

How the Income Elasticity of Meat Consumption differs between social groups? A case of the UK and the Czech Republic

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Abstract

The purpose of the article is to show different consumer behaviour between ten different income levels (deciles) and different countries and to examine the elasticity distance between income deciles in the UK (a high-income country) and the Czech Republic (a low-income country) within the context of meat consumption. The official statistic services provided data in the Czech Republic (Czech Statistical Office, 2020) and the UK (Office for National Statistics, 2020). Data on the Czech Republic come from the household budget surveys (HBS). In contrast, corresponding data on UK consumers was drawn from the Living Costs and Food survey, which succeeded the National food survey and household expenditure survey. Both sets of data were set according to households' structure from the EU-SILC Survey (national module of the European Union – Statistics on Income and Living Conditions). To estimate the income elasticity of meat in the Czech Republic and the United Kingdom in different consumer income groups, a time series cointegration analysis was applied to analyse the annual data for 2000-2017. The Törnquist equation and the difference between income elasticity in monetary and natural expression show saturation and preference of high quality meat in the higher-income consumers in the UK than the same groups in the Czech Republic and overall increasing demand for quality in other income groups. The results support the theory of nutrition transitions. The value of the research is that it would enable the exploration of the potential impact and nature of fiscal interventions for improving diets whilst enabling food producers to forecast meat consumption within the different customer segments.

Keywords

Price elasticity, income elasticity, meat consumption, saturation limit.

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Introduction

Livestock production is an important agricultural activity in the EU with some 45.2 million tons of meat produced across the 28 member states, which for the UK alone, represent 55.7% of all agricultural income (Cook, 2018). Meat remains an essential source of agri-business and food business income and essential use of land.

An examination of consumption trends shows significant variation between Lesser Economically Developed Countries (LEDCs) and More Economically Developed Countries (MEDCs). Such trends can be attributed variously; not least to income variations stimulated by economic, political and social change. For instance, after 1990,

following the fall of the Soviet Union, Central-and Eastern European countries per capita consumption of meat increased. Further increases per capita were evident in many of these countries following their entry into the EU in 2004; Czech Republic households showed stronger demand for higher-quality meat. Also, increased purchasing power made many Czech households more concerned as to product quality and content than under previous regimes (Euromonitor International, 2018).

Yet from the supply side, with the fall of the Eastern Block, Czech Republic meat producers and processors were faced with increased competition from new market entrants from western Europe. These events led to greater market concentration within the meat processing

sectors (Blazkova, 2016; Spicka, 2016), and a further reduction in their self-sufficiency in pork and poultry.

The situation in meat production and processing varies across Central European countries. The Czech Republic is surrounded by highly concentrated meat processing capacities in Germany and Poland. Poland is one of the top five producers of pork and poultry meat in the European Union. German meat processing capacities are in top-five ranking in beef, pork and poultry meat. Meat processing capacities in Austria are not so concentrated, but they are remarkable for high technology and labour productivity (Marquer, Rabade and Forti, 2015). Consequently, the policymakers, meat producers and processors need to find a way to promote indigenous production and convince customers to buy higher-quality meat products of Czech origin.

Income elasticity is an important determinant of consumer behaviour and is worth greater investigation. The benefits of improving self-sufficiency in the Czech Republic are both economic and social. The solutions can be seen to be in the hands of the policymakers, meat producers and processors.

The UK is similarly faced with a lack of self-sufficiency in meat production areas and is >72% self-sufficiency in poultry and >60% in pork. In conditions, of uncertainty in the political upheaval following Brexit may be faced with preferential trade agreements with the US, which could further threaten the self-sufficiency of the UK meat sector.

Demand-side and the factors affecting meat choice in the UK can be distinctive from the Czech Republic. The decline in meat consumption in the home and changes to consumption patterns have been linked to various factors such as consumer concerns over the impact of animal production on greenhouse emissions, animal welfare and concerns over the meat consumption on human health (Melina, Craig and Levin, 2016; Santeramo et al., 2018). Essential suggestions have been made within nutritional guidelines that encourage consumers to eat less meat, mainly processed meat products.

The meat production and patterns differ between the Czech Republic and the UK. British consumers prefer more beef and veal (11.4 kg per capita, 2019) and sheep meat (3.9 kg per capita, 2019) than the Czech consumers (9.1 kg beef and veal per capita, 2019; 0.4 kg sheep meat per capita,

2019). On the contrary, Czech consumers prefer pork meat (43 kg per capita, 2019) much more than British consumers (16 kg per capita, 2019). The consumption of poultry meat does not significantly differ between the Czech Republic and the UK (OECD, 2020; Czech Statistical Office 2020; meat consumption is measured in thousand tonnes of carcass weight). The differences are rooted in the history. Beef and sheep farming has a long tradition in the UK while large intensive pig farms has been typical type of farming in the Czechoslovakia since 50s/60s of the 20th century.

In the UK, beef is more consumed in the UK than a decade ago due to population growth. Nevertheless, per capita consumption remains relatively flat with any reduction yet to show in annual per capita figures. Sheep-meat (mostly lamb) consumption has seen a gradual decline in the UK for some time due to limited cooking versatility and a perceived higher price point. *“Although consumption has trended down 10% in the last decade, it is still much higher in the UK on a per capita basis than in many other developed nations, a legacy of the historic importance of the wool trade within Britain’s economy. Today consumers benefit from a high-quality product being readily available locally”* (Norton, 2020). Increasing productivity of pork and poultry farms reduced the production costs and price of pork and poultry meat and make them more affordable for Britons and partially substituted some of the beef and lamb within consumers’ baskets (Norton, 2020).

