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Nominal or Real? The Impact of Regional Price Levels on Satisfaction with Life

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Abstract

According to economic theory, real income, i.e., nominal income adjusted for purchasing power, should be the relevant source of life satisfaction. Previous work, however, has only studied the impact of inflation adjusted nominal income and not taken into account regional differences in purchasing power. Therefore, we use a novel data set to study how regional price levels affect satisfaction with life. The data set comprises about 7 million data points that are used to construct a price level for each of the 428 administrative districts in Germany. We estimate pooled OLS and ordered probit models that include a comprehensive set of individual level, time-varying and time-invariant control variables as well as control variables that capture district heterogeneity other than the price level. Our results show that higher price levels significantly reduce life satisfaction. Furthermore, we find that a higher price level tends to induce a larger loss in life satisfaction than a corresponding decrease in nominal income. A formal test of neutrality of money, however, does not reject neutrality of money. Our results provide an argument in favor of regional indexation of government transfer payments such as social welfare benefits.

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1 Introduction

Among the determinants of life satisfaction, income is of fundamental interest and importance to economists. Consequently, studies on the effect of income on life satisfaction are abundant. They range from cross-country studies on the relationship between gross national product and average reported life satisfaction to analyses of the effect of individual income on individual life satisfaction (for survey articles see, e.g., Oswald (1997), Frey and Stutzer (2002), Di Tella and MacCulloch (2006), Clark *et al.* (2008), Dolan *et al.* (2008), and Stutzer and Frey (2010)).[1] Lacking adequate data on cross-sectional variation of prices, all research on individual life satisfaction conducted so far has basically used inflation adjusted nominal income as explanatory variable. According to microeconomic theory, however, individuals should derive satisfaction from consumption of goods that they can afford with their income rather than from nominal income. Hence, real income, i.e., nominal income adjusted for the local price level, is the appropriate concept to measure the effect of income on life satisfaction.

This paper therefore studies whether differences in local price levels affect individual satisfaction with life once we control for nominal income and local heterogeneity. To this end, we match two sources of data. The first is a novel and very comprehensive data set on local price levels in Germany, a price index covering each of Germany's 428 administrative districts. The price index reveals substantial price differences within Germany (up to 37%) and is, to our knowledge, unique at such a disaggregated level. Information used to construct the price index comprises more than 7 million data points. Having information on prices at a more aggregate administrative level (i.e., federal states) would not be sufficient for studying the effects of prices on life satisfaction. To illustrate, both the cheapest and the most expensive German district are geographically located in the same federal state. We match our price index data with data from the German Socio-Economic Panel (SOEP), a household panel survey, which is representative of the German population. It includes a question on individual life satisfaction, a wide range of control variables, and district identifiers. To identify the effect of the price level on life satisfaction, we estimate both pooled OLS and ordered probit models that include a comprehensive set of individual time-variant and time-invariant characteristics, among many others the 'Big Five' personality traits and economic preferences. Moreover, we control for district characteristics other than the price level that poten-

[1] Besides studying absolute income, the role of relative income (e.g., Clark and Oswald (1996), Luttmer (2005), Ferrer-i Carbonell (2005), Fliessbach *et al.* (2007)) and aspiration income (e.g., Stutzer (2004)) for individual life satisfaction has been explored.

tially influence life satisfaction such as local unemployment rate, local employment rate, average local household income, distance to the center of the closest large city, and guests-nights per capita, a proxy for attractiveness of the respective community.

Our main finding is a 'purchasing power effect'. For a given nominal income, a higher price level reduces satisfaction with life. The effect sizes are economically relevant. In our main specification, a 10% increase in the price level is predicted to decrease satisfaction with life by about 0.1 units, where satisfaction with life is measured on a scale from 0 to 10. This effect is roughly comparable to the decrease in life satisfaction caused by an increase in the distance travelled to work of about 100 kilometers. Being unemployed instead of full-time employed resembles the effect size of doubled prices. We perform various robustness checks and extend our analysis to two subdomains of well-being, in which the difference between nominal and real income is conceptually important: individual satisfaction with household income and individual satisfaction with standard of living. The results further confirm the purchasing power effect. For a given nominal income, higher local price levels reduce satisfaction with household income and satisfaction with standard of living at statistically and economically significant rates.

Our results show that not adjusting nationwide payments to regional price differences treats equals unequally in terms of individual life satisfaction. In this sense, our results provide an argument in favor of regional indexation of government transfer payments. They also question country-wide uniform public sector or minimum wages.

Beyond documenting the importance of local price levels for individual well-being, our study adds to uncovering how people perceive nominal and real quantities. From an economic policy perspective, perception of real versus nominal terms is, for example, important for determining optimal inflation rates to be targeted by central banks (Akerlof and Shiller, 2009). Economic theory usually assumes neutrality of money, i.e., that people think and act in terms of real quantities and are not guided by nominal quantities. In our case, neutrality of money implies that a price decrease should affect life satisfaction in the same way as an increase in nominal income that exactly offsets the price decrease in real income terms. In principle, deviations from neutrality of money could go in two directions. People could either overreact to changes in nominal income or to changes in prices.

