SFB 649 Discussion Paper 2010-057

Consumption Growth and Volatility with Consumption Externalities

Runli Xie*

* Humboldt-Universität zu Berlin, Germany

This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk".

http://sfb649.wiwi.hu-berlin.de
ISSN 1860-5664

SFB 649, Humboldt-Universität zu Berlin
Spandauer Straße 1, D-10178 Berlin

Consumption Growth and Volatility with Consumption Externalities

Runli Xie*

This draft: November, 2010

Abstract

This paper studies the link between group-specific consumption growth and volatility within a framework of heterogeneous agents, under the assumption of a consumption externality. Household preferences are related to the volatility through asset holding decisions: volatility decreases with groups' degree of patience, and increases with household eagerness to keep up with the group average. Moreover, consumption growth is expected to relate positively to the volatility. This last hypothesis is tested using household data imputed from GSOEP and the German Income and Expenditure Survey (EVS), where a U-shaped relationship is found for the nondurable consumption. Moreover, examining the growth-inequality relationship using EVS data alone shows that it is positive for nondurable and negative for durable consumption.

Keywords: consumption growth, consumption volatility, within-group inequality, GSOEP, EVS
JEL codes: E21, D91, D31, D64

*Address for correspondence: Department of Economics, Humboldt University of Berlin, Spandauer Strasse 1, 10178 Berlin, Germany. Email: xierunly@staff.hu-berlin.de. I am grateful to Michael Burda, Lutz Weinke and participants of the Brown Bag Seminar at Humboldt University of Berlin for their extensive comments. This research was supported by the Deutsche Forschungsgemeinschaft through the CRC 649 "Economic Risk".

1 Introduction

Consumption inequality is a direct measure for the well-being of population, while consumption growth and volatility are alternative welfare measures at higher orders. Various socio-economic groups, defined by age, household size, occupation and etc., have diverse preferences and are subject to heterogeneous shocks. The modification of the trade-off between consumption/saving differs, which further affects consumption fluctuations and the growth trend to different extent. Consequently, not only consumption pattern but also the growth and fluctuation are divergent across groups. Groups subject to large shocks and lacking smoothing possibility appear to have on average lower growth and higher fluctuations, indicating that they are at disadvantageous welfare positions. For example, income and consumption growth inequality for different age groups are very different (Figure 1). As younger groups have higher consumption growth, their consumption volatility is also higher.

The contribution of this paper is three-fold: 1) providing a theoretical framework of heterogeneous agents with consumption externality in order to examine the link between group-specific consumption growth and volatility, 2) finding empirical evidence on the aforementioned relationship using matched household data from the German Socio-Economic Panel (GSOEP) and the German Income and Expenditure Survey (Einkommens- und Verbrauchsstichprobe, or EVS in later text), and 3) examining the empirical relationship between growth and within-group inequality.

Aiming at examining the relation between consumption growth and volatility, I use a framework stemming from the literature studying income shocks and consumption inequality. Complete market hypothesis is not preferred here for two reasons. First, the perfect insurance against idiosyncratic shocks implied by the complete market theory is rejected by plenty empirical evidence (Attanasio and Davis, 1996, Attanasio and Pavoni, 2007). Moreover, the complete market assumption, often resembled by a complete set of Arrow-Debreu security for each state, suggest that, given identical preferences, there should be no consumption mobility because everyone is insured similarly. This, however, is also strongly rejected by the data (Fisher and Johnson, 2006, Jappelli and Pistaferri, 2006). According to Lucas (1992), "if the children of Noah had been able and willing to pool risks, Arrow-Debreu style, among themselves and their descendants, then the vast inequality we see today, within and across

societies, would not exist."

On the contrast, incomplete markets models are generally adopted to study the diverse evolution of income and consumption inequality (Blundell and Preston, 1998, Blundell, Pistaferri and Preston, 2008). Be the reason of market incompleteness limited enforcement of contracts (Krüger and Perri, 2005) or private information problems (Attanasio and Pavoni, 2007), risk-sharing is not perfect but sufficient. In fact, a model with one single asset and heterogeneous household preferences can offer partial but relatively good insurance against income shocks (Krusell and Smith, 1998), whereas under certain assumptions it can match the real-world wealth distribution relatively well. More discussion and literature review on incomplete markets model can be found in Heathcote et al. (2009). For simplicity while not losing generosity, the theoretical framework of the current paper is reduced to a "standard incomplete market" model in an endowment economy, where a large number of agents draw idiosyncratic realizations of endowment, and make independent choices for consumption and asset holding. Their choices determine, in aggregate, the total amount of capital for production and the equilibrium rental rate for capital.

Households from various socio-economic groups differ in patience and attitude towards their reference, i.e. the group average consumption. This is different from the neoclassical economic reasoning, which is typically based on self-interest hypothesis, i.e., people are exclusively motivated by their material self-interest. Indeed, both absolute and relative consumption matter for households in the current model, whereas the idea of relative consumption associates with conceptual consumption (Ariely and Norton, 2009) and "social preferences"(Fehr and Fischbacher, 2002), and can go back to Veblen's (1899) discussion of conspicuous consumption and Duesenberry's Relative Income Hypothesis (1949).

Acknowledging consumption growth inequality as a result of income uncertainties (permanent and transitory) and consumption innovation, I approximate the Euler equation of heterogeneous households in general equilibrium to study the link between two key features of consumption evolution: growth and volatility. Comparative statics show that volatility decreases with groups' degree of patience, and increases with household eagerness to keep up with the group average. The strength of the effects vary over the business cycle. Moreover, the correlation between the group average growth and volatility indicated by the model is positive once parameters take consensus values. Due to data limitation, only the last proposition

is able to be examined empirically for distinct socio-economics groups.

The grouping method forming the heterogeneous preferences, indeed, is crucial for studying the link between growth and volatility of the economy. Cross-country estimates using aggregate data and cross-sector studies using sector level data can generate opposite results. For example, in the case of output growth, as Ramey and Ramey (1995) find higher volatility accompanied by lower growth in two samples of countries, Imbs (2007) re-examines the issue at sector level and presents evidence of positive correlation.

The procedure taken in this paper is adjusted to the availability and structure of the data. Studies on consumption inequality in Germany are less prevalent than on income inequality due to the limited availability of survey data. Recently, Fuchs-Schündeln, Krüger and Sommer (FSKS, 2010) look into both income and consumption inequality in Germany. They document an upward inequality trends of wage income after the reunification, and finds a more modest rise of consumption inequality over the same period[1]. The analysis of the current paper focuses on consumption growth and volatility, and complements a number of studies that use micro data to document the evolution of income or wage inequality in Germany in the last 25 years (among others, Biewen, 2000, Dustmann, Ludsteck and Schönberg, 2007).

Two data sets are under investigation, the German Income and Expenditure Survey (EVS) and an imputed sample from EVS and the German Socio-Economic Panel (GSOEP). There are two approaches to impute consumption: one by using the estimated coefficients, and the other through matching cells in EVS and GSOEP. The imputed consumption is used to construct consumption growth, volatility and within-group variance. The resulting consumption measure embodies the well-documented consumption and income information in EVS and the panel structure in GSOEP.

Although it is impossible to identify the direction of households' attitude towards peers' well-being with the current data, the finding of Knies' (2010) using income and life satisfaction

[1]Evidences on the trend of consumption inequality are mixed for other developed countries. Blundell and Preston (1998) document substantial differences in inequality growth over the 1980s across birth cohorts in the UK, while Crossley and Pendakur (2002) notice that overall consumption inequality in Canada has fallen slightly over the period 1969 to 1999. Barrett et al. (2000) find much lower inequality in consumption than in income in Australia. The disjuncture between income and consumption inequality, also found in the US over the 1980s, can be explained by changes in the persistence of income shocks (Blundell at al. 2008) or by predictable income shocks (Primiceri and van Rens, 2009).

data appears to support the "relative income" hypothesis in West Germany. The empirical focus of the current paper lies in identifying the correlation between growth and volatility, which is found positive and significant in fixed-effect estimates using EVS data. More complex nonlinear relationship is found when the data sets are matched so as to explore the panel structure. Moreover, group growth also appears to be positively linked to within-group variances, implying higher inequality as the welfare cost for faster growing groups regardless of the driving factors of growth. Household size, age and nationality of the household head turn out to be significantly relevant to individual consumption growth and volatility, whereas community size and heads' occupation are only related to volatility. Heads' education appears irrelevant. Figure 1 shows in detail how strong the age effect is not only in growth, but also in volatility.

The rest of the paper is organized as follows: Section 2 presents the theoretical model and derives four propositions; Section 3 introduces the data and specifies the grouping strategy; in Section 4 proposition four is tested and the estimate results are discussed; Section 5 concludes.

2 Consumption Growth and Volatility

2.1 Social Interaction and Relative Consumption

Among the extensions added to the incomplete market setup in the asset pricing literature, one special aspect is to include relative consumption into household utility as a consumption externality.

Psychological and economic studies often show that both absolute and relative consumption matter for individual well-being and behavior (see, e.g. Duesenberry, 1949, Diener et al. 1999, Luttmer, 2005). Individuals' satisfaction derived from being better than their peers can be interpreted as envy, inequity aversion, relative deprivation, or a human propensity to judge one's achievement relative to that of others. The "others" here are the reference groups of actors, a concept brought about in social psychology early in the 1940s (Hyman, 1942). Depending on the situation, they can be coworkers, relatives, neighbors, or members of clubs and organizations. Moreover, they can also be people who are geographically away and do not interact with the actor physically. According to Shibutani (1955), reference groups can be: (1) those serve as comparison points, (2) those to which men aspire, and (3)

those sharing the same perspectives with the individuals. The last category requires common communication channels, each of which gives rise to a separate world, or, a socioeconomic group. The social worlds can be ethnic minorities, the social elite, medicine association, theater audience, readers of certain periodicals, or, in today's context, groups on facebook. In a word, these associative reference groups realistically represent the individuals' current equals or near-equals, i.e. they are from the same socioeconomic background, which is the definition for groups in the current paper.

While others' income can hardly be detected, households can relatively easily observe the life styles and infer the consumption levels of others with similar socio-economic status. Their optimal security holding will adapt accordingly and their consumption smoothing path is different from an externality-free world. As result, their evaluation of others' consumptions affects the group consumption growth inequality. The direction of this effect depends on how exactly households react to their peers' well-being (whether they are "altruistic" or meant to "keep up with the Joneses"). Alternatively, this reaction can be interpreted as individuals' life satisfaction upon the change of their peers' income. While such attitude can be barely identified in empirical data, happiness is often used as proxy to capture individual's utility. Studies based on developed countries find that subjective welfare depends positively on one's own consumption but negatively on the average consumption level of others nearby (Easterlin, 2001, Blanchflower et al., 2004, Luttmer, 2005). Knies (2010) finds comparable evidence in West Germany where West Germans are significantly unhappier with their lives if their neighbors are getting richer, implying an urge of the West German households to avoid being lagging back from their neighbors, or alternatively, the urge to keep up. This effect is slightly more marked in neighborhoods with presumably more social interactions, so that households may be able to assess more accurately the change of their neighbors' financial position. On the opposite, Fafchamps and Shilpi (2008) find that in Napel, households in isolated areas care more about what their neighbors consume. Their reasoning is that in isolated communities neighbors can more accurately approximate the relevant reference group than in more mobile urban communities. These observations require economic models to take social environment into account, whose effects are heterogeneous according to agents' socio-economic background.

The preference on relative consumption can be regarded as a special form of physical con-

sumption or a conceptual consumption besides the physical consumption. Long discussed by sociologists and anthropologists in the field of consumer behavior, it is summarized in Ariely and Norton (2009) that "physical consumption is used not just to satisfy basic needs but also to signal to ourselves and others our beliefs, attitudes, and social identities". Therefore conceptual consumption strongly influences physical consumption, and the possession of a BMW convertible is often only partly due to the need for transport. The concept consumed is the (relative) social status, which dates back to Veblen's (1899) discussion of conspicuous consumption and Duesenberry's Relative Income Hypothesis (1949), and accords with the "social preferences" in Fehr and Fischbacher (2002).

As a special type of consumption externalities, relative consumptions serves as powerful non-pecuniary motives. The model setup of the current paper borrows the spirit of Galí(1994). How this externality exactly matters for individuals can be captured in individuals' utility in relative well-being comparing to their reference groups, which, as stressed in sociological literature, tends to consist of others who are similar in terms of background variables such as age, education and household size (see, for example, Merton and Kitt, 1950, and Festinger, 1954). Household preferences are assumed to be heterogeneous accordingly. As Shibutani (1955) emphasizes, culture, a perspective that is shared by those in a particular group, may also constitute the frame of the reference and matter for the direction of there preference. This is indeed documented in Knies (2010), where compared to West Germans' becoming unhappier on their neighbors' increasing wealth, East Germans' life satisfaction positively, though insignificantly, correlates with neighborhoods' income.

As previous sociologists and psychologists emphasize the role of positional goods (a similar concept to aforementioned conspicuous consumption) in relative consumption, it was assumed that higher income group care more about it since a larger part of their consumption composes of positional goods. However, relative consumption is also found to be important for vacation and insurance, which are typically seen as non-positional goods (Alpizar et al. 2005). Besides, evidence shows that poorer groups care no less about the relative consumption than their richer counterparts do (Fafchamps and Shilpi, 2008). It seems that the effect of relative consumption prevails over the economy.

What to keep up with are the associative references, or, the group mean. In a world of uncertainty, current group mean serves as the local norm for households to set realistic goals,

which is the third type of reference summarized by Shibutani (1955). As is mentioned above, the incentive to keep up can be interpreted as envy, inequity aversion, relative deprivation, or a human propensity to judge one's achievement relative to that of others. Take inequity aversion for instance, inequity averse persons want to achieve an equitable distribution of material resources, i.e. they want to neither surpass nor fall behind others in the reference groups, but keeping up with those above them and staying the same with those below them. Therefore, the group mean becomes their benchmark. This setup is slightly different from the case when individuals would like to emulate the top households of the group, which coincides with the "aspiring" case in Shibutani's (1955) definition and would cause more deviation from an externality-free economy.

There is a subtle difference if agents take past or current average consumption as benchmark. The former, which is a variation of the habit formation setup, is the case of "catching up with the Joneses" (Mehra and Prescott, 1985, Abel, 1990, Campbell and Cochrane, 1999) and the latter "keeping up with the Joneses" (Galí, 1994). While the former involves the interdependence between the agents' past, present and future well-being, the latter setup emphasizes contemporaneous trade-offs and generates simpler results[2]. Since the true task is to study contemporaneous consumption distribution in a cross-sectional panel setting, the current paper imposes "keeping up with the Joneses" assumption so as to avoid more complex intertemporal considerations.

