledged that the differential treatment was designed to counteract disadvantages faced by non civil servants due to other parts of pension regulations, and implicitly demanded a thorough revision of the pension regulations.

The general perception is that civil servant pensions are more generous than non civil servant pensions for people facing a steep income path over their life cycle. For people with comparatively flat income paths, it does not matter much whether pensions are calculated based on the average income or the last income, and the difference might be overcome by other regulations favoring non civil servants. Higher educated people face steeper income paths, and these are found in the the higher ranks of civil service. We redo our wealth regressions using two separate civil servant

---

[28]In the explanation of its ruling against the differential tax treatment of civil servant and non civil servant pensions on March 6, 2002, the German Supreme Court stated that, "to compare both pension systems, one has to recur to a large number of case studies considering income paths and employment durations, family or labor market related disruptions of employment, marital status and number of children, in addition to the variety of possible entry paths into retirement".

[29]The following descriptions just offer coarse summaries of the rules. For a detailed description of pension regulations for civil servants and non civil servants, see Börsch-Supan et al. (2002).

dummies for high (*gehobener* and *höherer Dienst*) and low (*unterer* and *mittlerer Dienst*) rank civil servants, instead of a common civil servant dummy for all civil servants. High rank civil servants may save less than non civil servants with the same average income not only because of the lower income risk they face, but additionally because of their more favorable pensions. For low rank civil servants, the difference to non civil servants consists mainly in their lower income risk.

The results of the estimation are shown in table 5. To economize on space we report only the coefficients and standard errors on the civil servant dummy. In most cases, the coefficients on the high rank civil servant dummy are smaller than those on the low rank civil servant dummy. This gives evidence that part of the lower wealth holdings by civil servants might indeed be due to the pension provisions favoring high rank civil servants. However, except for the high rank civil servant dummy in the 2SLS regressions, it is still true that the coeffcients on the high or low rank civil servant dummies are more negative in the East sample than the corresponding coefficients in the West sample. This difference should solely be based on risk differences.

Dep. variable: log(W)	Full Sample	West Sample	East Sample
excluding zero wealth observations			
low rank civil servant (unterer/mittlerer Dienst)	-0.094	-0.009	-0.318
	(0.072)	(0.091)	(0.205)
high rank civil servant (gehobener/höherer Dienst)	-0.198	-0.235	-0.214
	(0.074)	(0.093)	(0.178)
including zero wealth observations			
low rank civil servant (unterer/mittlerer Dienst)	0.233	0.571	-1.307
	(0.173)	(0.186)	(0.616)
high rank civil servant (gehobener/höherer Dienst)	-0.558	-0.386	-1.058
	(0.164)	(0.186)	(0.448)

Notes: Reported are the coefficients on the civil servant dummies from different wealth regressions (for details see the text); Standard errors are in parentheses and are corrected for pooling.

Table 5: Pension differences

7.3   Including housing wealth

In the baseline analysis above, we use a wealth measure that does only comprise financial wealth. There is a discussion in the literature whether or not housing wealth

is accumulated for precautionary reasons. One argument states that precautionary savings should be held in liquid assets in order to be easily and costlessly available in times of financial needs. However, one could as well argue that precautionary savings held for rare, but large, negative shocks should be invested in illiquid assets with higher returns.

In this section we extend our wealth measure to incorporate housing wealth in addition to financial wealth. Unfortunately there is no direct measure of housing wealth in the GSOEP. Therefore we construct such a measure combining information on mortgage payments and the length of the mortgage for households who have bought a house and not yet repaid their mortgage. For those households who have no debt on their house, we use information about their imputed rent and house characteristics to impute housing wealth.[30] The details are described in appendix A.3.

We reestimate both wealth regressions with and without zero wealth observations. The controls are the same as before, except that we exclude the dummy for home ownership. The results are presented in Table 6. The coefficients on the civil servant dummy in the East sample are almost unchanged in both regressions, while the standard errors have increased. This may be attributed to a loss in efficiency due to the measurement error in the dependent variable as a consequence of the imputation of housing wealth. The coefficient is still significant for the Tobit regression. In the West sample, the coefficients on the civil servant dummy are now positive and insignificant in both specifications with and without zero wealth observations. A Chow test shows that the difference between the civil servant dummies in the East and the West samples is significant at the 1% level for the Tobit regressions.

Although we lose some precision in the estimates, in general the results confirm our earlier results and show that they do not depend on the choice of the wealth measure.

7.4   Further sensitivity analyses

We conduct two further sensitivity analyses. First, we use data only from the year 2000 to avoid pooling of the data. Second, we confirm the results by including self-

---

[30]Due to missing values, the number of observations drops to 9529 in the full sample. The average logarithm of wealth increases from 9.556 to 10.438 in the full sample.

employed into the sample, again using all data from 1998-2000. For both robustness checks, we again reestimate the 2SLS wealth regressions and the instrumental variable Tobit wealth regressions, including the dummy for home ownership, and using the same instruments as before. Results are in Table 6.

Dep. variable: log(W)	including zero wealth obs.	Full Sample	West Sample	East Sample
including housing wealth	no	0.075	0.085	-0.225
		(0.067)	(0.078)	(0.222)
	yes	-0.018	0.200	-1.276
		(0.133)	(0.133)	(0.415)
only 2000 data	no	-0.103	-0.111	-0.210
		(0.064)	(0.075)	(0.195)
	yes	-0.178	0.031	-1.419
		(0.163)	(0.178)	(0.587)
including self-employed	no	-0.189	-0.184	-0.260
		(0.054)	(0.067)	(0.142)
	yes	-0.162	0.014	-1.043
		(0.128)	(0.143)	(0.352)

Notes: Reported is the coefficient on the civil servant dummy from different wealth regressions (for details see the text); Standard errors are in parentheses and are corrected for pooling.