In the Czech Republic, pork meat consumption is relatively stable in the recent years. The beef meat consumption has been slightly increasing in the recent years but it is much lower than before 1990. The total production of beef in the Czech Republic has long exceeded domestic consumption (Ministry of Agriculture, 2020). The popularity of the poultry meat has increased in the Czech Republic for a long time but the Czech Republic is not self-sufficient in the poultry meat production. The main reasons why the consumption of beef meat dropped and the popularity of poultry meat increased in the Czech Republic in the last thirty years are dietary concerns (consumers prefer poultry meat to red meat) and price relations (poultry meat became cheaper due to large-scale production and the price pressure of foreign production).

Research suggests that dietary change can be facilitated through prices and taxation schemes and health food subsidies (Niebylski et al., 2015). Taxation of unhealthy food increases food prices

and changes consumer preferences towards healthier food. Unhealthy food taxes and healthy food subsidies should be a minimum of 10 to 15% and preferably used in tandem (Smed, Jensen and Denver, 2007). In their systematic literature review, Thow et al. (2010) confirmed that taxes and subsidies influenced consumption in the desired direction, with larger taxes being associated with more significant changes in consumption, body weight and disease incidence. This conclusion is relevant for multiple-nutrient studies which allowed for substitution between different kinds of food. However, other studies suggested that a single target food would as extant research had failed to appreciate that consumers would simply switch to alternative foods.

Indeed, previous research suggests that different socio-economic and demographic groups respond differently to any price adjustment as a consequence of taxation (Spicka and Naglova, 2017) and to assess how policymakers can influence choice there is a need for greater understanding of the dynamics of price changes within the spectrum of income brackets. Thus, this paper examines the extent to which an understanding of price sensitivity can be used to influence dietary and food choices because the price is an important factor in food choice, especially for low-income consumers which are significantly more conscious of value and price than higher-income consumers (Steenhuis, Waterlander and de Mul, 2011). The quantification of price sensitivity and consumption saturation for different income levels between consumers and countries brings new information about consumer behaviour. This study focuses on meat as an essential part of the human diet in dietary concerns.

The article aims to calculate income elasticity and consumption saturation of major groups of meat and meat products in the Czech Republic and the United Kingdom in different income groups of consumers. The purpose of the article is to show different consumer behaviour between ten different income levels (deciles) and different countries. The literature review revealed interesting topics which are worth to be investigated. Thus, the article measures the elasticity distance between income deciles in the UK and the Czech Republic, countries with different level of income and consumer preferences.

The comparison with the United Kingdom should reveal differences between countries with different purchasing power and consumption patterns. The United Kingdom is considered as a high-

income country (GDP per capita in PPS = 104 % of the EU 27 in 2019, Eurostat) compared to the Czech Republic (GDP per capita in PPS = 92 % of the EU 27 in 2019, Eurostat).

The results can help policymakers set some fiscal interventions to improve diets and food producers to forecast meat consumption in different customer segments. Alternatively, policymakers might consider regressive food taxes to make healthy foods for a low-income population more affordable. Producers and retailers can use income elasticity information in targeting promotional discounts (Kučerová and Zeman, 2013).

Theoretical background

The conceptual basis for the estimation of income and price elasticity is the neoclassical theory of consumer behaviour. Income elasticity of demand measures sensitivity of the quantity demand for a good or service to a 1% change in income, while other factors are constant (Benda Prokešová and Hanová, 2016). It is similar to price elasticity of demand which “describes the percentage by which the demanded quantity of a food changes in response to a 1% increase in the price of the food” (Green et al., 2013). It is an important indicator of past and future consumers behaviour, and it is closely related to the income distribution of the population. The comparison between monetary and natural income elasticity also enables to reveal preferences of meat quality (Hálová, 2006). In this context, the key concern of this paper is the demand for meat and meat products.

This paper particularly compares consumption patterns and the influence of price on consumption patterns in the UK and the Czech Republic between 2000 and 2017. The question emerges as to whether the manipulation of prices through taxation can alter the nature of consumption and dietary choice.

It is possible to distinguish inferior, normal, necessity, luxury and superior goods through income elasticity. The case study from Slovakia indicated that dairy products, fruits and vegetables are perceived as luxuries. On the other hand, cereals, meat and fish and other food are normal goods with positive budget elasticity smaller than one and price inelastic demand (Čupák, Pokrivčák and Rizov, 2015; Hupková, Bielik and Turčáková, 2009).

There are differences in income elasticity between low-income customers and high-income customers (Smed et al., 2007). It is vital to stress Engel's law (Pearce, 1986), which assumes a falling proportion

of income spent on food when income rises, even if absolute expenditure on food rises (less than proportionally). Engel curves vary by gender and householder education, the number of minor children and adults (Li, Song and Ma, 2015).

Much literature empirically estimates income or price elasticity of various goods in different regions (Clements and Si, 2016; Muhammad et al., 2017; Ren et al., 2018). They use various methods of elasticity estimation. Experimental studies are the widely used way how to estimate willingness-to-pay for goods and services. Their main advantage is that “the controlled nature of experimental settings can help to disentangle the effect of the pricing intervention from confounders” (Mizdrak et al., 2015). On the other hand, they “cannot be used in isolation to determine the effects of pricing interventions” (Mizdrak et al., 2015). Another study used sectional, cohort and quasi-experimental research methods, mostly used supermarket scanner surveys (Green et al., 2013).

An important finding from the systematic literature review is that demand for all food groups was more responsive to price changes in lower-income countries than higher-income countries (Green et al., 2013). Generally, all meat products’ income elasticities tend to decline as per capita income increases (De Zhou et al., 2018). The income elasticity also depends on the importance of particular food category in the consumption. For example, pork meat’s income elasticity, the most important meat consumed in China, declined faster with higher per capita income than the elasticity any other meat products (poultry, beef & mutton).

