

## Research Article

Lucia Mangiavacchi, Luca Piccoli\* and Chiara Rapallini

# Personality Traits and Household Consumption Choices

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**Abstract:** This study examines the role personality traits play in influencing consumption decisions for both individuals and households by means of a complete system of Engel curves. Estimations are performed on the German Socio-Economic Panel (SOEP) using the following four different samples: single men, single women, childless couples and couples with children. Personality traits are found to moderately improve the general goodness of fit of the model, reducing the RMSE on average by 2.8%. This is the result of some traits strongly contributing to explaining specific consumption categories, such as Mental Openness contributing substantially to explaining expenditure in education and culture, and several non-significant personality trait-consumption category associations. Robustness analysis suggests that the effect is fairly stable across age groups within the same household type and that the effects of personality traits on consumption choices are independent of education level.

**Keywords:** Big Five personality traits, consumption choices, preferences

**JEL codes:** D12, J12, D91

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**\*Corresponding author: Luca Piccoli**, Department of Sociology and Social Research, Università degli Studi di Trento, via Verdi 26, 38122, Trento, Italy; and IZA, Institute of Labor Studies, Bonn, Germany, E-mail: [luca.piccoli@unitn.it](mailto:luca.piccoli@unitn.it). <https://orcid.org/0000-0002-0212-2429>

**Lucia Mangiavacchi**, Department of Political Sciences, Università degli Studi di Perugia, Perugia, Italy; and IZA, Institute of Labor Studies, Bonn, Germany. <https://orcid.org/0000-0002-3690-6723>

**Chiara Rapallini**, Department of Economics and Management, Università degli Studi di Firenze, Firenze, Italy. <https://orcid.org/0000-0003-3102-9095>

# 1 Introduction

This study examines the role personality traits play in influencing consumption decisions for both individuals and households. In the past two decades, an increasing number of contributions in the economics literature have investigated the role played by personality traits in predicting both individual decision making and life outcomes across a wide variety of domains, such as education and labor market, financial decisions, subjective well-being, social cohesion and the marriage market. As for the latter, the well-known evidence – among psychologists – that personality predicts couple formation (Roberts and Bogg 2004), as well as marital satisfaction (e.g., Gaunt 2006), is now acknowledged by economists who examine the role of personality in the marriage market (Dupuy and Galichon 2014), and in intrahousehold bargaining on time use and partners' labor supply (Flinn, Todd, and Zhang 2018). Indeed, the potential role of personality in couple formation was mentioned as early as Becker (1973) in his seminal model of the marriage market based on production-complementarities. Recent evidence highlights that similarity in personality is important for the sorting of men and women into marriage and that when personalities are too far divided, the probability of divorce increases, but it also indicates that the individual gains from marriage have become more consumption based (Lundberg 2012).

Perhaps surprisingly, the link between personality and consumption choices has been scarcely investigated. As underlined by Volland (2019), there are at least two main reasons why an individual's personality can be associated with different patterns of expenditure. First, personality traits may provide “a direct empirical operationalization of individual preference structure” (Volland 2019, pag. 73 and Caplan 2003). In fact, personality traits - like preferences - are heterogeneous among individuals, as well as being quite stable along the life course (more details are provided in Section 2.1). Given these features, personality traits can be used to explain (at least part of) the observed heterogeneity in demand behavior, as – up to now – heterogeneity has mainly been ascribed to broad demographic categories and to budget constraint differences. Second, the association between personality traits and consumption may be indirect, i.e., passing through income and risk attitude. As for the former, given the evidence that personality affects educational attainment and occupational choice (Almlund et al. 2011; Bowles, Gintis, and Osborne 2001; Heckman, Pinto, and Savelyev 2013; Rustichini et al. 2016), it thereby determines the income available for consumption (Fletcher 2013; Heineck 2011; Mueller and Plug 2006). In the latter case, personality traits have been found to be related to an

individual's willingness to take risks (Rustichini et al. 2016), which in turn may affect both an individual's consumption habits (for instance by increasing the likelihood of consumption of addictive goods) and financial decisions (Brown and Taylor 2014; Bucciol and Zarri 2017; Caliendo, Fossen, and Kritikos 2014; Caliendo, Künn, and Weißenberger 2016; Conlin et al. 2015; Xu et al. 2015).

This work aims at testing the direct impact of personality traits on the consumption of different broad categories of commodities for individuals living both in one-person households and couples, with and without children. The paper fills a gap in the literature by investigating, at the micro level, the effect of personality on the allocation of resources among different goods, such as food, clothes and shoes, health and hygiene, education and culture, communication and transportation, leisure and holiday and insurance. Specifically, we first estimate a system of Engel curves<sup>1</sup> for women and men, using samples of one-person households. The study of the consumption choices of single males and females, for whom no intrahousehold interactions exist and children are absent, allows us to first draw conclusions regarding the influence of personality on consumption. Second, we estimate a system of Engel curves for people living in childless couples, including both the husband's and wife's personality traits. Then, we estimate a system of Engel curves for a sample of couples with children, again considering the personality traits of both partners. In the analysis we are aware that at the household level the decision is taken by two adults and also of the possible existence of assortative mating on personality traits.

Similar to the bulk of literature investigating the role of personality in economic decisions, we adopt the Big Five taxonomy. There is substantial agreement among personality psychologists both regarding the use of the five-factor structure to account for substantive covariations in personality descriptions (Costa and McCrae 1989) and on their labeling. In brief, Extraversion is the attitude toward being active, being forthcoming and desiring social relationships; Agreeableness means being friendly, warm and sensitive towards others; Conscientiousness is the attitude of being systematic, goal-oriented and self-disciplined; Neuroticism is the tendency to worry, be nervous and be emotionally unstable, while Mental Openness is a proxy of intelligence together with being imaginative, creative, curious and unconventional. More details on this model, including the possible critiques and the practical issues raised by measuring personality, are reviewed in Section 2.

We use the German Socio-Economic Panel (SOEP), which records the Big Five personality traits assessment in several waves, including 2009, and comprehensive household consumption information in 2010. By pooling the two waves and retaining those households (and individuals) for which both consumption

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<sup>1</sup> Consumption preferences cannot be studied by means of a complete demand system because prices or unit values cannot be recovered with the available data.

expenditure and personality traits are observed, we are able to estimate a complete system of Engel curves and to address our research questions.

We show that personality traits improve the general goodness of fit of the model, although not by a large extent. Personality is more important for a group of specific combinations of personality trait and consumption category, while several combinations of trait and consumption category show coefficients that are not statistically significant. For instance, Mental Openness contributes substantially to explaining expenditure on education and culture but is not relevant for explaining expenditures on clothes and shoes, health and hygiene, leisure and holiday and insurances. Another example is Neuroticism, which increases the expenditure on health and hygiene and reduces the expenditure on leisure and holiday; however it is not relevant for education and culture and insurance expenditures. Furthermore, within the homogeneous family types used in the analysis, the effects of personality traits seem to be fairly stable across age groups and education levels.

The remainder of the work is organized as follows. Section 2 introduces the background literature. Section 3 describes the data and the empirical strategy. Section 4 discusses the main results. Section 5 concludes and suggests avenues for further research.

## 2 Background

### 2.1 The Big Five Model of Personality Theory

The Big Five model assumes a hierarchical structure of personality traits, meaning that the Big Five personality characteristics represent one level in a hierarchy of traits, and these traits can be subdivided into collections of facets that are related to each other but are not identical. The model originated from a lexical hypothesis (Allport and Odbert 1936), which posits that the most important individual differences are encoded in language; in the seminal study, by combing English dictionaries, the two psychologists found 4,504 personality-describing adjectives that were organized into five superordinate dimensions by means of factor analysis. These five superordinate dimensions have been known as the Big Five personality traits since Goldberg (1971). Given this origin, it is easy to understand one of the main critiques of the Big five model, i.e., the fact that it is an a-theoretical model. In the Borghans et al.'s (2008) words “the finding that descriptions of behavior as measured by tests, self-reports, and reports of observers cluster reliably into five

groups has not so far been explained by a basic theory.” In practice, the Big Five are usually measured using a self-reported Five Factor Inventory consisting of 60 items (Costa and McCrae 1989). With the onset of large household surveys incorporating personality traits (PTs), there has been a need to reduce the number of items, and both the German SOEP and the British Household Panel Study (BHPS) operate with 15 items. Though open for debate, there is reasonably strong support for the reliability of the small version of the questionnaire (Gosling, Rentfrow, and Swann 2003).