2.2 A Heterogeneous Agent Model

The setup follows Galí (1994) where households regard **contemporary** group average consumption as an external benchmark ("keeping up with the Joneses"). While Galí's (1994) model describes the homogeneous households in the whole economy, the current paper takes the perspective of each group, and the "keeping up" mechanism bounds the agents within the group. The heterogeneity of agents between groups is captured as the different preferences, namely patience and attitude toward the benchmark. Using a heterogeneous agent model

[2]In fact, Ljungqvist and Uhlig (2000) discusses optimal tax policies using these two differentiated cases and finds procyclical taxes for the former and a flat tax rate for the latter to be optimal. Guo (2003) elaborates the latter case by adding capital accumulation and imperfect competition in the goods market and finds a similar result.

enables the contemporaneous examination of consumption growth inequality within group, while still allowing for comparison in the time dimension and/or group-to-group dimension.

There is a continuum of households of measure 1 in this economy. Households belong to different groups $i \in \{1, ...M\}$, where the level of patience (β_i) and the attitude towards group average consumption (κ_i) differ. These differences capture the socio-economic heterogeneity in the population. In the empirical part of the paper later groups are defined according to household size, community size, household heads' nationality, age, education level and job type. One can also intuitively interpret a group as a highly similar neighborhood. p_i denotes the number of households in each group. Households belong to certain groups because of the aforementioned features but are still subject to small idiosyncratic shocks, either from income or consumption innovation. 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 be identical with the 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 household consumption decisions.

Households receive idiosyncratic endowment every period[3]. One household in group i has a stochastic endowment process $\{\Upsilon_t \Upsilon_{i,t} y_t\}$, where Υ_t and $\Upsilon_{i,t}$ are the stochastic economy-wide and group-specific income endowment respectively, and $\{y_t\}$ is the idiosyncratic component for each household in the economy. This implies that, within one group, households' endowments share a common group-specific element while differing in being subject to idiosyncratic shocks in each period. $\{y_t\}$ follows a Markov process with initial probability distribution $\Pi_0(\cdot)$ and transition probabilities $\pi_t(y'|y)$. $y^t = (y_0, y_1 ... y_t)$ captures the history of endowment shocks, such that the compound probability of a history y^t given an initial endowment y_0 is $\pi_t\left(y^t|y_0\right) = \pi_{t-1}(y_t|y_{t-1})\,\pi_{t-2}(y_{t-1}|y_{t-2})\,...\pi_0(y_1|y_0)$. At date t households are distinguished jointly by their group i, their initial asset holdings $\alpha_{ij,t}$, and their initial endowment shock y_t. Intertemporally, households transfer their resources by trading one single asset economy wide. The borrowing, however, is subject to a household-specific debt limit $A_{ij,t}\left(\Upsilon_t, \Upsilon_{i,t}, y^t\right)$, i.e., a pre-specified credit line is contingent on the economy, group

[3]This is a simplified version of a model with stochastic labor endowment, such as in Krüger and Perri (2006). Inclusion of labor supply in the current model is possible but not crucial.

and household specific endowment histories up to period t.

For simplicity it is assumed that households have zero mobility across groups at a point in time. The reason is two-fold. On the one hand, GSOEP data shows that mobility is not the dominant issue, since more than half of the households in the samples (56.8%) between 1984 and 2005 have never changed their groups, while among the group switchers over half of them (51.8%) have changed only once, among which over half happened due to aging. In a word, these heterogeneous households appeared to stay relatively persistently in their group. On the other hand, the later use of panel data is to examine consumption growth in sequential years, where cross-sectional comparison is the final aim.

Define $C_{ij,t}$ as the time t consumption of the jth household in ith group, with group average consumption $X_{i,t}$. Since the purpose of this paper is on the consumption dynamics, the model is reduced to an endowment economy and the household problem is boiled down to consumption and asset holding decisions. With a group-specific discount factor β_i, which implies that groups are different in patience, a household from group i of type $(\Upsilon_t, \Upsilon_{i,t}, y_t)$ chooses a consumption stream and asset holding plans for one single asset to solve the following maximization problem:

$$\max_{\{C_{ij,t}\}_{t=0}^{\infty}, \{\alpha_{ij,t+1}\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta_i^t \left[u\left(C_{ij,t}, X_{i,t}\right) \right]$$

subject to

$$C_{ij,t} + q_t * \alpha_{ij,t+1} \leq \Upsilon_t \Upsilon_{i,t} y_t + \alpha_{ij,t}, \tag{1}$$

One unit asset is priced q_t in period t and pays one unit of consumption good in period $t+1$. In econometric studies on consumption, household's consumption $C_{ij,t}$ are sometimes decomposed of a principal part and an exogenous idiosyncratic shock which captures small consumption innovation of the household (such as Blundell and Preston, 1998, and Blundell et al., 2008). Parker and Preston's (2005) estimate shows that such change in consumption preference is crucial for the variance of household consumption growth. Initial asset holding $\alpha_{ij,0}$ is given and the borrowing constraints hold in order to rule out Ponzi schemes:

$$-\alpha_{ij,t+1} \leq A_{ij,t}\left(\Upsilon_t, \Upsilon_{i,t}, y_t\right)$$

The utility function has the following isoelastic form:

$$u\left(C_{ij,t}, X_{i,t}\right) = \frac{C_{ij,t}^{1-\gamma} X_{i,t}^{-(1-\gamma)\kappa_i} - 1}{1-\gamma}. \tag{2}$$

γ is the risk aversion parameter and is usually larger than 1[4]. Note that in absence of household specific idiosyncratic shock, $C_{ij,t}$ equals $X_{i,t}$. (2) can be rewritten as

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

where $\gamma - (\gamma - 1)\kappa_i = \gamma_i$. This transformation implies that the combination of economy-wide identical risk aversion and group-specific attitude towards consumption externality is equivalent to a neoclassical economy with no consumption externality but heterogeneous risk aversion. Both cases lead to the same Euler equation, though.

Group consumption serves as an external benchmark, and $\kappa_i < \frac{\gamma}{\gamma-1}$ as the attitude of group i households towards this benchmark can be interpreted as "how important is my neighbors' consumption for me". Taking log of the core of the utility function yields:

$$(1-\gamma)\ln C_{ij,t} - (1-\gamma)\kappa_i \ln X_{i,t} = (1-\gamma)\left[(1-\kappa_i)\ln C_{ij,t} + \kappa_i \ln \frac{C_{ij,t}}{X_{i,t}}\right].$$

Scaled by parameter κ_i, the household's consumption preference is a weighted average of the absolute and relative consumption (compared to group average). There is no restriction on κ_i to be positive or negative, which allows us to examine three cases considering the group effect in consumption:

1. When $0 < \kappa_i < \frac{\gamma}{\gamma-1}$, the household would like to "keep up with the Joneses". Average consumption decreases the household's utility level but increases household's marginal utility of an additional unit of consumption. This reflects exactly the economic implication of "keeping up with the Joneses", since "any given addition to his current level of consumption becomes more valuable"[5]. In the later part of the paper, it will become clear that such partial preferences, keeping up with the Joneses, could reduce contemporaneous consumption growth

[4] Alternatively, to elaborate elastic labor supply, the utility function could take the form

$$u\left(c_t, x_{i,t}, l_t\right) = \frac{c_{ij,t}^{1-\gamma_i} x_{i,t}^{-(1-\gamma_i)\kappa_i} - 1}{1-\gamma_i} - \chi \frac{l_t^{1-\psi}}{1-\psi},$$

where $l_t = \Upsilon_t \Upsilon_{i,t} y_t$.

[5] Galí (1994).

inequality but drive up consumption volatility over the business cycle further from a model without consumption externalities.

2. When $\kappa_i < 0$, households do not take the group mean as benchmark, but rather gain utility once the others in the group are doing well. For philanthropists this could be interpreted as altruism. However, a more economic intuition is that the group mean welfare acts as "substitute" for the household's own welfare. In the absence of government in the current model, one can imagine the public good as good weather or air quality. Knies (2010) interprets it in another cultural context. Comparing West and East Germany and being in line with the result of Senik (2004, 2008), she conjectures that in East Germany this post-transition economy, positive changes in others' circumstances can serve as a positive signal for possible improvements in one's own financial situation. As a result, a positive association is expected between neighborhood income and life satisfaction.

3. When $\kappa_i = 0$, 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[6]:

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

Since all households in group i have the identical optimization problem, through aggregation, it holds for group i in general equilibrium:

$$q_t = \beta_i E_t \left[\left(\frac{X_{i,t+1}}{X_{i,t}} \right)^{-\gamma-(1-\gamma)\kappa_i} \right], \tag{3}$$

where q_t is determined by demand and supply in the financial market and is exogenous for single households. The aggregated Euler equation (3) implies that the degree of risk aversion, and the group-specific discount factor as well as the attitude to neighbors' consumption

[6]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

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

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.

determine the group consumption growth together. Group consumption growth is slow when households in the group are less patient (small β_i) and prefer current to future consumption, or when they put more value on their current relative position in the group (κ_i is positive and increases) and would rather "keep up" consumption than buying security (a similar effect to households' being "impatient").

If for most households the idiosyncratic shock y_t turns out to be negative, implying a negative income shock in the aggregate, net borrowing demand (sales of the security) increases and ceteris paribus, the asset price q_t will decrease, and the return for those households purchasing the security increases. Needless to say, in a general equilibrium q_t is also subject to the distribution of β_i, κ_i and γ.

2.3 Implication on Consumption Dynamics

The permanent income hypothesis states that periodical consumption 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 household consumption is additionally triggered by consumption innovations, the main shocks occurring to household consumption are often identified as contemporaneous income shocks in the related literature[7].

Another way to look at the sources of consumption growth is to track the causes in group level and individual level. This helps to bridge the individual level and group level variables, and approximate equation (3). The decomposition is analogous to that in a macroeconomic study on sectoral output growth and volatility in Imbs (2007), who disentangles the origin of sectoral output growth into three orthogonal shocks: a global, a country specific and a residual shock. The consumption growth rate of household j in group i is therefore given by

$$g_{ij,t} = \varrho_{ij} + \eta_t + \eta_{i,t} + \eta_{ij,t}. \tag{4}$$

Household consumption growth can deviate from an average constant ϱ_{ij} because of three orthogonal zero-mean, independent shocks: an economy-wide shock η_t affecting all households

[7] According to Meghir and Pistaferri (2004), among others, the log of income growth is subject to permanent and transitory income shocks. Once good panel 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).

in all groups (think about a common technology shock to the economy-wide endowment Υ_t in equation (1)), a group-specific shock $\eta_{i,t}$ which is related to the stochastic group-specific endowment $\Upsilon_{i,t}$, as well as a residual specific to household j in group i, $\eta_{ij,t}$. This last household specific residual contains the idiosyncratic endowment y_t and the consumption innovation shock η_t in equation (1). $g_{ij,t}$ is thus distributed i.i.d.$\sim (\varrho_{ij}, \theta + \theta_{i,t} + \theta_{ij,t})$ where $\theta = E_t\left[(\eta_t)^2\right]$, $\theta_i = E_t\left[(\eta_{i,t})^2\right]$, $\theta_{ij} = E_t\left[(\eta_{ij,t})^2\right]$.

The average consumption growth for group i is thus $g_{i,t}$

$$g_{i,t} = \frac{1}{J}\sum_j g_{ij,t} = \frac{1}{J}\sum_j \varrho_{ij} + \eta_t + \eta_{i,t} + \frac{1}{J}\sum_j \eta_{ij,t}. \tag{5}$$

with the mean and variance given by

$$E_t\left(\frac{1}{J}\sum_j g_{ij,t}\right) = \frac{1}{J}\sum_j \varrho_{ij} \equiv g_i, \tag{6}$$

$$V_t\left(\frac{1}{J}\sum_j g_{ij,t}\right) = \theta + \theta_i + \frac{1}{J^2}\sum_j \theta_{ij,t} \equiv \sigma^2_{g_i}. \tag{7}$$

The group average consumption growth rate is assumed to be stationary and (conditionally and unconditionally) log-normally distributed $g_{i,t+1} \sim \left(g_i, \sigma^2_{g_i}\right)$[8]. With this information and the help of a second order Taylor approximation, equation (3) turns out to be[9]:

$$q_t \approx \beta_i \exp\left[\left(-\gamma - (1-\gamma)\kappa_i\right) g_i + \frac{\left(-\gamma - (1-\gamma)\kappa_i\right)^2}{2}\sigma^2_{g_i}\right] \tag{8}$$

The security price q_t is determined in the general equilibrium as a product of the state of the economy, and the aggregation of all groups' saving and borrowing decisions, which in turn depend on the group-specific endowment and the distribution of the idiosyncratic income shocks. As consumption growth and its variance are also conditional on the aggregate economic condition (business cycle properties), the following arguments are first valid for cross-sectional comparison within one period. That is, holding q_t unchanged.

A none-zero κ_i leads to the deviation from an externality-free case where the household optimization problem is independent of others' consumption behavior. This deviation could

[8]Once define $G_{i,t+1} = 1 + g_{i,t+1} = \frac{x_{i,t+1}}{x_{i,t}}$, $\ln \frac{x_{i,t+1}}{x_{i,t}} = \ln G_{i,t+1} \approx g_{i,t+1}$.

[9]See Appendix I for a detailed derivation.

be one way to mitigate the equity premium puzzle in asset pricing. Rearranging equation (8) gives:

$$\sigma_{g_i}^2 = 2\frac{[\gamma + (1-\gamma)\,\kappa_i]\,g_i + \ln q_t - \ln \beta_i}{[\gamma + (1-\gamma)\,\kappa_i]^2} \tag{9}$$

It yields a relationship between the group average consumption growth and volatility. Note that once the group average plays no role for single households ($\kappa_i = 0$), the equation is reduced to the externality-free model:

$$\sigma_{g_i}^2 = 2\frac{\gamma g_i + \ln q_t - \ln \beta_i}{\gamma^2} > 0 \tag{10}$$

Comparing these two equations tells the effect of externality. Frank (1989) argues that, given this externality, market conditions for Pareto optimal are violated because "each person's consumption imposes negative externalities on others". The magnitude of these external effects is often very large because if any one person increases his consumption, he also raises the consumption standard for others unintentionally. Consequently, the efficient outcome based on independent decisions of self-seeking may not hold any longer. In an economy where goods vary in the degree of being positional, there would be excessive resources devoted to the production and acquisition of positional goods, insufficient resources devoted to non-positional goods (Frank, 1985a, 1985b). Moreover, agents will consume more and save less than in an externality-free world (see more discussion in Proposition 2). For a reasonable value of risk aversion, i.e. $\gamma > 1$ [10], the following propositions hold:

Proposition 1 *For a given consumption growth rate, more patient groups have smaller volatility.*

Proof: Taking partial derivatives of $\sigma_{g_i}^2$ in equation (9) according to group-specific discount factor β_i yields:

$$\frac{\partial \sigma_{g_i}^2}{\partial \beta_i} = -\frac{2}{[\gamma + (1-\gamma)\,\kappa_i]^2\,\beta_i} < 0.$$

The implication is straightforward. Patient households tend to have a higher propensity to

[10] Other than assuming the values of the key parameters, one can use maximum likelihood (MLE) to estimate them, which will be the next step of the research. The further task of the current paper is to examine the empirical relationship between group average consumption growth and volatility.

save, which insures the households against income shocks in next period to a higher degree. As result, the volatility of growth is smaller.