It has implications for the Czech Republic, where people are quite sensitive to price changes and look for discounts. Green’s literature review found the highest predicted price elasticities for meat in low-income countries the implication of the finding is twofold. First, the Czech government and food processors’ efforts to promote Czech products, which are mostly more expensive than imported food, can harm low-income groups. Second, at the aggregate level, “increases in food prices are likely to have a disproportionately greater impact on food consumption in low-income countries” (Green et al., 2013).

Alternative results can be found when calculating income elasticity in the high-income country, like in Sweden (Lundberg and Lundberg, 2012), not between high- and low- income countries.

In the high-income countries, additional income does not result in higher calories intake (as in low-income countries). Still, it may rather result in more aspirational spending towards diet diversification, improved quality, convenience, organic, fair trade, and animal welfare (Regmi and Meade, 2013). In the high-income country, the income elasticity is significantly higher for high-income households than in low-income households. Authors explain the effect by substitution of normal goods by exclusive goods when receiving an increase in income. This is an important difference from the low-income countries in Africa (Dubihlela, 2014). The difference in income elasticity between high- and low-income countries is also relevant for this study, which evaluates the differences between the United Kingdom (as a representant of the high-income country) and the Czech Republic (middle-income country) in Europe.

However, there are also significant differences in income elasticities across food and nutrient groups in low-income countries where people prefer basic diets, not exclusive food. Even in the low-income countries, the later research confirmed: “lower-income elasticities of basic foods compared to the less basic and more aspirational foods” (Colen et al., 2018). However, meat and fish consumption are no longer considered a luxury than in the past (Regmi and Meade, 2013).

Systematic literature review about price elasticity was conducted in the United States (Andrejeva, Long and Brownell, 2010). Authors found absolute value of mean price elasticity estimate at 0.75 for beef meat (0.67–0.83, 95% confidence interval), 0.72 for pork meat (0.66–0.78, 95 % CI) and 0.68 for poultry meat (0.44–0.92, 95% CI). The study points out the public health perspective. There is an area for investigation the cross-effects of price changes on substitutions from unhealthy to healthy food choices (e.g. from pork to poultry) or alternative substitutions.

Some empirical studies focus on the income elasticity of food in Central Europe and the UK. The income elasticity of meat and meat products’ expenditures varied between 0.372 in the highest quartile to 0.725 in the lowest quartile in Slovakia. Moreover, low-income households have unmet nutritional needs due to their low purchasing power. The income elasticity of bread and bakery products did not vary so much between income quartiles (Kubicová et al., 2011). Later study calculated income elasticity of meat at 0.915 on average by a different method (Cupák et al., 2015). Another

study focused on patterns, and preference changes in the consumer demand for meat in Slovakia showed that beef (2.162) and pork (1.027) were expenditure (income) elastic and hence could be considered as a luxury, while poultry (0.043) and fish (−0.345) were income inelastic meaning that those were of necessity” (Benda Prokešová and Hanová, 2016). In the Czech Republic, the income elasticity of meat and meat products was 0.8346 in the 1990s (Syrovátka, 2012), later study confirmed income elasticity of meat and meat products between 0.3 (pork meat) and 0.6 (beef) in the Czech Republic in 2004 (Hálová, 2006).

The study of food prices and household income in the UK confirmed lower-income elasticities for meat and fish than in Slovakia (De Agostini, 2014). The assumption is that the income elasticities of meat and meat products are higher in the Czech Republic than in the UK, indicating the relationships between food income elasticities in the EU study (Salotti et al., 2015). However, meat prices and income elasticities are more elastic than other food products such as dairy and eggs (Tiffin et al., 2011). Research in other countries such as Slovakia (Kubicová et al., 2011) a UK study suggests that price and income elasticity varies across socio-economic and demographic groups. Tiffin et al. (2011), based on findings within an earlier publication (Tiffin and Arnoult, 2010), find that price and income elasticities for meat for low-income families are lower than those of the total UK population. They conclude meat consumption in lower-income households in the UK are less affected by income changes than the national average (Tiffin et al., 2011). The literature also suggests that low incomes and children’s presence may have a negative impact on dietary quality (Tiffin and Arnoult, 2010). Similar results have been determined by Green et al. (Green et al., 2013) in a systematic review of over 162 different countries’ studies.

Studies about meat consumption in the UK have a strong focus on the effects of fiscal policy on a diet. The general conclusion is that “food taxes and subsidies have the potential to contribute to healthy consumption patterns at the population level” (Thow et al., 2010) but “the tax is insufficient to achieve this goal for fat intakes” (Tiffin and Arnoult, 2011). More impact evaluation is needed in developing countries.

The methodological problem related to the calculation of income elasticity is to select a suitable functional form. Different models are

used for stationary elasticity estimation, changing elasticities over time and relationships between income and price elasticities. When estimating the right functional form of the income/price elasticity, locally flexible functional forms have proved popular in empirical applications - indirect translog model (Christensen, Jorgenson and Lau, 1975), generalised Leontief, Fourier flexible demand model (Gallant, 1981), all explained by (Wohlgenant, 1984), and almost ideal demand system (AIDS).

