Trade-Off Between Consumption Growth and Inequality:

Theory and Evidence for Germany

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Abstract

This paper examines the structure and evolution of consumption inequality. Once heterogeneous agents relate their neighbors' consumption to their own, consumption volatility and inequality are affected. The model predicts a positive relationship between the group specific average consumption growth and within-group inequality, which is empirically confirmed using survey data from the German Socio-Economic Panel (GSOEP) covering the period 1984-2005. Age and household size are crucial for within-group inequality, as young and/or small households are more sensitive to income and consumption shocks. The data also shows increases of within-group inequality directly after the reunification and the introduction of the euro.

Preliminary!

Keywords: consumption inequality, consumption growth, German Socio-Economic Panel, altruism

JEL codes: E21, D91, D31, D64

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1 Introduction

The structure and evolution of income inequality has always been well documented for many countries, while studies on consumption inequality are relatively limited due to the availability of survey data. This is also the case for Germany, where most inequality studies focus on wage income, disposable income or household wealth. For the purpose of examining the well-being of population, however, consumption is a more direct measure. In this paper I use a theoretical model of heterogeneous agents to examine the link between within-group inequality and group average consumption growth, and empirically test my results using the German Socio-Economic Panel study.

As already mentioned above, my analysis of consumption inequality for Germany (West) complements a number of studies that use micro data to document the evolution of wage or income inequality in Germany in the last 25 years. Biewen (2000) studies the evolution of income inequality in Germany using recorded net household income (GSOEP), and finds that the West German income distribution between 1984 and 1996 was stable. The conventional idea is that in Germany the labor income/wage income distribution contributes most to the total income distribution. For example, Dustmann, Ludsteck and Schönberg (2007) cast a renewed view on the West German wage structure by exploring the IABS 2% random sample of social security records for the years 1975 to 2004. Due to the nature of the data set, this study focuses on those individuals covered by the social security system, excluding the self-employed, civil servants and marginal jobbers[1]. They find that German wage inequality has increased at the top of the distribution in the 1980s, while inequality at the bottom of the distribution started to rise in the 1990s.

Aside from the importance of labor income inequality, recent studies start to regard capital income as another source of inequality. Fräßdorf, Grabka and Schwarze (2008) compare Germany, the U.S. and the U.K., analyzing the weight of capital income in disposable income. After decomposing disposable income into single income components, they find that the capital income distribution is exceedingly changing and its share in disposable income has risen in recent years. Thus, a large part of the growing disparity of disposable income could be attributed to the increasing capital income inequality. From a more general perspective,

[1] Jobs with at most 15 hours per week or temporary jobs that last no longer than 6 weeks.

Becker (2000) looks at the influence of single income components on inequality in Germany, comparing the years 1988 and 1993. She finds that within-group inequality is larger compared to between-group inequality. While people within the same group receive various kinds of income, both their main income (labor income), and other types of income (including capital income and transfers) display substantial inequality in distribution.

A more general study is made by Fuchs-Schündeln, Krüger and Sommer (2008), as one of the first studies on the trend of consumption inequality in Germany. Combining the GSOEP and EVS data, they document the inequality trends of wage income, consumption and wealth in West Germany and find upward trends in wage and market income after the reunification. They find that, for West Germany, income inequality experienced an upward trend before the reunification, fell between 1988 and 1993, and climbed up again from 1993 onwards, while disposable income and consumption inequality only display a modest rise over the same period. The pattern of consumption inequality in their findings can also be found in this paper. Using yearly data from the GSOEP, my study fills in the blanks between the observations in their study based on EVS, which is only available every five years.

At the same time, a rich body of literature contributes to making aware of the connection between income shocks and consumption inequality, where incomplete risk-sharing/imperfect insurance are considered as the explanations to the diverse evolution of income and consumption inequality. Blundell, Pistaferri and Preston (2008) examine U.S. panel data on income from the PSID (1978-1992) and cross-section Consumer Expenditure Survey (CEX) data on consumption (1980-1992). Their study confirms that consumption inequality follows closely the trends in permanent earnings inequality, as Cutler and Katz (1991) showed earlier. They find extremely strong evidence against full insurance for permanent income shocks but not for transitory income shocks. This result is an extension of a previous study by Blundell and Preston (1998) using the British Family Expenditure Survey (FES), a cross-sectional micro data set on households consumption from 1968 to 1992, to distinguish effects of permanent and transitory income shocks on the growth of consumption inequality.

Krüger and Perri (2005) also look into the CEX data set and find that while between-group consumption inequality has tracked between-group income inequality quite closely, within-group consumption inequality has increased much less than within-group income inequality. Motivated by this empirical finding, they build a theoretical framework depicting the risk-

sharing behavior within groups when idiosyncratic labor income shocks occur, where the market is imperfect due to the lack of contract enforceability. In their model with endogenous debt constraints, agents enter risk-sharing contracts with their group members and have the option to default at any time. If default, agents have to pay the cost of losing their assets and the chance of future risk sharing. They find that when income becomes more volatile, risk-sharing turns out to be more valuable for agents, which reduces their incentive to default. As a result, within-group consumption inequality decreases.

Another type of discussion on consumption smoothing and risk-sharing focuses on private information problems. An example is Attanasio and Pavoni (2007). They summarize and differentiate two extreme types of models in risk-sharing, the complete insurance model and self insurance model, where the latter can be interpreted as a simple version of life cycle/permanent income hypothesis (PIH). They further present a setting with private information problems, introducing moral hazard and hidden savings. Their model generates a lower consumption insurance (thus lower consumption volatility) than the PIH type of model (where only one single asset with given interest rates is used to transfer resources), since consumers are able to insure more of their idiosyncratic risks under asymmetric information on efforts and secretive savings. Exploring micro data from the UK family Expenditure Survey from 1974 and 2002, they find results consistent with the implications of their asymmetric information model.

In this paper I choose a comparatively easy way of modeling to deal with the "excessive smoothing" of consumption. Similar to Galí (1994), I add a special type of consumption externalities, group average consumption, to a self insurance model. The attitude of households toward this externality is the key issue if the model produces "excessive smoothing" or not. Acknowledging consumption inequality as a result of income uncertainties (permanent and transitory), I use this model to study the link between the group average consumption growth and within-group inequality. The main theoretical finding is that this consumption externality drives agents from the original consumption smoothing path. When restrictions on the time series properties of consumption growth are relaxed, the deviation can be even larger. Nevertheless, regardless of the extent of the deviation, the model almost always predicts a positive correlation between the group average consumption growth and within-group inequality.

I further test this theoretical hypothesis using data from the German Socio-Economic Panel and find significantly positive correlation. Overall, the constructed consumption data does not show large changes in inequality during the sample period (1984-2005), except distinguishable increases directly after the reunification of Germany and the introduction of the euro. Compared to income inequality, the data shows a similar picture as what Krüger and Perri (2005) find in U.S. data, that between-group consumption inequality has tracked between-group income inequality much more closely than the within-group consumption inequality has followed the within-group income inequality.

The rest of the paper is organized as following: Section Two presents the theoretical model and an extension based on the random walk hypothesis of consumption growth; Section Three introduces the GSOEP data and discusses inequality trends in Germany in the 22 sampling years; in Section Four the grouping strategy of the sample is discussed, and tests are carried out on the relationship between consumption growth and inequality; Section Five concludes.