An overreaction to nominal quantities is usually referred to as money illusion. Fisher (1928) was the first to suggest that people may exhibit money illusion.[2] In contrast, an overreaction to

[2]Money illusion was basically ignored in economic research until it was again studied by Shafir *et al.* (1997) who

prices would imply that a decrease in prices increases life satisfaction more than a corresponding increase in disposable nominal income. An overreaction to prices is plausible if prices are more salient than nominal income. The importance of salience effects is documented in Chetty *et al.* (2009), Blumkin *et al.* (2012), and Finkelstein (2009) who provide evidence that consumers fail to sufficiently take into account less salient aspects in decision making.[3] Income is usually paid monthly and changes only infrequently. Furthermore, disposable income has many components that are not very salient such as taxes and government transfer payments. To the contrary, prices are experienced daily, at every instance of buying.

In contrast to most of the literature, our results on neutrality of money are based on yearly income data, i.e., large stakes for an individual. In favor of salience effects, our findings document that people tend to overreact to prices compared to nominal income. In our main specification, the estimated effect of a change of the price level on overall satisfaction with life is about 66% higher than the estimated effect of a corresponding change in nominal income. However, a formal test for neutrality of money, i.e., testing whether the coefficients of the logarithm of nominal income and the logarithm of the price level differ significantly, does not reject neutrality of money.

The only other study on subjective well-being and price levels we are aware of is Boes *et al.* (2007). Their study differs from ours in many respects: the dependent variable, the available price level data, and methodology. They regress satisfaction with household income on price level data that was collected in 50 German cities, i.e., not in rural areas (Roos, 2006). Urban price levels are used to interpolate prices to the level of 13 out of 16 German federal states. Boes *et al.* (2007) test if people exhibit money illusion and do not find evidence for it. In contrast, we discuss and empirically document the effect of the local price level on overall satisfaction with life, a commonly used proxy for individual utility. Senik (2004) analyzes whether reference group income influences life satisfaction due to social comparisons or by providing information used to form expectations about one's own future income. She constructs 'real' income measures by using

report evidence in favor of money illusion using questionnaire and experimental data. Weber *et al.* (2009) provide neuroeconomic evidence in favor of money illusion using functional magnetic resonance imaging. Using a laboratory experiment, Fehr and Tyran (2001) show that even a small extent of money illusion at the individual level may be sufficient to result in a large aggregate bias after a negative nominal shock.

[3]Chetty *et al.* (2009) show that consumers underreact to less salient taxes, i.e., taxes that are not included in price tags. In a lab experiment, Blumkin *et al.* (2012) find similar evidence. They show that less salient taxes distort the labor-leisure allocation. Finkelstein (2009) shows that drivers are less aware of tolls that are paid electronically and, as a consequence, driving is less elastic with respect to tolls that are paid electronically instead of manually.

information on regional poverty lines of 38 Russian regions that are provided by the Russian longitudinal monitoring survey (RLMS) data set. Compared to our data, regional prices refer to much larger geographical units and are only available for comestible goods that account for about 9% of components of the price index we use. Luttmer (2005) also analyzes the influence of reference group income on individual well-being using average earnings in 'Public Use Microdata Areas' of the USA. To control for local characteristics that are both correlated with average local income and life satisfaction, he uses local housing prices and state fixed effects. Housing prices correspond to about one fifth of the information our price index contains. He finds that local housing prices are (insignificantly) negatively correlated with life satisfaction.

The remainder of the paper is organized as follows: section 2 describes both sources of data and section 3 explains our empirical strategy. Section 4 presents our results and several robustness checks. We discuss implications of our results and conclude in section 5.

2 Data

We use information on price levels of all 428 German districts ('Kreise'). Districts constitute administrative units comprising one or more cities and their surroundings. Districts are the smallest division of Germany for which it is feasible to collect detailed price data, because in smaller units some of the products contained in the price index will not be available. The data on prices at district level have been collected by the German Administrative Office for Architecture and Comprehensive Regional Planning. Kawka *et al.* (2009) describe the data set, its collection and descriptive results on price levels in great detail.

The price index is based on the basket of commodities and the weights attached to each commodity that are used by the German Federal Statistical Office to calculate the German inflation rate. Table 1 lists the most important classes of goods that the basket of commodities contains. In terms of classes of goods, the price index covers 73.2% of this basket. In particular, more than 7 million data points on prices of 205 commodities have been collected at the district level. Commodities range from obvious candidates such as rental rates, electricity prices, or car prices to such detailed ones as dentist fees, prices for cinema tickets, costs for foreign language lessons, or entry fees for outdoor swimming pools.