As mentioned in the Introduction, the stability of personality traits is a feature that allows researchers to use personality measures in economic empirical investigations. Actually, the stability of personality traits is a research question that has been debated at length among psychologists (Boyce, Wood, and Powdthavee 2013; Lucas and Donnellan 2011; Roberts and DelVecchio 2000; Roberts 1997; Specht, Egloff, and Schmukle 2011; Specht, Egloff, and Schmukle 2013; Specht et al. 2014) and more recently among economists as well (Almlund et al. 2011; Borghans et al. 2008; Cobb-Clark and Schurer 2012). To clarify the different possible answers to this research question, the notion of change should be clearly defined. At the population level, at least two measures have been considered, i.e., mean-level changes and rank-order changes. “Mean-level change reflects shifts of group of people to higher or lower values on a trait over time” (Specht, Egloff, and Schmukle 2011, pag. 863), while “rank order consistency reflects whether groups of people maintain their relative placement to each other on trait dimensions over time” (Specht, Egloff, and Schmukle 2011, pag. 863). When these two notions of stability are adopted, the literature has found that the most evident changes occur during adolescence and old age, while the degree of consistency is much higher during middle age (Borghans et al. 2008; Caspi and Roberts 2001; Fraley and Roberts 2005; Lucas and Donnellan 2011; Roberts and DelVecchio 2000; Specht, Egloff, and Schmukle 2013; Thiel, Thomsen, and Büttner 2014). A third measure of personality trait stability is intra-individual changes, which assesses changes in the personality traits of each individual as he or she ages (Cobb-Clark and Schurer 2012, page 12). In our setting, intra-individual consistency matters for several reasons, which are reviewed in Section 3.3.

## 2.2 Personality Traits, Marriage Market and Consumption Preferences

The potential role of personality in couple formation was originally identified by Becker (1973), although most of the successive studies adopting this framework examined marital sorting based on a single-dimensional trait – mainly education or

earnings –. Actually, in the Beckerian framework, negative assortative mating on personality traits predicts positive outcomes in the labor market and household production, with the husband being high in traits associated with better labor market performance and the wife in traits that imply higher productivity in domestic tasks. However, as women's labor force participation has increased, and the relative significance of household (rather than market) production has declined, production complementarities have become less important sources of gains from marriage (Lundberg and Pollak 2007; Stevenson and Wolfers 2007). At the same time, complementarities in consumption began to be investigated as a source of benefit among individuals with similar preferences (Lam 1988). Actually, positive assortative mating on personality can be both the consequence of positive assortative mating on other individual characteristics – primarily the level of education – that are strongly related with personality, or can be interpreted as evidence that consumption complementarities, such as those due to the joint consumption of public goods, are of greatest benefit when individuals with similar preferences for consumption and leisure are matched (Lundberg 2012). Lundberg (2012) studied the role of production and consumption complementarities in couple formation and dissolution in Germany across different cohorts and examined the effects of personality traits. She argued that although production complementarities within the household have become less important than in the past, there is not enough direct evidence that individual gains from marriage have become more consumption-based. To fill this gap, she used personality traits, as proxies of preferences and capabilities, to directly examine the marital surplus due to the joint consumption of household public goods. In particular, she provided evidence that the Mental Openness and Conscientiousness traits are positive predictors of marriage and marital stability for the German couples in the younger cohorts. For the German couples in the older cohorts of the population, she instead found that psychological traits have more gender-specific effects, thus being consistent with the theoretical hypothesis of specialization in marriage. In summary, while the benefit in terms of joint-consumption, or due to similar consumption preferences, for partners who share similar personality traits is still an open issue, recent contributions provide evidence that sorting occurs on personality traits. Dupuy and Galichon (2014), using data on Dutch households, observed homogamy over the Conscientiousness trait and found that personality traits explain a percentage of couples' joint utility in marriage that is rather close to that of education, i.e., 17 versus 28%, respectively. Flinn, Todd, and Zhang (2018), using a sample of childless Australian couples, found marital sorting based on the Mental Openness and Neuroticism traits as well as a relation between positive sorting on these traits and higher levels of cooperation within a couple. They also found that personality is an important determinant of household bargaining weights and has an impact on wages that is comparable in magnitude to that of education.

## 2.3 Personality Traits and Consumption

In spite of the potential association between personality and consumption decisions, either directly – via preferences – or indirectly – by means of income and risk attitude – “little research in economics has focused on the effects of personality dimensions on demand behavior” (Volland 2019, pag. 72). This lack of investigation from the side of the economics literature goes hands in hands with the stagnant research from the side of personality psychologists (Baumgartner 2002). As for the latter, personality theory has informed marketing research since the 1950s, although the field was largely abandoned by the 1970s, which is when the Big Five construct reached stable recognition. In the following two decades, consumer behavior has been investigated with the lens of cognitive and social psychology, and personality theory regained relevance only in the 2000s (Bosnjak et al. 2007). In particular, the most recent contributions – which are in between personality psychology and marketing – investigate the willingness to purchase products and services online, the relationship between the consumer personality and the so-called brand personality, and the effects of different advertising methods (Bosnjak et al. 2007). As to the economic literature, Volland’s study is - as far as we know - the closest to ours. He uses data from the BHPS to explore the relationship between the Big Five PTs and the expenditure for food away from home and other leisure activities. He shows that Extroversion, Mental Openness and Agreeableness have non-negligible effects on the two categories of expenditures investigated, but also that these effects are mediated by other socio-economic characteristics.

## 3 Data and Empirical Strategy

### 3.1 Data and Sample Selection

This study uses data from the German SOEP,<sup>2</sup> a representative ongoing longitudinal survey of the German population. It is one of the few datasets recording information on Big Five personality traits, which is administered in several waves, including 2009. Additionally, it also collects comprehensive household

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<sup>2</sup> DOI: 10.5684/soep.v32.1, see Wagner, Frick, and Schupp (2007).

consumption information, although this was only done in 2010, by asking individuals about their household expenditures on several items in 2009. The two waves, i.e., 2009 and 2010, are pooled, and only those households for which both consumption expenditure and personality traits are observed are retained in the sample.<sup>3</sup>

To preserve a sufficient level of homogeneity in consumption behavior, four different samples are selected as follows: childless singles, men and women separately, childless couples and couples with children younger than 16.<sup>4</sup> In this way, we can study how personality influences consumption preferences for individuals living in households with different compositions. The samples of singles was composed of 3,715 individuals in total; however, once missing values in expenditures or other characteristics included in the empirical specifications were accounted for, it was reduced to 2,405 observations, including 1,381 women and 1,024 men. The samples of childless couples were composed of 4,428 observations in total; however, it was reduced to 2,661 once all missing values were accounted for. Finally, the sample of couples with children was composed of 1,982 families, which was reduced to 1,097 once all missing values were accounted for.

Such a large reduction in the number of observations due to missing values may hamper the representativeness of the results for the populations of interest. Tables 1 and 2, in the “Diff.” column, report the difference in the mean between the restricted and unrestricted samples, with an asterisk denoting a significant difference exists based on a two-sample *t*-test.<sup>5</sup> While all the differences are very small in comparison with the sample average, some are statistically significant at 5%. In particular, age is the most relevant one, for which the difference is significant for all samples except couples with children, while other characteristics, including some consumption variables, present significant differences in a less systematic fashion. Notably, no significant differences are found for the Big Five personality traits.

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**3** The SOEP data sample has been prepared using the PanelWhiz stata add-on (Haisken-DeNew and Hahn 2010).

**4** We consider only children younger than 16, as when older children are present, it would be implausible to assume that consumption decisions are made only by the two adults.

**5** Tables 1 and 2 do not report tests for the difference of means among the four sub-samples. For the vast majority of variables, including budget shares, total expenditure, demographic characteristics and some personality traits, differences in means are significantly different from 0. This is one of the reasons for which sub-samples separately have been analyzed separately.



**Table 1:** Descriptive statistics for the sample of single women and men.

Variable	Women			Men		
	Mean	Std. Dev.	Diff. <sup>1</sup>	Mean	Std. Dev.	Diff. <sup>1</sup>
<i>Budget shares</i>						
Food	0.386	0.188	−0.001	0.345	0.185	0.004
Clothes, shoes	0.068	0.060	0.001	0.054	0.053	0.001
Health, hygiene	0.107	0.084	0.003	0.064	0.058	0.003
Education, culture	0.025	0.051	0.002	0.025	0.047	0.001
Communication, transportation	0.130	0.090	0.006	0.152	0.109	0.004
Leisure, holiday	0.156	0.136	0.003	0.198	0.156	−0.001
Insurances	0.099	0.098	0.001	0.127	0.123	−0.001
Total expenditure	717.3	725.1	−15.8	765.2	672.2	−17.2
<i>Demographics</i>						
Current year age	61.6	18.1	−1.8 *	51.7	17.2	−1.7 *
Works full-time	0.223	0.416	0.015	0.469	0.499	−0.001
Works part-time	0.155	0.362	0.004	0.123	0.329	0.012
Old-age or disability pension	0.567	0.496	−0.041 *	0.317	0.466	−0.024
Immigrant to Germany since 1948	0.051	0.219	0.009	0.056	0.229	0.006
Own dwelling	0.336	0.473	−0.032	0.306	0.461	−0.027
Lives in an urban settlement	0.704	0.457	0.000	0.669	0.471	0.012
Lives in East Germany	0.254	0.436	−0.009	0.274	0.446	−0.026
Years of education	11.866	2.669	−0.016	12.450	2.713	−0.004
<i>Personality traits</i>						
Mental openness	4.419	1.323	−0.075	4.395	1.208	0.030
Conscientiousness	5.890	0.909	−0.044	5.747	0.951	−0.040
Extraversion	4.785	1.137	−0.024	4.638	1.161	0.024
Agreeableness	5.599	0.942	−0.026	5.280	0.937	−0.009
Neuroticism	3.980	1.264	0.014	3.545	1.192	0.024
Observations		1381			1022	

<sup>1</sup>Indicates the difference in the mean of variables of selected versus full sample. \*Indicates that a *t*-test on the difference is significant at 5%.