Table 6: Robustness checks

In the wealth regressions with only 2000 data, all variables have the same sign as in the pooled data, yet the significance levels vary. Especially in the East sample, some variables that are significant in the pooled data become insignificant, which might be due to the now smaller sample size. The standard errors on the civil servant dummies become larger in all three samples, yet the relative magnitudes of the coefficients are unchanged compared to the pooled data. The results from the Tobit regressions are very similar to the pooled regression results. In particular, the civil servant dummy is negative and highly significant in the East sample, while in the West sample the coefficient on this dummy is positive, but insignificant. The difference between these coefficients in East and West is statistically significant.

In the regressions including self-employed, all controls are very similar to the results of the regressions that exclude self-employed. In the full, East and West

samples, the civil servant dummies are even larger in absolute size and more significant than in the baseline results without self-employed. Again, the difference between the East and the West samples is more pronounced and statistically significant once we include all observations with zero wealth into our analysis.

Overall, the results in this section strongly support our earlier evidence for a presence of self-selection in the West sample and show that our main results do not depend on the pooling of sample years or the exclusion of self-employed from the sample.

8   Conclusion

We combine particular features of the German civil service system and the unique event of German reunification to present evidence for precautionary savings and to quantify the importance of self-selection into occupations due to differences in risk aversion. Our approach deals with the two principal problems of empirical studies of precautionary savings. First, an institutional feature of the German labor force allows us to identify an occupation group that experiences less income risk than other groups. As we show, German civil servants have an extremely secure job and their incomes can be predicted fairly well even over a long time horizon. Further, the lower income risk associated with the position of a civil servant compared to other occupations is not only observable by the econometrician, but is also perceived as such by the German public and individual households. Our results show that German households whose main income earner is a civil servant accumulate significantly lower wealth than those whose main income earner has another occupation. The results provide evidence for the presence of precautionary wealth. The amount is economically significant. We calculate that precautionary wealth accounts for 14% of all wealth.

Second, in our main contribution to the literature, we are able to demonstrate the importance of self-selection of individuals into occupations according to their risk aversion by using the German reunification 'experiment'. For East Germans German reunification caused an exogenous reassignment of income risks to different occupational groups. In particular, we argue that occupational risk is not correlated with risk aversion for individuals who chose their occupation in the former GDR.

Hence we can avoid a self-selection bias for a subsample of our data. Comparing the estimates from this subsample with the estimates from the sample of households in which occupational choice cannot be assumed to be independent of risk aversion, we provide evidence that self-selection is present in the latter households, and we are able to quantify the effects of self-selection. If we consider just the subsample of people who chose their occupation in East Germany before German reunification, our estimates for precautionary wealth amount to 22% of total wealth. This amount is almost twice as large as for the West sample. Results for the specifications with financial wealth as the dependent variable are generally confirmed by results for a broader wealth measure including housing wealth. Moreover, we can conclude that the wealth gap between civil servants and the rest of the population in the East sample is statistically different from this gap in the West sample in wealth regressions that include zero or negative wealth observations.

We draw the following conclusions from the results in this paper: First, risk-aversion influences the occupational choice of individuals. Second, individuals act according to the theory of precautionary savings. Third, self-selection, if not appropriately controlled for, can lead to a significant underestimation of the relevance of precautionary savings. The self-selection bias might help to explain the extreme differences in results of past empirical studies of precautionary savings.

References

[1] Börsch-Supan, Axel, Reinhold Schnabel, Simone Kohnz and Giovanni Mastrobuoni (2002): Micro Modeling of Retirement Decisions in Germany, in: Jonathan Gruber and David A. Wise (eds.): Social Security Programs and Retirement around the World: Micro-Estimation, The University of Chicago Press, forthcoming.

[2] Börsch-Supan, Axel, Anette Reil-Held, Ralf Rodepeter, Reinhold Schnabel and Joachim Winter (1999): Ersparnisbildung in Deutschland: Meßkonzepte und Ergebnisse auf Basis der EVS, *Allgemeines Statistisches Archiv*, 83(4), 385-415.

[3] Browning, Martin and Annamaria Lusardi (1996): Household Saving: Micro Theory and Micro Facts, *Journal of Economic Literature*, 34, 1797-1855.

[4] Carroll, Christopher D. (2001): A Theory of the Consumption Function, With and Without Liquidity Constraints, *Journal of Economic Perspectives*, 15(3), 23-46.

[5] Carroll, Christopher D. (2000): Why Do the Rich Save So Much?, in: Slemrod, J.B. (ed.): Does Atlas Shrug? The Economic Consequences of Taxing the Rich, Cambridge.

[6] Carroll, Christopher D. (1997): Buffer Stock Saving and Life Cycle/Permanent Income Hypothesis, *Quarterly Journal of Economics*, 112(1), 1-56.

[7] Carroll, Christopher D. and Andrew A. Samwick (1998): How Important Is Precautionary Saving?, *Review of Economics and Statistics*, 80(3), 410-419.

[8] Cramer, J.S., J. Hartog, N. Jonker and C.M. Van Praag (2002): Low risk aversion encourages the choice for entrepreneurship: an empirical test of truism, *Journal of Economic Behavior & Organization*, 48, 29-36.

[9] Deaton, Angus (1991): Saving and Liquidity Constraints, *Econometrica*, 59(5), 1221-1248.

[10] Deutsche Bundesbank: Statistischer Anhang zu Monatsberichten, various issues.

[11] Dynan, Karen E. (1993): How Prudent Are Consumers?, *Journal of Political Economy*, 101(6), 1104-13.

[12] Engen, Eric M. and Jonathan Gruber (2001): Unemployment Insurance and Precautionary Saving, *Journal of Monetary Economics*, 47, 545-579.

[13] Gourinchas, Pierre-Olivier and Jonathan A. Parker (2002): Consumption over the Life Cycle, *Econometrica*, 70(1), 47-89.

[14] Guiso, Luigi, Tullio Jappelli and Daniele Terlizzese (1992): Earnings Uncertainty and Precautionary Savings, *Journal of Monetary Economics*, 30(2), 307-337.