2 Consumption Growth and Inequality

In modern economics there are two major hypothesis connecting income shocks and consumption insurance. The complete market hypothesis assumes that consumption is fully insured against idiosyncratic income shocks (both permanent and transitory), which is soundly rejected in micro data (e.g. Attanasio and Davis, 1996). The other one, the permanent income hypothesis, assumes that personal savings serve as the only mechanism to smooth income shocks, and exclusively against transitory shocks (Deaton, 1992). This hypothesis is also rejected by, for example, Attanasio and Pavoni (2007). Their paper, as well as an earlier paper by Campbell and Deaton (1989), finds that consumption exhibits "excessive smoothness" by reacting too little to permanent income shocks; while some other studies find that consumption shows "excessive sensitivity" by reacting too much to transitory shocks (e.g. Hall and Mishkin, 1982). The truth seems to lie somewhere in between, and therefore partial insurance of consumption to income shocks becomes slowly the consensus.

Standing on the shoulders of these works and acknowledging the effects of income shocks on consumption insurance, I add some special "flavor" to a simple self insurance (PIH) model, which as a result is consistent with the idea of partial insurance. However, my true task is

to use such a model to study the cross-sectional moments based on a panel setting. To be specific, the model helps to discover the connection between consumption growth and inequality.

The paper starts with discussing two possible extensions of a standard PIH model where agents use one asset to transfer resources intertemporally. The first extension involves some external criteria for the households: the households cast their preference not only on their own consumption, but also on that of their neighbors (other households who are in the same social class). Relative standard of living becomes another important issue besides the absolute level. The consumption smoothing path of the household in the standard PIH model would be distorted, and variance of consumption would change. The direction of this change depends on households' attitude to their neighbors' well-being (if they are altruistic or meant to "keep up with the Joneses"). The result, however, is reached regardless of the assumption about the time series properties of the group average growth (the cross sectional moments such as means and variances), and the relaxation of this assumption will be examined as the second extension.

2.1 A Heterogeneous Agent Model

The economy is composed of a large number of heterogeneous households, which can be divided into m groups according to characteristics such as household size, members' age, education, occupation and so on. Households within one group share the aforementioned features but are still subject to idiosyncratic income and consumption shocks. Although households in a given group do not observe the exact income of other group members, they can observe their consumption patterns. If they would like to compare with others in a similar socio-economic class, it is the case of "keeping up with the Joneses". Otherwise, if they also benefit when others are doing well, we have altruistic households. I label the result of this additional externality a group effect on households' consumption decision. The setup is similar to Galí(1994) and Abel (1990), only that in Abel's case households regard agents' own consumption habits and the group average consumption in the previous period as a benchmark for their current period consumption ("catching up with the Joneses")[2].

[2]Abel (1990) introduces jointly the agent's own consumption habit and past aggregate consumption into current utility: $u(C_t, v_t) = [C_t/v_t]^{1-\alpha}/(1-\alpha)$, where the preference parameter $v_t \equiv \left(C_{t-1}^D v_{t-1}^{1-D}\right)^\gamma$. Let

In this simple model households transfer their resources between periods by buying and selling a risk-free one-period bond which pays off one unit of consumption good. Let $\{q_t\}_{t=0}^{\infty}$ be the sequence of bond prices and $\{A_{ij,t+1}\}_{t=0}^{\infty}$ the plan of asset holdings. A typical PIH model also allows for endogenous labor supply and non-stationary income (Bewley, 1977). However, since the purpose of this paper is on the consumption dynamics, I reduce the households' problem to consumption and asset holding decisions. To rule out other possible deterrents to consumption smoothing, I also assume there are no credit constraints for any household.

Define $C_{ij,t}$ as the time t household consumption of the jth household in the ith group, $X_{i,t}$ the group-average consumption and $Y_{ij,t}$ the endowment realization at the same period. γ is the risk aversion parameter and is usually larger than 1. Household j in group i has the following maximization problem[3]:

$$\max_{\{C_{ij,t}\}} E_t \sum_{t=0}^{\infty} \beta^t \left[U\left(C_{ij,t}, X_{i,t}\right)\right]$$

subject to

$$C_{ij,t} + q_t A_{ij,t+1}\left(A_0, Y^t, X_i^t\right) \leq Y_{ij,t} + A_{ij,t}\left(A_0, Y^{t-1}, X_i^{t-1}\right),$$

where A_0 is given and $\lim_{T\to\infty} q_T A_{ij,T} = 0$ so that Ponzi schemes are ruled out.

The utility function has the following isoelastic form:

$$U\left(C_{ij,t}, X_{i,t}\right) = \frac{C_{ij,t}^{1-\gamma} X_{i,t}^{-(1-\gamma)\alpha} - 1}{1-\gamma}$$

The parameter α can be interpreted as the weight of group average consumption relative to household's own consumption. There is no restriction on α to be positive or negative, which allows us to examine three cases considering the group effect in consumption:

$D = 0$, then the current consumption only takes external habit (aggregate consumption) as benchmark, which is also the case here.

[3]To elaborate in income, e.g. Krüger and Perri (2005), the utility function takes the form

$$U\left(C_{ij,t}\right) = \frac{C_{ij,t}^{1-\gamma} X_{i,t}^{-(1-\gamma)\alpha} - 1}{1-\gamma} - \frac{N_{ij,t}^{1-\psi}}{1-\psi}.$$

Labor income is considered as the product of an economy-wide wage and idiosyncratic labor endowment, and the latter consists of a group-specific part (explainable by group characteristics) and an unexplained part (which includes a permanent and a transitory part).

1. When $\alpha < 0$, the household would like to "keep up with the Joneses". The consumption part of the utility can be decomposed into two parts taking logarithms:

$$(1-\gamma)\ln C_{ij,t} - (1-\gamma)\,\alpha \ln X_{i,t} = (1-\alpha)\,(1-\gamma)\ln C_{ij,t} + \alpha\,(1-\gamma)\ln \frac{C_{ij,t}}{X_{i,t}}.$$

Intuitively, households value a weighted average of absolute and relative consumption (compared to group average). In the later part of the paper, it will become clear that such partial preferences, keeping up with the Joneses, would smooth the consumption further than an original self insurance model.

Note that marginal utility of household consumption decreases as group average consumption increases. This reflects exactly the economic implication of "keeping up with the Joneses", since when the neighbors are better off, households suffer from not being able to keep up.

2. When $\alpha > 0$, households do not take the group mean as benchmark, but rather gain utility once the others in the group are doing well. This could be of course interpreted as altruism. However, a more economic intuition is that the group mean consumption acts as "substitute" for the household's own consumption. This would be the feature of a public good. Here, a single household benefits from an increase in the group average.

3. When $\alpha = 0$, the utility function is reduced to a typical self insurance version, where agents are only concerned with their own consumption.

The resulting Euler equation is:[4]

$$q_t = \beta E_t \left[\left(\frac{C_{ij,t+1}}{C_{ij,t}} \right)^{-\gamma} \left(\frac{X_{i,t+1}}{X_{i,t}} \right)^{-(1-\gamma)\alpha} \right].$$

2.2 Implication on Consumption Dynamics

Even though household income does not enter the model directly, it is closely related to household consumption. The permanent income hypothesis states that periodical consump-

[4]In Abel's (1990) model households compare themselves with the previous consumption of the group members, so as to "catch up with the Joneses". Households still buy one unit of risk-free bond at price q_t

$$q_t \left(\frac{X_{i,t}}{X_{i,t-1}} \right)^{-(1-\gamma)\alpha} = \beta E_t \left[\left(\frac{C_{ij,t+1}}{C_{ij,t}} \right)^{-\gamma} \right]$$

Taking logs gives the same result as above, since the growth rate of $X_{i,t}$ is time invariant. This picture, however, can be totally different if consumption growth is time-variant.

tion is subject to lifetime resources, instead of each period's income. Household wealth is thus a better candidate as a consumption constraint. However, while the change of households' consumption is additionally triggered by consumption innovations, the main shocks occurring to households' consumption are often identified as contemporaneous income shocks in the related literature.