## 3.2 Consumption Variables

In wave 2010, the SOEP collected information on household consumption in 2009, asking for information on expenditures on the following 16 aggregated commodities and services: food at home, food out of the home, clothing and shoes, personal hygiene, health, telecommunications, education, culture, leisure time, vacations, life and pension insurance, other insurance, car repairs, transportation, furniture, and other expenditures. For each item, the following three questions were asked: whether there was an expenditure on the specific item, the amount of the monthly expenditure and the amount of the yearly expenditure (Appendix A reports the

**Table 2:** Descriptive statistics for the samples of couples with and without children.

Variable	Childless couples			Couples with children		
	Mean	Std. Dev.	Diff. <sup>1</sup> <i>t</i>	Mean	Std. Dev.	Diff. <sup>1</sup> <i>t</i>
<i>Budget shares</i>						
Food	0.347	0.165	−0.002	0.342	0.146	0.001
Clothes, shoes	0.060	0.050	0.002	0.074	0.052	0.001
Health, hygiene	0.081	0.063	−0.001	0.052	0.031	0.002
Education, culture	0.019	0.031	0.002 *	0.023	0.048	−0.001
Communication, transportation	0.117	0.083	0.007 *	0.132	0.083	0.002
Leisure, holiday	0.211	0.141	0.000	0.180	0.121	0.002
Insurances	0.126	0.103	0.004	0.162	0.102	0.001
Total expenditure	1414.7	1229.1	−67.5 *	1604.5	1454.7	−75.3
<i>Demographics</i>						
Husband's age	62.2	13.9	−2.6 *	40.9	6.9	0.1
Wife's age	59.4	13.9	−2.8 *	38.0	6.4	0.2
Husband full-time worker	0.342	0.475	0.005	0.819	0.386	0.095 *
Wife full-time worker	0.247	0.431	0.012	0.165	0.371	0.005
Husband part-time worker	0.109	0.312	−0.008	0.127	0.333	0.016
Wife part-time worker	0.206	0.405	−0.001	0.563	0.496	0.036
Husband old-age or disability pension	0.576	0.494	−0.012	—	—	—
Wife old-age or disability pension	0.455	0.498	−0.009	—	—	—
Husband is immigrant	0.067	0.249	0.004	0.116	0.320	−0.002
Wife is immigrant	0.075	0.264	0.002	0.139	0.346	−0.005
Owner of dwelling	0.598	0.490	−0.039 *	0.592	0.492	−0.037 *
Live in a urban settlement	0.659	0.474	0.004	0.647	0.478	0.016
Lives in East Germany	0.279	0.449	−0.020	0.210	0.407	−0.005
Number of children	—	—	—	1.802	0.765	−0.069 *
Husband's years of education	12.639	2.852	−0.046	12.935	2.887	−0.116
Wife's years of education	12.000	2.623	0.071	12.812	2.616	0.010
<i>Personality traits</i>						
Husband's openness	4.348	1.196	−0.031	4.277	1.141	0.003
Wife's openness	4.499	1.212	−0.037	4.492	1.205	−0.009
Husband's conscientiousness	5.833	0.931	−0.006	5.812	0.909	0.018
Wife's conscientiousness	5.966	0.867	−0.020	5.900	0.883	0.009
Husband's extraversion	4.599	1.109	0.006	4.731	1.169	0.032
Wife's extraversion	4.807	1.086	0.002	4.950	1.105	0.027
Husband's agreeableness	5.178	0.989	0.010	5.088	1.012	0.015
Wife's agreeableness	5.528	0.934	−0.004	5.460	0.935	−0.013
Husband's neuroticism	3.606	1.180	−0.006	3.461	1.177	0.011
Wife's neuroticism	4.144	1.235	−0.012	4.083	1.200	−0.002
<i>Observations</i>	2661			1097		

\*Indicates that a *t*-test on the difference of selected versus full sample is significant at 5%.

questions used by the SOEP to assess household consumption).<sup>6</sup> We use the monthly expenditure as our main consumption measure, substituting the yearly expenditure divided by 12 when the monthly value is missing and 0 when both are missing and the household declared that it did not consume the item.

Because of the large number of missing records in certain consumption categories, we aggregated some expenditure categories (see Appendix A for more details). As a consequence, the final system includes the following eight categories: food, clothes and shoes, health and personal hygiene, education and culture, telecommunications and transportation, leisure and holiday, insurances, and other expenditures. Although slightly aggregated, all the expenditure categories were preserved, producing a complete consumption expenditure system for non-durable goods (as in Pollak and Wales 1981, for instance), where the total expenditure is the sum of expenditures in all categories. Descriptive statistics on budget shares and total expenditure are reported in the first parts of Tables 1 and 2 for singles and couples, respectively. The largest share of the household budget is spent on food, accounting for roughly 34–38% in all samples, followed by leisure and holiday, with 15–21%. All other budget shares are below 15%, and the smallest ones are education and culture at approximately 2–2.5%.

Finally, as detailed in Section 3.5, one possible concern when estimating demand systems is the potential endogeneity of the total expenditure. The main cause is measurement error, due either to the infrequency of purchases or to recall errors. As instruments for total household expenditure, it is common practice to use wealth indicators and/or monetary income. In this case, we use personal income derived from either work or pension and ownership of several items, such as cars, motorcycles, microwaves, dishwashers, washing machines, stereos, color TVs, DVD players, DVD recorders, PCs/laptops, telephones, mobile phones, deep freezers, dryers, vacation homes, air conditioning systems, alarm systems and solar systems. These indicators are summarized by the first three components of a principal component analysis (Jackson 2005), each of which have an eigenvalue larger than 1 in all samples, a criterion often used to assess the number of relevant components.<sup>7</sup>

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<sup>6</sup> The pros and cons of collecting survey data on consumption by recall, versus the diary method, have been reviewed by Crossley and Winter (2015), who showed that information collected by the former method is quite accurate. Marcus, Siegers, and Grabka (2013) compared consumption data collected in wave 2010 of the SOEP survey with those of the Income and Expenditure Survey (EVS) that was conducted in 2008 and was based on diary records. After pointing out several reasons that a perfect overlap between the consumption distributions of the two data sources should not be expected, they concluded that the two likely reflect the relative relevance of consumption categories in similar ways.

<sup>7</sup> Details on eigenvalues and correlation matrices are available upon request.

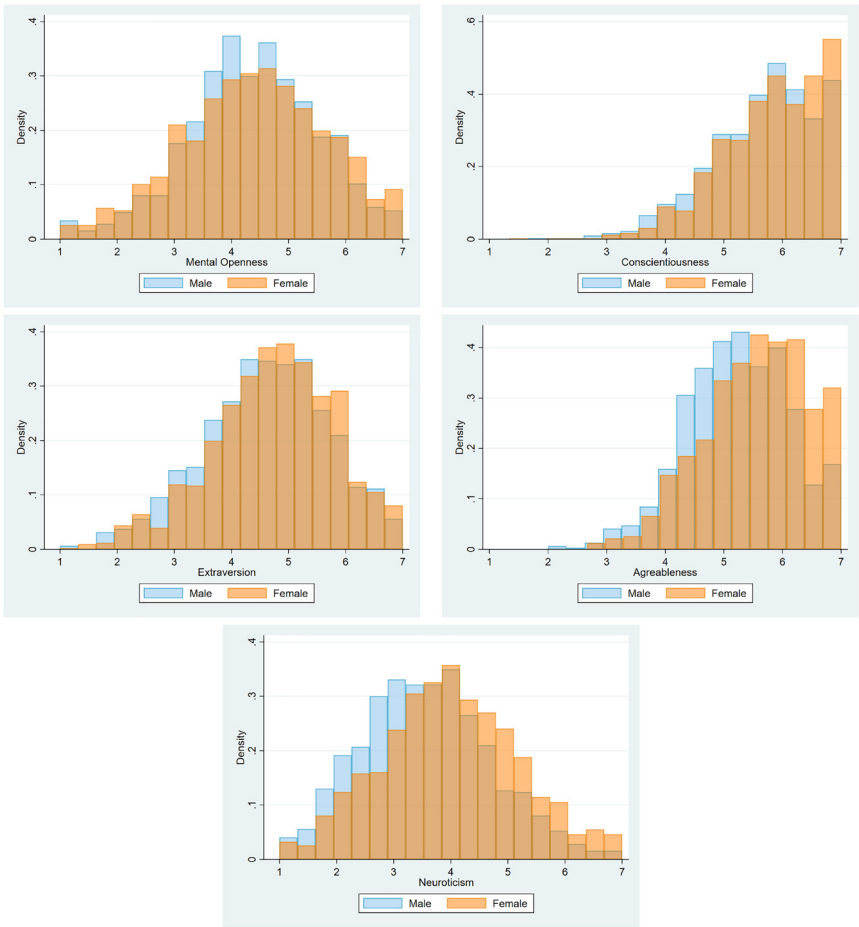


Figure 1: Densities of the Big Five personality traits for singles by gender.