This proposition is well shown in the data. The empirical study in the later part of the paper shows that consumption volatility is significantly related to age: older households appear to have smaller volatility. One of the possible reasons of such finding lies on the link between income growth and degree of patience. Carroll (2001) has argued that, "positive income growth makes consumers more impatient (in the sense of wanting to spend more than current income) because forward-looking consumers with positive income growth will want to spend some of their higher future income today". On the opposite, older population, with expected lower future income growth, thus are more patient and have a weaker wish to discount future consumption, which, consequently, leads to smaller consumption volatility.

Proposition 2 *In presence of precautionary saving, volatility increases with household eagerness to keep up.*

Proof: Taking the partial derivative of $\sigma_{g_i}^2$ with respect to κ_i yields:

$$\frac{\partial \sigma_{g_i}^2}{\partial \kappa_i} = \frac{2(\gamma - 1)}{[\gamma + (1-\gamma)\kappa_i]^2}\left[g_i + 2\frac{(\ln q_t - \ln \beta_i)}{\gamma + (1-\gamma)\kappa_i}\right].$$

Using the steady state value of g_i, which is derivable from equation (3), the equation above can be written as

$$\frac{\partial \sigma_{g_i}^2}{\partial \kappa_i} = \frac{2(\gamma - 1)}{[\gamma + (1-\gamma)\kappa_i]^2}\frac{\ln q_t - \ln \beta_i}{\gamma + (1-\gamma)\kappa_i}. \tag{11}$$

Rearranging equation (9) delivers

$$\ln q_t - \ln \beta_i = \frac{[\gamma + (1-\gamma)\kappa_i]^2}{2}\sigma_{g_i}^2 - [\gamma + (1-\gamma)\kappa_i]\, g_i. \tag{12}$$

Under precautionary saving, i.e., agents attempt to 'self-insure' against consumption fluctuations, prudent agents increase savings (here demand for the single asset) when growth is more volatile. Greater demand of assets puts downward pressure on interest rates, and return of the security is slightly below the discount rate of patient agents. Accordingly, security price q_t is larger than the discount factor β_i, so that $\ln q_t > \ln \beta_i$. Meanwhile, because $\frac{\gamma}{\gamma - 1}$ is the upper bound to κ_i, $\gamma + (1-\gamma)\kappa_i > 0$. Hence in equation (11), $\frac{\partial \sigma_{g_i}^2}{\partial \kappa_i} > 0$.

Household preferences show a dislike of deviation from the group average. The faster the others in your group are upgrading than you are, the larger is the "punishment" of not being

able to keep up with them. At a high degree of such dislike (the case of "keeping up with the Joneses" , with a positive κ_i approaching 1), households prefer current consumption to security purchases, which leads to low insurance against future shock and higher volatility in consumption growth. Following the same argument, volatility is lower in the case when households weigh group average well-being more heavily (regarding it as a public good) or lack the incentive to keep up.

Proposition 3 *The effect of households' eagerness to keep up on consumption volatility is strengthened (weakened) in booms (recessions).*

Proof: Recall the partial derivative $\frac{\partial \sigma_{g_i}^2}{\partial \kappa_i}$ in (11), taking derivative according to the security price q_t leads to:

$$\frac{\partial \sigma_{g_i}^2 / \partial \kappa_i}{\partial q_t} = \frac{2(\gamma - 1)}{[\gamma + (1-\gamma)\kappa_i]^2} \frac{1}{\gamma + (1-\gamma)\kappa_i} \frac{1}{q_t}.$$

As discussed above, $\gamma > 1$ and $\gamma + (1-\gamma)\kappa_i > 0$, therefore $\frac{\partial \sigma_{g_i}^2 / \partial \kappa_i}{\partial q_t} > 0$, implying that the effect of households' eagerness on consumption volatility increases in security price q_t.

Comparing to the first two propositions with a particular groups' perspective, the business cycle effects are general and apply to all groups (all κ_i). Because the economy-wide endowment Υ_t is subject to a positive shock, most agents expect to experience income growth in booms and are willing to lend out their resources (through buying more securities). Higher demand of securities drives up the unit price q_t in general equilibrium, which further intensifies the effect of household preferences (degree of patience and households' attitude toward external benchmark). In contrast, when most agents are subject to negative income shocks in recessions, an overwhelming borrowing wish leads to a decline of the security price and dampens the preference effect.

Proposition 4 *There is a positive relationship between growth and volatility, unless agents have extremely high desire to "keep up with the Joneses" ($\kappa_i > \frac{\gamma}{\gamma - 1}$).*

Proof: In equation (9), taking partial derivative of $\sigma_{g_i}^2$ with respect to g_i shows

$$\frac{\partial \sigma_{g_i}^2}{\partial g_i} = \frac{2}{\gamma + (1-\gamma)\kappa_i}. \tag{13}$$

Under condition that κ_i is bounded by $\frac{\gamma}{\gamma - 1}$, there is a positive relationship between $\sigma_{g_i}^2$ and g_i, which suggests that groups with higher consumption growth also have to bear the welfare cost of larger volatility. Nonetheless, for a large κ_i, i.e. when it's extremely important for

agents to keep up, they would short sell securities up to the liquidity constraints. By doing so, they indirectly insure their consumption next period, achieving a small volatility at a given consumption growth rate.

The current paper does not aim at empirically identifying the direction of households' attitude towards group mean, whereas the "keeping up with the Joneses" hypothesis is indirectly confirmed by Knies' (2010) finding about West Germany, i.e. a negative neighborhood income effect on individual life satisfaction. In the following Sections, the correlation between group consumption growth and volatility (Proposition 4) is the key hypothesis to be tested.

3 Bringing the Model to the Data

The partial equilibrium derived from the theoretical model suggests a relationship between average consumption growth and volatility for different socio-economic groups, which can be examined cross-sectionally using micro data. Micro data with panel structure such as the Panel Study of Income Dynamics (PSID) or British Family Expenditure Survey data would be ideal for this study purpose. In a social democratic country like Germany, where conventional measures show that inequality grows in recent years but is still lower than the Anglo-Saxon countries, the study on consumption is rather scarce due to data limitation. An exploration of two main micro data set on households' income and consumption, nonetheless, can help to reveal part of the story on consumption inequality. These are the German Income and Expenditure Survey (Einkommens- und Verbrauchsstichprobe, EVS) and the German Socio-Economic Panel (GSOEP).

Both EVS and GSOEP are related to Micro Census. EVS is a quota sample with voluntary participation to the annual Micro Census, while GSOEP is annual longitudinal survey with stratified random samples where Micro Census serves as weighting benchmark. EVS takes continuous bookkeeping approach to record income and consumption in detail, whereas GSOEP household income is imputed from monthly household income on the survey month ("screener"), major gross income components in the month of interview and the retrospective income data for previous year. EVS recorded tax payment and deduction apart from the tax benefit, while GSOEP estimates tax payment based on households' account on the previous year tax payment, and the possible tax benefit is not included. More differences between

EVS and GSOEP are summarized in Becker et al. (2002), and can be found in Table 1.

Before entering the discussion about group consumption patterns, the crucial question would be, how to define groups so that it makes sense. Factor analysis using principle components is used to distill the various household characteristics into the most informative ones in both data sets. Regressions of the consumption growth and volatility on household demographics can further reveal those significantly associated characteristics (Table 9). With variables such as federal states discarded, the variables contributing most to group the households in EVS are age, gender, and occupation of the household heads, as well as household size, whereas the best grouping criteria for the imputed data are age, education, occupation and nationality of household heads, and household size (see Table 6 and 7). Even though community size does not account much for consumption difference between households, the theoretical model implies an indirect impact of the comparison and attitude of group members on group average consumption growth and volatility. A reasonable deduction is that community size affects the extent to which households can observe others with similar socioeconomic backgrounds, and therefore community size is added as one grouping condition for both EVS and GSOEP.

3.1 EVS: data and methodology

EVS is one of the major surveys containing personal and households' income and consumption distributions in Germany[11]. The Federal Statistical Office delivers a cross sectional survey every five years starting from the early 1960s. Until 2008 there are surveys in 1962/1963, 1969, 1973, 1978, 1983 and 1988 for West Germany, and thereafter extended to East Germany in 1993, 1998 and 2003. The purpose of bringing in the EVS is to use its information on the consumption/income ratio on GSOEP's panel environment. Therefore I choose the public-use micro data sets from 1983 until 2003.

The EVS data has several advantages. Besides the rich information on consumption and income it contains, it includes a large number of households (defined as consumer units),

[11]EVS is not a random sample but a quota sample with voluntary participation. However, it takes as benchmark for recruiting participants the annual Current Population Survey of Germany (Mikrozensus), which is a mandated random survey of large size. Consequently, the household net income brackets in the EVS are defined identically to those in the Mikrozensus.

and even more observations when individuals are concerned. While individual samples are comparatively easy to be extracted from the household observations, they contain dependent employees, self-employed, unemployed as well as citizens who are out of labor force. This large variety of occupational status enriches the objects of the study to the general population and makes it possible to examine consumption and welfare effects over time.

As Cutler and Katz (1991) takes a "top-down" approach to construct nondurable consumption out of total expenditure, data structure in EVS allows for constructing nondurable, durable and total consumption (the sum of nondurable, durable consumption plus rent) in a "bottom-up" manner. In all, this paper takes the same point as Cutler and Katz (1991) to exclude housing costs, vehicle purchases, spending on major appliances, insurance premia and expenditures for financial services from nondurable consumption. Specifically, I construct nondurable consumption of households using the existing detailed account on Classification of Individual Consumption by Purpose (COICOP), in line with Fuchs-Schündeln, Krüger and Sommer (2010). What are included in the nondurable consumption are expenditures for food, clothes, energy, health, body care, travel, communication, education, rent, and household services, while part of leisure and miscellaneous also belong to nondurables. Exceptions such as electric appliances, photo camera, sport equipment or other high-valued durable goods join furniture, car repairs, garage rental fee, and large electric device maintenance to be counted as durable consumption. Summing up the durable, nondurable consumption as well as the rent, yields the total consumption. One should note that the every-five-year data collection in EVS may cause little bias to nondurable consumption due to its smooth feature. However, since durable consumption is much more sensitive to business cycle than the nondurbales and may vary much from year to year (Mankiw, 1985), the reported durable consumption in EVS sample years may not be representative over the study years. The imputation of durable consumption is thus less justified than the nondurables. This may be one of the reasons why the later estimations concerning the imputed data are significant for nondurables but insignificant for durable consumption (Table 15).

The groups are defined by households characteristics available for all waves, i.e. household size, age of household head, occupation of household head, community size and the gender of household head. The information on the nationality of household head only starts from 1988 and the education (professional training) level starts from 1993, therefore they are not used

for dividing the groups. The exact grouping criteria is summarized in Table 6.

Though there is no direct micro information on households' consumption growth, we can use difference of group average log consumption to approximate the average group consumption growth, because

$$\frac{1}{J}\sum_j g_{ij,t} \approx \frac{1}{J}\sum_j \left(c_{ij,t} - c_{ij,t-1}\right) = \frac{1}{J}\sum_j c_{ij,t} - \frac{1}{J}\sum_j c_{ij,t-1} = c_{i,t} - c_{i,t-1}$$

where the lower case c is the log of consumption. The econometric framework would be:

$$\underbrace{c_{i,t} - c_{i,t-1}}_{g_{i,t}} = \alpha_0 + \alpha_1 \underbrace{SD_t\left(\triangle c_{i,t}\right)}_{\sigma_{i,t}} + X'_{i,t}\alpha_2 + \mu_i + \delta_t + \epsilon_{i,t} \tag{14}$$

where $SD_t\left(\triangle c_{i,t}\right)$ denotes the standard deviation of consumption growth from mean[12], and α_1 and α_2 are vectors of coefficients assumed common across groups. μ_i captures the time-invariant group characteristics which are used to group the samples (fixed effect), δ_t is a time dummy and the residual $\epsilon_{i,t}$ represents the deviation of growth from its predicted value. $X_{i,t}$ is a vector of controls for the group, a unique combination of which determines the group-specific parameters β_i and κ_i in the theoretical model.

Meanwhile, the data allows for exploring the relationship between consumption growth and the change of within-group inequality. In the following regression equation, the main difference from (14) is the $\Delta SD_t\left(c_{i,t}\right)$ term, representing the change of within-group standard deviation across household observations at time t along the group mean consumption growth. This serves as an additional examination of the welfare effect of the consumption growth.

$$c_{i,t} - c_{i,t-1} = \alpha_0 + \alpha_1 \underbrace{\Delta SD_t\left(c_{i,t}\right)}_{\Delta_i} + X'_{i,t}\alpha_2 + \mu_i + \delta_t + \epsilon_{i,t} \tag{15}$$

Table 8 provides some summary statistics for EVS on the cross-section and over time of g_i, σ_i and Δ_i. The size of all groups over time varies between 1 and 4864, with 210.7 as mean and 53 as median, showing a large variation between the groups. Unconditional correlation between group growth and its standard deviation for each time period is negative while that between group growth and change in within-group standard deviation is positive. These correlations between aggregated variables can not tell much since no group or time effect is taken into consideration.

[12]Instead of variance, using standard deviation as control variable helps to interpret the result of the point estimation as percentage to percentage change.

The EVS, nonetheless, can only provide an approximation of the consumption growth due to lack of panel structure. Since only limited household characteristics are available, sampled households in one group in different time period can bear large consumption variation due to unobservable features, implying a time-variant household specific residual (θ_{ij}) and thus a varying $\sigma^2_{g_i}$ in equation (7). Moreover, the inclusion of various households in every wave naturally increases the dispersion of the residuals, suggesting an overestimation of the $\sigma^2_{g_i}$ and thus $\sigma_{i,t}$ in (14). Additionally, since the EVS survey was carried out every five years, possibly each wave is at a similar time point of the business cycle, say, in the extreme case, all above or all below the long run trend of output. The direct result, comparing to a panel-structured study over the years, would be an underestimation of the variation of θ. The impact on θ_i is more difficult to tell, which depends on the distribution of the group-specific shocks. In all, the use of EVS data can only provide a rough picture.

3.2 Imputation with GSOEP

An alternative strategy is to borrow the panel structure from the GSOEP and to match the two data sets so that household consumption growth can be derived. Starting from 1984, GSOEP data is based on household interviews, and contains crucial questions on living and income. The sample used in this paper includes all West German from 1984, whereas immigrants households are added starting in 1995. Considering the lower end of the income distribution, both EVS and GSOEP do not cover homeless households, while GSOEP covers a bit better of the social benefits recipient households. From 2002 on GSOEP include a subsample of high income households whose monthly income exceeds 4,500 euro. But because EVS does not include high income household, I exclude these high income household samples in GSOEP for year 2002 and 2003.