[15] Hille, Barbara (1991): Nicht nur Blauhemden: Die Situation der Jugendlichen in der ehemaligen DDR, Deutschland-Report 13 der Konrad-Adenauer-Stiftung. Verlag Ernst Knoth, Melle.

[16] Kazarosian, Mark (1997): Precautionary Savings - A Panel Study, *Review of Economics and Statistics*, 79(2), 241-247.

[17] Lusardi, Annamaria (1998): On the Importance of the Precautionary Savings Motive, *American Economic Review (Papers and Proceedings)*, 88(2), 449-453.

[18] Lusardi, Annamaria (1997): Precautionary Saving and Subjective Earnings Variance, *Economics Letters*, 57(3), 319-326.

[19] Münnich, Margot (2001): Einkommens- und Geldvermögensverteilung privater Haushalte in Deutschland - Teil 2. Ergebnis der Einkommens- und Verbrauchsstichprobe 1998, in: *Wirtschaft und Statistik*, 2/2001, 121-137.

[20] Münnich, Margot (1999): Haus- und Grundbesitz sowie Wohnverhältnisse privater Haushalte in Deutschland. Ergebnisse der Einkommens- und Verbrauchsstichprobe 1998, in: *Wirtschaft und Statistik*, 3/1999, 210-220 and 183*-190*.

[21] Newey, Whitney (1987): Efficient estimation of limited dependent variable models with endogenous explanatory variables. *Journal of Econometrics*, 36, 231-250.

[22] Quint, Peter (1997): The Imperfect Union. Constitutional Structures of German Unification, Princeton University Press, Princeton.

[23] Rytlewski, Ralf, and Manfred Opp de Hipt (1982): Die Deutsche Demokratische Republik in Zahlen, 1945/49-1980, Verlag C.H. Beck, München.

[24] Schäfgen, Katrin (1998): Die Verdoppelung der Ungleichheit. Sozialstruktur und Geschlechterverhältnisse in der Bundesrepublik und in der DDR, Dissertation, Humboldt-Universität.

[25] Sinn, Hans-Werner (2002): Germany's Economic Unification: An Assessment after Ten Years, *Review of International Economics*, 10(1), 113-128.

[26] Skinner, Jonathan (1988): Risky Income, Life Cycle Consumption, and Precautionary Savings, *Journal of Monetary Economics*, 22(2), 237-255.

[27] SOEP Group (2001): The German Socio-Economic Panel (GSOEP) after more than 15 years - Overview, in: Elke Holst, Dean R. Lillard und Thomas A. DiPrete (ed.): Proceedings of the 2000 Fourth International Conference of German Socio-Economic Panel Study Users (GSOEP 2000), *Vierteljahrshefte zur Wirtschaftsforschung*, 70(1), 7-14.

[28] Statistisches Bundesamt: Statistisches Jahrbuch, various issues.

[29] Stephan, Helga and Eberhard Wiedemann (1990): Lohnstruktur und Lohndifferenzierung in der DDR: Ergebnisse der Lohndatenerfassung vom September 1988, *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung*, 23, 550-562.

A Data appendix

A.1 Income and saving

We identify household net monthly income and saving from the following questions.

The question regarding household income reads: "If you take a look at the total income from all members of the household: how high is the monthly household income today? Please state the net monthly income, which means after deductions for taxes and social security. Please include regular income such as pensions, housing allowance, child allowance, grants for higher education, support payments etc. If you do not know the exact amount, please estimate the amount per month."

The question about saving reads: "Do you usually have an amount of money left over at the end of the month that you can save for larger purchases, emergency expenses or to acquire wealth?" If yes, "how much?"

A.2 Construction of the financial wealth measure

Direct wealth measures are not available in the GSOEP. We construct a measure for accumulated financial wealth as follows. We use a question concerning income from interest and dividends to infer financial wealth, assuming that the average interest rate on financial assets was 3.3% in 1998, 2.8% in 1999 and 4% in 2000, calculated based on average wealth portfolios and average rates on savings accounts, bonds and stocks in the respective years (Statistisches Bundesamt, Deutsche Bundesbank, various issues).

The survey question regarding interest and dividends reads: "How high was the income received from interest, dividends and profits from these savings and securities in the last calendar year?" Some households give an exact amount, while others just indicate one of five given ranges (less than 500 DM, 500 to 2000 DM, 2000 to 5000 DM, 5000 to 10000 DM, more than 10000 DM). For those choosing to indicate a range, we use the mean income of households who actually give the exact amount within this range as a proxy.

A.3   Construction of the housing wealth measure

GSOEP contains only information on home ownership, but does not state the value of the house or the accumulated amortization payments on a mortgage. We calculate this information as follows.

For people who still pay back a mortgage on their home, GSOEP reports the monthly payments of amortization plus interest. To calculate the amortization amount out of this annuity, we make the following assumptions. First, we assume that the overall duration of the mortgage is 30 years. Second, the interest rate on the mortgage is equal to the average interest rate on 10 year fixed mortgages during the period 1971 to 2001, namely 8.25% (according to Rheinische Hypo Bank Frankfurt). Third, we assume that the mortgage is paid back in constant annuities, and last that interest accrues yearly. We take the year the household moved into the current house as the year of the take-up of the mortgage. Alternatively, if a household indicates that it purchased the house it was living in before for rent, we take the year of the purchase as the year of the take-up of the mortgage. Given this information, we can calculate the accumulated amount of amortization payments, which corresponds to the wealth of the household accumulated through mortgage payments. Similarly, we can calculate the overall amount of the mortgage. From the value of the mortgage, we calculate the downpayment on the house purchase, based on the assumption that the downpayment amounts to 20% of the purchase price. The housing wealth of the household, evaluated at housing prices at the year of purchase, is the sum of the downpayment plus the accumulated amortization payments. We inflate this value to year 2000 values, based on the year of purchase and the price index for residential buildings provided by the German Statistical Office. Implicitly, we assume that depreciation of the house is offset each year with equivalent investment into the house.