### 3.3 Measurement of Personality Traits and Assortative Mating

The Big Five personality traits – Mental Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism – are measured by the average points of three questions each on a 7-point scale (see Appendix B). Descriptive statistics of the Big Five personality traits are presented in the last parts of Tables 1 and 2, while the distribution of each trait by gender is presented in Figure 1 for singles.<sup>8</sup> The average values are higher for the Conscientiousness trait and the Agreeableness trait, at approximately 5.8 and 5.3, respectively, and are lower for the Neuroticism trait,

<sup>8</sup> The personality traits distributions for couples follow similar patterns and are not reported here.

with values around 3.5–4. In general, the gender distributions are similar, except that women show higher values for the Agreeableness trait (5.5 vs. 5.2) and the Neuroticism trait (4 vs. 3.5). The equality of the males and female distribution of each personality trait has been analyzed by a Kolmogorov-Smirnov two-sample test. The results reveal that, with the exception of Mental Openness, all traits are statistically differently distributed between men and women at least at 1%. This suggests that in the analysis of couples, the personality traits of both members should also be retained among the regressors.

Using the personality traits of both members of the couple as regressors could reduce the efficiency of the estimates if the traits are highly correlated, as in the case of strong assortative mating. Previous empirical evidence suggests positive assortative mating for the Mental Openness, the Conscientiousness and the Neuroticism traits (see e.g., Flinn, Todd, and Zhang 2018; Lundberg 2012). To obtain a better idea of the correlation between husband and wife personality traits in our samples, the correlation coefficients of the husband and wife personality traits are summarized in Table 3, which also highlights the association between different traits. The results confirm the overall finding of the previous literature, with the largest correlation found for Mental Openness and Conscientiousness, although Agreeableness also shows some relevant association. While almost all of the correlation coefficients reported in Table 3 are significant at 5%, the values are generally very small, and even Mental Openness and Conscientiousness have a correlation coefficient below 0.3, which should thus not pose efficiency concerns for the estimations.<sup>9</sup>

To improve the comparability of the results in the empirical analysis, personality traits are standardized to have a mean of 0 and a standard deviation of 1.

As mentioned in Section 2.1, an important feature of personality traits is their stability across ages and life events, as well as external and cyclical shocks. In

**Table 3:** Correlation coefficients for husband and wife personality traits, education and personal income.

Wife	Husband				
	Mental openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
Mental openness	0.2943*	0.0862*	0.0638*	0.0541*	−0.0448*
Conscientiousness	0.0715*	0.2828*	0.1100*	0.1615*	−0.0594*
Extraversion	0.0786*	0.1144*	0.0577*	0.0484*	−0.0716*
Agreeableness	0.0705*	0.1920*	0.0798*	0.2287*	−0.0478*
Neuroticism	−0.0236	0.0877*	−0.0711*	−0.0697*	0.1204*

\* $p \leq 0.05$ .

9 A robustness check, presented in Section 4.3, has been conducted using the couple’s average personality traits.

particular, in our setting, intra-individual consistency matters for at least two reasons. First, considering that the 2010 SOEP collects information on consumption referring to expenditures made in 2009 and that information on personality traits was collected only in 2009, the knowledge that they are statistically stable supports the choice of matching the 2009 survey data with the 2010 consumption information for individuals observed in both years. Second, since the consumption and personality information was collected in the middle of the 2008 great recession, and since consumption may have been affected by the crisis, the stability of personality traits over time would help to identify their relationship with consumption choices independently of economic trends.<sup>10</sup>

### 3.4 Other Individual and Family Characteristics

As is common practice in consumption demand analysis, the additional demographic variables used in all specifications are as follows: age and its square, being a part-time worker, being a full-time worker, being retired, and being an immigrant. For the samples of couples with and without children, all of these variables are included for both the husband and the wife. The other household characteristics include the property status of the dwelling (1 if owner), whether the household members reside in a urban settlement, whether they reside in East Germany, and the number of children.

An important aspect is the age selections in each sample. In particular, the samples of single and childless couples are composed mainly of relatively elderly people, although both contain a cluster of young people. For this reason, in each analysis, it is important to control for the age of the respondents and for the retirement status. The sample of couples with children aged 16 or below is instead more homogeneous in this respect. Specifically, the sample of singles has a different composition when separated by gender; the majority of female singles are retired (57%), and only 37% of them work, either full-time (22%) or part-time (15%). The figures are different for single males, of whom 47% work full-time and 12% work part-time, whereas 32% are retired. The difference in the average age, i.e., approximately 10 years, is also quite relevant, leading to a significant difference in the education level, which is higher for males by 0.6 years. The proportion of immigrants is similar for males and females, at approximately 5%. Given such a heterogeneous composition of the sample of singles, we decided to not only analyze consumption using the two samples of single males and females but also

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**10** The existing empirical evidence shows differentiate reactions to the financial crisis by individuals with different personality traits but not the inverse effect.

to perform a specific robustness check by separating those who are younger than 60 years of age from those who are older than 60 years of age in the estimations.

The sample of couples is also quite heterogeneous when those with and without children are considered separately; in the sample of childless couples, the average age of husbands and wives is higher by almost 22 years than that of the couples with children; the husband works full time in 82% of families with children, versus 34% of childless families, and the wife is less likely to work full-time when there are children, i.e., 16% versus 25%. In contrast, in families with children, the wife is much more likely to work part-time, i.e., 57% versus 21%, and as expected, the proportion of retired individuals is negligible, i.e., below 2% for both husbands and wives, versus 58% and 46%, respectively. In the sample of couples with children, the members are younger, and both the husbands and wives have higher levels of education, with little difference between them. In contrast, in the sample of childless couples, a relevant difference exists between the education level of the spouses (approximately 0.6 years). Among couples with children, both parents are much more likely to be immigrants (approximately 12–13% versus approximately 7%). The sample of couples with children aged 16 or below has, on average, 1.8 children.

### 3.5 Engel Curves Specification

The use of Engel curves to study consumption when no price information is available dates back to Engel (1857), and they have been applied countless times in economics since then. In this study, we apply the quadratic budget share specification of the Engel curves proposed by Banks, Blundell, and Lewbel (1997), incorporating observed heterogeneity as linear demographic translating functions (Gorman 1976; Lewbel 1985; Pollak and Wales 1981).<sup>11</sup> This specification implies that the share of total expenditure of different consumption categories are jointly regressed on a quadratic polynomial of the logarithm of total expenditure and a set of demographic variables, i.e., as follows:

$$\left\{ \begin{array}{l} w_{i1} = \alpha_1 + \lambda_1 \mathbf{d}_i + \beta_1^{(1)} \ln y_i + \beta_1^{(2)} (\ln y_i)^2 + v_{i1} \\ w_{i2} = \alpha_2 + \lambda_2 \mathbf{d}_i + \beta_2^{(1)} \ln y_i + \beta_2^{(2)} (\ln y_i)^2 + v_{i2} \\ \dots \\ w_{ij} = \alpha_j + \lambda_j \mathbf{d}_i + \beta_j^{(1)} \ln y_i + \beta_j^{(2)} (\ln y_i)^2 + v_{ij} \end{array} \right. \quad (1)$$

<sup>11</sup> While more general demographic transformations exist and could potentially produce better fit, we chose the simplest transformation, as it avoids estimation issues and produces results that are easier to interpret.

where  $w_{ij}$  is the budget share of the  $j$ th commodity category for individual  $i$ ; coefficients  $\beta_j^{(1)}$  and  $\beta_j^{(2)}$  capture the effect of the log of total expenditure on the share of household expenditure spent on commodity  $j$ ; and  $\mathbf{d}$  is a set of demographic variables whose impact on consumption is captured by shifting parameters  $\lambda_j$ , which capture how demographic characteristics shape preferences for the consumption of a specific commodity  $j$ . The Big Five personality traits are included among demographic variables  $\mathbf{d}$  together with other control variables used to capture the preferences heterogeneity. For the couples, the personality traits of the husbands and wives are included separately, while a robustness check using the couple's average personality traits is presented in Appendix C.