GSOEP does not offer much information on consumption, and it is also unfeasible to construct consumption from the available information on financial inflows and outflows because there is little information on yearly credit or any other form of borrowing the households have taken. The forcible imputation of consumption would bear large bias, which is especially serious for low-income households who compose of the fat left tail of the imputed consumption distribution.

Serving as basis for calculating group-specific consumption growth and volatility, household consumption can be imputed in two ways from EVS and GSOEP. The first method follows Skinner (1987) and Fisher and Johnson (2006), and involves imputing consumption using EVS information on household consumption, net income, and various household demographics for the available six waves, namely 1978, 1983, 1988, 1993, 1998 and 2003. It shows that,

$$c_{i,t} = \alpha_0 + \alpha_1 * inc + X'_{i,t}\alpha_2 + \epsilon_{i,t} \tag{16}$$

Interpolating the estimated coefficients for the between years and applying the results to the comparable[13] GSOEP samples (multiplying the household net income and demographics with respective coefficients) yield the imputed household consumption.

Table 2 compares mean and median household income and consumption in EVS and the imputed data, where the imputed consumption appears to be lower than the EVS level, and the imputation basis, net income, is substantially lower in GSOEP than in the EVS. This observation is in line with Becker et al. (2002). The reasoning is many fold: 1) GSOEP covers slightly more social benefits recipient households and many more households with foreign heads. 2) Compared to EVS' detailed recorded income and expenditure in diary, income information in GSOEP is an imputation of current month income and a rough estimation of income from previous year, therefore GSOEP income is highly possibly subject to underestimation. 3) Concerning the tax issue, GSOEP tax estimates based on households' account on the previous year tax payment exclude the possible tax benefit, and therefore possibly GSOEP tax payment is overestimated and household net income is underestimated. 4) Concerning the demographics of the households in the overlapping sample years (1988, 1993, 1998 and 2003), the EVS and GSOEP data bear strong similarities in most characteristics, except the occupation distribution of the household heads. EVS includes a much higher share of civil servants and the dependently employed, while the GSOEP samples include a larger portion of self-employed, workers and the unemployed/inactive ones (Table 3).

This result is similar for the second imputation method, whose focus is on the consumption/income ratio of each specific group in five waves (1983-2003). Small cells are formed

[13]Households in EVS and GSOEP with the same demographics are compared, and households with insufficient information are not included in the matching process.

according to common households' characteristics in the EVS and GSOEP, including the residing federate state, community size, households' type, the age and the occupation of household head[14]. Average consumption/income ratios are calculated for EVS for available waves and linear interpolation helps to fill in the gaps between the waves. Needless to say, in this data matching process, the more precise are the criteria, the smaller the cells are, and the better the match. This ideal match would be that each single household in EVS can be matched to its GSOEP counterpart, which is, however, impossible given the heterogeneity of the two data sets. Aggregation of the consumption/income ratio for households sharing the same characteristics results in less variance among the households when consumption growth is derived in GSOEP, and reduces θ_{ij} due to elimination of the household specific shocks. Consequently, volatility of the group consumption growth across time would be underestimated. Such limitation requires that the results relating to the imputed data should be very carefully interpreted. For the data matching purpose, I choose a relatively detailed definition of the group (Table 4), which altogether form 43,200 cells.

Interpolating this ratio between the observation years using a year trend and applying the estimated propensities to those GSOEP households in the same cells, one can impute the consumption for GSOEP samples between 1984 and 2003 and further calculate the corresponding consumption growth rate. As a result, the imputed consumption growth rate would both reflect consumption, income information in the EVS and pick up the income and time structure in the GSOEP. Table 5 reports the average consumption / income ratios of all groups in each wave, where the consumption is either nondurable, durable or total, and income is the net household income. Over the waves, nondurable consumption is slightly less than half of the net income, and durable consumption varies between $13.4\% - 17.4\%$ of the income, indicating that nondurable consumption is dominant and about three times of durable consumption. This is reasonable in the sense that durable goods consumption, such as the purchase of TV sets and cars, is much less frequent than the nondurable consumption. Therefore reported durable consumption for the EVS sample years is less representative than the nondurables. Examining the ranks of the groups in various consumption definition displays that, compared to the durable consumption, groups' positions in nondurable consumption distribution resem-

[14]Some other household characteristics such as education level or years are available either in the GSOEP or in the EVS but not simultaneously, thus they can not be used to construct the cells.

ble their positions in total consumption to a greater extent[15]. Consequently, the behavior and properties of total consumption is more similar to the nondurable consumption.

Both imputation methods have pros and cons. In all, because the estimated and imputed coefficients in first method are average of all EVS households in each wave, the heterogeneity in the imputed GSOEP consumption is even more underrepresented than in the second method. Therefore, in the following I will report consumption growth and volatility based on imputed consumption with the second method.

Net income and nondurable consumption[16] in the EVS are used to calculate the ratio, which can be understood as the average propensity to consume. As nondurable consumption is calculated as above, net income is defined as the household gross income[17] net of health insurance, pension insurance, unemployment insurance, various income tax, church tax as well as other social contribution.

Complementary to the EVS data, the GSOEP survey data include important information on the household members' education level both in schooling years and according to the International Standard Classification of Education (ISCED-1997). Moreover, occupation profiles are also recorded in detail according to the Erikson Goldthorpe Classification (EGP) and the occupational position (Stellung im Beruf, coded by Statistisches Bundesamt). I use the ISCED[18] and EGP[19] to be in line with the related literature when grouping the samples, even though an alternative estimation using schooling years and occupational position does not show a significant difference. 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 EGP

[15]In about 70% of the cases, group rank in total consumption is closer to its rank in nondurable consumption than that in durable consumption.

[16]The inclusion of durable goods, especially real estate and automobiles, requires much information and complex imputation. Neither the EVS nor the GSOEP provides sufficient information for a sound imputation and therefore this paper chooses to examine the nondurable consumption which is precise in both data sets.

[17]Including wage income, freelancing income, financial income, public and non-public transfer and real estate leasing income.

[18]Dividing levels of education into: Pre-Primary Education, Primary Education or First Stage of Basic Education, Lower Secondary or Secondary Stage of Basic Education, (Upper) Secondary Education, Post-Secondary Non-Tertiary Education, First Stage of Tertiary Education, and Second Stage of Tertiary Education.

[19]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, and Pensioner.

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

As is shown in Table 7, other household characteristics used to group the households include household size, community size, and the age and nationality of household heads. The division of household size, community size and age of household heads follow the same rule to that of EVS. Regarding age particularly, 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. Finally, the households can be "German" or "Non-German" according to the nationality of the household head. Altogether, these classifications divide the sample into 144 groups. Note that the criteria and classifications used to group households are different from those in the data matching process because they serve for different purposes.

The regression equation is similar to equation (14) and the main difference is how group average consumption growth is calculated. Because the imputed data allows to calculate per capita consumption growth directly, which avoids the missing link between the EVS households over time, group average consumption growth is a mean of all group members' consumption growth. Since the imputed data presents a nonlinear relationship between group consumption growth and volatility, a quadratic term $\sigma_{i,t}^2$ is added to the right hand side of the regression equation. Moreover, what're also included are relevant households characteristics, according to which households are included in certain socio-economic groups and bear group-specific preferences such as patience and attitude toward consumption benchmark in the theoretical model.

$$g_{i,t} = \alpha_0 + \alpha_1 \underbrace{SD_t\left(g_{i,t}\right)}_{\sigma_{i,t}} + \alpha_2 \sigma_{i,t}^2 + X_{i,t}' \alpha_3 + \mu_i + \delta_t + \epsilon_{i,t} \tag{17}$$

where

$$g_{i,t} = \frac{1}{J} \sum_j g_{ij,t}$$

The data also allows to study the relationship between consumption growth and within-group dispersion. The question is, do groups with average higher consumption growth rates also see higher within-group differences? Again standard deviation and variance of consumption growth within-group are included on the right-hand side to account for nonlinearity:

$$g_{i,t} = \alpha_0 + \alpha_1 \Delta_t + \alpha_2 \Delta_t^2 + X'_{i,t}\alpha_3 + \mu_i + \delta_t + \epsilon_{i,t} \tag{18}$$

where

$$\Delta_t^2 = \frac{1}{J}\sum_j \left(g_{ij,t} - g_{i,t}\right)^2 .$$

Table 10 summarizes the key variables and correlations for the imputed data. Group mean growth rate, volatility and the unconditional correlations bear differences from those in the EVS (Table 8). While the low group growth in EVS is due to the approximation method aiming at constructing consumption growth by taking difference of the aggregated consumption, the higher cross-sectional group average consumption growth rate and volatility in the imputed data may result from both differences in household income (from GSOEP) and the variation in consumption-income ratio (from EVS). Regarding durable consumption, the unconditional correlations between growth and volatility and between growth and standard deviation are shown as positive, while these correlations concerning nondurable consumption are negative. These unconditional correlation, however, can not tell us much since many important issues such as group specific effect and time effect are not considered yet.

Due to the panel structure of the imputed consumption, it's possible to attain the direct relationship between individual consumption growth and its volatility, which share a slightly positive unconditional correlation of 0.02. For a more direct view, Figure 2 plots the consumption growth against its volatility for the 144 groups in the imputed data set, which are defined by household size, community size, age, education level, occupational background and nationality of household heads. The unconditional correlation is captured by the slightly non-linear curve, even though when outliers are excluded the fitted line is not any more upward-sloping. A more sensible analysis would go beyond the rough unconditional correlation, and explore the time structure and panel structure of the data.

4 Estimation results

4.1 The most and least advantageous

The positive and significant link suggested by the regression results can be interpreted as the welfare price the groups have to pay when they experience high group average consumption growth. And what are these fast-growing groups? In another word, what would be the important explanatory variables for per capita consumption growth? This question can be answered by the following regression equation:

$$g_{ij,t} = \alpha_0 + X'_{ij,t}\alpha_1 + \epsilon_{ij,t} \tag{19}$$

with X denoting household specific control variables including community size, household size, household heads' age, nationality, education level, job type. The OLS regression using the imputed data controlling for heteroskedacity shows that these household characteristics associate similarly to the growth and volatility of nondurable and durable goods consumption. As Table 9 shows, household size links negatively to the volatility of growth, indicating that larger households turn to experience less volatility. This possibly results from better insurance among the members in large households with more diverse income resources. The age of household heads seem to relate significantly and slightly negatively to both growth and volatility, implying slower growth and smaller volatility for older households. When the household heads are non-German, the members turn to have slower growth and more volatility, suggesting an inferior position of non-German households in welfare measure comparing to their German counterparts. As higher education and more skilled jobs appear to have positive though insignificant link to growth, they are negatively associated to volatility, suggesting possible insurance from income associated with higher education and more skilled jobs. Community size seems to be irrelevant to household consumption growth and volatility.

More precisely, what are the groups with high consumption growth along with high volatility? Among all 144 groups in Figure 2, these are small foreign households with higher education and skilled jobs. It is surprising to see the groups at the weakest position from the welfare perspective (low growth and high volatility) are households, be there foreign or native German, with high education but unskilled jobs. Moreover, young, small families with higher vocational education turn to have higher consumption growth.

Figure 1 shows in more details the age effect of consumption growth inequality, where income and consumption growth of the young, middle and old groups are compared. Just as is shown in Figure 1, young households seem to have the highest and most volatile income and consumption growth inequality, and old households the lowest and flattest growth inequality over the years. Again, 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. Different from the level case where income variance dominates consumption variance, sometimes consumption growth presents a higher variance than income growth, especially from end 1980s until middle 1990s. Middle-aged and old households appear to have a much lower income and consumption growth variance than the younger ones, whereas it is almost always the case that their consumption growth variance surpasses their income growth variance. This is also the case for old households. This may reflect the different saving habits of households when they are young, or different credit constraints for older households which are based on their existing wealth and credit history.

4.2 EVS

The upper panels of Table 11, 12 and 13 present cross-sectional fixed effect estimations of group nondurable consumption growth on volatility (equation (14) and (17)) for nondurable, durable and total consumption respectively. The estimators are cluster robust. To exclude the effect of household size, per capita consumption growth is the key variable in both the current and next section, where OECD defined equivalent scale is employed. Group fixed effects are considered for all regressions and one extreme outlier is excluded. Column (1) is the result of a cross-sectional regression of group consumption growth on the volatility. The lagged group consumption is added in (2) and (3), while time dummies are included in (3). Neither of durable, nondurable or total consumption sees significant relation between consumption growth and volatility, and the signs of the estimated coefficient concerning volatility is also mixed.

The data also allows for studying the welfare effect of consumption growth. The key

question lies on the evolution of the within-group standard deviation along with the group average growth, as are summarized by equation (15) and (18). Regression results are summarized in the lower panels of Table 11-13. The relationship between growth and inequality is positive but insignificant for nondurable consumption, while durable consumption growth seems to negatively relate to the within-group inequality. It implies that groups with higher durable goods consumption also appear to be more equal. In the "keeping up with the Joneses" context and especially regarding the conventional hypothesis on positional goods, this makes sense because groups with high durable consumption growth might be those signaling strongly with the purchase of the positional goods, where the average will to keep up with others is also stark. The growth-inequality relationship turns to the opposite when it comes to total consumption. Also significant, it seems that groups with high total consumption growth also observe within-group inequality. This result is not controversial to the previous one because the high-growing groups here are not the same as in the durable consumption case. They can be more described as young, small households who are at their start of career and subject to more diverse income and other shocks. Nondurable consumption grows fast while durables still pick up slowly due to their budget constraint. The positive regression results thus reflect the dominant nondurable share in total consumption.

4.3 The Imputed Consumption

Figure 2 and 3 vaguely display nonlinear growth-volatility associations for durable and nondurable consumption with 95% confidence interval. The U-shaped relationships for nondurable and total consumption (negative coefficient for standard deviation and positive coefficient for its square) are confirmed in cross-sectional fixed effect regressions (Table 14 and 16). Similar to the regressions for EVS consumption, group fixed effect and time effect are considered, whereas lagged consumption and time effect are gradually added to the right hand side of the equation. Perhaps due to the unrepresentative information on durable consumption, there is no significant growth-volatility relation reported.

Let's focus on the nondurable and total consumption. For groups with consumption growth under a threshold growth rate $\bar{g}$, the growth is accompanied by diminishing volatility; above $\bar{g}$, faster growing groups witness higher volatility. This threshold growth rate can be calculated using the estimates of the coefficients $(-\frac{\widehat{\alpha_1}}{2\widehat{\alpha_2}})$. Recall the results presented in

Table 9. Those groups with high nondurable consumption growth and high volatility are the young households, who are mapped at the upper right area in Figure 2. Those with relatively low growth and medium volatility are the older and / or foreign head households, located at the middle of the fitted line. A large number of groups gather at the left end of Figure 2. These dominant medium growth, low volatility households may be described as, among others, older aged, large in number, well educated and with skilled jobs. Nonetheless, as is mentioned before, the interpretation of the imputed data should be very careful due to the over/under-estimation problem of the volatility. In the process of matching, the underestimation of personal shocks θ_{ij} may differ in group consumption level and is possibly particularly serious in the lower end of the distribution (assuming poorer households usually have higher consumption volatility due to tighter credit constraint). Consequently, the the difference in growth-volatility relationships for households with faster and slower consumption growth may partly result from the data imputation process.