Following Meghir and Pistaferri (2004), I assume that per period labor income $Y_{ij,t}$ follows the following process:

$$y_{ij,t+1} = \ln Y_{ij,t} = \varphi Z_{ij,t} + P_{ij,t} + \varpi_{ij,t}$$

where $Z_{ij,t}$ is a set of observable characteristics, $P_{ij,t}$ is the permanent income component, and $\varpi_{ij,t}$ is the transitory component.[5]

The permanent component of income follows a martingale process (random walk):

$$P_{ij,t+1} = P_{ij,t} + \zeta_{ij,t+1}$$

where $\zeta_{ij,t}$ is the permanent shock and serially uncorrelated.

The log of income growth is therefore

$$\triangle y_{ij,t+1} = y_{ij,t+1} - y_{ij,t} = \varphi \triangle Z_{ij,t+1} + (\zeta_{ij,t+1} + \triangle \varpi_{ij,t+1}) .$$

Once data are available on income and consumption, one can even identify the degrees to which permanent and transitory income shocks affect the change of consumption (see Blundell et al., 2008). Even though this is not the focus of my paper, it serves as the premise of my approach. Based on the strong correlation between consumption and income, a natural guess is that the change in log consumption is subject to part of the permanent income shock, transitory income shocks and consumption innovation shocks. The consumption growth rate of household j in group i is approximately the difference of log consumption and can be decomposed into $g_{i,t+1}$, the average growth rate of group i, and some household specific shock $v_{ij,t+1}$:

$$\begin{aligned} g_{ij,t+1} &= c_{ij,t+1} - c_{ij,t} = g_{i,t+1} + v_{ij,t+1} \\ \text{where } g_{i,t} &= \frac{1}{J_i}\sum_{j=1}^{J_i} g_{ij,t}, \quad j = 1, 2, ..., J_i \\ \text{and } v_{ij,t+1} &\sim i.i.d.N\left(0, \sigma_{v_i}^2\right) \end{aligned} \tag{1}$$

[5]Meghir and Pistaferri (2004) use U.S. data to test the autocovariance of the unexplained earnings growth rate. Their result suggests that the transitory shock follows a moving average of degree 1.

As is mentioned, this unexplained consumption shock $v_{ij,t+1}$ contains information about income shocks (permanent and transitory), as well as some consumption innovation (Blundell et al. 2008). In the most simple case, where the growth of consumption is assumed to be log-normally distributed, I can assume $g_{i,t+1}$ to be time-invariant (g_i).

Accordingly, the distribution of consumption growth is $\triangle c_{ij,t+1} \sim i.i.d.N\left(g_i, \sigma^2_{v_i}\right)$. When I aggregate the households within each group i, the idiosyncratic shocks average out and

$$\triangle x_{i,t+1} = x_{i,t+1} - x_{i,t} = g_{i,t+1}$$

Apparently, $X_{i,t}$ is also log-normally distributed, and has a rather simple distribution $N\left(g_i, 0\right)$[6]. Therefore the one-period bond price is

$$q_t = \beta \exp\left[\left[\left(\gamma - 1\right)\alpha - \gamma\right] g_i + \frac{\gamma^2 \sigma^2_{v_i}}{2}\right] \tag{2}$$

A none-zero α leads to the deviation from the standard PIH case where the households' optimization problem is independent of others' consumption behavior. This deviation could be one way to solve the equity premium puzzle in asset pricing. To focus on growth and inequality, I take logs and rearrange equation (2) as:

$$\sigma^2_{v_i} = 2\frac{\left[\gamma + \alpha\left(1 - \gamma\right)\right] g_i + \ln q_t - \ln \beta}{\gamma^2} \tag{3}$$

It yields a relationship between the within-group variance and group average consumption growth. Note that once no group mean is taken into account by the household ($\alpha = 0$), the equation is reduced to the standard PIH model

$$\sigma^2_{v_i} = 2\frac{\gamma g_i + \ln q_t - \ln \beta}{\gamma^2}. \tag{4}$$

Comparing these two equations can tell us the effect of including neighbors' "business". A reasonable value of risk aversion makes $1 - \gamma < 0$. In the case of keeping up with the Joneses,

[6]Then it holds that

$$\ln\left(\frac{C_{ij,t+1}}{C_{ij,t}}\right)^{-\gamma} + \ln\left(\frac{X_{i,t+1}}{X_{i,t}}\right)^{-(1-\gamma)\alpha} \sim N\left(\left[\left(\gamma - 1\right)\alpha - \gamma\right] g_i, \gamma^2 \sigma^2_{v_i}\right)$$

assuming no correlation between the economy-wide shock and the other two shocks. As a result, I write

$$E_t\left[\left(\frac{C_{ij,t+1}}{C_{ij,t}}\right)^{-\gamma}\left(\frac{X_{i,t+1}}{X_{i,t}}\right)^{-(1-\gamma)\alpha}\right] = \exp\left[\left[\left(\gamma - 1\right)\alpha - \gamma\right] g_i + \frac{\gamma^2 \sigma^2_{v_i}}{2}\right]$$

and plug it into the FOC.

the variance of the unexplained part of the consumption $\sigma^2_{v_i}$, as well as consumption itself, is higher than in a typical PIH model. To be specific, in booms, instead of buying more claims so as to convey consumption to tomorrow, households take their neighbors' consumption level as comparison and consume more; while in a recession they restrict their consumption even more than they would otherwise, since everyone else is thrifty. Therefore the variance of consumption increases. Following the contrary argument, when households are enthusiastic about group average well-being (regarding it as a public good), the variance is smaller and consumption smoothing becomes excessive.

Another major concern, which will be elaborated in the empirical part of the paper, is on the sign of the relationship between g_i and $\sigma^2_{v_i}$. A positive correlation like in the typical self insurance case (4) suggests that groups with higher consumption growth also have to pay the price of larger within-group inequality. In (3), however, there is also a possibility that the correlation becomes negative, if the risk aversion parameter and externality parameter satisfy $\alpha > \frac{\gamma}{\gamma-1}$. More discussion can be found in next subsection.

2.3 Adding Time Series Properties to Group Consumption Growth Rate

A further extension of the model includes relaxing the time-invariance assumption about the group average consumption growth. Note that the theoretical result (3) does not depend on if group-specific consumption growth is time-invariant or not. However, asset pricing theory tells that the assumption about the evolution of consumption growth rate is very important for the theoretical model to reproduce the price volatilities of the risk-free bonds. Campbell and Mankiw (1989) use aggregate data to test if the change in consumption is unpredictable, and their regression result significantly rejects the random walk hypothesis. But does it also hold true for consumption growth? A simple test can be done using the GSOEP data. I choose the Shapiro-Wilk normality test on the difference between subsequent growth rates (See Appendix I). At the 5% significance level, 23 out of 24 groups fail to reject the null hypothesis of normality. This result suggests that the difference of subsequent consumption growth rates are normally distributed, and, in other words, it implies a random walk process of consumption growth. In the following, I will show how it matters for the examination of consumption inequality.