With these data, a price index is constructed that provides an overall price level for each district. When constructing a price index, a weight needs to be attached to each individual

Table 1: Main components of the basket of commodities

Commodity group	‰ of whole basket
Rent for dwellings (including rental value for owner-occupied dwelling)	203.30
Comestible goods	89.99
Goods and services for privately used vehicles	75.57
Electricity, gas, and other fuels	59.82
Clothing	39.42
Purchase of vehicles	37.50
Water supply and other dwelling related services	33.04
Food services	32.12
Leisure and cultural services	28.99
Telecommunication	27.12
Furniture, interior equipment, carpeting, and other floor coverings	26.50
Insurance services	24.88
Tobacco products	22.43
Personal hygiene	21.54
Leisure products, garden products, pets	21.53
Audiovisual, photographic, and information-processing devices and related equipment	19.01

Reproduced from the German Federal Statistical Office (2005) (see http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Statistiken/Preise/Verbraucherpreise/WarenkorbWaegungsschema/Waegungsschema,property=file.pdf). Displayed commodity groups account for about 750 ‰ of the whole basket of commodities.

commodity measuring its share of the whole basket of commodities. The price index is based on the weights that are used by the German Federal Statistical Office to construct the inflation rate. The weights are inferred from a household survey with 53,000 households that are asked about their income and consumption habits. With these weights, the price index is constructed as an arithmetic mean. The weighting is the same for each individual and each district, i.e., it does not adjust for different consumption habits of rich and poor people, men and women, families and singles, young and old people or, more generally, for different individual or regional preferences for consumption. Such an approach certainly introduces some measurement error. Due to feasibility, it is, however, the standard approach in economics concerning price indices and also inflation rates. A clear advantage of this approach is that it allows for a direct comparison of different regional price levels and for a straightforward interpretation of the price index. Intuitively, we can ask what 'an average individual traveling through Germany' would need to pay for a given

consumption bundle in each district. Since collecting such comprehensive data cannot be managed in a single year, the data were gathered in the years 2004 to 2009, with most of the data, roughly 85%, being collected from 2006 to 2008. The data are used to build a single time-invariant price level for each district.

The price index uses the district of the former German capital Bonn as baseline (100 points). The cheapest district is Tirschenreuth in the federal state of Bavaria with 83.37 points, while Munich with 114.40 points (also in Bavaria) is the most expensive district. Hence, the most expensive district is 37% more expensive than the cheapest, revealing a substantial price difference within Germany. Figure A.1 in the Appendix shows a map of Germany indicating the price level of each district. Three observations are worth mentioning: price levels are generally lower in East than in West Germany and lower in Northern than in Southern Germany. Moreover, urban areas are more expensive than rural ones.

To obtain a measure of prices that accounts for both cross-sectional variation of prices at the district level and variation of prices over time, we multiply district specific price levels with inflation rates using 2006 as baseline year. The smallest geographical unit for which regional inflation rates are available in Germany is at the level of the 16 federal states.[4]

We match the price index data and data from the SOEP using district identifiers.[5] The SOEP is a representative panel study of German households that started in 1984. We use five waves from 2004 to 2008.[6] In each wave, about 22,000 individuals in 12,000 households are interviewed. Data cover a wide range of topics such as individual attitudes, preferences, and personality, job characteristics, employment status and income, family characteristics, health status, and living conditions. Schupp and Wagner (2002) and Wagner *et al.* (2007) provide an in-depth description of the SOEP.

Since the first wave in 1984 participants are asked about their satisfaction with life on an

[4]From 2004 to 2008, 13 out of a total of 16 federal states report inflation rates for each year. For the federal state of Bremen, only the value for 2004 is missing. The federal states Hamburg and Schleswig-Holstein do not report own inflation rates in any year. For all missings, we interpolate the state level inflation rates with the German wide inflation rate of the corresponding year.

[5]Due to data privacy protection rules, working with the SOEP data at district level requires a special mode of online access to the SOEP data, SOEPremote.

[6]We cannot comprehensively match the price data to SOEP data from 2009 onwards. In 2009, some district boundaries were restructured. The new district boundaries are only reflected in the SOEP data, but not in the price index data.

eleven point Likert scale, which constitutes our main dependent variable. The life satisfaction question reads: "How satisfied are you with your life, all things considered?". Life satisfaction is often used as a measure for individual welfare or utility.[7] It is also gaining importance as an evaluation tool for economic policy. For example, in 2008, French President Nicholas Sarkozy asked a commission of economists to develop better measures for economic performance and social progress than, for example, GDP. In their report, the so called 'Sarkozy commission' notes that "... the time is ripe for our measurement system to shift emphasis from measuring economic production to measuring people's well-being." (p.12, Stiglitz *et al.* (2009)).

As alternative dependent variables, we use individual satisfaction with household income and individual satisfaction with standard of living. They are elicited in the following SOEP questions: "How satisfied are you with your household income?" and "Overall, how satisfied are you with your standard of living?". Satisfaction with household income is available from 2004 to 2008, while satisfaction with standard of living is only available from 2004 to 2006. Both questions use an eleven point Likert scale. Compared to general satisfaction with life, satisfaction with household income or standard of living is smaller in scope and less apt as a proxy for overall individual utility. However, they are even more closely linked to real (as opposed to nominal) income. Thus, the two alternative dependent variables will be useful to provide further evidence on how regional price levels affect well-being.

Besides a district's price level, nominal income is the main explanatory variable. We measure nominal income by household disposable nominal income, i.e., after tax household income including all kinds of government transfer income.[8] Instead of calculating equivalence income, we control for the logarithm of persons living in the household.