Similar to the nondurable growth-volatility distribution, a large number of the groups are accumulated at the left end where both nondurable consumption growth and inequality are low (Figure 4). The distribution of durable consumption inequality is more dispersed, with the concentration of the groups spanning wider than the nondurable case. The lower panels of Table 14-16 report the regression results of group growth on within-group inequality, where the U-shaped relationship also holds but is only significant for nondurable consumption. Groups with very low inequality can be those at older age and with stable occupation, who are rather subject to similar income and preference shocks. Such stability consequently allows for decent consumption growth. At the other end, highly unequal groups are subject to remarkably varied idiosyncratic shocks, where the high group growth rate could be a result of those households with extremely large positive shocks.

5 Summary

This paper explores the link between household consumption growth and volatility from both theoretical and empirical perspectives. Heterogeneous households transfer resources intertemporally via trading one type of asset, which helps to store value and insure against income shocks. Different from typical neoclassical models, households incorporate group

average consumption as reference, so that the relative standard of living becomes relevant besides the absolute level. The degree of (im)patience is another important group-specific parameter influencing households' decision on security holding against current consumption.

The incomplete market setup, among other traits, offers partial insurance against income shocks and contributes to consumption smoothing. Still, the general model equilibrium predicts a positive link between consumption growth and volatility, implying unstable growth over time. Moreover, consumption dynamics vary among households with different preferences, especially when group average consumption serves as external benchmark. While more patient groups experience smaller volatility, household eagerness to keep up with group mean intensifies the volatility of the whole group. In a business cycle context, dominant positive income shocks and preference on consumption smoothing drive up the security price, and further strengthens the power of household preferences.

I further use German data to construct household consumption growth in order to test the hypothesis on the positive link between growth and volatility of durable, nondurable and total consumption. A look at individual level consumption growth, volatility and the households' characteristics helps to identify the controls with important economic impacts. Household size, the age and nationality of household heads are relevant to growth and volatility, whereas heads' education does not seem important. Community size and heads' job profiles are positively associated with consumption volatility. The most unfavorable households in the imputed data are those have high education but unskilled jobs, whose low growth and high volatility may come from low income and frequent change of jobs. Households with foreign heads also often find themselves in the category of low consumption growth and high volatility.

As EVS can not provide significant evidence on the link, the imputed data reveals a U-shaped relationship in nondurable consumption growth and volatility. At the right end are those young households who experience both high growth and high volatility, at the left end are the households at older age, large in number, well educated and / or with skilled jobs, whereas those with relatively low growth and medium volatility are the older and / or foreign head households. From another perspective of welfare cost, also in the EVS, the link between group growth and within-group inequality is found positive for nondurable consumption but negative for the durables. The results suggest that lower income households, mostly young and small-sized, are experiencing higher growth in nondurable consumption and subject to

more diverse shocks; higher income households with faster growing purchase of positional goods are more identical in the case of durable consumption.

References

[1] Abel, A. (1990), "Asset Prices under Habit Formation and Catching Up with the Joneses," *American Economic Review* 80(2), 38-42.

[2] Alpizar, F., F. Carlsson and O. Johansson-Stenman (2005) "How Much Do We Care About Absolute Versus Relative Income and Consumption?" *Journal of Economic Behavior and Organization* 56, 405-21.

[3] Ariely, D. and M.I.Norton (2009), "Conceptual Consumption," *Annual Review of Psychology* 60, 475–99.

[4] Ariely, D. and M.I.Norton (2009), "How Concepts Affect Consumption," *Harvard Business Review*, June 2009.

[5] Attanasio, O. and S. Davis(1996), "Relative Wage Movements and the Distribution of Consumption," *Journal of Political Economy* 104(6), 1227-62.

[6] Attanasio, O. and N. Pavoni(2007), "Risk Sharing in Private Information Models with Asset Accumulation: Explaining the Excess Smoothness of Consumption," *NBER* Working Papers 12994.

[7] Barrett, G.F., T.F. Crossley and C. Worswick (2000), "Demographic Trends and Consumption Inequality in Australia between 1975 and 1993," *Review of Income and Wealth* 46 (4), 437-56.

[8] Becker, I (2000), "Einkommensverteilung in Deutschland: Strukturanalyse der Ungleichheit nach Einkommenskomponenten," *EVS* Working Papers 25.

[9] Becker, I. et al.(2002), "A Comparison of the Main Household Income Surveys for Germany: EVS and SOEP," in Hauser, R. and I. Becker (2002), Reporting on Income Distribution and Poverty. Perspectives from a German and European Point of View, Heidelberg: Springer, 55-90.

[10] Bewley, T. (1977), "The Permanent Income Hypothesis: A Theoretical Formulation," *Journal of Economic Theory* 16(2), 252-292.

[11] Blanchflower, D.G., A.J. Oswald (2004), "Well-being Over Time in Britain and the USA," *Journal of Public Economics* 88, 7–8.

[12] Blundell R. and I. Preston (1998), "Consumption Inequality and Income Uncertainty," *Quarterly Journal of Economics* 113(2), 603-640.

[13] Blundell R., L. Pistaferri and I. Preston (2008), "Consumption Inequality and Partial Insurance," *IFS* Working Papers W04/28.

[14] Biewen, M. (2000), "Income Inequality in Germany During the 1980s and 1990s," *Review of Income and Wealth* 46(1), 1-19.

[15] Campbell, J. Y. and J. H. Cochrane (1999), "By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior," *Journal of Political Economy* 107(2), 205-51.

[16] Campbell, J. Y. and A. Deaton (1989), "Why is Consumption so Smooth?," *Review of Economic Studies* 56(3), 357-73.

[17] Campbell, J. Y. and N. G. Mankiw (1989), "Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence," *NBER* Working Papers 2924.

[18] Carroll, C. (2001), "A Theory of the Consumption Function, with and without Liquidity Constraints," *The Journal of Economic Perspectives* 15(3), 23-45.

[19] Crossley, T.F. and K. Pendakur (2002), "Consumption Inequality," Department of Economics Working Papers 2002-09, McMaster University.

[20] Cutler D. and L. Katz (1991), "Macroeconomic Performance and the Disadvantaged," *Brookings Papers on Economic Activity* 1991(2), 1-74.

[21] Deaton, A. (1992), *Understanding Consumption*, Oxford University Press, New York.

[22] Diener, E., E.M. Suh, R.E. Lucas and H.L. Smith (1999), "Subjective Well-being: Three Decades of Progress," *Psychology Bulletin* 125 (2), 276–303.

[23] Duesenberry, J. (1949), *Income, Saving and the Theory of Consumer Behavior*, Harvard University Press, Cambridge, Massachusetts.

[24] Dustmann, C., J. Ludsteck and U. Schönberg (2007), "Revisiting the German Wage Structure," *IZA* Discussion Papers 2685.

[25] Easterlin, R.A. (2001), "Income and Happiness: Towards a Unified Theory," *Economic Journal* 111, 465–84.

[26] Fafchamps, M. and F. Shilpi (2008), "Subjective Welfare, Isolation, and Relative Consumption," *Journal of Development Economics* 86, 43-60.

[27] Fehr, E. and U. Fischbacher (2002), "Why Social Preferences Matter - The Impact of Non-Selfish Motives on Competition, Cooperation and Incentives," *Economic Journal* 112 (478), 1-33.

[28] Festinger, L. (1954), "A Theory of Social Comparison Processes," *Human Relations*, 2(7), 117-40.

[29] Fisher, J. and D. Johnson (2006), "Consumption mobility in the United States: Evidence from two panel data sets," *B.E. Journal of Economic Analysis & Policy* 6(1), 16. Available at http://www.bepress.com/bejcap/topics/vol6/iss1/art16.

[30] Flavin, M. (1984), "Excess Sensitivity of Consumption to Current Income: Liquidity Constraints or Myopia?," *NBER* Working Papers 1341.

[31] Frank, R.H. (1985a), "The Demand for Unobservable and Other Nonpositional Goods," *American Economic Review* 75, 101-16.

[32] — (1985b), "Choosing the Right Pond," New York: Oxford University Press.

[33] — (1989), "Frames of Reference and the Quality of Life," *American Economic Review* 79 (2), Papers and Proceedings of the Hundred and First Annual Meeting of the American Economic Association, 80-5.

[34] Fräßdorf, Grabka and Schwarze (2008), "The Impact of Household Capital Income on Income Inequality: A Factor Decomposition Analysis for Great Britain, Germany and the USA," *IZA* Discussion Papers 3492.

[35] Fuchs-Schündeln N., D. Krüger and M. Sommer (2010), "Inequality Trends for Germany in the Last Two Decades: A Tale of Two Countries," *Review of Economic Dynamics* 13(1).

[36] Galí J. (1994), "Keeping Up with the Joneses: Consumption Externalities, Portfolio Choice, and Asset Prices," *Journal of Money, Credit, and Banking* 26(1), 1-8.

[37] Guo J-T. (2004), "Tax Policy under Keeping Up with the Joneses and Imperfectly Competitive Product Markets," *Econometric Society 2004 North American Winter Meetings* 17.

[38] Hall, R. and F. Mishkin (1982), "The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data of Households," *Econometrica* 50(2), 261-81.

[39] Heathcote, J., K. Storesletten and G.L. Violante (2009), "Quantitative Macroeconomics with Heterogeneous Households," *Annual Review of Economics* 1, 319-54.

[40] Hyman, H.H. (1942), "The Psychology of Status," *Archives of Psychology*, Columbia University, No. 269.

[41] Imbs, J (2007), "Growth and volatility," *Journal of Monetary Economics* 54(7), 1848-62.

[42] Jappelli T. and L. Pistaferri (2000), "Using subjective income expectations to test for excess sensitivity of consumption to predicted income growth," *European Economic Review* 44(2), 337–58.

[43] Knies, Gundi (2010), "Income Comparisons among Neighbours and Life Satisfaction in East and West Germany," *SOEP* papers 298, DIW Berlin.

[44] Krusell, P. and A. Smith (1998), "Income and Wealth Heterogeneity in the Macroeconomy," *Journal of Political Economy* 106(5), 867-896.

[45] Krüger, D. and F. Perri (2005), "Does Income Inequality Lead to Consumption Inequality? Evidence and Theory," *Review of Economic Studies* 73(1), 163-93.

[46] Ljungqvist, L. and H. Uhlig (2000), "Tax Policy and Aggregate Demand Management under Catching Up with the Joneses," *American Economic Review* 90(3), 356-66.

[47] Lucas, R.E. (1992), "On efficiency and distribution," *Economic Journal* 102(411), 233-47.

[48] Luttmer, E.F.P. (2005), "Neighbors as Negatives: Relative Earnings and Well-Being," *The Quarterly Journal of Economics* 120(3), 963-1002.

[49] Mankiw, N.G. (1985), "Consumer Durables and the Real Interest Rate," *The Review of Economics and Statistics* 67(3), 353-62.

[50] Meghir, C. and L. Pistaferri (2004), "Income Variance Dynamics and Heterogeneity," *Econometrica* 72(1), 1-32.

[51] Mehra, R. and E. Prescott (1985), "The Equity Premium Puzzle," *Journal of Monetary Economics* 15(2), 145-61.

[52] Merton, R.K. and A.S. Kitt (1950), "Contributions to the Theory of Reference Group Behavior," in R.K. Merton and P.F. Lazarsfeld, eds., *Continuities in Social Research: Studies in the Scope and Method of "The American Soldier"*, Glenco: Free Press, 40-105.

[53] Parker, J. A. and B. Preston (2005), "Precautionary Saving and Consumption Fluctuations," *American Economic Review* 95(4), 1119-43.

[54] Primiceri, G. E. and T. van Rens (2009), "Heterogeneous life-cycle profiles, income risk and consumption inequality," *Journal of Monetary Economics* 56(1), 20-39.

[55] Ramey, G. and V. A. Ramey (1995), "Cross-Country Evidence on the Link between Volatility and Growth," *American Economic Review* 85(5), 1138-51.

[56] Ravn, M.O. and H. Uhlig (2002), "On adjusting the Hodrick-Prescott filter for the frequency of observations," *The Review of Economics and Statistics* 84(2), 371-5.

[57] Senik, C. (2004), "When information dominates comparison. Learning from Russian subjective panel data", *Journal of Public Economics* 88(9-10), 2099–123.

[58] — (2008), "Ambition and Jealousy: Income Interactions in the 'Old' Europe versus the 'New' Europe and the United States", *Economica* 75(299), 495-513.

[59] Shibutani, T. (1955), "Reference Groups as Perspectives", *The American Journal of Sociology* 60(6), 562-9.

[60] Veblen, T. (1899), "Theory of the Leisure Class: An Economic Study in the Evolution of Institutions", New York: Macmillan. 400.