Assume that the group-wide growth rate $g_{i,t+1}$ of consumption follows a driftless random

walk with a group-specific shock $u_{i,t+1}$:

$$g_{i,t+1} = g_{i,t} + u_{i,t+1};\ u_{i,t+1} \sim i.i.d.N\left(0, \sigma_u^2\right) \tag{5}$$

which implies that consumption growth is conditionally log-normally distributed:

$$E_t\left[g_{i,t+1}\right] = g_{i,t} \text{ and } var_t\left[g_{i,t+1}\right] = \sigma_u^2$$

The variance of this group-specific shock can be interpreted as one of the sources of between-group variance. Recall from (1) that the difference between individual consumption growth and the group mean is merely the idiosyncratic shock $v_{ij,t}$. Combining (5) with (1) yields $g_{ij,t+1} = g_{i,t} + u_{i,t+1} + v_{ij,t+1}$, where the conditional mean and variance are

$$E_t\left[g_{ij,t+1}\right] = g_{i,t} \text{ and } var_t\left[g_{ij,t+1}\right] = \sigma_u^2 + \sigma_{v_i}^2.$$

and the group average growth rate $g_{i,t+1} \sim i.i.d.N\left(g_{i,t}, \sigma_u^2\right)$. Equation (2) would look different:

$$q_t = \beta \exp\left[\left[\left(\gamma - 1\right)\alpha - \gamma\right] g_{i,t} + \frac{\gamma^2\sigma_{v_i}^2 + \left[\gamma^2 + \left(1-\gamma\right)^2\alpha^2\right]\sigma_u^2}{2}\right]$$

Obviously, the additional uncertainty from group consumption growth drives up household demand for a secure transfer of their consumption between periods, thus increasing the bond price. Besides, when current growth $g_{i,t}$ is high, households expect high consumption growth tomorrow. Due to their smoothing motive, they would like to borrow against future growth, thus also driving up bond prices.

The non-stationary consumption growth also adds a new element to consumption inequality:

$$\sigma_{v_i}^2 = \frac{2\left[\left(\gamma + \alpha - \gamma\alpha\right) g_{i,t} + \ln q_t - \ln\beta\right]}{\gamma^2} - \frac{\left[\gamma^2 + \left(1-\gamma\right)^2\alpha^2\right]\sigma_u^2}{\gamma^2}$$

Keeping all other parts unchanged, within-group inequality decreases as a large part of the variance is now attributed to the between-group differences.

However, the correlation between the group growth rate and within-group variance is the same as in (3).

As mentioned above, except that households are highly altruistic and risk averse, both the standard PIH case and the extensions would predict a positive correlation between the group growth and within-group variance. It suggests that groups with faster consumption growth

have also higher variance. One may argue that such are the groups with a lower consumption level and therefore especially sensitive to income shocks. However, since a larger part of their income is used to purchase basic goods with a very low demand elasticity, and a relatively small portion of the consumption is sensitive to the business cycle (luxury goods) compared to the higher income group, I may conclude that it is the higher endowment group who should bear more consumption inequality. This hypothesis may be tested using the GSOEP data set where annual household consumption can be constructed in subsequent years between 1995 and 2005. The next section will describe the data and report the results.

3 Bringing the Model to the Data

For the purpose of testing this theoretical framework, I need panel data to get the growth rate of household consumption. While the EVS (*Einkommens- und Verbrauchs-Stichprobe)* data can offer us a deep and detailed view of the household consumption, it is carried out only every 5 years, which, unfortunately, can not help constructing the growth rates (Becker et al., 2002).

Another source is the German Socio-Economic Panel. Starting from 1984, this panel data set is based on household interviews, and contains crucial questions on living and income. However, GSOEP does not offer much data on consumption, especially not on nondurable goods consumption. What one can do is to construct consumption from the available information on financial inflows and outflows. Besides the households' monthly net income and savings, there are data on extra income: yearly rental income, capital/investment income, additional income from winnings and inheritance; and detailed expenditures: cold rent (rent excluding heating, water and other expenses), the cost of heating and water, the credit and interest repayment. Unfortunately, there are neither data on expenditure on durable goods (which would otherwise decrease the amount of nondurable consumption), nor data on total amount of consumption credit (which would otherwise increase the total amount of the expenditure). I can only make the assumption that the two missing parts of the puzzle, the underestimation and overestimation, approximately cancel each other out, i.e. consumption credit is only used for durable goods. This, however, is a reasonable assumption due to the often high prices of the durables.

I follow Cutler and Katz (1991) to construct consumption from the expenditure of house owners, where I need to impute the market-valued cold rent for all house owners. In case some house owners also report their own estimation of the rental value of the housing, I also impute the estimated cold rent for other house owners who did not report their estimation. The imputations are based on relevant house characteristics such as size of the apartment, family size, family monthly net income, area of the apartment (only available in 1985, 1994, 1999, 2004). Year and federal state dummies are included[7]. Then I add the imputed cold rent/estimated cold rent to expenditure and deduct the mortgage payments and interest, the expenses to maintain the house, as well as the costs for water, garbage removal and street cleaning, in order to get an approximation of consumption for these house owners. Further I calculate consumption growth of each household. Regressions of within-group variances on the group average growth rate, using these two imputed values separately, yield slightly different results (see Figure 1 and 2).

Before entering the discussion about within-group and between-group effects, the crucial question would be, what criteria I should use for dividing the groups. For this purpose I regress consumption growth on crucial household characteristics such as household size, household members' age, occupation and education, as well as year dummies. As the fitted part counts for the between-group variance, the residuals (unexplained variables) are equivalent to the within-group inequality.

The best explanatory variables for consumption are age and age-squared, education level (using the International Standard Classification of Education, ISCE-1997), occupation (Erikson Goldthorpe Classification[8]) of the household head, household size and its square, as well as the interaction term of education and occupation. Year dummies are included.

As an important by-product, the evolution of between-group and within-group inequality is shown in Figure 1. We can observe a notable increase in inequality directly after the reunification in the year 1990, which is fueled by a 33% surge of within-group variance. This

[7]The two imputed results are highly correlated with a correlation coefficient of 0.915, which indicates that the estimated cold rent by the house owner does not differ too much from the market value. In 62.4% of the cases, the estimated rent is higher than the market value of the apartment/house.

[8]Dividing occupations into: High Service, Low Service, Routine Non Manual, Self-Employed With Employees, Self-Employed No Employees, Manual Supervise, Skilled Manual, Semi - Unskilled Manual, Farm Labor, Self-Employed Farm, Unemployed, Pensioner

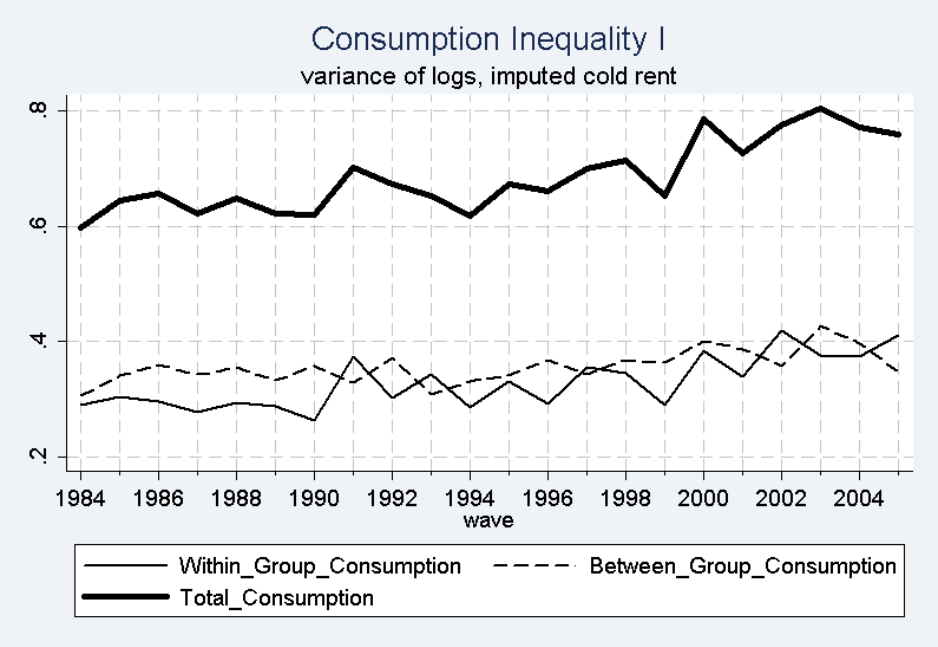

Figure 1: Consumption Inequality I

may be a result of the influx of East German workers to West Germany. This is not a period when a trained doctor from the East could immediately get a job with the same payment as his West German colleague. Another time point of sharp increase in inequality comes in 2000, after the euro was introduced, and then shortly afterwards when Germany experienced a boom (2002/2003). High inflation followed the arrival of the new currency and joined the upturn of the economy, which may have distorted people's usual consumption behavior. To be observed at first is an increase of within-group variance, which is more "nominal" and may result from differences in heterogeneous preferences and idiosyncratic shocks. Afterwards, the real economy may also be affected and the structure of economic sectors and industries could potentially change, which may consequently raise the inequality between different groups.