Given the possible concern about the endogeneity of total household expenditure, instead of the standard instrumental variables method, the control function approach is used to estimate Eq. (1) (Terza, Basu, and Rathouz 2008). The control function approach is a two-step procedure equivalent to the linear-IV for linear regressions, but it can be applied without modifications to non-linear regressions as well. In the first stage, total expenditure is regressed on the same set of covariates as in the main model plus the exclusion restrictions (results are presented in Tables D.1 and D.2). As established in the literature, as exclusion restrictions, we use individual income from work and pension and the first three components of a principal component analysis on the ownership of a number of items (detailed in the previous section), which can be interpreted as composite indices for household wealth. The first-stage equation can be formalized as follows:

$$\ln y_i = \alpha + \lambda \mathbf{d}_i + \gamma \mathbf{z}_i + \epsilon_i.$$

In the second stage, the prediction of the idiosyncratic component of the first stage  $\hat{\epsilon}_i$  is included as an additional regressor in each equation of the system (1), i.e., as follows:

$$\left\{ \begin{array}{l} w_{i1} = \alpha_1 + \lambda_1 \mathbf{d}_i + \beta_1^{(1)} \ln y_i + \beta_1^{(2)} (\ln y_i)^2 + \eta_1 \hat{\epsilon}_i + v_{i1} \\ w_{i2} = \alpha_2 + \lambda_2 \mathbf{d}_i + \beta_2^{(1)} \ln y_i + \beta_2^{(2)} (\ln y_i)^2 + \eta_2 \hat{\epsilon}_i + v_{i2} \\ \dots \\ w_{ij} = \alpha_j + \lambda_j \mathbf{d}_i + \beta_j^{(1)} \ln y_i + \beta_j^{(2)} (\ln y_i)^2 + \eta_j \hat{\epsilon}_i + v_{ij} \end{array} \right. \quad (2)$$

The Engel curve system specified in Eq. (2) is estimated jointly by means of seemingly unrelated regressions, allowing for correlation of the error terms.<sup>12</sup>

<sup>12</sup> The last category, i.e., other expenditures, accounting for approximately 3.5% of the total expenditure, on average, is omitted from the demand system to avoid collinearity.



Parameters  $\lambda_j$  can be straightforwardly interpreted as consumption shifters or preference parameters (Lewbel 1985); considering any good  $j$ , a positive personality trait parameter  $\lambda_j$  implies that people characterized by a stronger trait also have stronger preferences for good  $j$ . The information contained in the total expenditure parameters of the Engel curves,  $\beta_j^{(1)}$  and  $\beta_j^{(2)}$ , can be effectively synthesized by computing income elasticities, which return the percentage increase in expenditure on commodity  $j$  if total expenditure  $y$  increases by 1%. Formally, income elasticities are defined as follows:

$$\eta_j = \frac{\partial e_j}{\partial y} \frac{y}{e_j} = \frac{\partial y w_j}{\partial y} \frac{y}{y w_j} = 1 + \frac{\partial w_j}{\partial y} \frac{y}{w_j},$$

where  $e_j$  is the expenditure on commodity  $j$ , and the structure of Eq. (1) permits translating the coefficients into income elasticities as follows:

$$\eta_j = 1 + \frac{1}{w_j} (\beta_j^{(1)} + 2\beta_j^{(2)} \ln y).$$

## 4 Results and Discussion

In the Engel curves estimation, including standardized personality traits as shifting parameters allows us to capture whether and how personality shapes consumption preferences and how individuals' traits may change the budget share devoted to each category of consumption. Section 4.1 discusses the goodness of fit statistics used to assess to what degree personality traits help explaining the observed heterogeneity in consumption. Section 4.2 discusses the coefficients of the Big Five personality traits obtained from the estimations of the systems of Engel curves in Eq. (2) for the samples of single men, single women, women and men in childless couples, and women and men in couples with children. They synthesize how personality impacts consumption preferences. The last part reports the income elasticities obtained for each consumption category and sample. Finally, Section 4.3 reports the results of the robustness checks performed to assess the reliability of the main results. For all results reported here, full estimation tables are available upon request.

### 4.1 Goodness of Fit

Table 4 reports the average RMSE (Root Mean Square Error) resulting from a cross-validation analysis performed for each consumption category in each sample when

the regressions include or do not include personality traits among the explanatory variables. We performed a leave- $k$ -out cross-validation analysis with  $k = 10$ , which randomly splits the estimation sample into  $k$  equal size partitions, perform an estimation (training) of the model on the  $N-k$  sub-sample and validates the prediction of the model against the  $k$  sub-sample. This is repeated for all  $k$  and the RMSE results are averaged across the  $k$  validations. Computing the average RMSE for the restricted model, which excludes personality traits from the list of exogenous variables, and the unrestricted model, we test the contribution of the Big Five personality traits to the explanatory power of the Engel curve specification. To this aim, the “Var.” columns in Table 4 report the percentage variation of the RMSE induced by the introduction of personality traits among the regressors. For instance, including the PTs in the estimation of the education and culture equation reduces the RMSE for single men by 11.6%. The overall role of personality traits in shaping consumption preferences and explaining part of the observed heterogeneity in the restricted model is rather limited, reducing the RMSE by 2.8% on average.<sup>13</sup> There is, however,

**Table 4:** System of Engel curves: goodness of fit.

Consumption category <sup>1</sup>	Single men		Single women		Childless couples		Couples w/ch.	
	RMSE	% var.	RMSE	% var.	RMSE	% var.	RMSE	% var.
Food	0.160	7.4%	0.165	−5.6%	0.143	−3.5%	0.130	−3.8%
with PTs	0.172		0.156		0.138		0.125	
Clothes/shoes	0.062	−1.8%	0.064	−6.2%	0.053	0.4%	0.053	−1.6%
with PTs	0.061		0.060		0.054		0.052	
Health, hygiene	0.087	1.1%	0.084	2.5%	0.064	−0.8%	0.035	−3.8%
with PTs	0.088		0.086		0.064		0.033	
Education, culture	0.051	−11.6%	0.050	−8.7%	0.038	−23.2%	0.046	2.8%
with PTs	0.045		0.046		0.030		0.047	
Comm. and transp.	0.116	−4.2%	0.111	−1.2%	0.092	−4.6%	0.085	−1.2%
with PTs	0.111		0.110		0.087		0.084	
Leisure, holiday	0.141	−1.7%	0.145	−1.1%	0.135	−2.8%	0.119	−2.2%
with PTs	0.138		0.143		0.131		0.117	
Insurances	0.108	−0.1%	0.107	1.1%	0.109	1.2%	0.112	−6.1%
with PTs	0.108		0.108		0.110		0.105	

<sup>1</sup>For each consumption category, the first row show the average Root-Mean-Square Error obtained from a leave- $k$ -out cross-validation ( $k = 10$ ) for a regression that include the following control variables: age, age-squared, being immigrant, working part-time, working full-time, being retired, years of education, being owner of the dwelling, living in an urban settlement and living in East-Germany. For couples with children, number of children is also included. The second row also includes the Big Five personality traits as additional regressors.

**13** This figure is obtained by taking the average variation in the RMSE over each consumption/sample combination.

substantial heterogeneity in their explanatory power, both by sub-sample and by consumption category. For example, PTs substantially improve the RMSE of the expenditures in education and culture for singles and couples without children. For some consumption categories/samples combinations, personality traits may even increase the RMSE – for example, food consumption for single men – through a reduced efficiency of the estimator, as their inclusion reduce the degrees of freedom.

## 4.2 Personality and Consumption Preferences

The coefficients reported in Tables 5–7 correspond to the marginal effect of an increase in one standard deviation in a PT on a budget share. A first interesting result pertains to the individuals who score high in the Mental Openness trait, i.e., those who are more curious, intelligent, and unconventional, who show a higher share of budget devoted to expenditure on education and culture. This finding is verified not only for single men and women (see Table 5) but also for both the male and the female components of childless couples (see Table 6) and for the female partners of couples with children (see Table 7). In terms of the magnitude of the effect, a one standard deviation increase in the Mental Openness trait increases the budget share by 0.6 percentage points both for single men and for women in couples with children, by 0.4 percentage points for single women and slightly less for men and women living in childless couples. Thus, for instance, for single men, the budget share rises from 0.025 to 0.031, or approximately 24%, and the average monthly expenditure would rise from 17.9 euro to 22.2 euro. In comparative terms, the positive effect of the Mental Openness trait on male expenditure for culture and education is twice as much the negative effect of age, meaning that an increase in one standard deviation of the Mental Openness trait increases the share of expenditure on this category for an amount that is double the reduction predicted by one year aging. Regarding the interpretation, we should first consider that the Mental Openness trait has the higher correlation coefficients in the couple; i.e., it is one of the traits with higher positive assortative mating (see Table 3). Then, we can argue that agreement between the partners on using household resources for consumption related to education and culture is highly probable, or we may expect joint consumption of these goods for couples in which both partners share this personality trait. This interpretation is reinforced by examining the Mental Openness trait score average in the couple instead of the personality score of each partner (see Table C.1). In fact, when the average score is considered, the coefficients are statistically significant for both couples with children and childless couples, and the magnitudes of the coefficients are even higher.