6 Appendix I: Taylor approximation of the group average Euler equation

According to second order Taylor approximation,

$$\ln G_{i,t+1} \approx \ln G_i + \frac{1}{G_i}\left(G_{i,t+1} - G_i\right) - \frac{1}{2G_i^2}\left(G_{i,t+1} - G_i\right)^2$$

Since $EG_{i,t+1} = G_i$, taking unconditional mean of both sides yields

$$E \ln G_{i,t+1} = \ln EG_{i,t+1} + \frac{1}{G_i}\underbrace{E\left(G_{i,t+1} - G_i\right)}_{0} - \frac{1}{2G_i^2}E\left(G_{i,t+1} - G_i\right)^2.$$

Rearrange it, we have

$$\ln EG_{i,t+1} = E \ln G_{i,t+1} + \frac{1}{2}E\left[\left(\frac{G_{i,t+1} - G_i}{G_i}\right)^2\right] \tag{20}$$

$$\text{or, } E\left[G_{i,t+1}\right] \approx \exp\left\{E \ln G_{i,t+1} + \frac{1}{2}E\left[\left(\frac{G_{i,t+1} - G_i}{G_i}\right)^2\right]\right\}.$$

Similarly according to Taylor approximation,

$$\begin{aligned} G_{i,t+1}^{(-\gamma-(1-\gamma)\kappa_i)} \approx\ & G_i^{(-\gamma-(1-\gamma)\kappa_i)} + \left(-\gamma-(1-\gamma)\kappa_i\right) G_i^{(-\gamma-(1-\gamma)\kappa_i-1)}\left(G_{i,t+1} - G_i\right) \\ & + \frac{\left(-\gamma-(1-\gamma)\kappa_i\right)\left(-\gamma-(1-\gamma)\kappa_i-1\right)}{2} G_i^{(-\gamma-(1-\gamma)\kappa_i-2)}\left(G_{i,t+1} - G_i\right)^2 \end{aligned}$$

and

$$\begin{aligned} EG_{i,t+1}^{(-\gamma-(1-\gamma)\kappa_i)} \approx\ & G_i^{(-\gamma-(1-\gamma)\kappa_i)} + \left(-\gamma-(1-\gamma)\kappa_i\right) G_i^{(-\gamma-(1-\gamma)\kappa_i-1)}\underbrace{E\left(G_{i,t+1} - G_i\right)}_{0} \\ & + \frac{\left(-\gamma-(1-\gamma)\kappa_i\right)\left(-\gamma-(1-\gamma)\kappa_i-1\right)}{2} G_i^{(-\gamma-(1-\gamma)\kappa_i-2)} E\left(G_{i,t+1} - G_i\right)^2 \end{aligned}$$

$$EG_{i,t+1}^{(-\gamma-(1-\gamma)\kappa_i)} \approx G_i^{(-\gamma-(1-\gamma)\kappa_i)}\left[1 + \frac{\left(-\gamma-(1-\gamma)\kappa_i\right)\left(-\gamma-(1-\gamma)\kappa_i-1\right)}{2} E\left(\frac{G_{i,t+1} - G_i}{G_i}\right)^2\right]$$

Taking log of both sides yields

$$\ln EG_{i,t+1}^{(-\gamma-(1-\gamma)\kappa_i)} \approx \ln G_i^{(-\gamma-(1-\gamma)\kappa_i)} + \ln\left[1+\frac{(-\gamma-(1-\gamma)\kappa_i)(-\gamma-(1-\gamma)\kappa_i-1)}{2}E\left(\frac{G_{i,t+1}-G_i}{G_i}\right)^2\right].$$

Since $E\left(\frac{G_{i,t+1}-G_i}{G_i}\right)^2$ is very small,

$$\ln\left[1+\frac{(-\gamma-(1-\gamma)\kappa_i)(-\gamma-(1-\gamma)\kappa_i-1)}{2}E\left(\frac{G_{i,t+1}-G_i}{G_i}\right)^2\right] \approx \frac{(-\gamma-(1-\gamma)\kappa_i)(-\gamma-(1-\gamma)\kappa_i-1)}{2}E\left(\frac{G_{i,t+1}-G_i}{G_i}\right)^2.$$

Using the result from (20),

$$\begin{aligned}\ln EG_{i,t+1}^{(-\gamma-(1-\gamma)\kappa_i)} &\approx (-\gamma-(1-\gamma)\kappa_i)\left[E\ln G_{i,t+1}+\frac{1}{2}E\left(\frac{G_{i,t+1}-G_i}{G_i}\right)^2\right] \\ &\quad+\frac{(-\gamma-(1-\gamma)\kappa_i)(-\gamma-(1-\gamma)\kappa_i-1)}{2}E\left(\frac{G_{i,t+1}-G_i}{G_i}\right)^2 \\ &= (-\gamma-(1-\gamma)\kappa_i)E\ln G_{i,t+1}+\frac{(-\gamma-(1-\gamma)\kappa_i)^2}{2}E\left(\frac{G_{i,t+1}-G_i}{G_i}\right)^2,\end{aligned}$$

where $E\ln G_{i,t+1} = E\ln(1+g_{i,t+1}) \approx Eg_{i,t+1} = g_i$, and

$$\begin{aligned}&E\left[\left(\frac{G_{i,t+1}-G_i}{G_i}\right)^2\right] \\ &\approx E\left[\ln\left(\frac{G_{i,t+1}-G_{i,t}}{G_i}+1\right)\right]^2 = E\left[\ln\left(\frac{G_{i,t+1}}{G_i}\right)\right]^2 = E\left[\ln G_{i,t+1}-\ln G_i\right]^2 \\ &= E\left[\ln(1+g_{i,t+1})-\ln(1+g_i)\right]^2 \approx E\left[(g_{i,t+1}-g_i)^2\right] = \sigma_{g_i}^2.\end{aligned}$$

Therefore

$$\begin{aligned}\ln EG_{i,t+1}^{(-\gamma-(1-\gamma)\kappa_i)} &= (-\gamma-(1-\gamma)\kappa_i)g_i+\frac{(-\gamma-(1-\gamma)\kappa_i)^2}{2}\sigma_{g_i}^2 \\ \text{or } EG_{i,t+1}^{(-\gamma-(1-\gamma)\kappa_i)} &= \exp\left[(-\gamma-(1-\gamma)\kappa_i)g_i+\frac{(-\gamma-(1-\gamma)\kappa_i)^2}{2}\sigma_{g_i}^2\right].\end{aligned}$$

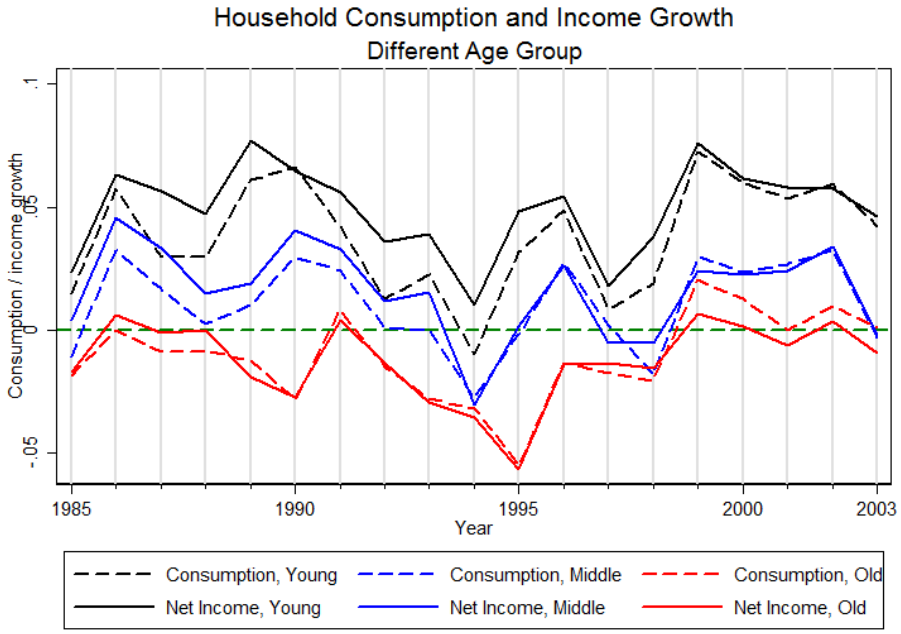

Figure 1: Income and Consumption Growth Inequality, At Different Age

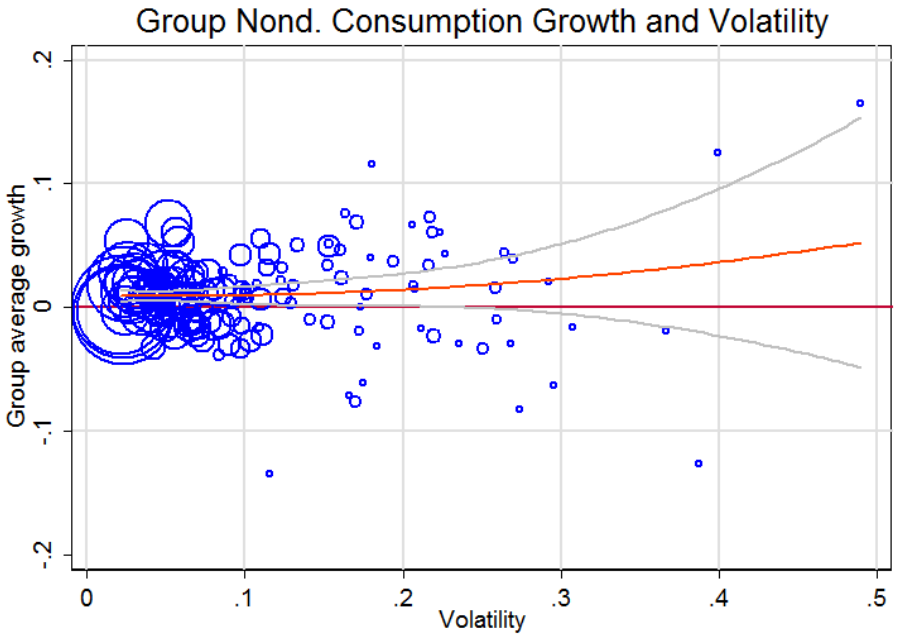

Figure 2: Group Consumption Growth and Volatility, Imputed Data

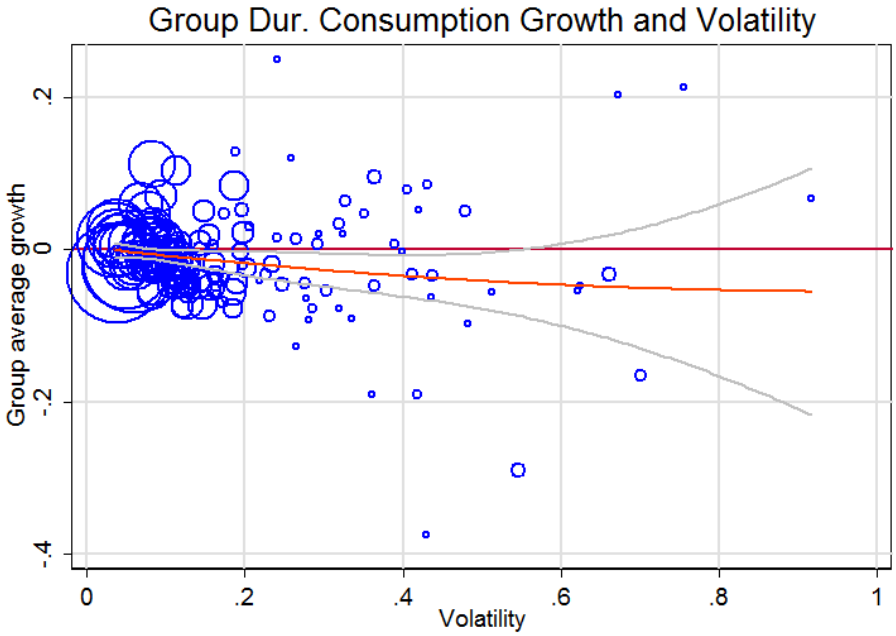

Figure 3: Group Consumption Growth and Volatility, Imputed Data

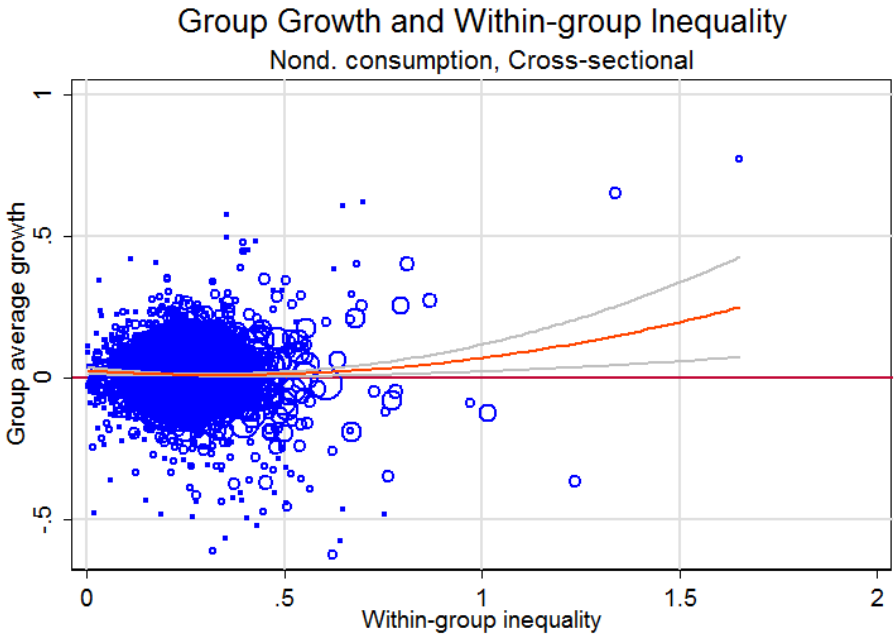

Figure 4: Group Consumption Growth and Inequality, Imputed Data

Table 1. Methodological Characteristics of Household Income Surveys in EVS and GSOEP

	EVS	SOEP
Survey	repeated cross-section	panel
Sampling method	quota sample based on the mandatory random Micro Census	stratified random sample
Sample size	1998: app. 60,000 households	1984-2000: app. 6,000 households; since 2001: app. 12,000 households
Collection of income data	continuous bookkeeping by the participants	monthly (net) household income; major gross income components in the interview month; retrospective income data for the previous year
Foreign household head	Coverage since 1993	explicit over-sampling
Coverage of upper and lower end	no homeless; non-coverage of households with monthly net income over 35,000 DM (1998)	no homeless; starting 2002 SOEP includes an additional sample of the very rich
Tax and social security contribution	payments during the response period included in survey, but no allowance for final tax assessment	imputation based on basic tax routines and flat deduction for employees, provisional lump sums, tax exemptions for capital income, and child allowances

Table 2. Comparison of GSOEP and EVS Consumption by Year (1995 price=100)

	1988		1993		1998		2003	
	SOEP	EVS	SOEP	EVS	SOEP	EVS	SOEP	EVS
Net Income	24114	33569	25745	36057	24395	38568	26240	38724
	(22642)	(31693)	(24213)	(33229)	(22986)	(35314)	(24179)	(35379)
Non. consumption	11898	14695	12572	15149	12351	15878	13446	16281
	(11688)	(14388)	(12551)	(14743)	(12323)	(15467)	(13546)	(16042)
(Original EVS)	-	14721	-	15184	-	15895	-	16292
	-	(13851)	-	(14000)	-	(14545)	-	(14929)
Dur. consumption	4212	5596	4614	6000	3584	5024	3376	4475
	(4202)	(5665)	(4605)	(5895)	(3657)	(4993)	(3356)	(4394)
(Original EVS)	-	5616	-	6022	-	5061	-	4518
	-	(3580)	-	(4017)	-	(2609)	-	(2590)
Tot. consumption	20459	25498	21791	26620	22224	28829	22971	28282
	(20129)	(25062)	(21594)	(25851)	(22269)	(28079)	(22920)	(27607)
(Original EVS)	-	25540	-	26663	-	28968	-	28407
	-	(23813)	-	(24535)	-	(26005)	-	(25643)

Table 3. Descriptive Statistics: Comparison of GSOEP and EVS Demographics by Year