For households who own a house but do not have a mortgage, we impute the value of the house as follows. For all home owners, we have information about various characteristics of the house, and about the rent the household would find appropriate for living in this house. For those who pay back a mortgage, we can calculate the approximate inflated value of the house as the value of the mortgage plus the downpayment as described above. For these households, we regress the value of the house on various house characteristics, the imputed rent, and interaction terms between characteris-

tics and imputed rent. We get a predicted value of the house from this regression for households who do not pay back any mortgage.

We proceed similarly for non owner-occupied dwellings. The only difference to owner-occupied housing is that we do not know the year of purchase, and hence we assume that the mortgage is in the median year of the mortgages on owner-occupied housing, corresponding to the eighth year.

Our real wealth measure consists of the housing wealth related with owner-occupied and non owner-occupied housing.

A.4 Validity of saving and wealth measures

To check the validity of the constructed wealth data, we recur to comparisons with the Einkommens- und Verbrauchsstichprobe (EVS - Income and Expenditure Survey), which is considered to be the best source for recorded household wealth in Germany. The EVS is conducted every five years without a panel component, with the last survey round being 1998. Unfortunately, these data are not available to researchers residing outside Germany, yet the Federal Statistical Office records detailed sample statistics from this data, to which we compare our data. In the 1998 round, EVS interviewed more than 62000 households, and its sample size is hence almost five times bigger than the GSOEP sample size. The EVS data is therefore well suited for a robustness check of our data. Note that the EVS reports current residence, but not residence before reunification, and hence in the following comparisons between EVS and GSOEP we use current residence for the sample split. This is the reason why we cannot do our analysis using EVS data, but have to recur on GSOEP data. As in GSOEP, in the EVS the relative number of civil servant households in the East is around one third of the relative number in the West. Civil servants compose 14% of the EVS sample in western Germany, and 5% in eastern Germany.

Our wealth measure would especially be problematic if the composition of financial wealth would differ significantly between civil servants and non civil servants, because in this case we might systematically bias the estimates of wealth holdings based on different returns earned on different forms of investment. Figures 6 and 7 show the composition of financial wealth in 1998 for civil servants and the overall population from EVS, separately for western and eastern Germany (Münnich, 2001). Focusing
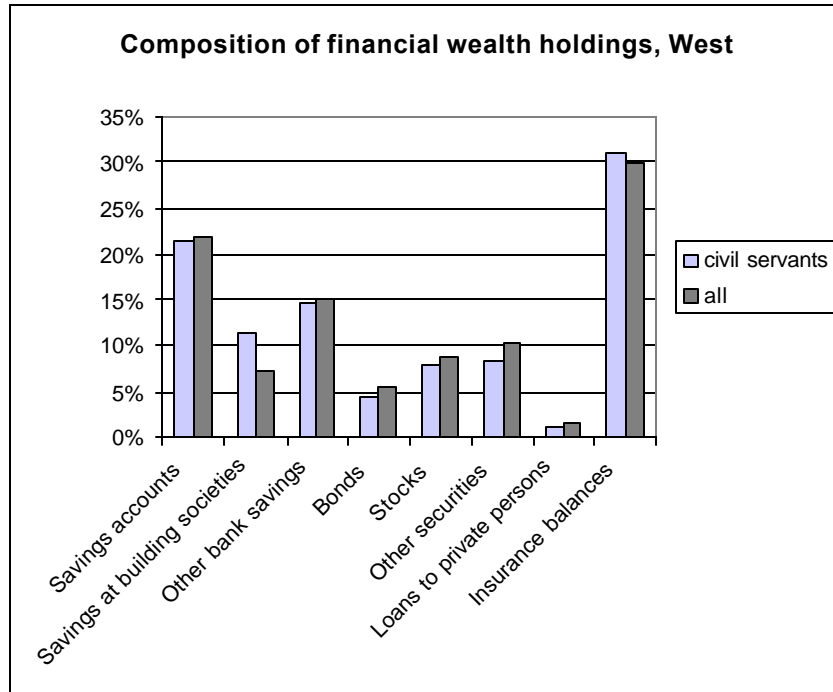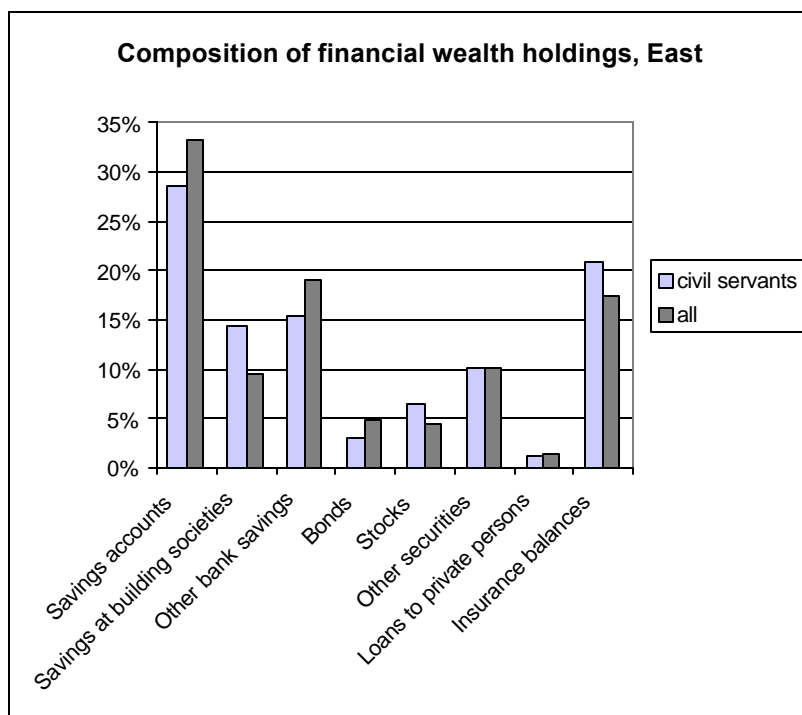
Figure 6: Composition of financial wealth held by civil servants and the whole population in western Germany, based on EVS 1998

on western Germany, the differences between the wealth composition of civil servants and the overall population are minimal. Civil servants tend to hold a larger share of their portfolio in savings at building socities, and a smaller share in riskier securities like stocks, bonds and other securities. Note that the last result gives a further indication that civil servants might be more risk averse than the rest of the population. Turning to eastern Germany, the differences between the wealth composition of civil servants and the overall population are somewhat bigger. Civil servants tend to hold more wealth in savings at building socities, stocks and insurances, and less in savings accounts, other bank savings and bonds.