The cross-effects between food and other goods or between different food categories can be captured through almost ideal demand system AIDS, developed by (Deaton and Muellbauer, 1980) and applied recently in the linear form, e.g., by Aftab, Yaseen and Anwar (2017), quadratic form (Konig and Dovadova, 2016) and generalised form (Hovhannisyan and Gould, 2014). The AIDS system has been widely used in the price- and income elasticity estimation because its properties in relation to the consumers’ preferences are well known (Ulubasoglu et al., 2015). However, “one drawback with this approach is the complexity of the demand system and the increasing number of parameters to be estimated as the number of equations and covariates increases” (Lundberg and Lundberg, 2012). An alternative approach is to estimate one single demand function where all other consumption determinants are regarded as the numeraire goods, recently described by (Lundberg and Lundberg, 2012). The approach enables to include many potentially important determinants of food demand and expenditure.

Time series analysis, especially cointegration and error correction (ECM) analysis, was applied by Türkekul and Unakitan (2011). This approach is useful when data about prices, income and consumption in various income groups are available in a sufficiently long time series. Using time-series here makes sense statistically to control the correlation in elasticity between different time points (Engle and Granger, 1987). We will follow this approach in the article.

Material and methods

The official statistic services provided data in the Czech Republic (Czech Statistical Office, 2020) and the UK (Office for National Statistics, 2020) because they are not publicly available. The Czech Republic uses representative household budget surveys (HBS) in approximately 3000

households (Czech Statistical Office, 2020). Selection of households for HBS had been made using a quota sampling technique till 2016. The quota frames used to be set following households' structure from EU-SILC Survey (national module of European Union – Statistics on Income and Living Conditions). The sampling and reporting unit of HBS was the private household whose members entered all expenses into diaries during the whole year. Diaries used to be structured according to international COICOP (Classification of Individual Consumption by Purpose) classification. Meat and meat products in the COICOP are classified in the following way; some items were joined because of data availability.

The Czech database was manually harmonised with Living costs and food survey (LCF). Like the HBS, data is collected for a sample of more than 5000 households across the United Kingdom using self-reported diaries (Office for National Statistics, 2020). The investigated product group – meat and meat products – includes the following groups of products.

- 01.1.2.2: Meat, fresh, chilled or frozen
 - **Beef** = Beef joints (on the bone); Beef joints (boned); Beefsteak (less expensive), Beefsteak (more expensive); Minced beef; All other beef and veal
 - **Pork** = Pork joints; Pork chops; Pork fillets and steaks; All other pork
 - Poultry = Chicken, uncooked (whole chicken or chicken pieces); Other poultry, uncooked (including frozen); Cooked poultry not purchased in cans
- 01.1.2.3: Meat, dried, salted, in brine or smoked
 - **Bacon and ham** = cooked, uncooked
- 01.1.2.4: Offal, blood and other parts of slaughtered animals, fresh, chilled or frozen, dried, salted, in brine or smoked
 - **Other meat and offal** = Liver of all animals; Other fresh, chilled and frozen meat; Mutton and lamb
- 01.1.2.5: Meat, offal, blood and other parts of slaughtered animals' preparations
 - **Canned meat, other meat-based products** = Sausages (uncooked); Meat pies and sausage rolls; ready to eat; Meat pies, pastries and puddings, frozen or not frozen; Burgers, frozen or not frozen; Ready meals

and convenience meat products; Pate and delicatessen type sausage; Meat pastes and spreads; Takeaway meats; Corned beef, canned or sliced; Other cooked meat; Other canned meat and canned meat products

Fish and seafood are not included because of their marginality in the Czech Republic. Meat and meat products do not include public catering and eating in restaurants. If we include the food outside the home in foodservice operations etc., then consumption of meat has risen in the UK. This is because more and more consumption takes place outside the home. That's the main limitation of the study.

Data about net monetary income, net monetary expenditures and natural consumption of meat and meat products per capita are divided by income deciles. For example, the first 10% decile covers 10 % of the households with the lowest income. We also calculated the unit price as the annual net monetary expenditure divided per capita by annual natural consumption. Deciles make the analysis more detailed than quintiles which have been usually published. Because monetary data from the Czech Republic and the UK are not comparable, they were converted to Euro through the Eurostat's official annual average exchange rate.

The time series starts in 2000 because of the strategic document Agenda 2000 that established pre-accession negotiations on EU enlargement (the Czech Republic joined the EU in 2004). Another reason is methodological. The Czech Statistical Office has used the COICOP classification since 1999/2000. The older data are not comparable. Due to major changes in methodology in the Czech Republic, the HBS time series was discontinued in 2016, but authors received an estimation by Czech Statistical Office for 2017. So, the time series covers 18 years (2000–2017).

To estimate the income elasticity of meat in the Czech Republic and the United Kingdom in different income groups of consumers, a cointegration analysis of time series was performed (Engle and Granger, 1987). We identified the cointegration analysis and separated the long-term relationships between the analyzed indicators from the short-term relationships using an error correction model (ECM).

Since our goal is to estimate elasticity and all analysed time series are non-stationary,

a cointegration regression model in logarithmic expression in the form of

$$\ln CON_t = \beta_0 + \beta_1 \ln INC_t + \varepsilon_t \quad \text{or} \\ \ln NME_t = \beta_0 + \beta_1 \ln INC_t + \varepsilon_t, \quad (1)$$

where CON is natural meat consumption (kg per capita per year), NME is average net money expenditure (monetary consumption per capita per year) and INC is annual average net money income per capita, β_0 a β_1 (β_1 expresses elasticity) are model parameters that we estimate through OLS and ε_t is a non-systematic component of the model with white noise properties.

Regression models of non-stationary time series are often burdened by so-called spurious regression. To eliminate this problem, we performed an Engle-Granger test of cointegration (Engle and Granger, 1987) using the ADF unit-root test (Dickey and Fuller, 1979). The last step of our analysis was to perform diagnostic tests on the estimated models, i.e. the Breusch-Godfrey test of autocorrelation (Breusch and Godfrey, 1986), the ARCH test of heteroscedasticity (Darnell, 1994) and the Jarque-Bera normality test (Jarque and Bera, 1980).