**Table 5:** System of Engel curves: Singles.

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Mental openness</i>							
Men	-0.007	-0.001	-0.001	0.006***	0.008*	-0.001	-0.003
Women	-0.009*	-0.001	0.000	0.004**	0.002	0.001	0.002
<i>Conscientiousness</i>							
Men	0.011**	-0.003	0.002	-0.002	-0.001	-0.008	0.002
Women	0.006	0.000	0.000	0.000	-0.001	-0.006	0.002
<i>Extraversion</i>							
Men	0.013**	0.004*	0.001	0.001	-0.013***	0.003	-0.008*
Women	0.013***	0.001	0.000	0.001	-0.006**	-0.004	-0.007**
<i>Agreeableness</i>							
Men	-0.009*	0.002	0.000	0.001	0.001	0.003	0.001
Women	0.010**	-0.003	-0.001	0.000	0.001	-0.008**	0.000
<i>Neuroticism</i>							
Men	-0.006	0.000	0.008***	0.001	0.008**	-0.013**	0.001
Women	0.005	-0.003*	0.005**	0.000	-0.002	-0.011***	0.000

Estimation also include the following control variables, not reported in the table: age, age-squared, being immigrant, working part-time, working full-time, being retired, years of education, being owner of the dwelling, living in an urban settlement and in East-Germany. Full estimation tables are available upon request. \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

As with Mental Openness and expenditure on education and culture, expenditure on food is affected by the Extroversion trait for men and women similarly. Single men and women who are high in this trait, and thus are forthcoming and desire social relationships, are relatively more prone to devoting high shares of their budget to food, probably because they both invite their friends to their home and they also dine out often (see Table 5). For women, this result also holds when they are in couples with children and our interpretation is reinforced by the effect of the Agreeableness trait; in fact, the Agreeableness trait positively predicts a higher budget share on food for women that are single or are in households with children (see Table 7).

The Neuroticism trait plays a role in increasing the shares of the expenditure on health and hygiene goods quite consistently across gender and household composition (see Tables 5–7); this finding is confirmed in examining the average trait in childless couples (see Table C.1). As this trait is a measure of an individual's tendency to be emotionally unstable and inclined to worry, it is easily understandable that this feature leads to increased expenditures on health and related products.

Unlike the above mentioned traits, the Conscientiousness trait affects consumption in a more gender-specific way. For instance, there is a positive effect on

**Table 6:** System of Engel curves: Couples without children.

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Mental openness</i>							
Men	-0.001	0.000	-0.002*	0.003***	0.001	0.000	-0.002
Women	-0.002	0.001	0.002	0.002**	0.002	0.000	-0.001
<i>Conscientiousness</i>							
Men	0.001	0.000	0.000	0.000	0.002	-0.002	-0.003
Women	0.002	-0.001	0.001	0.000	-0.003	0.000	0.002
<i>Extraversion</i>							
Men	-0.003	0.000	0.002	0.000	0.001	0.002	0.000
Women	0.001	0.000	-0.002	-0.001	-0.002	0.005*	0.001
<i>Agreeableness</i>							
Men	0.002	0.000	-0.001	-0.001	0.002	-0.003	0.003
Women	0.004	0.000	0.001	0.000	-0.001	-0.002	-0.002
<i>Neuroticism</i>							
Men	0.002	-0.003***	0.000	-0.001**	0.002	-0.004*	0.002
Women	0.001	-0.001	0.005***	-0.001	0.005***	-0.009***	-0.002

Estimation also include the following control variables, not reported in the table: age, age-squared, being immigrant, working part-time, working full-time, being retired, years of education, for each member of the couple, plus being owner of the dwelling, living in an urban settlement and in East-Germany. Full estimation tables are available upon request. \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

expenditure on food, but only for single men (see 5). This effect is confirmed for men living in couples with children (see Table 7) but is not verified for women.

Finally, Table 8 reports income elasticities for the seven categories of expenditures included in the Engel curves systems for each sub-samples. A first relevant result, which confirms our empirical strategy of analyzing the four samples separately, is the substantial variability of elasticities across samples. For example, food has a small elasticity for all groups but it is almost 0 for single men and four times larger for childless couples. Clothing is inelastic for men and childless couples and becomes elastic for single women and couples with children. A large variation can also be observed for health and hygiene expenditure, which is inelastic for singles and childless couples, but it become quite elastic for couples with children. Education and culture consumption is quite inelastic for single men, is elastic for women and presents a nearly unitary elasticity for couples. Communication and transportation consumption presents the largest elasticity for single men (almost 1.9), while it is less elastic for women and childless couples and is inelastic for couples with children. Leisure and holiday consumption is always elastic but is much less so when children are present. Interestingly insurance expenditure is quite elastic for singles of both sexes but reduces substantially for childless couples, supporting the idea that marriage has a relevant insurance value. The elasticity, however, increases

**Table 7:** System of Engel curves: Couples with children.

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Mental openness</i>							
Men	0.002	−0.001	0.000	0.002	−0.007**	0.011**	−0.005
Women	0.001	0.001	0.000	0.006**	0.001	−0.007*	−0.003
<i>Conscientiousness</i>							
Men	0.015***	0.002	0.001	0.000	−0.004	−0.006	−0.009**
Women	0.004	−0.002	0.000	0.001	0.002	−0.002	−0.003
<i>Extraversion</i>							
Men	−0.001	0.004*	0.001	0.000	0.001	0.003	−0.007*
Women	0.008*	−0.001	0.002	−0.001	−0.001	0.007	−0.012***
<i>Agreeableness</i>							
Men	−0.009**	−0.001	0.001	0.003	−0.001	0.003	0.007
Women	0.009**	−0.002	−0.001	0.000	−0.006**	0.002	−0.003
<i>Neuroticism</i>							
Men	0.000	0.000	0.002**	0.000	0.001	−0.004	−0.002
Women	0.006	−0.005**	0.000	0.000	0.003	−0.001	−0.010***

Estimation also include the following control variables, not reported in the table: age, age-squared, being immigrant, working part-time, working full-time, being retired, years of education, for each member of the couple, plus number of children, being owner of the dwelling, living in an urban settlement and in East-Germany. Full estimation tables are available upon request.\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

**Table 8:** System of Engel curves: Elasticities.

Consumption category	Single men	Single women	Childless couples	Couples w/ch.
Food	0.081	0.271	0.376	0.183
Clothes, shoes	0.856	1.194	0.865	1.176
Health, hygiene	0.853	0.694	0.764	1.303
Education, culture	0.787	1.147	0.910	0.979
Communication, transportation	1.878	1.255	1.203	0.875
Leisure, holiday	1.744	1.865	1.664	1.297
Insurances	1.810	1.866	1.120	2.449

substantially again – to almost 2.5 – when children are present, suggesting a strong desire to reduce the economic uncertainty for the offspring.

### 4.3 Robustness and Heterogeneity Analysis

To verify the stability of the results to the empirical specifications adopted in the main analysis, a battery of robustness checks is performed along three main dimensions. First, the choice of introducing personality traits separately for each

spouse is verified against the use of couple-average personality traits. Second, the possible correlation between years of education and personality traits is analyzed in depth. Third, the effect of age composition within sub-samples is analyzed.

Although Table 3 shows that the correlation coefficients of personality traits between husbands and -wives is always below 0.3, suggesting that the efficiency loss induced by the inclusion of separate PTs for husbands and wives should be small, Table C.1 provides evidence that averaging personality traits of the couple generates an information loss. Examining the first column, the only impact of personality in determining food consumption is observed for the Conscientiousness trait for the sample of couples with children. Examining the same column of Table 7, a richer picture emerges, with the Agreeableness trait being important but with opposite impacts for husbands and wives. Similar patterns can be observed for several other combinations of consumption category and personality trait, while in only one case combining the personalities of husbands and wives allows a significant relationships to emerge that was not captured by the main analysis, i.e., a negative relationship between the Mental Openness trait and insurance expenditure for couples with children.

To analyze the consequences, in terms of the explanatory power of personality traits, of including education among the control variables, we propose a battery of tests. Actually, if personality traits (in particular Mental Openness and Conscientiousness) predict educational outcomes (Almlund et al. 2011; Heckman, Pinto, and Savelyev 2013; Rustichini et al. 2016), including years of education, its coefficients may capture part of the effect of personality on consumption. To better understand the influence of education on the estimates of the impact of personality traits on consumption, we propose some tests. The first is to simply exclude education from the regressions and analyze how the significance of PT parameters change. Table C.2 shows whether a coefficient becomes significant with the exclusion of years of education (denoted with a “+”), whether a coefficient loses significance (denoted with a “–”), or whether nothing changed (denoted with a “.”). While for couples no significance changes are detected (and then they are not shown in the Table), for single some changes are observed for all consumption categories except clothes and shoes and health and hygiene. The majority of them, however, move in the direction of significance loss, indicating that education is not “stealing” significance from personality traits.

To better understand the implications of excluding education from the regressions, Table C.3 reports the results of a test on the difference of parameters.<sup>14</sup> The asterisks denote that the difference in the parameter estimated with and without years of education is significantly different from 0 at 5%. The table

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<sup>14</sup> We use a test for independent normal distributions, where  $z = |\beta_1 - \beta_2| / \sqrt{\sigma_1^2 + \sigma_2^2}$ , with  $\beta_i$  indicating coefficient values and  $\sigma_i$  the corresponding standard errors.

presents very few significant differences for singles, concentrated on the relationship of the Agreeableness trait with food and clothes and shoes and on Neuroticism with communication and transportation. No significant differences are detected for the samples of couples with and without children (not shown in the Table).