Next, we compare the amounts of average financial wealth holdings constructed from the GSOEP data in 1998 to the average amounts reported by EVS (Münnich, 2001).[31] While the EVS reports average gross financial household wealth of 61,200 DM

---

[31]To make the results from GSOEP representative, we use the full sample and cross-sectional weights.

Figure 7: Composition of financial wealth held by civil servants and the whole population in eastern Germany, based on EVS 1998

in western Germany and 31,900 DM in eastern Germany, our wealth measure reports averages of 50,500 DM in western Germany and 19,800 DM in eastern Germany, i.e. 71% and 62% of the values from EVS. Hence, it seems that we understate the true amount of financial household wealth by around one third. If one omits wealth invested in life insurances from the gross financial wealth holdings reported by EVS, the GSOEP data corresponds to 101% in the West and 75% in the East. We are probably missing this component of financial wealth with our wealth measure, since life insurance contracts do not pay yearly interest. Life insurance contracts represent relatively illiquid wealth, and hence their omission might be valid in a focus on liquid financial wealth. We are still underrepresenting the amount of wealth held by East Germans.

Figures 8 and 9 show the amount of financial wealth for different occupational groups in western and eastern Germany as reported by EVS, with and without life insurances, and GSOEP. Note that some cell sizes are fairly small, and hence this distribution is less reliable than a comparison of the overall wealth holdigns. For western Germany, the constructed GSOEP data are fairly similar to the EVS data without life insurance, except that GSOEP reports significantly less financial wealth for self-employed and unemployed. For East Germany, GSOEP reports significantly higher wealth for self-employed and lower wealth for white collar workers than EVS, again excluding life insurance. GSOEP and EVS data differ most for self-employed. It is a well known problem that wealth of self-employed is difficult to measure, and hence we exclude self-employed in our main analysis, and just incorporate them in a robustness check in section 7.4.

For civil servants, the constructed GSOEP data matches the EVS data without life insurance fairly well in East and West. In the West, the wealth of civil servants is slightly underestimated, as is the wealth of white collar workers, blue collar workers and unemployed. If we believe that the true wealth holdings correspond to the wealth reported in EVS, we could do the following. For every occupational group, we calculate the multiplication factor that has to be applied to data from GSOEP such that average wealth matches the one reported in the EVS, and we apply this factor to the wealth of each household belonging to the occupational group. The multiplication factor for civil servants would be slightly smaller than for the other groups. Replicat-

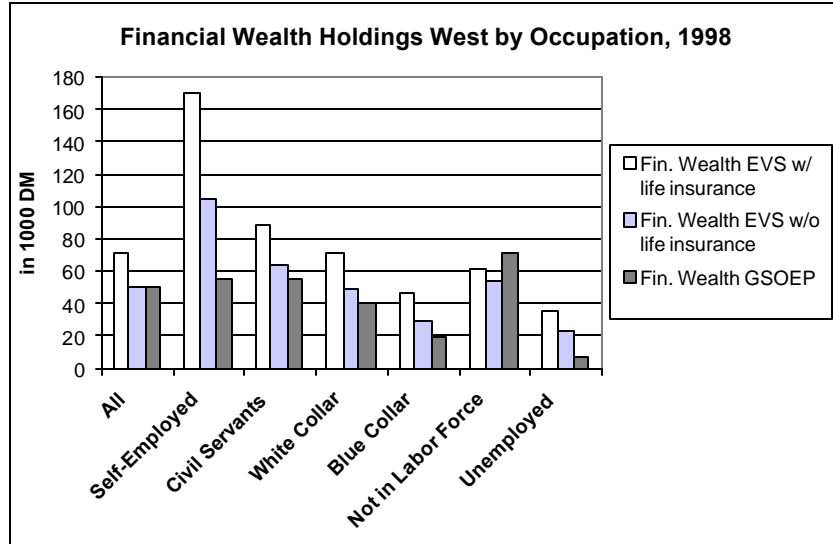**Financial Wealth Holdings West by Occupation, 1998**

Figure 8: Financial wealth of west German households by occupational groups as reported by EVS and GSOEP

ing our analysis with this new inflated wealth measure, we would hence find evidence for slightly higher precautionary savings in the west sample than in our analysis using GSOEP data. If we rescale wealth levels for the East similarly, the multiplication factor would be bigger than 1 for all groups except civil servants, whose wealth is overestimated by GSOEP. Therefore, redoing our analysis with these rescaled data would give a much more negative coefficient on the civil servant dummy. In conclusion, our evidence for self-selection in the West and its quantitative importance would be even larger than in our main analysis.[32]

To compare our constructed real wealth measue with data from the Einkommens- und Verbrauchsstichprobe, we focus on the average gross value of owner-occupied plus non owner-occupied housing (i.e. without deducting mortgage debt). As Börsch-Supan et al. (1999) state, the EVS overestimates home ownership. In 1993, EVS reports that 46.7% of the households own the house they are living in, while GSOEP reports the number to be 40%, which is closer to the most trusted number of 40.9% that comes from the Gebäude- und Wohnungsstichprobe (Building and Apartment