Additionally, we use a very comprehensive and well-established set of control variables at both individual and district level. The time-varying control variables at the individual level are age, age squared, dummies for marital status (married, separated, divorced, widowed; single as omitted category), dummies for employment status (employed full-time, employed part-time, maternity leave, non-participant; unemployed as omitted category), years of education, a binary variable indicating whether an individual is disabled, a continuous variable indicating the official level of

[7] For a detailed discussion on the relationship between satisfaction with life and utility see, for example, Clark *et al.* (2008) and Oswald (2008).

[8] We exclude about 60 observations with incomes above 500,000 Euro to avoid results being influenced by extreme outliers. Including them does not change our results.

disability, the number of children in the household, and the distance travelled to the workplace in kilometers.

Furthermore, we use a comprehensive set of individual specific, time-invariant control variables. We include dummies for gender, German nationality, whether an individual describes himself as religious, and information on the political orientation of a person, which was elicited in SOEP wave 2005 on a scale from 0 (extreme left wing) to 10 (extreme right wing). Most importantly, we control for an individual's personality, economic preferences, and beliefs. Becker *et al.* (2012) show that concepts from psychology and economics should be combined when modeling individual differences. Using this approach, a large fraction of the variance in outcomes such as life satisfaction can be explained. Building on research in personality psychology, our control variables encompass the so called "Big Five", which are five superordinated character traits into which most of the subordinated character traits can be mapped (Costa and McCrae, 1992). The Big Five are openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism.[9] For each trait, we use standardized questionnaire measures that were elicited in the 2005 wave of the SOEP. A further important personality trait is the so called locus of control (Rotter, 1966). Locus of control measures the extent to which people think they are in control of events in their life. Our measure of locus of control uses standardized questionnaire measures from the 2005 wave of the SOEP. In economics, individual differences are commonly modeled by differences in preferences and beliefs. Important preferences are the preference for risk and time as well as social preferences (altruism, positive and negative reciprocity). An important belief is trust. Except for time preferences, all preferences and beliefs mentioned above were elicited at least once in the SOEP between 2004 to 2008. Whenever we have multiple measures for a given concept, we use the average to reduce measurement error. All measures are standardized.

To model district characteristics other than the price level that could both influence satisfaction with life and be correlated with the price level, we also include control variables at district level. The time-varying control variables mainly encompass macroeconomic variables that capture the current economic situation at district level: the average unemployment rate, the average employment rate in jobs subject to social security contributions, and the logarithm of the average household income. The time-invariant variables include the district size in square kilometers, the distance to the center of the closest large city (measured at individual level in 2004), and the number of guest-nights per capita in 2007 that proxy local attractiveness in terms of natural

[9]For a detailed description of the Big Five see, e.g., Borghans *et al.* (2008).

beauty or cultural facilities.

3 Empirical Strategy

We estimate a pooled OLS model with error terms clustered at district level for individual i's satisfaction with life in district j and a given year t, H_{ijt}:

$$H_{ijt} = \beta_0 + \beta_1 ln(N_{it}) + \beta_2 ln(p_{jt}) + \beta_3 ln(s_{it}) + \mathbf{x}'_{it}\boldsymbol{\gamma}_1 + \mathbf{c}'_i\boldsymbol{\gamma}_2 + \mathbf{d}'_{jt}\boldsymbol{\gamma}_3 + \mathbf{d}'_j\boldsymbol{\gamma}_4 + \gamma_{5t}h_t + \epsilon_{ijt}$$

N_{it} is nominal income. p_{jt} is the price index that captures cross-sectional variation of prices across districts and variation of prices over time. s_{it} is the number of persons living in the household, $\mathbf{x}_{it}$ is a vector including individual specific, time-varying control variables, $\mathbf{c}_i$ is a vector of time-invariant individual characteristics. $\mathbf{d}_{jt}$ and $\mathbf{d}_j$ are vectors of time-variant and time-invariant control variables at district level, h_t is a year dummy, β_0 is a constant term, and ϵ_{ijt} the error term.

Our primary research question is whether, for a given nominal income, differences in regional price levels affect individual satisfaction with life, i.e., whether β_2 is significantly different from zero. In addition, the specification at hand allows for a direct test of neutrality of money by testing whether β_1 is significantly different from β_2 in absolute value. According to economic theory, real income, i.e., nominal income adjusted for the regional price level, as opposed to pure nominal income should be the relevant source of satisfaction with life. Consequently, the two coefficients β_1 and β_2 should be of the same size in absolute terms. Assuming that β_1 is positive and β_2 is negative, a β_1 that is larger than $|\beta_2|$ would indicate that people exhibit nominal illusion. If $|\beta_2|$ were larger than β_1, the average individual would overreact to prices compared to nominal income, i.e., would suffer more from a price increase than it would suffer from a corresponding decrease in nominal income.