To estimate the saturation level, a_1 of the second Törnquist function was calculated (Hálová, 2015). A basic economic assumption is that if a disposable income increases, the consumption of considered estate will increase and vice versa. However, this statement is true only up to a specific income limit. To obtain such an income limit, when the consumption grows no longer further, we speak about a level of saturation with the given estate. The consumer is unwilling to spend his/her income to purchase such an estate and orientates to other goods. The second Törnquist function can be expressed in the following way.

$$y_i = a_1 \frac{x_p - a_3}{a_2 + x_p} \quad (2)$$

Parameters a_1 and a_2 were estimated by iterative gradient optimisation method (MS Excel solver).

To reveal the demand for quality, the authors calculated the difference between monetary and natural income elasticities (monetary minus natural elasticities). The greater the difference between income elasticity in monetary and natural expression, the more the consumer chooses better quality goods and vice versa. The consumer is willing to provide much higher expenditure on higher-quality goods with approximately the same demand in kind.

Results and discussion

Table 1 shows the estimates of the dependence of natural consumption on income (first part) and the dependence of net monetary expenditures on income (second part) for the UK. Table 2 then contains the same estimates for the Czech Republic. The second and third columns of the tables contain parameter estimates and their significance level (the elasticity parameter is highlighted). R^2_{adj} demonstrates the quality of the model. This is followed by a cointegration test (ADF test) and individual diagnostic tests on the estimated models. The last column, denoted by D, represents the year for which it was necessary to introduce the dummy variable in the case of a structural breakpoint in the analysed time series.

At the 5% significance level, the results show that the ADF test rejected the spurious regression in all models. Furthermore, the dependence of each pair of matching deciles of individual indicators was demonstrated in all models (statistically insignificant intercepts were left in the models for their comparability). Diagnostic tests show that the non-systematic component of the models is not autocorrelated, homoskedastic and has a normal distribution, i.e. it has white noise characteristics in all models.

Income is an important driving force that motivates people to change their consumption patterns. In the Czech Republic, the income elasticity in terms of natural consumption and net monetary expenditures is higher in first-decile households than in top-decile households. There are two possible reasons. Meat is a relatively expensive commodity, and wealthier consumers start to value health and environmental concerns (Vranken et al., 2014). Inter-deciles differences have no apparent trend in the UK. It confirms the empirical results that there is no clear relation between meat consumption and income. Still, there is a set of high-income countries where meat consumption is relatively low (Mathijs, 2015). Instead of the linear relationship between income and meat consumption, the authors suggested a non-linear, U-shaped relationship between meat consumption and income. "Initially, meat consumption increases with income, but from a certain point onwards higher levels of income lead to lower levels of meat consumption" (Mathijs, 2015; Vranken et al., 2014).

The income elasticity coefficient can be interpreted as a 1 per cent increase in the income is associated with a certain percentage decrease in quantity

dec.	$\hat{\beta}_0$		$\hat{\beta}_1$		R^2_{adj}	ADF		Breusch-Godfrey		ARCH		Jarque-Bera		D
	t	p-value	t	p-value		t	p-value	F	p-value	F	p-value	JB	p-value	
consumption of meat														
10	5.721	0.000	-0.209	0.018	0.275	-3.112	0.004	0.915	0.425	1.580	0.229	0.262	0.877	
20	8.429	0.000	-0.476	0.000	0.638	-3.017	0.005	0.616	0.555	0.852	0.372	0.693	0.707	
30	6.414	0.000	-0.255	0.008	0.342	-2.721	0.010	0.638	0.544	0.030	0.864	0.591	0.744	
40	6.584	0.000	-0.269	0.019	0.512	-2.430	0.019	1.691	0.222	0.058	0.814	4.307	0.116	2009
50	7.350	0.000	-0.340	0.001	0.473	-4.004	0.001	1.810	0.203	0.007	0.934	0.009	0.995	
60	6.466	0.000	-0.246	0.000	0.564	-4.724	0.000	0.262	0.774	0.007	0.934	1.023	0.600	
70	7.896	0.000	-0.381	0.001	0.509	-3.908	0.001	0.064	0.939	0.048	0.830	0.481	0.786	
80	7.372	0.000	-0.324	0.000	0.560	-4.074	0.001	0.526	0.603	1.249	0.283	0.423	0.809	
90	6.289	0.000	-0.217	0.012	0.555	-4.728	0.000	0.655	0.537	0.131	0.722	0.201	0.905	2005 2008
100	7.311	0.000	-0.301	0.008	0.343	-3.069	0.005	1.184	0.337	0.471	0.504	3.142	0.208	
net money expenditures														
10	-0.841	0.441	0.694	0.000	0.674	-2.734	0.010	1.306	0.304	0.516	0.484	1.333	0.513	
20	1.438	0.058	0.429	0.000	0.671	-3.106	0.004	1.008	0.392	0.140	0.714	0.245	0.885	
30	-2.413	0.002	0.822	0.000	0.919	-3.381	0.003	0.413	0.671	0.845	0.373	0.527	0.768	2000
40	-3.336	0.004	0.904	0.000	0.838	-3.137	0.004	0.235	0.794	0.293	0.597	0.565	0.754	
50	-3.351	0.036	0.896	0.000	0.697	-2.654	0.012	1.102	0.361	0.065	0.803	0.753	0.686	
60	-3.543	0.006	0.907	0.000	0.809	-2.054	0.042	3.210	0.074	0.652	0.433	0.553	0.758	
70	-2.476	0.051	0.794	0.000	0.751	-2.264	0.027	1.719	0.218	0.148	0.706	0.379	0.827	
80	-2.131	0.068	0.753	0.000	0.763	-2.776	0.010	1.048	0.378	0.481	0.499	2.785	0.248	
90	-3.620	0.001	0.884	0.000	0.877	-3.413	0.002	0.483	0.627	0.989	0.337	0.263	0.877	
100	-2.433	0.134	0.741	0.000	0.638	-3.222	0.003	0.231	0.797	1.245	0.283	0.931	0.628	