---

[32]Note that this exercise relies on the assumption that there was no migration after reunification in the EVS sample, since we cannot deduce residence before reunification from the EVS.
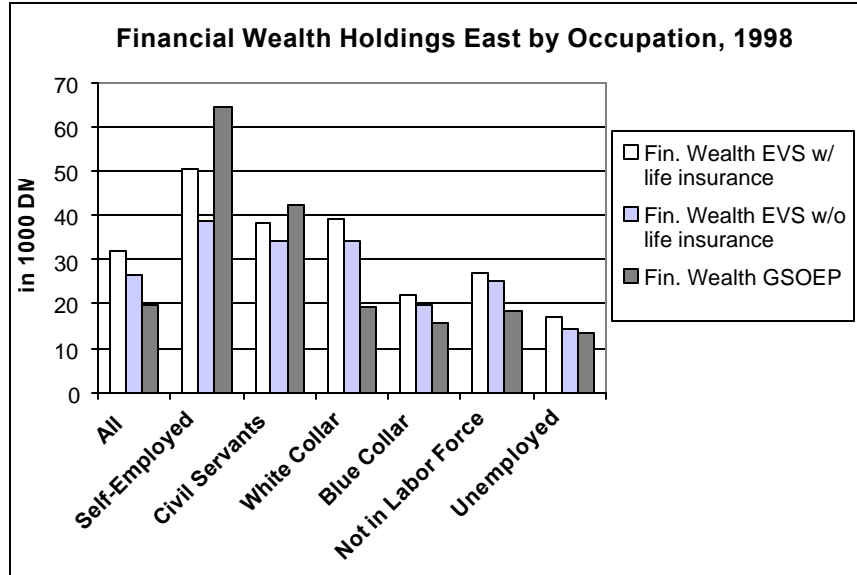
Financial Wealth Holdings East by Occupation, 1998

Figure 9: Financial wealth of east German households by occupational groups as reported by EVS and GSOEP

Survey). We similarly find that for the 1998 data, EVS reports higher home ownership rates than GSOEP (see figure 10).

To circumvent this inconsistency, we compare average gross house values conditional on possessing housing wealth. The gross average total value of owner and non-owner occupied housing in 1998 constructed by us from GSOEP amounts to 391,000 DM in western Germany, and 203,000 DM in eastern Germany.[33] These compare to 467,000 DM in western Germany and 231,000 DM in eastern Germany in the 1998 EVS (Münnich 1999), i.e. to 83.7% and 87.9% of the EVS data. Münnich (1999) stresses that the amount provided by households in the EVS is supposed to reflect the sales price of the property in the current market, but that very often the impression arises that households are too optimistic in the estimation of their property. The true value of the property might actually lie between the values constructed from GSOEP and those provided by EVS.

Figures 11 and 12 show the average amount of gross real wealth by occupation of the household head, separately for western and eastern Germany.[34] For western

---

[33]For the construction of these data, we again use the entire sample and cross-sectional weights.

[34]Münnich (1999) provides data for self-employed splitted into farmers and others. We average

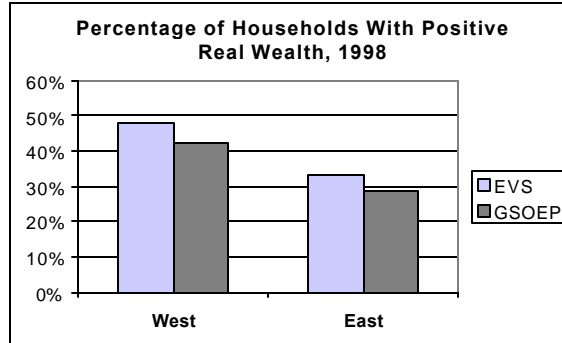**Percentage of Households With Positive Real Wealth, 1998**

Figure 10: Percentage of households with positive real financial wealth from EVS and GSOEP, 1998, separately for western and eastern Germany

Germany, GSOEP provides lower estimates of real wealth than EVS for every occupation, with the difference being largest for self-employed and civil servants. For eastern Germany, the estimates from GSOEP are higher than those from EVS for households whose head is not in the labor force. If we would again rescale the GSOEP data per group to match the average EVS data, in the West sample the multiplication factor would be biggest for civil servants, while in the East sample it would be smallest for civil servants. Hence, our evidence for precautionary savings would be weaker in the West sample and stronger in the East sample, corroborating our evidence for self-selection in the West.

Overall, we conclude that, based on a comparison to the best available wealth data from EVS, the wealth measures constructed from the GSOEP data seem to match the true wealth holdings reasonably well. While there are certain specific shortcomings, the unique episode of German reunification can be used to test for and quantify the importance of self-selection only based on GSOEP data. From a comparison to EVS, it seems that our qualitative results would not change, and our quantitative results might be even stronger, if we could use EVS data for our analysis.

Calculating the saving rate as household saving divided by disposable household income, we get saving rates of 9.6% in 1998 and 1999, and 9.1% in 2000 from the GSOEP data. These rates are very similar to the ones reported by the German Central Bank, namely 10.3% in 1998, and 9.8% in 1999 and 2000.

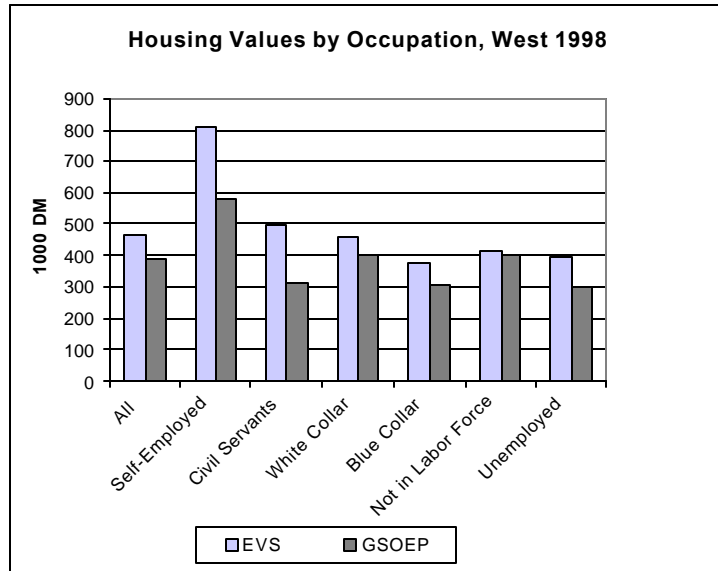this data by assuming that 10% of self-employed are farmers.