Figure 2 shows a slightly different version of the evolution of inequality. Instead of imputed cold rent, the imputed estimation of cold rent is added to expenditure (and effectively to consumption). While the between-group variances do not change much, the within-group variance is higher in absolute value. Accordingly, in most of the years, within-group variance overtakes between-group variance. This is a result from the overestimation of cold rent compared to the market value of the rent. The imputed expenses in consumption of house owners

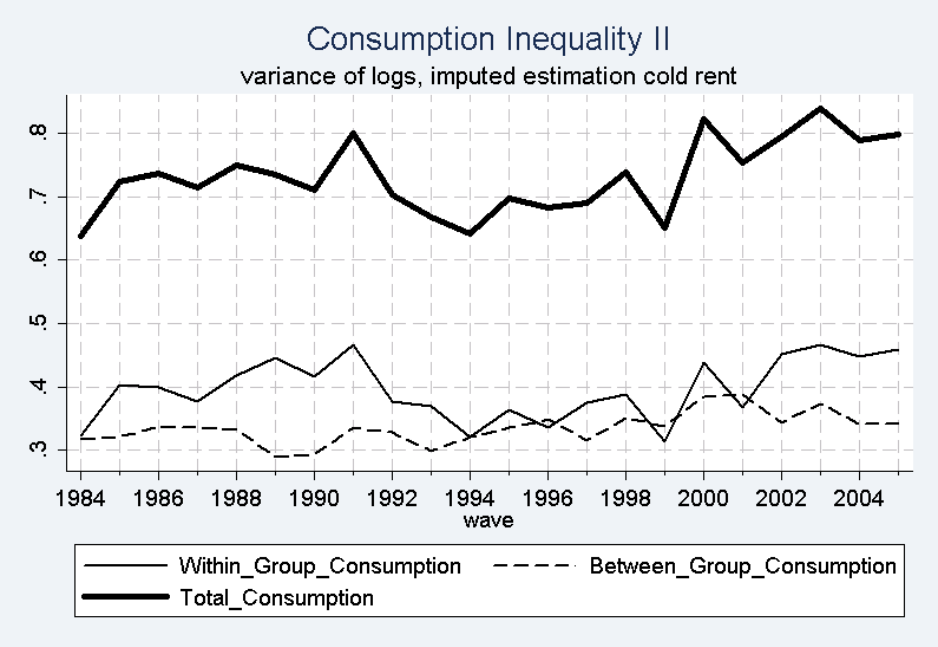

Figure 2: Consumption Inequality II

are thus higher, and so is the difference between them and the renters. Subsequently, consumption inequality within the same group increases, and the increase after the reunification is even more impressive.

Additionally, Figure 3 compares the inequality of income and consumption (calculated with the imputed cold rent) within groups and between groups. W_Income represents the within-group income inequality, W_Consumption the within-group consumption inequality, B_Income the between-group income inequality, and B_Consumption the between-group consumption inequality. Similar to what is found by Krüger and Perri (2005) for U.S., between-group consumption inequality has tracked between-group income inequality more closely, while within-group consumption inequality has increased less than within-group income inequality.

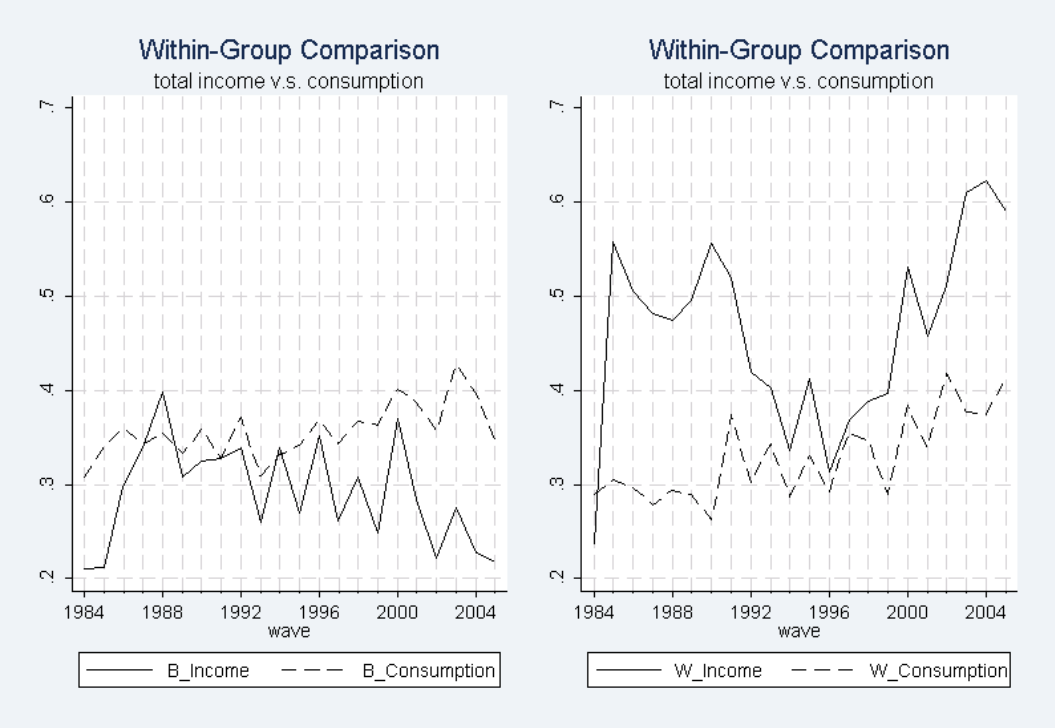

Figure 3: Consumption Inequality II

4 Empirical Test for Correlation

4.1 Grouping Strategy

I use household size and household head's age, education and occupation to divide the sample into 24 groups. Particularly, a household is regarded as small once there are fewer than 3 members, otherwise it is large. Regarding age, suppose on average one person can work 40 years (between 25 and 65 years old), then the first 10 years (25-35) would be the phase of trying out and getting stabilized, and the last 10 years is the adjusting period before retirement, and the middle 20 years is the most stable period in the sense of income and social status. Therefore I consider the household head to be young if she or he is under 35, middle aged if between 35 and 55, and old if older than 55. For education levels, the ISCE-1997 classification is used as the criteria, and a household is counted as higher educated if one has at least post-secondary non-tertiary education, or lower educated otherwise. At last I use the Erikson Goldthorpe Classification for occupation to label the job as of higher level if the index is less or equal to 8 (including high/low level service, routine non-manual,

self-employed, manual supervision, and skilled manual jobs), otherwise it is considered as lower level.