Source: own calculations

Table 1: Income elasticity coefficients of meat consumption in the UK.

dec.	$\hat{\beta}_0$		$\hat{\beta}_1$		R^2_{adj}	ADF		Breusch-Godfrey		ARCH		Jarque-Bera		D
	t	p-value	t	p-value		t	p-value	F	p-value	F	p-value	JB	p-value	
consumption of meat														
10	-1.768	0.025	0.494	0.000	0.784	-2.221	0.030	2.517	0.119	0.241	0.631	0.109	0.947	
20	0.829	0.123	0.264	0.000	0.748	-3.350	0.002	1.397	0.285	0.225	0.642	0.813	0.666	2008
30	-0.050	0.934	0.354	0.000	0.742	-4.393	0.000	0.983	0.400	0.238	0.633	1.321	0.517	
40	0.644	0.251	0.297	0.000	0.708	-2.474	0.017	1.601	0.242	1.851	0.195	1.089	0.580	2016
50	0.225	0.762	0.334	0.000	0.632	-2.377	0.021	1.373	0.288	0.040	0.844	0.800	0.670	
60	1.268	0.058	0.244	0.000	0.561	-2.598	0.013	0.699	0.515	0.020	0.891	0.523	0.770	
70	-0.491	0.322	0.390	0.000	0.851	-5.432	0.000	0.717	0.506	1.635	0.222	0.050	0.975	
80	0.257	0.713	0.329	0.000	0.665	-3.148	0.004	0.261	0.775	1.868	0.193	0.164	0.921	
90	1.395	0.055	0.233	0.001	0.511	-3.737	0.001	0.014	0.986	0.475	0.502	0.235	0.889	
100	1.897	0.000	0.188	0.000	0.681	-2.787	0.009	0.543	0.594	0.420	0.527	2.024	0.363	
net money expenditures														
10	-2.092	0.001	0.925	0.000	0.961	-3.052	0.005	1.148	0.347	0.096	0.762	0.669	0.716	
20	0.657	0.280	0.675	0.000	0.914	-5.339	0.000	0.001	0.999	2.480	0.138	0.727	0.695	
30	0.522	0.451	0.693	0.000	0.897	-2.333	0.024	0.672	0.528	1.502	0.241	0.443	0.801	
40	1.646	0.003	0.597	0.000	0.930	-2.595	0.014	2.151	0.156	0.151	0.703	0.102	0.950	
50	0.891	0.205	0.662	0.000	0.891	-3.119	0.004	0.812	0.465	1.971	0.182	0.173	0.917	
60	1.733	0.002	0.589	0.000	0.937	-2.763	0.010	1.165	0.343	0.308	0.588	0.538	0.764	
70	0.657	0.351	0.675	0.000	0.895	-2.773	0.009	0.931	0.419	0.392	0.541	1.215	0.545	
80	0.857	0.252	0.656	0.000	0.881	-2.714	0.010	1.645	0.231	0.119	0.735	0.571	0.751	
90	1.571	0.022	0.593	0.000	0.895	-3.127	0.004	1.116	0.357	0.123	0.731	1.431	0.489	
100	2.343	0.000	0.517	0.000	0.909	-2.603	0.013	2.344	0.138	0.256	0.621	0.715	0.699	2001, 2013

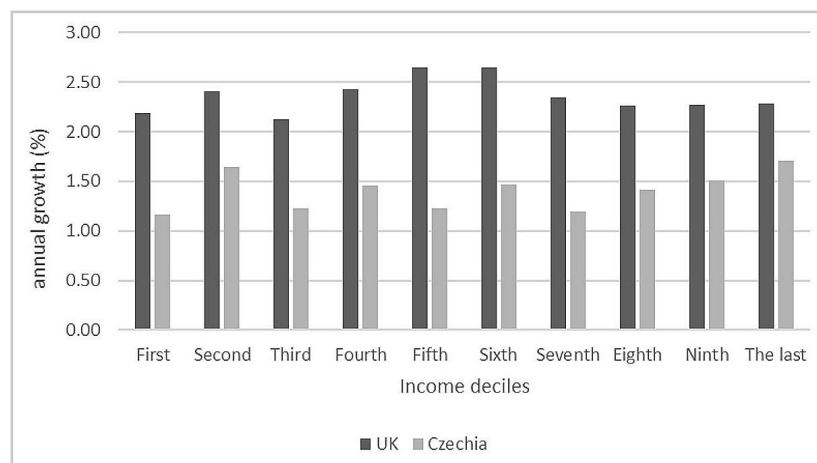
Source: own calculations

Table 2: Income elasticity coefficients of meat consumption in the Czech Republic.

demand (sales), on average. For example, when considering the first income decile and natural meat consumption in the Czech Republic, the elasticity is 0.494. So, a 1 per cent increase in the income is associated with a 0.494 per cent increase in quantity demanded. The elasticity calculated from the net money expenditures is always higher than elasticity based on natural consumption because of price-related effects.