	1988		1993		1998		2003	
	SOEP	EVS	SOEP	EVS	SOEP	EVS	SOEP	EVS
Household size	2.710	2.696	2.630	2.601	2.519	2.597	2.407	2.441
Age of hh head	48.159	48.369	48.488	48.347	48.999	48.209	51.966	50.080
Male head	75.5%	72.4%	71.3%	68.1%	66.2%	67.5%	64.0%	64.4%
Female head	24.5%	27.6%	28.7%	31.9%	33.8%	32.5%	36.0%	35.6%
Berlin west	3.9%	4.0%	3.6%	3.3%	3.4%	2.3%	3.1%	0.6%
Schl.-Holstein	3.4%	5.0%	3.3%	5.7%	3.3%	5.1%	3.8%	5.0%
Hamburg	2.5%	2.9%	1.9%	3.2%	1.8%	3.2%	2.0%	2.9%
Niedersachsen	10.3%	9.9%	10.7%	9.5%	11.5%	10.2%	11.2%	9.5%
Bremen	1.2%	1.2%	1.3%	1.4%	1.2%	1.5%	1.1%	1.5%
Nord.-Westfalen	27.0%	27.5%	27.0%	30.0%	27.0%	27.2%	28.3%	27.3%
Hessen	9.8%	8.8%	9.9%	8.6%	9.2%	8.5%	8.5%	9.9%
Rhein.-Pfalz	7.1%	7.9%	6.9%	8.3%	7.7%	7.7%	8.4%	8.0%
Baden-Württemberg	18.2%	14.5%	17.8%	13.9%	16.9%	15.4%	15.4%	15.7%
Bayern	16.7%	18.3%	17.5%	16.2%	18.0%	18.8%	18.2%	19.6%
Below 20,000 pop.	34.8%	40.2%	34.6%	38.6%	38.4%	40.3%	38.8%	42.3%
20,000-100,000	27.3%	25.9%	27.4%	25.7%	27.1%	25.4%	28.1%	26.0%
Over 1000,000	38.0%	34.0%	37.9%	35.7%	34.5%	34.3%	33.1%	31.7%
Sing. women	13.4%	13.3%	14.1%	15.3%	15.2%	14.1%	16.1%	15.7%
Sing. men	9.1%	6.3%	9.3%	8.9%	9.4%	8.3%	11.1%	9.2%
Sing. par+1 kid	3.5%	2.6%	3.5%	2.8%	3.6%	2.8%	3.8%	3.0%
Sing. par+more kids	2.1%	1.3%	1.4%	1.5%	2.0%	2.1%	2.1%	1.8%
Couple no kid	24.4%	26.0%	26.4%	28.5%	28.9%	29.8%	31.2%	33.6%
Couple+1 kid	17.5%	18.5%	17.7%	15.3%	16.1%	13.1%	13.7%	11.9%
Couple+more kids	25.8%	26.7%	22.8%	25.1%	21.2%	25.6%	19.9%	21.1%
Others	4.2%	5.3%	4.8%	2.7%	3.5%	4.1%	2.1%	3.7%
Farmer	0.8%	0.7%	0.6%	0.6%	0.4%	0.5%	0.0%	0.4%
Self-employed	6.0%	1.6%	6.3%	2.5%	2.1%	2.6%	0.5%	2.6%
Civil servant	6.4%	16.8%	6.1%	16.3%	5.6%	14.0%	5.6%	11.3%
Employed	22.4%	36.4%	20.3%	35.7%	24.1%	42.7%	26.7%	41.1%
Worker	32.4%	15.7%	29.9%	14.8%	24.3%	11.8%	20.4%	11.9%
Unempl./inactive	32.0%	28.9%	36.8%	30.2%	43.5%	28.3%	46.8%	32.6%
Sample size	4793	43803	4419	31497	5123	39060	7310	33818

Table 4. Data matching

Matching Criteria	Community Size	Federal States	Age of Household Head	Occupation of Household Head	Household Type	Survey Years
Nr of Categories	3	10	6	6	8	5
Definition	1 if less than 20000 residents, 2 if between 20000-100000 residents, 3 if more than 100000 residents	All old federal states incl. West Berlin	1 if no older than 25, 2 if between 25-35, 3 if between 35-45, 4 if between 45-55, 5 if between 55-65, and 6 if older than 65	1 if self-employed farmer, 2 if other self-employed, 3 if civil servants, 4 if dependent employee, 5 if worker and 6 if unemployed or not inactive	1 if single women, 2 if single men, 3 if single parent with 1 child, 4 if single parent with 2 or more children, 5 if pair with no child, 6 if pair with 1 child, 7 if pair with 2 or more children and 8 if others, including multi-generation households	1983, 1988, 1993, 1998, 2003

Table 5. Consumption / income ratios over the years

Year	Mean (C_{nd})	Std. Dev. (C_{nd})	Mean (C_d)	Std. Dev. (C_d)	Mean (C_t)	Std. Dev. (C_t)	Nr. of Obs
1985	0.492	0.086	0.162	0.059	0.820	0.121	3773
1986	0.486	0.079	0.163	0.058	0.817	0.114	3441
1987	0.481	0.082	0.164	0.068	0.817	0.128	3425
1988	0.476	0.096	0.164	0.078	0.817	0.147	3372
1989	0.474	0.085	0.167	0.065	0.816	0.132	3666
1990	0.473	0.085	0.169	0.064	0.817	0.134	3439
1991	0.474	0.084	0.169	0.062	0.817	0.129	3439
1992	0.471	0.083	0.171	0.064	0.816	0.126	3218
1993	0.471	0.097	0.174	0.084	0.820	0.154	3359
1994	0.471	0.091	0.171	0.084	0.829	0.150	3125
1995	0.470	0.090	0.165	0.073	0.834	0.144	3374
1996	0.473	0.097	0.160	0.086	0.847	0.158	3426
1997	0.476	0.109	0.156	0.096	0.860	0.185	3399
1998	0.473	0.109	0.151	0.114	0.864	0.183	3305
1999	0.478	0.100	0.148	0.095	0.866	0.176	3465
2000	0.478	0.087	0.147	0.091	0.860	0.158	3415
2001	0.483	0.097	0.140	0.078	0.858	0.159	5549
2002	0.484	0.111	0.137	0.085	0.853	0.176	5512
2003	0.485	0.089	0.134	0.091	0.845	0.154	5906
Total	0.482	0.104	0.499	0.108	102931		

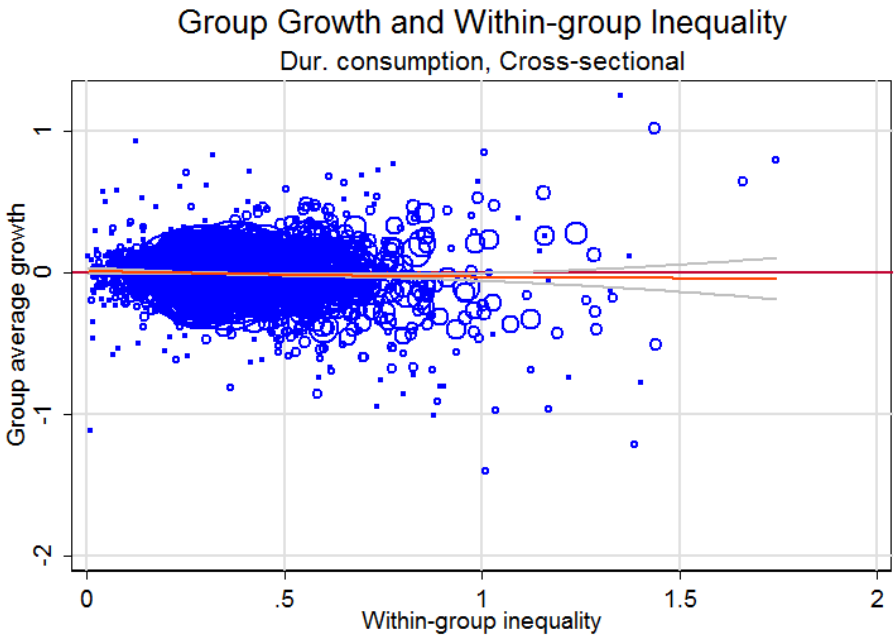

Figure 5: Group Consumption Growth and Inequality, Imputed Data

Table 6. EVS Grouping Criteria

EVS					
Grouping Criteria	Community Size	Household Size	Age of Household Head	Gender of Household Head	Occupation of Household Head
Nr of Categories	3	2	3	2	6
Definition	1 if less than 20000 residents, 2 if between 20000-100000 residents, 3 if more than 100000 residents	1 if fewer than 3, 2 if 3 or more than 3	1 if no older than 35, 2 if between 35-55, 3 if older than 55	1 if male, 2 if female	1 if self-employed farmer, 2 if other self-employed, 3 if civil servants, 4 if dependent employee, 5 if worker, 6 if unemployed or not inactive

Table 7. Imputed Data Grouping Criteria

Matched sample						
Grouping Criteria	Community Size	Household Size	Age of Household Head	Education of Household Head	Occupation of Household Head	Nationality of Household Head
Nr of Categories	3	2	3	2	2	2
Definition	1 if less than 20000 residents, 2 if between 20000-100000 residents, 3 if more than 100000 residents	1 if fewer than 3, 2 if 3 or more than 3	1 if no older than 35, 2 if between 35-55, 3 if older than 55	1 if one has at least post-secondary non-tertiary education (higher educated), 2 if otherwise	1 if more skilled (high/low level service, routine non-manual, self-employed, manual supervision, and skilled manual jobs), 2 if otherwise	1 if German native, 2 if not

Table 8. EVS: Summary Statistics of Per Capita Consumption

	Mean	Median	Min	Max	Frequency
Nondurable consumption					
g_i	0.87%	0.74%	-0.98	1.05	200
σ_i	0.13	0.09	0	0.62	200
Δ_i	0.011	0.008	-0.22	0.42	200
$Correlation(g_i, \sigma_i) = -0.09$					
$Correlation(g_i, \Delta_i) = 0.31$					
Durable consumption					
g_i	-0.093%	-0.062%	-2.589	1.531	200
σ_i	0.474	0.317	0	2.959	200
Δ_i	0.003	0	-0.832	0.386	200
$Correlation(g_i, \sigma_i) = -0.19$					
$Correlation(g_i, \Delta_i) = 0.03$					
Total consumption					
g_i	0.023%	0.017%	-0.714	0.955	200
σ_i	0.137	0.095	0	0.62	200
Δ_i	0.005	0.005	-0.234	0.312	200
$Correlation(g_i, \sigma_i) = -0.12$					
$Correlation(g_i, \Delta_i) = 0.14$					

Table 9. Imputed Data: Nondurable v.s. durable consumption growth and volatility

	(1)	(2)	(3)	(4)
	Nond. Cons Growth	Volatility	Durab. Cons Growth	Volatility
Community size	0.001	-0.002	0.002	0.003
	(0.59)	(-1.41)	(1.00)	(0.87)
Household size	0.002*	-0.002**	0.000	-0.007***
	(1.71)	(-2.41)	(0.01)	(-3.25)
Age of hh head	-0.000***	-0.001***	-0.001***	-0.003***
	(-4.75)	(-6.83)	(-4.47)	(-12.51)
Non German	-0.011***	0.010**	-0.014**	0.032***
	(-3.14)	(2.56)	(-2.38)	(3.39)
Higher education	0.005*	-0.002	0.007	-0.003
	(1.73)	(-0.69)	(1.50)	(-0.49)
Skilled jobs	0.004	-0.015***	0.009*	-0.042***
	(1.48)	(-4.99)	(1.89)	(-5.90)
Constant	0.013	0.119***	0.000	0.326***
	(1.46)	(10.20)	(0.01)	(13.42)
Observations	10842	10842	10841	10841
r2	0.007	0.010	0.006	0.026

t statistics in parentheses

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

All regressions use imputed data, where consumption is adjusted with equivalent scale.

Table 10. Imputed Data: Summary Statistics of Per Capita Consumption

	Mean	Median	Min	Max	Nr. of HHs
Nondurable consumption					
g_{ij}	0.98%	1.11%	-2.19	2.96	11062
σ_{ij}	0.17	0.14	0	2.25	11062
$Correlation(g_{ij}, \sigma_{ij}) = 0.008$					
g_i	0.01	0.012	-0.134	0.165	144
σ_i	0.116	0.086	0.021	0.490	144
Δ_i	0.242	0.241	0.003	0.566	144
$Correlation(g_i, \sigma_i) = 0.09$					
$Correlation(g_i, \Delta_i) = 0.07$					
Durable consumption					
g_{ij}	-0.51%	-0.38%	-3.52	4.22	11061
σ_{ij}	0.248	0.194	0	2.88	11062
$Correlation(g_{ij}, \sigma_{ij}) = 0.009$					
g_i	-0.014	-0.017	-0.375	0.25	144
σ_i	0.202	0.140	0.034	1.00	144
Δ_i	0.385	0.392	0.032	0.809	144
$Correlation(g_i, \sigma_i) = -0.06$					
$Correlation(g_i, \Delta_i) = -0.11$					
Total consumption					
g_{ij}	1.04%	1.13%	-2.19	2.9	11062
σ_{ij}	0.169	0.143	0	2.25	11062
$Correlation(g_{ij}, \sigma_{ij}) = 0.015$					
g_i	0.013	0.012	-0.112	0.186	144
σ_i	0.116	0.085	0.013	0.538	144
Δ_i	0.241	0.236	0.01	0.56	144
$Correlation(g_i, \sigma_i) = 0.15$					
$Correlation(g_i, \Delta_i) = -0.02$					

Table 11. EVS: Nond. Consumption Growth on Volatility / Inequality

	(1)	(2)	(3)
		Volatility	
σ_{nd}	-0.072	0.099	0.106
	(-0.65)	(1.24)	(1.48)
Lag nond. consumption		-1.180***	-1.211***
		(-21.09)	(-20.65)
Time effect			significant***
Constant	0.013	10.691***	10.993***
	(1.07)	(21.27)	(20.76)
Observations	935	935	935
F	0.421	287.443	140.395
$r2_{within}$	0.002	0.576	0.628
$r2_{between}$	0.009	0.006	0.007
$r2_{overall}$	0.003	0.091	0.103
		Inequality	
Δ_{nd}	0.061	0.079	0.101
	(0.48)	(1.22)	(1.64)
Lag nond. consumption		-1.170***	-1.205***
		(-22.52)	(-21.13)
Time effect			significant***
Constant	0.004***	10.614***	10.948***
	(2.79)	(22.53)	(21.13)
Observations	935	935	935
F	0.234	253.687	135.238
$r2_{within}$	0.001	0.575	0.628
$r2_{between}$	0.096	0.007	0.008
$r2_{overall}$	0.004	0.094	0.106
t statistics in parentheses			
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$			

The dependent variable is $g_{i,t}$, and the time period is from 1984-2003. (1) is the result of a cross-sectional regression of group nondurable consumption growth on its volatility. The lagged group nondurable consumption is added in (2) and (3), while time dummies are included in (3).

Table 12. EVS: Durable Consumption Growth on Volatility / Inequality

	(1)	(2)	(3)
		Volatility	
σ_d	0.229	-0.087	-0.155*
	(0.57)	(-1.07)	(-1.73)
Lag dur. consumption		-1.324***	-1.389***
		(-10.85)	(-10.24)
Time effect			significant***
Constant	-0.162	9.999***	10.216***
	(-1.05)	(10.86)	(10.13)
Observations	935	935	935
F	0.324	62.920	185.051
$r2_{within}$	0.011	0.660	0.742
$r2_{between}$	0.041	0.102	0.124
$r2_{overall}$	0.000	0.333	0.383
		Inequality	
Δ_d	-0.545***	-0.183***	-0.106**
	(-7.54)	(-3.37)	(-2.23)
Lag dur. consumption		-1.272***	-1.336***
		(-9.63)	(-11.04)
Time effect			significant***
Constant	-0.068***	9.575***	9.771***
	(-85.18)	(9.56)	(10.98)
Observations	935	935	935
F	56.864	170.629	223.625
$r2_{within}$	0.088	0.668	0.741
$r2_{between}$	0.001	0.086	0.098
$r2_{overall}$	0.081	0.339	0.376
t statistics in parentheses			
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$			

The dependent variable is $g_{i,t}$, and the time period is from 1984-2003. (1) is the result of a cross-sectional regression of group durable consumption growth on its volatility. The lagged group durable consumption is added in (2) and (3), while time dummies are included in (3).