Figure 11: Average gross amounts of housing values conditional on owning a house by occupation in western Germany, taken from EVS and GSOEP 1998
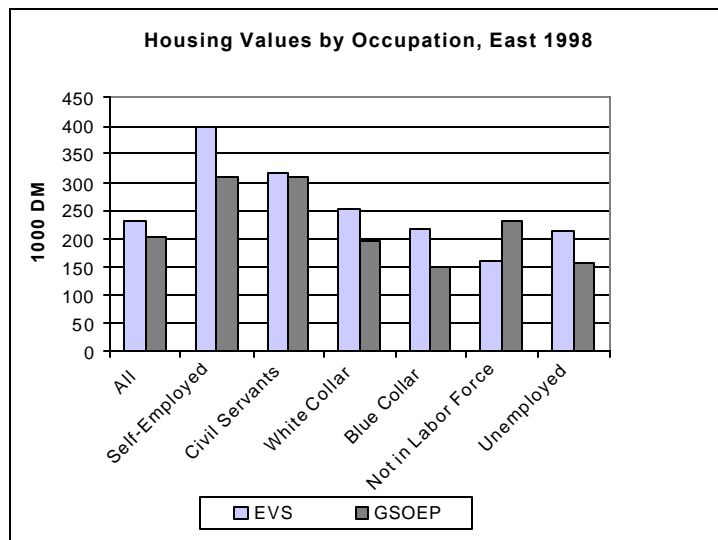

Figure 12: Average gross amounts of housing values conditional on owning a house by occupation in eastern Germany, taken from EVS and GSOEP 1998

B Income variations of civil servants and non civil servants

In one of our main identification assumptions, we argue that civil servants face lower income risk than the rest of the population because they cannot be dismissed, and because they can predict their future income better than other people. We base our claim on several institutional factors. We see one of the main advantages of our analysis in the fact that we do not have to estimate income variances from an assumed income process. Such estimated risk might not coincide with the subjectively perceived risk. Hence, even if we would observe a higher income variance for civil servants than for non civil servants, we would still believe that our identification assumption is true and our analysis valid. Nevertheless, in this appendix we show that using simple coefficients of variation for income, civil servants also seem to face lower income variations than non civil servants.

In figures 13 and 14, we show kernel densities of the coefficients of variation of household income, inflated to year 2000 values, over the years 1984 to 2000 for households whose heads were civil servants or non civil servants, respectively. Restricting our sample to households whose main income earner did not change over the 17 years and who responded in every survey year leaves us with a small sample, consisting of 49 civil servants and 219 non civil servants. Figure 13 shows kernel density estimates for coefficients of variations smaller than 175, which is the median value for non civil servants, while figure 14 includes all observations. Both figures show that the coefficients of variations of income are smaller for civil servants than for non civil servants. Hence, in addition to being able to predict their future incomes better than non civil servants due to institutional reasons, civil servants also face lower income variations than non civil servants. We do several sensitivity analyses, which all confirm this result. First, since it is unclear whether working part-time constitutes a choice or a negative shock in the case of non civil servants, we exclude households whose main income earner worked part time in any year. Second, we focus on households with only a single income earner. Last, to increase the number of observations, we include households for whom we have income information for at least 10 of the 17 years.[35]

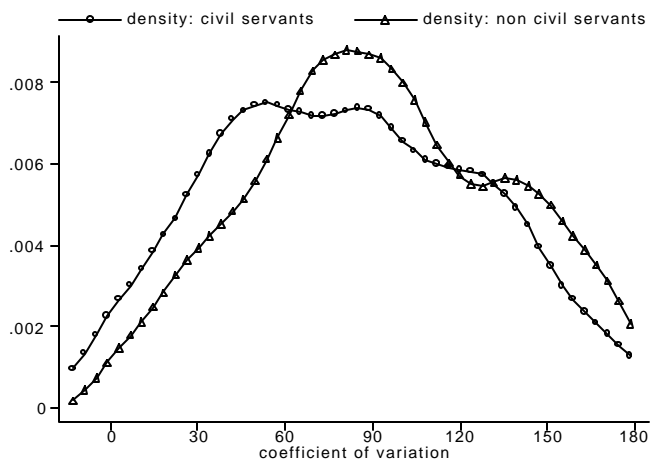[35]Results are available from the authors upon request.

Figure 13: Kernel density estimates for coefficient of variation of household incomes of civil servants and non civil servants, excluding observations with coefficient of variation larger than 175
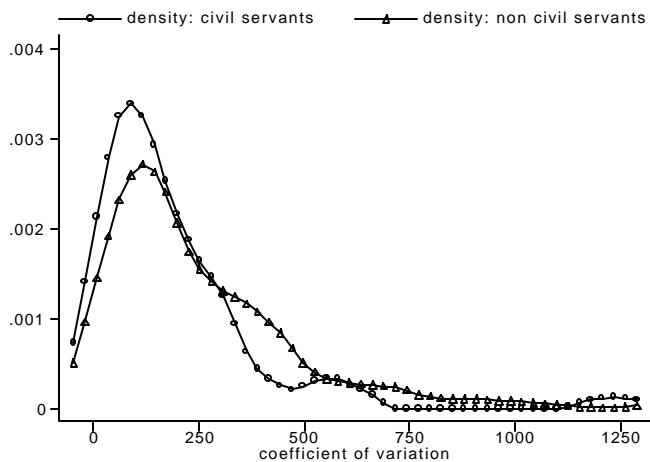

Figure 14: Kernel density estimates for coefficient of variation of household incomes of civil servants and non civil servants, including all observations

C Housing choices of civil servants and non civil servants

In this appendix, we show some evidence that supports our claim that home ownership of civil servants is comparatively high due to their high job security. We show that civil servants are less likely to move than people in other occupations, and that they are more likely to own a house even after controlling for income and other relevant variables.