With the data at hand, it is not feasible to identify how regional price differences affect satisfaction with life by estimating an individual and / or district fixed effects model with $ln(p_{jt})$ as key explanatory variable. Since $ln(p_{jt}) = ln(p_j) + ln(inflation_t)$, the price index consists of a time-invariant part, $ln(p_j)$, that contains cross-sectional price variation and a time-variant part, the inflation rate. In a fixed effects regression using individual or district fixed effects, the time-invariant part of the price level, $ln(p_j)$, does not contribute to identifying the coefficient of $ln(p_{jt})$. The coefficient of $ln(p_{jt})$ would only be identified via the inflation rate. Thus, it would not contain any information on how regional price levels influence satisfaction with life.

This argument neglects that individuals who move from one district to another provide an alternative source of variation in local prices that could potentially be used to identify the effect of the regional price level on individual satisfaction with life. However, movers constitute only a very small group of our sample. Furthermore, movers are likely to be a peculiar subset of the population, experiencing particularly strong shocks to life satisfaction caused by shocks to unobserved heterogeneity, e.g., frequent reasons for moving are changing the job or moving to live together with the partner. Thus, we are reluctant to generalize results that are based on movers only to the population as a whole and exclude movers from our main specification. In fact, estimating a fixed effects specification that uses only observations on movers estimates the impact of income on happiness to be negative which is in stark contrast to all existing literature (see, e.g., the survey of Dolan *et al.* (2008)).

Since we cannot include individual or district fixed effects, we use a very comprehensive set of time-invariant individual and district characteristics as regressors to explicitly model time-invariant sources of heterogeneity in overall satisfaction with life as advocated by, e.g., Ferrer-i-Carbonell and Frijters (2004).

4 Results

We first present and discuss the effect of cross-sectional variation of prices on overall satisfaction with life, before studying how cross-sectional variation of prices affects individual satisfaction with household income and individual satisfaction with standard of living, the two alternative dependent variables we use.

4.1 Results for overall satisfaction with life

Table 2 displays the main estimation results. In all specifications, the logarithm of nominal income has a statistically significant, positive influence on satisfaction with life ($p < 0.01$). Moreover, all specifications document economies of scale at the household level as the coefficient of the logarithm of household size ($p < 0.01$) is smaller than the coefficient of the logarithm of nominal income in absolute terms.

Table 2: Life Satisfaction

	(1) Pooled OLS no district characteristics	(2) Pooled OLS main specification	(3) Ordered Probit main specification	(4) Pooled OLS including movers	(5) Pooled OLS including East dummy
$ln(N)$	0.520***	0.485***	0.338***	0.458***	0.474***
	(0.028)	(0.029)	(0.019)	(0.026)	(0.029)
$ln(P)$	0.567**	−0.806**	−0.571**	−0.626*	−0.693*
	(0.281)	(0.398)	(0.290)	(0.369)	(0.399)
ln(persons in household)	−0.446***	−0.409***	−0.290***	−0.404***	−0.396***
	(0.048)	(0.048)	(0.031)	(0.046)	(0.048)
individual controls	yes	yes	yes	yes	yes
district controls	no	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes
p-value of test ($\beta_1 = -\beta_2$)	0.000	0.417	0.418	0.647	0.581
R^2	0.2254	0.2298	–	0.2272	0.2313
# of observations	55,366	55,366	55,366	59,212	55,366

Dependent variable is individual life satisfaction. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Standard errors, clustered at district level, are shown in parentheses. Time-varying individual controls are age, age squared, dummies for marital status (married, separated, divorced, widowed; single as omitted category), dummies for employment status (employed full-time, employed part-time, maternity leave, non-participant; unemployed as omitted category), years of education, a dummy for being disabled, a continuous variable indicating the official level of disability, the number of children in the household, and the distance travelled to the workplace in kilometers. Individual specific, time-invariant control variables are dummies for gender, German nationality, religiosity, a variable for political orientation, standardized measures of the Big Five (openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism), locus of control, preference for risk, altruism, positive and negative reciprocity, trust. Control variables at district level include the average unemployment rate, the average employment rate, and the logarithm of the average household income. The time-invariant variables at district level are the district size in square kilometers, the distance to the center of the closest large city, and the number of guest-nights per capita. Finally, year dummies are included.

Column (1) shows the results of a regression including individual specific controls (time-varying and time-invariant), but no district characteristics other than the price level. In this specification, higher prices are associated with an increase in satisfaction with life ($p < 0.05$). At first sight, this result seems surprising. However, it is likely due to omitted variable bias: more 'attractive' districts have higher price levels. To control for the 'attractiveness' of a given district, we proceed by adding district level control variables in column (2). First, the local

unemployment rate, the employment rate, and the average district household income describe the current economic situation at district level. Second, the district's size and the distance to the center of the closest large city are proxies for how rural or urban a given district is and thus also for its infrastructure. Finally, the number of guest-nights per capita proxies local attractiveness in terms of natural beauty or cultural facilities.