An additional robustness check is conducted with respect to the educational composition of the samples, by comparing the coefficients estimated with only high-educated vs low-educated individuals (with and without a secondary school level). A statistically significant difference among singles is reported in Table C.4 with an asterisk.<sup>15</sup> The results suggest that although there are not many statistically relevant differences, it is still convenient to control for education, as the impact of personality on consumption is indeed different depending on the level of education attained. An interesting result is related to the impact of the Mental Openness trait on expenditure on education and culture separated by education levels. Table C.5 reports the coefficients for the two sub-samples of low- and high-educated men and women. In brief, both single men and women who score high in Mental Openness are predicted to consume a higher share of their budget on education and culture, even if they are low-educated. The same is true for men in childless couples.

The final robustness check considers the heterogeneous age composition of singles and childless couples. Running separate regressions for individuals younger than 60 and for those who are older reveals few statistically significant differences in the coefficients of personality traits (see Table C.6). While the general validity of the analysis is not hampered by the age heterogeneity, some difference emerge in the impact of personality on consumption, and these results confirm the need to control for the age and retirement statuses of individuals.

## 5 Conclusions

In this study, we have analyzed the role played by personality traits in household consumption decisions for both singles and couples. Our investigation is based on the estimation of a system of Engel curves for single men, single women, men and women in childless couples and men and women in couples with children, with each group considered separately.

A first contribution of the paper is to show that the inclusion of personality traits among demographic shifters helps to reduce the unobserved heterogeneity and improves the goodness of fit of the Engel curves specification, although to a limited

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<sup>15</sup> Less significant differences are observed for the samples of couples, which mostly coincide with those observed for singles.



extent. The reduction in unobserved heterogeneity is verified for almost all the categories of goods and services considered here, even if it is diversified by the kind of expenditure and sample of analysis. Second, the paper shows that a few personality traits predict household expenditure on several categories of goods and services, even if there are several combinations of trait and consumption category with a coefficient not being statistically significant. In terms of the magnitude of the statistically significant coefficients, we give evidence that when personality predicts consumption, the effect is comparable to other individual demographic traits. Finally, the study gives evidence that there are traits that affect consumption quite similarly across gender, while other traits show gender-specific effects. As an example of the former, we find that the expenditure on culture and education is higher for men and women who score high in the Mental Openness trait. This is true for men and women not only when living alone, but also for childless couples and for women in couples with children. Considering that the Mental Openness trait either predicts higher levels of education and it is the personality trait with the highest positive assortative mating, this finding has two contrasting possible explanations. The first is that two individuals who score high in this trait are predicted to have high education levels, and then they will have a high probability of becoming partners in the marriage market. The alternative explanation is that the Mental Openness trait generates positive assortative mating and also predicts preferences for expenditure for education and culture. The analysis presented here does not allow us to give unique support to one of these two explanations. In fact, we show that the positive effect of the Mental Openness trait on expenditure on education and culture is not entirely due to the level of education of individuals, but this is true for single men and women (and for men in childless couples) and not for women in childless couples and both for men and women in couples with children. We, therefore, may conclude that the Mental Openness trait is an antecedent of the education level, predicting an increase in the consumption expenditure on education and culture for singles both high and low-educated. In addition, this trait generates positive assortative mating - passing through the level of education or not - and it increases the consumption expenditure on education and culture by the couples. Other examples of similar effects across gender are that of the Neuroticism trait, which plays a role in increasing the shares of the expenditure on health and hygiene goods, and the Extroversion trait for positively predicting food expenditure. Two examples of the gender-specific effects are that of the positive effect on food consumption for women who score high in the Agreeableness trait and for men who score high in the Conscientiousness trait.

We conclude with the following caveat: our analysis is to some extent limited by the simplified model of household decision making adopted for couples. In fact, we assume that households are maximizing a single utility function because we are

unable to explicitly differentiate between partners' preferences within a couple using individual utility functions or to model any kind of strategic interaction between the two.<sup>16</sup> Given the relevance of the household decision-making process in the economics literature, as well as the usefulness of personality traits for understanding household labor supply (as shown e.g., by Flinn, Todd, and Zhang 2018) and consumption decisions, further insights into this issue remain for future research.

## Appendices

### A. Questions about Household Consumption in the SOEP 2010 Household Questionnaire

Question 72 of the household 2010 questionnaire reads as follows:

In the following, you see a list of possible expenditures that we have not asked about so far in this survey. Did you or another household member make any of the following expenditures? If yes: how much in total did these expenditures cost your household in 2009?

You can state the expenditures for 2009 either as monthly averages or as total yearly expenditures!

1. *Food, groceries at home*
2. *Food/drinks outside the home*
3. *Clothes, shoes*
4. *Body care cosmetics/hairdresser*
5. *Health (e.g., medicines, courses, consultation fees)*
6. *Telecommunications (landline, cellular phone, Internet)*
7. *Education/further training*
8. *Culture (theater, cinema, concerts, museums, exhibitions)*
9. *Leisure activities, hobbies, sports, yard and garden, animals*
10. *Vacation trips, including short vacations*
11. *Life insurance, private pension insurance*
12. *Other insurance policies (e.g., car, legal, household goods)*
13. *Motor vehicle repairs (including motorcycle)*
14. *Transport (car, train, bus, etc.)*

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<sup>16</sup> Further insights on these aspects could be analyzed by means of collective consumption models, such as Browning et al. (1994), Menon, Perali, and Piccoli (2018), Mangiavacchi, Perali, and Piccoli (2018) or Betti, Mangiavacchi, and Piccoli (2020), but data limitations prevented us from estimating such models in the current analysis.

15. *Furniture, household appliances not mentioned previously*
16. *Other expenditures*

As stated in Section 3, to avoid an excessive number of missing values, we aggregate items 6, 13 and 14 into an unique category “Communication and transportation”; categories 7 and 8 into “Education, culture”; categories 4 and 5 into “Health, hygiene”; 2, 9 and 10 into “Leisure, holiday”; and 11 and 12 into “insurance”.

## B. Questions about Personality Traits in the SOEP 2009 Individual Questionnaire

Question 120 of the individual 2009 questionnaire reads as follows:

Below are different qualities that a person can have.

*You will probably find that some apply to you perfectly and that some do not apply to you at all. With others, you may be somewhere in between.*

*Please answer according to the following scale: 1 means “does not apply to me at all”, 7 means “applies to me perfectly”.*

*With values between 1 and 7, you can express where you lie between these two extremes.*

*I see myself as someone who ...*

1. *does a thorough job*
2. *is communicative, talkative*
3. *is sometimes somewhat rude to others*
4. *is original, comes up with new ideas*
5. *worries a lot*
6. *has a forgiving nature*
7. *tends to be lazy*
8. *is outgoing, sociable*
9. *values artistic, aesthetic experiences*
10. *gets nervous easily*
11. *does things effectively and efficiently*
12. *is reserved*
13. *is considerate and kind to others*
14. *has an active imagination*
15. *is relaxed, handles stress well*
16. *is eager for knowledge*

Of these, the last one is not used, and each triplet defines one personality trait as the average score of the three questions (thus, the scores of 3, 7, 12 and 15 have to be reverted) as follows:

- Openness:** 4, 9, 14
- Conscientiousness:** 1, 7, 11
- Extraversion:** 2, 8, 12
- Agreeableness:** 3, 6, 13
- Neuroticism:** 5, 10, 15

C. Robustness

Table C.1: System of Engel curves for couples: average PTs.

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Mental openness</i>							
Childless couples	−0.002	0.000	0.000	0.004***	0.003	0.000	−0.003
Couples w/children	0.003	0.001	0.000	0.007**	−0.005	0.002	−0.008**
<i>Conscientiousness</i>							
Childless couples	0.003	−0.001	0.001	0.000	0.000	−0.002	−0.001
Couples w/children	0.016***	0.001	0.001	0.001	−0.002	−0.008	−0.010**
<i>Extraversion</i>							
Childless couples	−0.002	0.000	0.000	−0.001	−0.001	0.006*	0.001
Couples w/children	0.005	0.002	0.002	−0.001	0.000	0.007	−0.014***
<i>Agreeableness</i>							
Childless couples	0.004	0.000	0.000	−0.001	0.001	−0.004	0.001
Couples w/children	−0.002	−0.002	0.000	0.003	−0.005	0.005	0.004
<i>Neuroticism</i>							
Childless couples	0.003	−0.003**	0.004***	−0.001***	0.005***	−0.011***	0.000
Couples w/children	0.005	−0.004*	0.002	0.000	0.003	−0.003	−0.010***

Estimation also include the following control variables, not reported in the table: age, age-squared, being immigrant, working part-time, working full-time, being retired, years of education, being owner of the dwelling, living in an urban settlement and in East-Germany. For couples with children, number of children is also included. Full estimation tables are available upon request.\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

Table C.2: Change in significance of the PT coefficients when excluding years of education for the sample of single women and men.