Table 7 shows the result of a probit estimation regressing home ownership on income, education, family status and family size, age, and the civil servant dummy. For this estimation, we use the same sample selection criteria as in our main analysis, but include data from 1992 to 2000 in order to increase the sample size. This estimation corroborates that civil servants are significantly more likely to own a house than people in other occupations.

Dep. variable: home ownership	Coeff.	Std. error
income($*10^3$)	0.156	0.008
children	0.124	0.015
adults	0.122	0.016
age	0.026	0.001
married	0.159	0.039
divorced	-0.360	0.055
college	-0.042	0.062
vocational training	0.199	0.054
intermediate/technical schooling	-0.347	0.101
civil servant	0.232	0.057
constant	-2.562	0.087
# of observations	37,773	
log likelihood	-22023.9	

Note: standard errors are corrected for pooling

Table 7: Probit estimation of home ownership

There exist two variables in GSOEP from which we can deduce whether people moved recently. The first question asks whether the household moved into the current apartment in the last year. While this variable captures movings perfectly, it does not tell whether the move was associated with a significant change of location. Second,

from 1998 on GSOEP reports the federal state (*Bundesland*) of residence, and hence for 1999 and 2000 we can deduce whether a household moved to a new state. These moves are very infrequent; only 1.2% of households moved to a new state in these two years. For both variables, we estimate probit regressions, and report the results in table 8. In general, we can explain the probability of changing the apartment much better than the probability of moving to a new federal state. This is not very surprising, since the latter variable is somewhat arbitrary. The coefficient on the civil servant dummy is negative in both estimations, but only significant in the first one. We conclude that civil servants are less likely to move than the rest of the population.

	Dep. variable: changed apartment		Dep. variable: moved to new state	
	Coeff.	Std. error	Coeff.	Std. error
income($*10^3$)	0.008	0.005	0.027	0.019
children	-0.014	0.012	-0.045	0.056
adults	-0.102	0.012	-0.298	0.079
age	-0.016	0.001	-0.035	0.006
married	-0.063	0.029	-0.055	0.122
divorced	0.288	0.036	-0.058	0.153
college	-0.076	0.045	0.205	0.185
vocational training	-0.110	0.041	-0.112	0.166
intermediate/technical schooling	0.039	0.076	-0.463	0.402
civil servant	-0.073	0.040	-0.057	0.179
constant	-0.247	0.062	-0.413	0.301
# of observations	28,321		7644	
log likelihood	-10,031.1		-435.5	

Note: standard errors are corrected for pooling

Table 8: Probit estimation of moving

D Summary statistics

Variable	full sample		
	Obs.	Mean / Per cent	Std. Dev.
log (wealth)	10007	9.56	1.17
log (saving)	10007	4.37	2.87
log (income)	10007	8.34	0.45
age	10007	38.89	8.66
children	10007	0.85	0.96
adults (age>16)	10007	2.15	0.91
sex (male=1)	10007	69.2 %	
married	10007	60.5 %	
divorced	10007	10.7 %	
college	10007	23.2 %	
vocational training	10007	69.2 %	
secondary schooling	10007	4.1 %	
west (living in west at time of survey=1)	10007	70.3 %	
own house	10007	45.3 %	
civil servant	10007	9.5 %	

Note: monetary values are in DM, inflated to 2000
values (1 DM approx. 0.5 Dollar); log(saving) has
been set equal to 0 if saving is smaller than 0

Table 9: Summary statistics for the full sample

	Variable	Obs.	Mean	Std. Dev.
civil servants	log (wealth)	952	9.83	1.17
	log (saving)	952	5.04	2.67
	log (income)	952	8.59	0.39
other occupations	log (wealth)	9055	9.53	1.17
	log (saving)	9055	4.30	2.88
	log (income)	9055	8.32	0.45

Note: monetary values are in DM, inflated to 2000 values
(1 DM approx. 0.5 Dollar);
log(saving) has been set equal to 0 if saving is smaller or equal to 0.

Table 10: Occupation group characteristics

Variable	West sample			East sample		
	Obs.	Mean / Per cent	Std. Dev.	Obs.	Mean / Per cent	Std. Dev.
log (wealth)	5532	9.74	1.20	2510	9.36	1.07
log (saving)	5532	4.51	2.84	2510	4.30	2.91
log (income)	5532	8.46	0.42	2510	8.27	0.42
age	5532	41.51	7.05	2510	42.02	6.86
children	5532	0.97	1.03	2510	0.83	0.87
adults (age>16)	5532	2.13	0.89	2510	2.39	0.96
sex (male=1)	5532	76.0 %		2510	61.2 %	
married	5532	67.4 %		2510	70.3 %	
divorced	5532	11.8 %		2510	14.0 %	
college	5532	22.2 %		2510	34.0 %	
vocational training	5532	69.7 %		2510	64.0 %	
secondary schooling	5532	4.8 %		2510	1.1 %	
west (living in west at time of survey=1)	5532	99.2 %		2510	8.6 %	
own house		54.2 %		2510	43.1 %	
civil servant	5532	12.9 %		2510	3.7 %	

Note: monetary values are in DM, inflated to 2000 values (1 DM approx. 0.5 Dollar)
log(saving) has been set equal to 0 if saving is smaller or equal to 0.

Table 11: Summary statistics West sample and East sample