Column (2) presents the results of our main specification.[10] There are two key insights. First, for a given nominal income, higher local prices decrease individual satisfaction with life ($p < 0.05$). A 10% increase in the price level is predicted to decrease satisfaction with life by 0.08 units, where satisfaction with life is measured at a 11 point Likert scale. To get a better intuition for the magnitude of the price level effect on life satisfaction, we compare the coefficient of the price level with coefficient of other explanatory variables. For example, an increase of the price level by around 8% decreases life satisfaction as much as an increase in the distance travelled to work of around 100 kilometers. Being unemployed instead of full-time employed resembles the effect size of a doubling of prices.

Second, our results do not reject neutrality of money. Testing whether the coefficient of nominal income, β_1, is significantly different from the coefficient of the price level, β_2, in absolute terms yields $p = 0.42$. However, in absolute terms, the coefficient of the logarithm of the price level is 66% larger than the coefficient of the logarithm of nominal income, indicating that people have the tendency to react stronger to changes in prices than to corresponding changes in nominal income. For example, while a 10% increase in the price level is predicted to decrease satisfaction with life by 0.08 units, a 10% decrease in nominal income is predicted to reduce satisfaction with life by only 0.05 units. Salience effects (Chetty *et al.* (2009), Blumkin *et al.* (2012), Finkelstein (2009)) offer a possible explanation for a larger impact of prices than of nominal income on satisfaction if prices are more salient than disposable income. This seems likely. Many components of disposable income might be less salient, e.g., taxes and government transfer payments, and, for most people, income changes are relatively rare events. In contrast, prices and price changes are experienced frequently, prices at every instance of buying.

We check the robustness of our main specification in various ways. First, in column (3), we take into account the ordinal nature of our dependent variable by estimating an ordered probit

[10] Table A.1 in the Appendix displays all estimated coefficients of the main specification. It documents that, in general, the estimated coefficients of our control variables are well in line with the existing literature. The time-invariant personality traits and economic preferences contribute significantly to explaining life satisfaction.

model. Using the ordinal model, the coefficient of the price level remains significantly negative ($p < 0.05$). As a second robustness check, in column (4), we add observations from all movers to the sample. As noted before, movers constitute a peculiar subgroup that, when analyzed separately in a fixed-effects framework, show a negative relationship between nominal income and satisfaction with life. However, including movers in our sample, results stay qualitatively the same. For a given nominal income, a higher price level is still predicted to decrease satisfaction with life ($p < 0.1$). Again, we do not reject neutrality of money. Finally, we include an additional dummy variable indicating whether a district lies in East or West Germany in column (5). Frijters *et al.* (2004) document that life satisfaction in East Germany is generally lower than in West Germany. Our district level explanatory variables should already capture a large share of differences between East and West Germany that still exist and affect satisfaction with life, such as differences in economic conditions. Including an East / West dummy allows controlling for potential further differences between East and West Germany. Once more, our results are stable and document that, for a given nominal income, higher prices reduce satisfaction with life ($p < 0.1$). Again, we do not reject neutrality of money ($p = 0.58$).

4.2 Results for satisfaction with household income and satisfaction with standard of living

In order to obtain further evidence on how the local price level affects individual well-being, we investigate the influence of the local price level on satisfaction with household income and satisfaction with standard of living. Real income seems to be a driving force for both subdomaines of individual well-being. In contrast, it is a well-established result that income has a significant impact on overall satisfaction with life, but, compared to other explanatory variables such as unemployment or health, the role of income is relatively small. Consequently, we hypothesize that the coefficients of nominal income and the local price level are larger in those two domains than for overall satisfaction with life.

Table 3: Satisfaction with Household Income

	(1) Pooled OLS no district characteristics	(2) Pooled OLS main specification	(3) Ordered Probit main specification	(4) Pooled OLS including movers	(5) Pooled OLS including East dummy
$ln(N)$	1.622***	1.586***	0.906***	1.550***	1.569***
	(0.042)	(0.041)	(0.024)	(0.039)	(0.041)
$ln(P)$	−0.134	−1.394**	−0.858**	−1.213**	−1.220**
	(0.360)	(0.599)	(0.338)	(0.569)	(0.602)
ln(persons in household)	−1.239***	−1.209***	−0.698***	−1.218***	−1.190***
	(0.069)	(0.069)	(0.037)	(0.066)	(0.069)
individual controls	yes	yes	yes	yes	yes
district controls	no	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes
p-value of test ($\beta_1 = -\beta_2$)	0.000	0.749	0.888	0.555	0.563
R^2	0.3068	0.3095	–	0.3077	0.3116
# of observations	54,921	54,921	54,921	58,721	54,921

Dependent variable is satisfaction with household income. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Standard errors, clustered at district level, are shown in parentheses. The control variables are exactly the same as in Table 2.