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Mental openness</i>							
Men	.	.	.	.	.	.	.
Women	.	.	.	.	.	.	.

Table C.2: (continued)

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Conscientiousness</i>							
Men	.	.	.	+	.	.	.
Women	—	.	.	.	.	.	.
<i>Extraversion</i>							
Men	—	.	.	.	.	.	—
Women	.	.	.	.	—	.	.
<i>Agreeableness</i>							
Men	—	.	.	.	.	—	.
Women	+	.	.	.	.	+	.
<i>Neuroticism</i>							
Men	.	.	.	.	+	.	.
Women	.	.	.	.	—	.	.

“+” means that the coefficient of a PT becomes significant (at 5%) in explaining consumption of a good when years of education is excluded from the regression. “—” means that a significant coefficient loses significance when years of education is excluded from the regression. “.” means that no changes in significance are observed when years of education is excluded from the regression. The test is reported only for single men and single women, as no significance changes are observed for couples. Full estimation tables are available upon request.

**Table C.3:** Change in coefficients when excluding years of education for the sample of single women and men.

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Mental openness</i>							
Men	.	.	.	.	.	.	.
Women	.	.	.	.	.	.	.
<i>Conscientiousness</i>							
Men	.	.	.	.	.	.	.
Women	.	.	.	.	.	.	.
<i>Extraversion</i>							
Men	.	.	.	.	.	.	.
Women	.	.	.	.	.	.	.
<i>Agreeableness</i>							
Men	*	*	.	.	.	.	.
Women	*	*	.	.	.	.	.
<i>Neuroticism</i>							
Men	.	.	.	.	*	.	.
Women	.	.	.	.	*	.	.

“\*\*” means that the difference of coefficients between High- and Low- educated samples is significant (at 5%). “.” means that the difference is not significantly different from 0. Results for couples are not reported as no significant difference is observed. Full estimation tables are available upon request.

**Table C.4:** Differences in the PT coefficients of the high- and low-educated single women and men.

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Mental openness</i>							
Men	.	.	.	*	*	*	.
Women	.	.	.	.	.	.	.
<i>Conscientiousness</i>							
Men	.	.	.	.	.	.	*
Women	.	.	.	.	.	.	.
<i>Extraversion</i>							
Men	.	.	.	.	.	.	.
Women	.	.	.	.	.	.	.
<i>Agreeableness</i>							
Men	*	.	.	.	*	.	.
Women	.	.	.	.	*	.	.
<i>Neuroticism</i>							
Men	.	.	.	.	.	.	.
Women	*	.	.	.	.	.	.

“\*\*” means that the difference of coefficients between high- and low-educated samples is significant (at 5%).  
“.” means that the difference is not significantly different from 0. The test is reported only for single men and single women. Full estimation tables are available upon request.

**Table C.5:** Impact of Mental openness on expenditure in education and culture by education level, in all samples.

Expenditure in education and culture	Mental openness	
	Low-educated	High-educated
<i>Singles</i>		
Men	0.004***	0.005
Women	0.005***	0.001
<i>Childless couples</i>		
Men	0.002***	0.005***
Women	0.001	0.003**
<i>Couples with children</i>		
Men	−0.002	0.006
Women	0.004	0.008**

Estimation also include the following control variables, not reported in the table: age, age-squared, being immigrant, working part-time, working full-time, being retired, years of education (for each member of the couple in the samples of couples), plus being owner of the dwelling, living in an urban settlement and in East-Germany, and, for couples with children, the number of children. Full estimation tables are available upon request.\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

**Table C.6:** Differences in the PT coefficients of the young and elderly single women and men.

Personality traits	Consumption category						
	Food	Clothes, shoes	Health, hygiene	Education, culture	Communication, transportation	Leisure, holiday	Insurances
<i>Mental openness</i>							
Men	.	.	.	*	.	.	*
Women	.	.	.	.	.	.	.
<i>Conscientiousness</i>							
Men	.	.	.	*	.	.	.
Women	.	.	.	.	.	.	.
<i>Extraversion</i>							
Men	.	.	.	.	*	.	.
Women	.	*	.	.	.	.	.
<i>Agreeableness</i>							
Men	*	.	.	.	.	.	.
Women	.	.	.	.	*	.	.
<i>Neuroticism</i>							
Men	.	.	.	.	.	.	.
Women	.	.	.	.	*	.	.

“\*\*” means that the difference of coefficients between young and old single women and men is significant (at 5%). “.” means that the difference is not significantly different from 0. The test is reported only for single men and single women. Full estimation tables are available upon request.

## D. First-Stage Estimations for Total Expenditure Endogeneity

**Table D.1:** Estimation results of the first-stage regression for single men and single women.

Variable	Men		Women	
	Coeff.	Std. Err.	Coeff.	Std. Err.
Income from pension or work	0.007	0.005	0.011*	0.006
Principal component n. 1 for wealth indicators	0.433***	0.154	0.516***	0.090
Principal component n. 2 for wealth indicators	-0.144	0.178	-0.158	0.166
Principal component n. 3 for wealth indicators	0.199	0.155	0.217*	0.114
Current year age	0.002	0.006	0.019***	0.005
Current year age: Square	0.000	0.000	0.000***	0.000
Works full-time	0.433***	0.065	0.309***	0.066
Works part-time	0.109	0.070	0.039	0.054
Perceives an onld-age or disability pension	0.313***	0.079	0.112*	0.064
Immigrant to Germany since 1948	-0.098	0.075	-0.042	0.062
Own dwelling	0.182***	0.041	0.229***	0.032
Lives in an urban settlement	0.123***	0.039	0.093***	0.032
Eastern Germany	-0.201***	0.042	-0.067*	0.034
Amount of education or training in years	0.167***	0.018	0.168***	0.016

**Table D.1:** (continued)

Variable	Men		Women	
	Coeff.	Std. Err.	Coeff.	Std. Err.
Openness	0.019	0.020	0.016	0.015
Conscientiousness	0.026	0.018	0.029*	0.016
Extraversion	0.038**	0.018	0.042***	0.016
Agreeableness	−0.029	0.018	0.023	0.015
Neuroticism	−0.037**	0.019	0.002	0.014
Constant	5.437***	0.157	4.987***	0.129

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .**Table D.2:** Estimation results of the first-stage regression for couples with and without children.

Variable	Childless couples		Couples with children	
	Coeff.	Std. Err.	Coeff.	Std. Err.
Husband income from pension or work	0.004	0.004	−0.008**	0.004
Wife income from pension or work	0.017***	0.004	0.002	0.005
Principal component n. 1 for wealth indicators	0.759***	0.111	0.705**	0.294
Principal component n. 2 for wealth indicators	0.138***	0.053	0.099	0.070
Principal component n. 3 for wealth indicators	−0.281**	0.109	−0.502*	0.289
Husband's age	0.012	0.011	0.021	0.020
Wife's age	0.014	0.010	−0.054**	0.024
Husband's age squared	0.000	0.000	0.000	0.000
Wife's age squared	0.000	0.000	0.001***	0.000
Husband full-time worker	0.179***	0.042	0.384***	0.065
Wife full-time worker	−0.020	0.043	0.164***	0.060
Husband part-time worker	0.063*	0.037	0.289***	0.071
Wife part-time worker	−0.054	0.037	0.114**	0.049
Husband perceives an onld-age or disability pension	0.027	0.044		
Wife perceives an onld-age or disability pension	−0.116***	0.041		
Husband is immigrant	−0.078*	0.046	0.079	0.053
Wife is immigrant	−0.065	0.044	0.008	0.048
Number of children			0.117***	0.031
Owner of dwelling	0.129***	0.022	0.017	0.031
Live in a urban settlement	0.078***	0.022	−0.102***	0.039
Lives in East Germany	−0.204***	0.025	0.110***	0.019



Table D.2: (continued)

Variable	Childless couples		Couples with children	
	Coeff.	Std. Err.	Coeff.	Std. Err.
Husband's years of education	0.141***	0.012	0.128***	0.017
Wife's years of education	0.076***	0.012	0.075***	0.018
Husband's openness	0.012	0.011	0.012	0.015
Wife's openness	0.014	0.011	0.014	0.015
Husband's conscientiousness	−0.018*	0.011	0.017	0.015
Wife's conscientiousness	0.009	0.011	−0.010	0.015
Husband's extraversion	0.019*	0.011	0.015	0.015
Wife's extraversion	0.015	0.011	0.024	0.015
Husband's agreeableness	−0.011	0.010	−0.024*	0.014
Wife's agreeableness	−0.011	0.010	0.001	0.015
Husband's neuroticism	−0.006	0.010	−0.005	0.014
Wife's neuroticism	−0.017*	0.010	0.013	0.014
Constant	5.519***	0.142	6.482***	0.403

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

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**Supplementary Material:** The online version of this article offers supplementary material (<https://doi.org/10.1515/bejeap-2020-0189>).