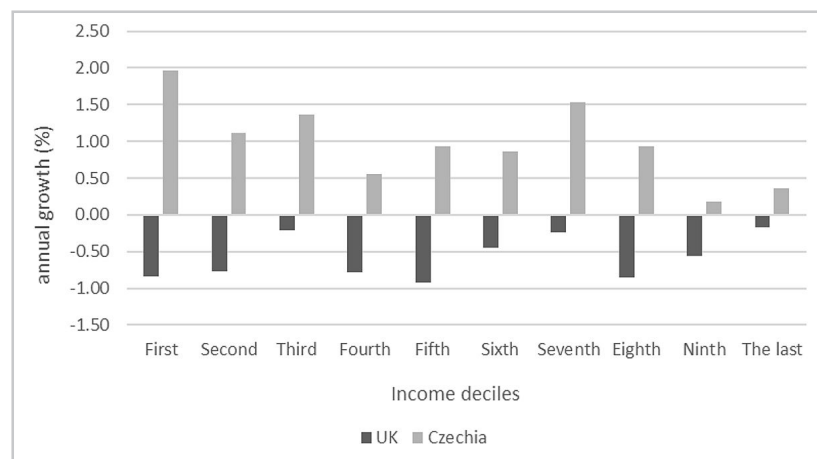
At first glance, there is a big difference in the income elasticity of natural consumption between the two countries. The income elasticity of meat is positive in the Czech Republic ranging between 0.188 and 0.494; the UK has negative income elasticity from -0.476 to -0.209. However, the income elasticity of net money expenditures is positive in both countries. The chief cause of the discrepancy between income elasticity of natural consumption and net monetary expenditures is the UK's unit price (Figure 1).

Figure 1 clearly shows the higher price growth of meat in the UK than in the Czech Republic in all income deciles. However, the UK's meat consumption declines in the long term in all income deciles, as Figure 2 presents. The more detailed statistics revealed that the decline of red meat consumption was more dynamic than poultry meat consumption in most income deciles in the UK. Alternatively, there is a positive relationship between income development and meat consumption in the Czech Republic. Thus, the results indicate completely different dietary trends between the two countries. Increasing evidence suggests that a final shift occurs, following behavioural change towards consuming higher-quality fats, more whole grains, fruit and vegetables, and particularly less meat in high-income and developed countries, such as the UK (Mathijs, 2015). This process is called nutrition transitions (Popkin, 2006). There are various factors which can cause a downward trend



Source: authors

Figure 1: Average annual growth of per-unit meat prices (%).



Source: authors

Figure 2: Average annual growth of natural meat consumption (%).

in meat consumption in high-income countries.

The possible explanation of different consumption trends in the Czech Republic and the UK can be found in saturation level and different demand for quality. Tables 3 a 4 present differences between monetary and natural income elasticities in both countries.

The differences are similar in the lower-income deciles in both countries but significantly differ in higher-income deciles between the Czech Republic and the UK. The critical finding is that

consumers with above-average income in the UK prefer quality much more than the same groups in the Czech Republic. Nevertheless, the demand for quality has increased in all income groups in the Czech Republic and lower-income groups in the UK. Alternatively, the higher-income groups in the UK have not increased the demand for quality in the long period since they are nearly saturated (Table 5).

In the UK, the saturation limit is lower than in the Czech Republic, and consumers focus

CZ	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Trend (geo-mean)
First 10 %	0.052	0.060	0.063	0.061	0.068	0.074	0.060	0.063	0.067	0.062	0.050	0.049	0.050	0.047	0.050	0.056	0.063	0.073	102.0
Second 10 %	0.057	0.066	0.070	0.067	0.076	0.083	0.069	0.075	0.079	0.075	0.059	0.060	0.062	0.058	0.060	0.068	0.076	0.090	102.7
Third 10 %	0.059	0.069	0.073	0.071	0.079	0.087	0.073	0.080	0.084	0.081	0.063	0.065	0.066	0.062	0.064	0.073	0.080	0.097	102.9
Fourth 10 %	0.061	0.070	0.074	0.072	0.081	0.089	0.076	0.084	0.088	0.085	0.066	0.067	0.069	0.065	0.066	0.076	0.083	0.100	103.0
Fifth 10 %	0.062	0.072	0.076	0.074	0.083	0.091	0.078	0.087	0.091	0.089	0.068	0.070	0.071	0.067	0.068	0.079	0.085	0.104	103.1
Sixth 10 %	0.063	0.073	0.077	0.075	0.085	0.093	0.081	0.089	0.094	0.093	0.070	0.072	0.073	0.069	0.069	0.081	0.088	0.109	103.3
Seventh 10 %	0.064	0.074	0.079	0.077	0.086	0.096	0.084	0.093	0.098	0.098	0.072	0.076	0.075	0.072	0.071	0.084	0.090	0.114	103.5
Eighth 10 %	0.065	0.075	0.080	0.078	0.088	0.098	0.087	0.097	0.103	0.105	0.076	0.080	0.078	0.075	0.073	0.088	0.094	0.120	103.7
Ninth 10 %	0.065	0.076	0.081	0.080	0.090	0.101	0.091	0.101	0.107	0.112	0.079	0.084	0.080	0.079	0.076	0.092	0.097	0.128	104.0
The last 10 %	0.063	0.074	0.080	0.079	0.089	0.101	0.094	0.106	0.113	0.124	0.082	0.091	0.083	0.084	0.077	0.097	0.099	0.138	104.7

Source: own calculation

Table 3: Differences between monetary and natural income elasticities in the Czech Republic.