4.2 Is Inequality the Price for Growth?

Although I try to include all legitimate explanatory variables, it may still happen that some important candidates are not available in the data set. In fact an omitted-variable test suggests that the model does have omitted variables. Therefore the regression residual includes both the within-group variances and the error term $\varepsilon_{i,t}$ due to the lack of regressors.

$$g_{ij,t} = \alpha \triangle Z_{ij,t+1} + v_{ij,t} + \varepsilon_{i,t} \tag{6}$$

As the changes in group-specific characteristics are usually very limited across years, $\triangle Z_{ij,t+1}$ is close to zero. Averaging (6) over all j within each group i produces the group average growth rate, which is approximately equal to the measurement error $\varepsilon_{i,t}$.

As a result, a better estimation for the within-group variance is the demeaned group rate

$$E\left(g_{ij,t} - g_{i,t}\right)^2 = E\left(v_{ij,t}^2\right) = \sigma_v^2.$$

Table 2. Regression of Within-Group Variance on Group Consumption Growth

VARIABLES	Within_Variance_coldrent	Within_Variance_est_coldrent
mean_growth_coldrent	**0.066*****	
	[0.015]	
mean_growth_est_coldrent		**0.315*****
		[0.023]
Constant	0.38***	0.33***
	[0.00]	[0.00]
Observations	135076	137005
R-squared	0.13	0.06
Adj.R-squared	0.12	0.06
Robust standard errors in parentheses		
*** p<0.001, ** p<0.01, * p<0.05		

Note: OLS regression. Heteroskedasticity-robust standard errors in brackets. All year dummies are highly significant but not reported.

Table 2 shows the OLS regression result of the group variance on average group growth and year dummies. Heteroskedasticity of the error terms is controlled for. At the 0.1% significance level, the regression coefficient of the group average growth rate is slightly positive (0.066) when the imputed cold rent is used, whereas if I use imputed estimation of cold rent the

coefficient increases to 0.315 with a t-value of 13.47. I can therefore confirm the theoretical result: higher consumption growth is accompanied by higher within-group inequality. But what are those groups exactly? The data shows the groups with highest consumption growth are young, small sized households. This result is easy to understand, since once a person finishes education and starts working, an abrupt change in income usually leads to a big change in consumption. The resource constraint for younger people is relaxed to a great extent. The data also shows that older, bigger households often suffer from little consumption growth or even consumption reduction.

Meanwhile, younger groups also observe higher within-group inequality especially. One possible reason can be that a large portion of the young population is still studying or under training, with very limited income. Besides, even among those who are working, people are subject to more shocks and changes at the beginning of their career, particularly due to different educational backgrounds and job types, which could also contribute to the high inequality within younger group. A further deduction is, as they grow older, working experience can make up for the lack of education and the income and consumption differences between the group members should decrease.

The data provides evidence in line with these arguments, which shows that the remarkable difference between age groups controlling for education, occupation and household size. Younger households have much higher consumption growth and within-group variance than similar but older households.

Especially, Figure 4 shows consumption growth of three groups of small households whose heads have less education and skilled jobs. On average, the youngest households have experienced the highest consumption growth, the oldest households in most periods endure negative consumption growth, and the middle-aged households lie somewhere in between.

In Figure 5, the pattern for small households whose heads have less education and unskilled occupations is generally similar, only that the youngest households here also underwent the highest volatility in consumption growth. This age effect can also be found in big households with other education level and occupations.

A look at the variance of within-group differences may help to get a clearer explanation (Figure 6). For small, less educated households with skilled occupation, the youngest group almost always has the highest within-group variance in consumption.