Table 4: Satisfaction with Standard of Living

	(1) Pooled OLS no district characteristics	(2) Pooled OLS main specification	(3) Ordered Probit main specification	(4) Pooled OLS including movers	(5) Pooled OLS including East dummy
$ln(N)$	0.908***	0.880***	0.606***	0.867***	0.869***
	(0.036)	(0.036)	(0.024)	(0.034)	(0.036)
$ln(P)$	−0.363	−1.158***	−1.134***	−1.295**	−1.419***
	(0.329)	(0.535)	(0.357)	(0.511)	(0.541)
ln(persons in household)	−0.799***	−0.777***	−0.542***	−0.791***	−0.763***
	(0.062)	(0.069)	(0.039)	(0.059)	(0.060)
individual controls	yes	yes	yes	yes	yes
district controls	no	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes
p-value of test ($\beta_1 = -\beta_2$)	0.093	0.234	0.139	0.404	0.311
R^2	0.2601	0.2633	–	0.2609	0.2645
# of observations	32,926	32,926	32,926	35,186	32,926

Dependent variable is satisfaction with standard of living. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Standard errors, clustered at district level, are shown in parentheses. The control variables are exactly the same as in Table 2.

Tables 3 and 4 present the results for satisfaction with household income and satisfaction with standard of living, respectively. Except for the dependent variable, they rely on exactly the same specifications as table 2. In all specifications, it is indeed the case that the coefficients of nominal income and the local price level are, in absolute terms, larger for satisfaction with household income and satisfaction with standard of living than for overall life satisfaction. Furthermore, our main results derived for overall satisfaction with life are replicated for the two new dependent variables: there is a significant positive relationship between nominal income and satisfaction, but a negative effect of the local price level on satisfaction with household income and standard of living once district level control variables are included. Furthermore, neutrality of money is not rejected in any specification.

A further interesting finding is that, when evaluating their satisfaction with standard of living, we again find that people react stronger to changes in prices than to changes in nominal income. This effect is, however, not significant at conventional levels ($p = 0.23$). In contrast, for satisfaction with household income, the coefficient of the price level is slightly smaller than the coefficient of nominal income. This difference is not significant either ($p = 0.75$). One plausible

explanation could again be salience effects: if people are directly asked about their satisfaction with household income, nominal income might be particularly salient.

5 Discussion

We have used a novel and very comprehensive data set on local price levels in Germany to study whether cross-sectional variation in price levels affects satisfaction with life once nominal income is controlled for. Our results show that information on price levels matters when analyzing satisfaction with life. We find that people exhibit significantly lower life satisfaction when living in a more expensive region. The effect of an increase in the price level on life satisfaction is also economically significant: A 10% increase in the price level decreases satisfaction with life by 0.08 units on a scale ranging from 0 to 10. Moreover, although a marginal price decrease is estimated to have a 66% stronger impact on life satisfaction than a corresponding increase in nominal income, this discrepancy is not large enough to reject neutrality of money. The result that, for a given nominal income, a higher price level reduces individual well-being also extends to subdomains of well-being, in particular satisfaction with household income and satisfaction with standard of living.

Our results are of relevance for advising policy, in particular if policy aims at treating equals equally. In that sense, our findings call for a regional indexation of government transfer payments, such as the US Supplemental Security Income (SSI), unemployment benefits, or social welfare benefits. Our results also put country-wide uniform public sector or minimum wages into question. In all examples, not adjusting nationwide payments to regional price differences risks treating equals unequally in terms of individual satisfaction with life.[11]

We believe that the price index data employed in this paper offer lots of scope for future research. Relevant questions that require detailed information on local price levels comprise, e.g., the effect of the price level on whether wages are perceived as fair, how job search activity or investments in human capital depend on regional price differences, and whether local price levels affect migration within a country.

[11] Of course, the validity of these arguments rests on a ceteris paribus assumption, i.e., groups who get compensated for differences in the price level are assumed to be small enough for a change in their nominal income not to affect the local price level.

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Appendix

Figure A.1: Regional Price Index

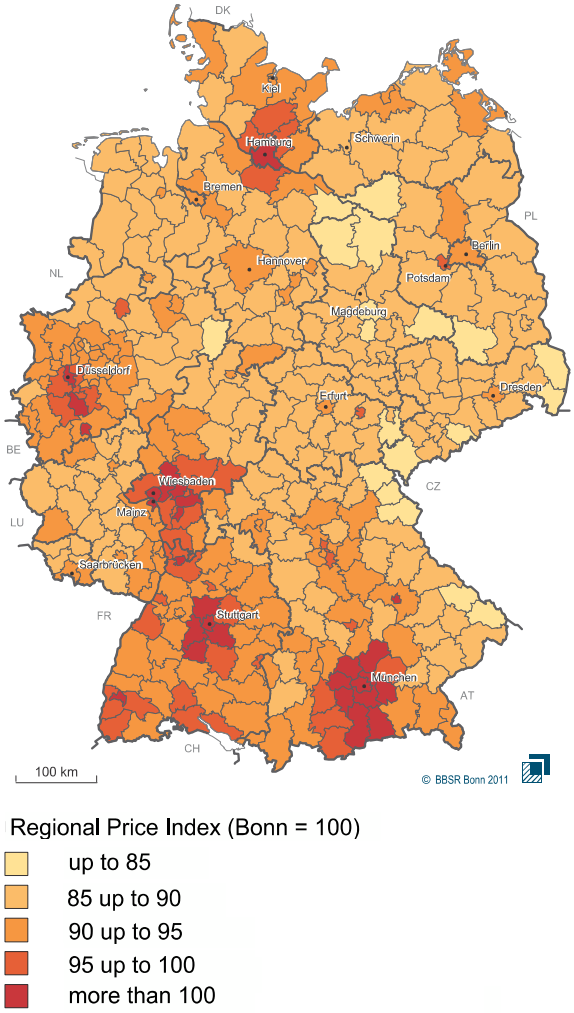

Figure from Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR), Raumordnungsbericht 2011, Bonn 2012. The colors display ranges of the originally scaled price index. Borders of the districts are marked by grey lines while borders of federal states are marked by dark grey lines.