Table 13. EVS: Total Consumption Growth on Volatility / Inequality

	(1)	(2)	(3)
		Volatility	
σ_t	-0.234	0.041	0.109
	(-1.04)	(0.36)	(1.04)
Lag total cons.		-0.986***	-1.159***
		(-18.67)	(-22.53)
Time effect			significant***
Constant	0.046***	9.490***	11.210***
	(3.53)	(18.82)	(22.73)
Observations	935	935	935
F	4.178	186.012	182.866
$r2_{within}$	0.014	0.491	0.622
$r2_{between}$	0.017	0.002	0.002
$r2_{overall}$	0.011	0.099	0.118
		Inequality	
Δ_t	0.348**	0.177**	0.158**
	(2.60)	(2.17)	(2.13)
Lag total cons.		-0.961***	-1.121***
		(-17.74)	(-22.08)
Time effect			significant***
Constant	0.017***	9.251***	10.853***
	(16.73)	(17.76)	(22.06)
Observations	935	935	935
F	6.746	186.423	194.739
$r2_{within}$	0.038	0.501	0.627
$r2_{between}$	0.020	0.002	0.003
$r2_{overall}$	0.034	0.108	0.128
t statistics in parentheses			
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$			

The dependent variable is $g_{i,t}$, and the time period is from 1984-2003. (1) is the result of a cross-sectional regression of group total consumption growth on its volatility. The lagged group total consumption is added in (2) and (3), while time dummies are included in (3).

Table 14. Imputed Data: Nondurable Consumption Growth on Volatility / Inequality

	(1)	(2)	(3)
		Volatility	
σ_{nd}	-0.366***	-0.349***	-0.331***
	(-4.93)	(-4.32)	(-4.08)
σ^2_{nd}	0.815***	0.764***	0.757***
	(5.13)	(4.60)	(4.54)
Lag nond. consumption		-0.182***	-0.194***
		(-6.56)	(-6.55)
Time effect			significant**
			(2.49)
Constant	0.026***	1.633***	1.716***
	(6.25)	(6.67)	(6.56)
Observations	2567	2423	2423
F	14.113	27.840	8.586
$r2_{within}$	0.063	0.110	0.130
$r2_{between}$	0.074	0.001	0.000
$r2_{overall}$	0.064	0.055	0.068
		Inequality	
Δ_{nd}	-0.217***	-0.240***	-0.237***
	(-3.91)	(-4.03)	(-3.86)
Δ^2_{nd}	0.300***	0.311***	0.317***
	(3.64)	(3.83)	(3.82)
Lag nond. consumption		-0.162***	-0.175***
		(-6.95)	(-7.22)
Time effect			significant**
Constant	0.040***	1.478***	1.578***
	(4.40)	(7.13)	(7.40)
Observations	2346	2226	2226
F	7.839	19.941	8.322
$r2_{within}$	0.017	0.065	0.096
$r2_{between}$	0.001	0.016	0.011
$r2_{overall}$	0.014	0.016	0.031
t statistics in parentheses			
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$			

Group nondurable consumption growth rate is the dependent variable.

Table 15. Imputed Data: Durable Consumption Growth on Volatility / Inequality

	(1)	(2)	(3)
		Volatility	
σ_d	0.094	0.068	0.088
	(0.54)	(0.37)	(0.49)
σ_d^2	-0.190	-0.168	-0.172
	(-0.93)	(-0.80)	(-0.84)
Lag dur. consumption		-0.104***	-0.115***
		(-3.96)	(-3.90)
Time effect			significant**
			(2.49)
Constant	-0.015	0.784***	0.912***
	(-1.07)	(3.82)	(4.04)
Observations	2567	2423	2423
F	0.892	6.262	8.261
$r2_{within}$	0.025	0.039	0.081
$r2_{between}$	0.006	0.241	0.250
$r2_{overall}$	0.020	0.010	0.039
		Inequality	
Δ_d	0.108	0.112	0.140
	(0.59)	(0.61)	(0.77)
Δ_d^2	-0.240	-0.245	-0.247
	(-1.31)	(-1.34)	(-1.35)
Lag dur. consumption		-0.089***	-0.091***
		(-4.15)	(-3.86)
Time effect			significant**
Constant	-0.011	0.674***	0.727***
	(-0.30)	(3.98)	(4.00)
Observations	2345	2225	2225
F	6.478	10.575	9.804
$r2_{within}$	0.051	0.067	0.113
$r2_{between}$	0.043	0.050	0.053
$r2_{overall}$	0.047	0.027	0.063
t statistics in parentheses			
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$			

Group durable consumption growth rate is the dependent variable.

Table 16. Imputed Data: Total Consumption Growth on Volatility / Inequality

	(1)	(2)	(3)
		Volatility	
σ	-0.378***	-0.362***	-0.349***
	(-5.07)	(-4.93)	(-4.73)
σ^2	0.765***	0.751***	0.749***
	(4.61)	(4.76)	(4.74)
Lag total cons.		-0.198***	-0.215***
		(-7.03)	(-6.58)
Time effect			significant**
			(2.49)
Constant	0.031***	1.887***	2.021***
	(6.70)	(7.16)	(6.61)
Observations	2567	2423	2423
F	13.901	38.348	11.649
$r2_{within}$	0.074	0.136	0.150
$r2_{between}$	0.096	0.014	0.011
$r2_{overall}$	0.074	0.065	0.072
		Inequality	
Δ	-0.070	-0.096	-0.092
	(-1.12)	(-1.46)	(-1.41)
Δ^2	0.156	0.177*	0.179*
	(1.48)	(1.70)	(1.73)
Lag total cons.		-0.159***	-0.174***
		(-6.53)	(-6.35)
Time effect			significant**
Constant	0.017*	1.521***	1.652***
	(1.84)	(6.60)	(6.44)
Observations	2346	2226	2226
F	1.167	14.431	4.828
$r2_{within}$	0.008	0.056	0.076
$r2_{between}$	0.000	0.028	0.028
$r2_{overall}$	0.008	0.009	0.016
t statistics in parentheses			
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$			

Group total consumption growth rate is the dependent variable.

SFB 649 Discussion Paper Series 2010

For a complete list of Discussion Papers published by the SFB 649, please visit http://sfb649.wiwi.hu-berlin.de.

001 "Volatility Investing with Variance Swaps" by Wolfgang Karl Härdle and Elena Silyakova, January 2010.
002 "Partial Linear Quantile Regression and Bootstrap Confidence Bands" by Wolfgang Karl Härdle, Ya'acov Ritov and Song Song, January 2010.
003 "Uniform confidence bands for pricing kernels" by Wolfgang Karl Härdle, Yarema Okhrin and Weining Wang, January 2010.
004 "Bayesian Inference in a Stochastic Volatility Nelson-Siegel Model" by Nikolaus Hautsch and Fuyu Yang, January 2010.
005 "The Impact of Macroeconomic News on Quote Adjustments, Noise, and Informational Volatility" by Nikolaus Hautsch, Dieter Hess and David Veredas, January 2010.
006 "Bayesian Estimation and Model Selection in the Generalised Stochastic Unit Root Model" by Fuyu Yang and Roberto Leon-Gonzalez, January 2010.
007 "Two-sided Certification: The market for Rating Agencies" by Erik R. Fasten and Dirk Hofmann, January 2010.
008 "Characterising Equilibrium Selection in Global Games with Strategic Complementarities" by Christian Basteck, Tijmen R. Daniels and Frank Heinemann, January 2010.
009 "Predicting extreme VaR: Nonparametric quantile regression with refinements from extreme value theory" by Julia Schaumburg, February 2010.
010 "On Securitization, Market Completion and Equilibrium Risk Transfer" by Ulrich Horst, Traian A. Pirvu and Gonçalo Dos Reis, February 2010.
011 "Illiquidity and Derivative Valuation" by Ulrich Horst and Felix Naujokat, February 2010.
012 "Dynamic Systems of Social Interactions" by Ulrich Horst, February 2010.
013 "The dynamics of hourly electricity prices" by Wolfgang Karl Härdle and Stefan Trück, February 2010.
014 "Crisis? What Crisis? Currency vs. Banking in the Financial Crisis of 1931" by Albrecht Ritschl and Samad Sarferaz, February 2010.
015 "Estimation of the characteristics of a Lévy process observed at arbitrary frequency" by Johanna Kappusl and Markus Reiß, February 2010.
016 "Honey, I'll Be Working Late Tonight. The Effect of Individual Work Routines on Leisure Time Synchronization of Couples" by Juliane Scheffel, February 2010.
017 "The Impact of ICT Investments on the Relative Demand for High-Medium-, and Low-Skilled Workers: Industry versus Country Analysis" by Dorothee Schneider, February 2010.
018 "Time varying Hierarchical Archimedean Copulae" by Wolfgang Karl Härdle, Ostap Okhrin and Yarema Okhrin, February 2010.
019 "Monetary Transmission Right from the Start: The (Dis)Connection Between the Money Market and the ECB's Main Refinancing Rates" by Puriya Abbassi and Dieter Nautz, March 2010.
020 "Aggregate Hazard Function in Price-Setting: A Bayesian Analysis Using Macro Data" by Fang Yao, March 2010.
021 "Nonparametric Estimation of Risk-Neutral Densities" by Maria Grith, Wolfgang Karl Härdle and Melanie Schienle, March 2010.

SFB 649 Discussion Paper Series 2010

For a complete list of Discussion Papers published by the SFB 649, please visit http://sfb649.wiwi.hu-berlin.de.

022 "Fitting high-dimensional Copulae to Data" by Ostap Okhrin, April 2010.
023 "The (In)stability of Money Demand in the Euro Area: Lessons from a Cross-Country Analysis" by Dieter Nautz and Ulrike Rondorf, April 2010.
024 "The optimal industry structure in a vertically related market" by Raffaele Fiocco, April 2010.
025 "Herding of Institutional Traders" by Stephanie Kremer, April 2010.
026 "Non-Gaussian Component Analysis: New Ideas, New Proofs, New Applications" by Vladimir Panov, May 2010.
027 "Liquidity and Capital Requirements and the Probability of Bank Failure" by Philipp Johann König, May 2010.
028 "Social Relationships and Trust" by Christine Binzel and Dietmar Fehr, May 2010.
029 "Adaptive Interest Rate Modelling" by Mengmeng Guo and Wolfgang Karl Härdle, May 2010.
030 "Can the New Keynesian Phillips Curve Explain Inflation Gap Persistence?" by Fang Yao, June 2010.
031 "Modeling Asset Prices" by James E. Gentle and Wolfgang Karl Härdle, June 2010.
032 "Learning Machines Supporting Bankruptcy Prediction" by Wolfgang Karl Härdle, Rouslan Moro and Linda Hoffmann, June 2010.
033 "Sensitivity of risk measures with respect to the normal approximation of total claim distributions" by Volker Krätschmer and Henryk Zähle, June 2010.
034 "Sociodemographic, Economic, and Psychological Drivers of the Demand for Life Insurance: Evidence from the German Retirement Income Act" by Carolin Hecht and Katja Hanewald, July 2010.
035 "Efficiency and Equilibria in Games of Optimal Derivative Design" by Ulrich Horst and Santiago Moreno-Bromberg, July 2010.
036 "Why Do Financial Market Experts Misperceive Future Monetary Policy Decisions?" by Sandra Schmidt and Dieter Nautz, July 2010.
037 "Dynamical systems forced by shot noise as a new paradigm in the interest rate modeling" by Alexander L. Baranovski, July 2010.
038 "Pre-Averaging Based Estimation of Quadratic Variation in the Presence of Noise and Jumps: Theory, Implementation, and Empirical Evidence" by Nikolaus Hautsch and Mark Podolskij, July 2010.
039 "High Dimensional Nonstationary Time Series Modelling with Generalized Dynamic Semiparametric Factor Model" by Song Song, Wolfgang K. Härdle, and Ya'acov Ritov, July 2010.
040 "Stochastic Mortality, Subjective Survival Expectations, and Individual Saving Behavior" by Thomas Post and Katja Hanewald, July 2010.
041 "Prognose mit nichtparametrischen Verfahren" by Wolfgang Karl Härdle, Rainer Schulz, and Weining Wang, August 2010.
042 "Payroll Taxes, Social Insurance and Business Cycles" by Michael C. Burda and Mark Weder, August 2010.
043 "Meteorological forecasts and the pricing of weather derivatives" by Matthias Ritter, Oliver Mußhoff, and Martin Odening, September 2010.
044 "The High Sensitivity of Employment to Agency Costs: The Relevance of Wage Rigidity" by Atanas Hristov, September 2010.
045 "Parametric estimation of risk neutral density functions" by Maria Grith and Volker Krätschmer, September 2010.

SFB 649 Discussion Paper Series 2010

For a complete list of Discussion Papers published by the SFB 649, please visit http://sfb649.wiwi.hu-berlin.de.

046 "Mandatory IFRS adoption and accounting comparability" by Stefano Cascino and Joachim Gassen, October 2010.
047 "FX Smile in the Heston Model" by Agnieszka Janek, Tino Kluge, Rafał Weron, and Uwe Wystup, October 2010.
048 "Building Loss Models" by Krzysztof Burnecki, Joanna Janczura, and Rafał Weron, October 2010.
049 "Models for Heavy-tailed Asset Returns" by Szymon Borak, Adam Misiorek, and Rafał Weron, October 2010.
050 "Estimation of the signal subspace without estimation of the inverse covariance matrix" by Vladimir Panov, October 2010.
051 "Executive Compensation Regulation and the Dynamics of the Pay-Performance Sensitivity" by Ralf Sabiwalsky, October 2010.
052 "Central limit theorems for law-invariant coherent risk measures" by Denis Belomestny and Volker Krätschmer, October 2010.
053 "Systemic Weather Risk and Crop Insurance: The Case of China" by Wei Xu, Ostap Okhrin, Martin Odening, and Ji Cao, October 2010.
054 "Spatial Dependencies in German Matching Functions" by Franziska Schulze, November 2010.
055 "Capturing the Zero: A New Class of Zero-Augmented Distributions and Multiplicative Error Processes" by Nikolaus Hautsch, Peter Malec and Melanie Schienle, November 2010.
056 "Context Effects as Customer Reaction on Delisting of Brands" by Nicole Wiebach and Lutz Hildebrandt, November 2010.
057 "Consumption Growth and Volatility with Consumption Externalities" by Runli Xie, November 2010.