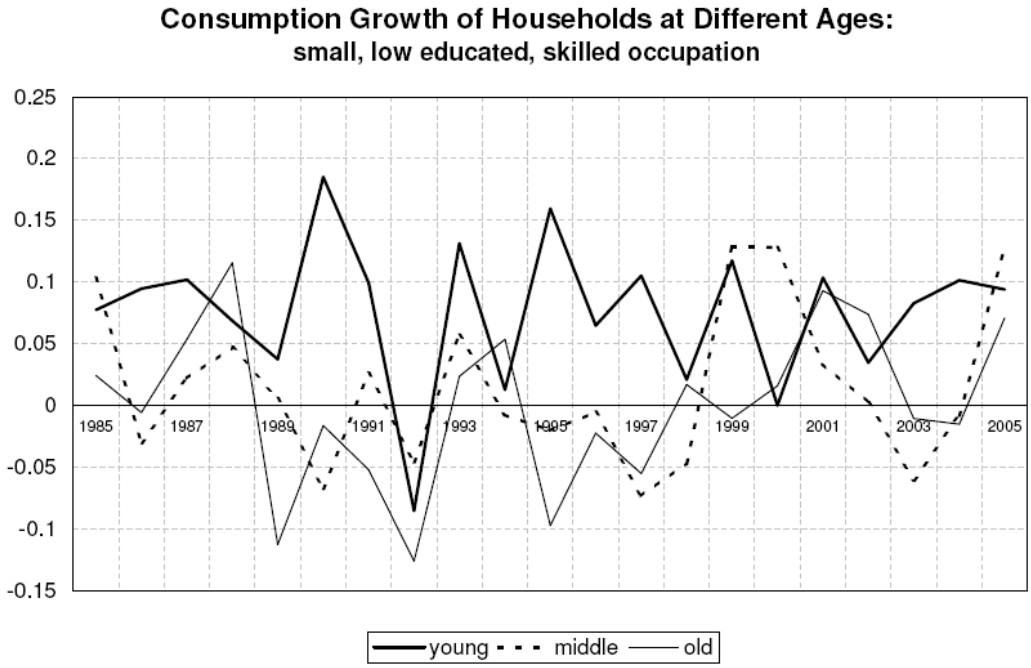

Figure 4: Consumption Growth I-YOUNG v.s. OLD

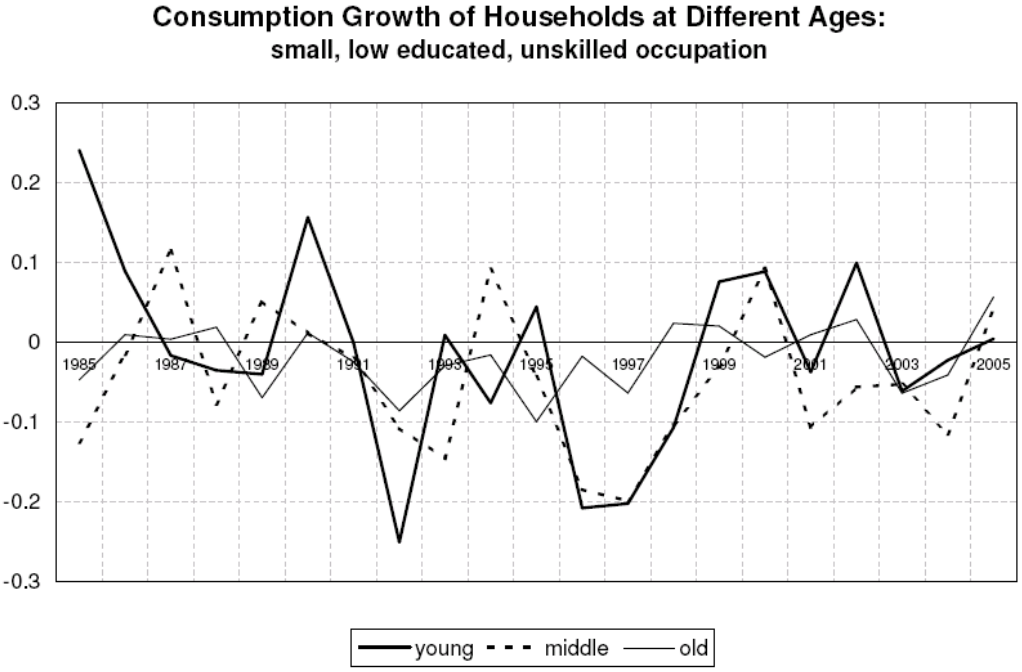

Figure 5: Consumption Growth II-YOUNG v.s. OLD

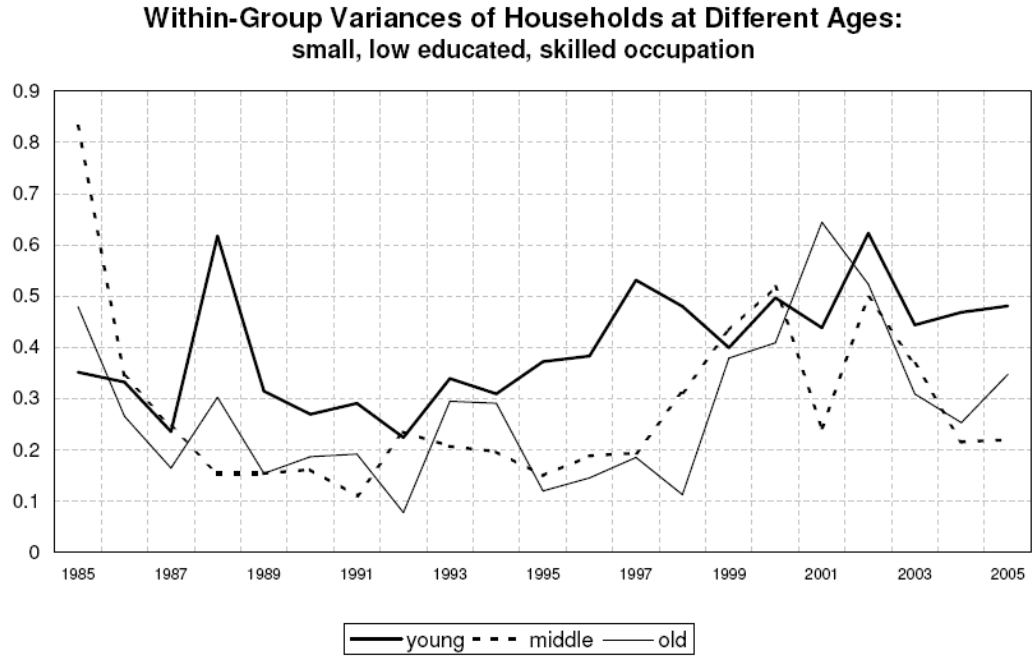

Figure 6: Variances I-YOUNG v.s. OLD

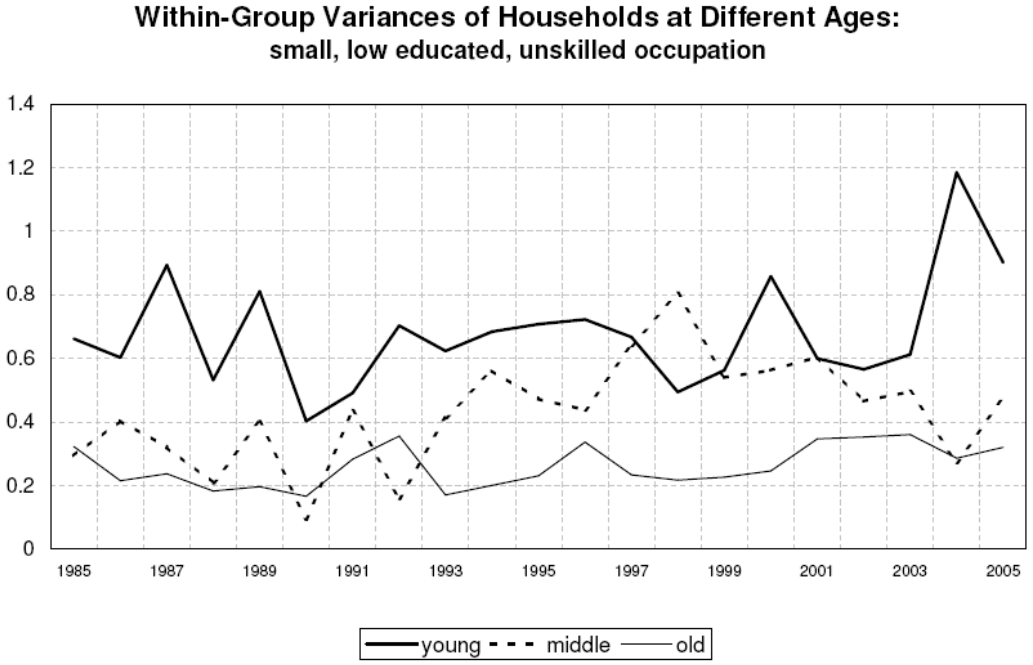

Figure 7: Variances II-YOUNG v.s. OLD

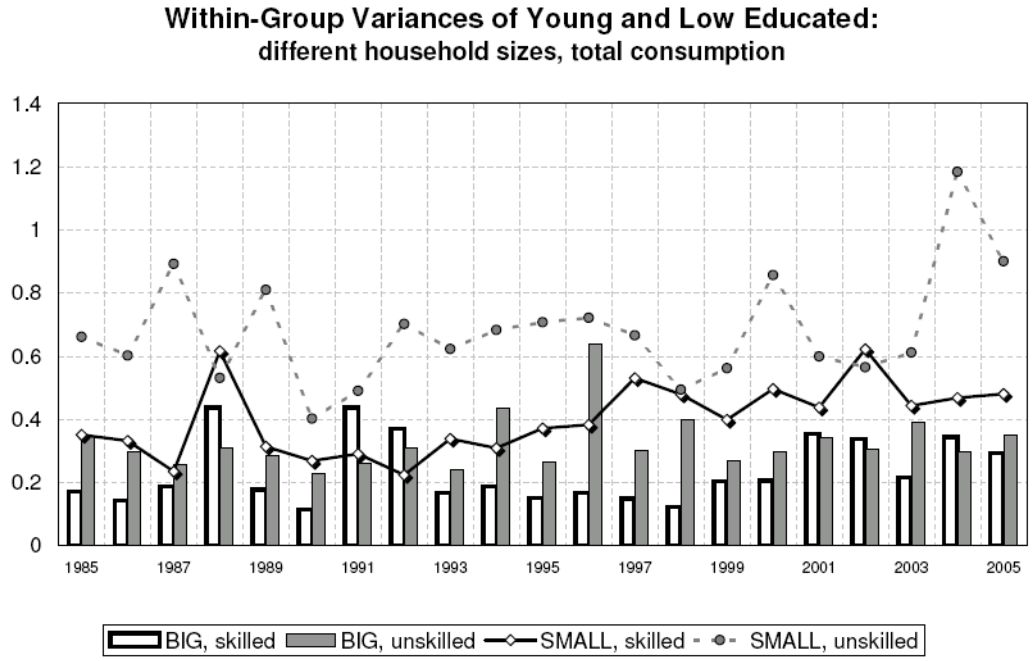

Figure 8: Variances III-SMALL v.s. BIG

Meanwhile, Figure 7 shows that for small, less educated households with unskilled jobs the pattern is rather similar in the way that younger families bear higher variances in their group. These figures are consistent with the regression result shown above.

Another important variable affecting within-group variance is household size. Smaller size always means fewer income resources, and as a result smaller households are more vulnerable to exogenous shocks (both aggregate and idiosyncratic ones) than bigger households.