Table A.1: Detailed Results of Main Specifications (OLS)

	Life satisfaction	Satisfaction with household income	Satisfaction with standard of living
$ln(N)$	0.485***	1.586***	0.880***
	(0.029)	(0.041)	(0.036)
$ln(P)$	−0.806**	−1.394**	−1.518***
	(0.398)	(0.599)	(0.535)
ln(persons in household)	−0.409***	−1.209***	−0.777***
	(0.048)	(0.069)	(0.061)
dummy disabled	0.076	−0.066	0.118
	(0.097)	(0.096)	(0.098)
degree of disability	−0.012***	−0.004***	−0.007***
	(0.002)	(0.002)	(0.002)
male	0.008	−0.093***	−0.062**
	(0.021)	(0.028)	(0.025)
age	−0.039***	−0.069***	−0.060***
	(0.006)	(0.007)	(0.007)
age^2	0.038***	0.073***	0.063***
	(0.006)	(0.007)	(0.006)
years of education	−0.008*	−0.003	0.008
	(0.005)	(0.006)	(0.005)
number of children	0.087***	0.183***	0.123***
	(0.019)	(0.028)	(0.024)
dummy foreigner	0.049	−0.135	−0.250**
	(0.065)	(0.106)	(0.123)
married	0.152***	0.278***	0.216***
	(0.047)	(0.061)	(0.052)
separated	−0.502***	−0.380***	−0.444***
	(0.115)	(0.143)	(0.142)
divorced	−0.273***	−0.391***	−0.416***
	(0.062)	(0.085)	(0.079)
widowed	−0.127**	0.032	−0.111
	(0.064)	(0.083)	(0.071)
full-time employed	0.770***	1.111***	0.764***
	(0.054)	(0.065)	(0.067)
part-time employed	0.787***	1.046***	0.779***
	(0.055)	(0.066)	(0.066)
parental leave	1.156***	0.960***	0.941***
	(0.078)	(0.092)	(0.088)
out of the labor force	0.941***	1.335***	0.935***
	(0.055)	(0.069)	(0.070)
distance to work (in km)	−0.001**	0.000	0.000
	(0.000)	(0.000)	(0.000)

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Table A.1 – *Continued from previous page*

	(1)	(2)	(3)
openness	0.087***	0.049**	0.070***
	(0.016)	(0.019)	(0.016)
conscientiousness	0.076***	0.080***	0.076***
	(0.016)	(0.019)	(0.019)
extraversion	0.042***	0.010	0.027*
	(0.015)	(0.017)	(0.016)
agreeableness	0.108***	0.069***	0.088***
	(0.015)	(0.019)	(0.015)
neuroticism	−0.083***	−0.086***	−0.054***
	(0.014)	(0.016)	(0.014)
locus of control	0.324***	0.323***	0.353***
	(0.015)	(0.019)	(0.019)
risk preference	0.097***	−0.047**	0.008
	(0.017)	(0.019)	(0.019)
positive reciprocity	0.029*	0.054***	0.055***
	(0.015)	(0.018)	(0.017)
negative reciprocity	0.032**	0.019	0.017
	(0.015)	(0.021)	(0.020)
trust	0.202***	0.227***	0.165***
	(0.015)	(0.019)	(0.017)
altruism	0.076***	0.052***	0.089***
	(0.015)	(0.019)	(0.019)
political orientation (large values indicate right wing)	0.023***	−0.001	0.011
	(0.007)	(0.009)	(0.009)
dummy religious	0.078**	0.173***	0.094**
	(0.032)	(0.040)	(0.036)
area of district (in 1000 km^2)	−0.024	−0.033	−0.021
	(0.031)	(0.041)	(0.036)
employment rate of district	−0.020***	−0.014**	−0.009*
	(0.005)	(0.007)	(0.005)
unemploymentrate of district	−0.031***	−0.029***	−0.020***
	(0.005)	(0.008)	(0.006)
log of average household income of district	0.262	0.275	0.381
	(0.234)	(0.352)	(0.333)
distance to next city center of district	−0.005	0.014	0.016
	(0.012)	(0.015)	(0.014)
yearly guest-nights per capita of district	0.000	−0.005	−0.006*
	(0.003)	(0.004)	(0.003)
year dummies	yes	yes	yes
p-value of test ($\beta_1 = -\beta_2$)	0.417	0.749	0.234
R^2	0.2298	0.3095	0.2633
# of observations	55,366	54,321	32,926

Dependent variable is individual life satisfaction. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Standard errors, clustered at district level, are shown in parentheses. Section 2 contains a description the explanatory variables.