Representatively, Figure 8 shows exactly this. For the same young, less educated households, whether skilled or unskilled, the smaller-sized ones experience higher within-group variances than the bigger households. The results for older and higher educated households are similar. An exception occurs in the years 1991 and 1992. Among all young, less educated skilled workers, big households experience higher within-group variance; i.e. more inequality among their peers. This may reflect the disorder during the reunification period, where political distortion of the labor market was enhanced by the influx of workers from East Germany.

One may argue that economies of scale in household consumption are crucial and should

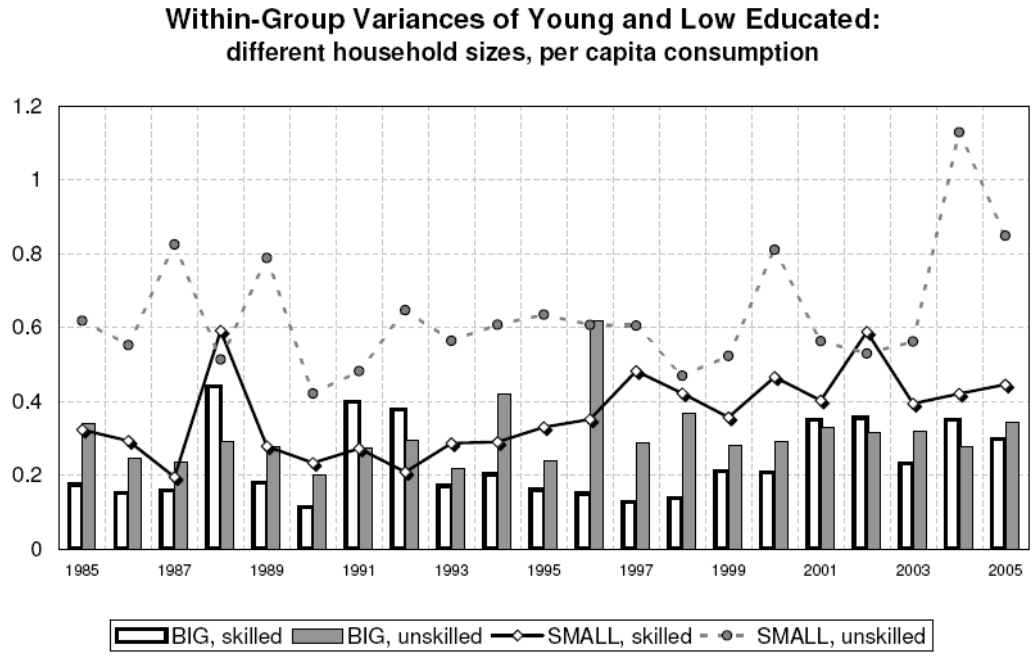

Figure 9: Variances IV-SMALL v.s. BIG

not be ignored. I control for household size by using equivalent scales and calculating per capita consumption. However, it still holds that smaller households go through much higher within-group variances than their bigger-sized counterparts (see Figure 9).

5 Summary

This paper offers an overview of consumption inequality in Germany between 1984-2005. A theoretical model borrowed from the asset pricing literature is used to examine the relationship between consumption growth and inequality.

Both complete market hypothesis and self insurance hypothesis are rejected in micro data. To get around this problem, the literature suggests settings of unenforceable contracts and private information. Alternatively, I propose a simple extension from a typical PIH model, which can generate "excessive smoothness", and I use it to examine the dynamics of consumption inequality. The basic idea is that even though households can not observe the income of other families with similar socio-economic status, they can observe the living standards and consumptions of others, and how they evaluate others' consumptions affects

the consumption volatility. Particularly if they want to keep themselves in pace with their neighbors in consumption, consumption becomes more volatile than a typical PIH model; while when they enjoy the well-being of others, their "altruism" reduces the variances in consumption, or, in another word, creates "excessive smoothness".

Concerning the time series properties of the group consumption growth rates, a test using the German Socio-Economic Panel suggests a random walk process. The deviation from the original consumption smoothing is thus even stronger. But however far the deviation is, the model would always predict a positive relationship between the group average growth rate and within-group variance given reasonable parameter values; i.e., the group with higher consumption growth should also observe higher inequality within the group. This theoretical result is tested using GSOEP survey data, where I divide the sample households into 24 groups according to household characteristics such as size, head's age, education, occupation and so on.

My regression results confirm that high group average consumption growth is accompanied by within-group inequality. Furthermore, under my grouping strategy, age and household size are undoubtedly crucial for growth and variance. Since a large part of the young population is still out of the labor force and has limited income, consumption differences between them and young professionals are big. However, once they start working, the sudden relaxation of their financial constraint boosts up their consumption to such a degree that the consumption growth of the young groups is higher than the growth of the older groups. When it comes to household size, in the sense of risk sharing, smaller households are more vulnerable to economic shocks. Even after I control for economies of scale and look at the per capita consumption, I can still find a much higher within-group variances in the smaller-sized households. The data also shows that the otherwise relatively stable consumption inequality, especially within-group inequality, undergoes increases immediately after the reunification of Germany and the introduction of the euro.

These results offer an overall picture of consumption inequality in Germany in the last 20 years. Furthermore, business cycle effects are most likely also important for examining consumption inequality. Is within-group inequality generally procyclical, countercyclical or acyclical? Which groups are especially sensitive to booms and/or recessions? These questions are left for future research.

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6 Appendix

Appendix I. Shapiro-Wilk Test for Normality on the Change of the Growth Rates

Group	Variable	Obs	W	V	z	Prob>z
1	g_{t+1}-g_t	20	0.98399	0.379	-1.956	0.97477
2	g_{t+1}-g_t	20	0.95438	1.08	0.155	0.43851
3	g_{t+1}-g_t	20	0.96088	0.926	-0.155	0.56157
4	g_{t+1}-g_t	20	0.94989	1.186	0.344	0.36545
5	g_{t+1}-g_t	20	0.94437	1.317	0.555	0.2896
6	g_{t+1}-g_t	20	0.982	0.426	-1.719	0.95723
7	g_{t+1}-g_t	20	0.97426	0.609	-0.998	0.84096
8	g_{t+1}-g_t	20	0.94858	1.217	0.396	0.3461
9	g_{t+1}-g_t	20	0.94886	1.21	0.385	0.35019
10	g_{t+1}-g_t	20	0.90177	2.325	1.701	**0.04451**
11	g_{t+1}-g_t	20	0.9747	0.599	-1.033	0.84927
12	g_{t+1}-g_t	20	0.9685	0.746	-0.592	0.72303
13	g_{t+1}-g_t	20	0.95215	1.133	0.251	0.40095
14	g_{t+1}-g_t	20	0.97908	0.495	-1.417	0.9217
15	g_{t+1}-g_t	20	0.96683	0.785	-0.487	0.68705
16	g_{t+1}-g_t	20	0.92271	1.829	1.217	0.11174
17	g_{t+1}-g_t	20	0.96813	0.754	-0.568	0.71498
18	g_{t+1}-g_t	20	0.97307	0.638	-0.907	0.81785
19	g_{t+1}-g_t	20	0.96043	0.937	-0.132	0.55242
20	g_{t+1}-g_t	20	0.91429	2.029	1.426	0.07697
21	g_{t+1}-g_t	20	0.93437	1.553	0.888	0.18737
22	g_{t+1}-g_t	20	0.9551	1.063	0.123	0.45117
23	g_{t+1}-g_t	20	0.93448	1.551	0.884	0.18823
24	g_{t+1}-g_t	20	0.9596	0.956	-0.09	0.53582