UK	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Trend (geo-mean)
First 10 %	0.036	0.053	0.052	0.069	0.047	0.078	0.065	0.054	0.060	0.055	0.046	0.051	0.060	0.057	0.062	0.057	0.063	0.062	103.2
Second 10 %	0.062	0.083	0.086	0.108	0.077	0.118	0.104	0.086	0.099	0.087	0.077	0.080	0.093	0.093	0.103	0.097	0.105	0.103	103.1
Third 10 %	0.082	0.103	0.109	0.132	0.094	0.141	0.127	0.106	0.124	0.106	0.096	0.097	0.109	0.112	0.124	0.111	0.119	0.117	102.1
Fourth 10 %	0.103	0.123	0.128	0.154	0.111	0.162	0.146	0.125	0.145	0.123	0.112	0.113	0.127	0.128	0.142	0.127	0.136	0.134	101.6
Fifth 10 %	0.122	0.141	0.145	0.175	0.126	0.180	0.165	0.142	0.164	0.140	0.127	0.129	0.144	0.143	0.158	0.143	0.142	0.150	101.2
Sixth 10 %	0.144	0.162	0.163	0.195	0.141	0.199	0.184	0.161	0.183	0.157	0.144	0.147	0.162	0.161	0.177	0.161	0.168	0.168	100.9
Seventh 10 %	0.167	0.183	0.183	0.218	0.159	0.220	0.204	0.181	0.204	0.176	0.164	0.167	0.181	0.180	0.197	0.181	0.181	0.188	100.7
Eighth 10 %	0.200	0.208	0.205	0.242	0.180	0.243	0.228	0.206	0.233	0.198	0.189	0.190	0.203	0.201	0.220	0.206	0.212	0.212	100.3
Ninth 10 %	0.252	0.246	0.236	0.276	0.211	0.278	0.263	0.239	0.272	0.230	0.224	0.224	0.235	0.233	0.251	0.237	0.239	0.243	99.8
The last 10 %	0.492	0.363	0.337	0.364	0.319	0.369	0.355	0.348	0.376	0.318	0.328	0.338	0.329	0.318	0.325	0.329	0.323	0.335	97.8

Source: own calculation

Table 4: Differences between monetary and natural income elasticities in the UK.

	Monetary (USD/cap)		Natural (kg/cap)	
	CZ	UK	CZ	UK
Saturation limit	628.4	494.4	86.8	54.2
The share of consumption to the saturation limit				
First 10 %	40.3%	62.2%	46.4%	87.8%
Second 10 %	48.4%	71.9%	53.5%	94.3%
Third 10 %	57.0%	75.2%	64.0%	96.3%
Fourth 10 %	60.8%	75.3%	67.4%	95.9%
Fifth 10 %	63.4%	78.2%	70.8%	96.2%
Sixth 10 %	65.6%	81.6%	71.4%	97.9%
Seventh 10 %	66.5%	85.9%	71.3%	98.3%
Eighth 10 %	70.4%	88.8%	75.6%	98.7%
Ninth 10 %	75.0%	94.6%	78.2%	98.7%
The last 10 %	78.8%	100.0%	80.2%	93.9%

Source: own calculation

Table 5: Saturation limit and the share of consumption to saturation limit (%) in monetary and natural expression (average of 2000–2017).

on other goods and services. In the Czech Republic, there is a potential to increase monetary and natural expression consumption, not in the UK where the saturation level was nearly reached.

Firstly, there are the impacts culture and tradition on preferred food choice and the choice of meats between the UK and the Czech Republic. The UK consumers prefer beef, poultry, fish and tinned meat while the most favourite meat of Czech consumers is pork and poultry meat. The Czech Republic is landlocked and does not have access to fresh seafood.

A second factor can be identified from recent studies, which have shown that the mortality rate could be affected by high intake of both red and processed meat whilst there are no or only moderate inverse associations observed for poultry (Etemadi et al., 2017; Wang et al., 2016). However, the results may be biased as high meat intakes may be associated with other major risk factors such as smoking, alcohol consumption and obesity. The most substantial evidence was found in association with colorectal cancer. Red meat is classified as probably carcinogenic to humans (Bouvard et al., 2015). Processed meat consumption also seems to be associated with risk for cardiovascular disease (Rohrmann et al., 2013) and chronic diseases such as diabetes and obesity (Wolk, 2017).

Additionally, meat consumption is associated with the level of income and wellbeing. “In high-income Western countries, a lower meat intake may

be a marker of a health-conscious lifestyle, but in low-income countries, lower meat intakes are more likely to be markers of poverty and associated with other risk factors for poor health” (Godfray et al., 2018). Moreover, people in low-income countries often have limited access to alternative nutrient-dense foods.

The economic impacts of red meat consumption are closely associated with nutritional and environmental issues. The consumption of different types of meat and meat products has significant effects on people’s health, and livestock production can negatively affect the environment. Thus, the taxation of unhealthy food is a topical issue in developed countries. Attempts to change diets through fiscal interventions also lies within a rational choice framework. For example, a coalition of the UK’s health professions has called for a climate tax imposed on food with a heavy environmental impact by 2025, unless the industry takes voluntary action on the impact of their products. Denmark operated a tax on the 49% saturated fat content of foods between 2011 and 2012, raising prices of some meat products by 15% (Godfray et al., 2018). A recent study estimated that “under optimal taxation, prices for processed meat increased by 25% on average, ranging from 1% in low-income countries to over 100% in high-income countries, and prices for red meat increased by 4%, ranging from 0.2% to over 20%. Consumption of processed meat decreased by 16% on average, ranging from 1% to 25%, whilst red meat consumption remained stable

as a substitution for processed meat compensated price-related reductions” (Springmann et al., 2018). Optimal taxation will also reduce the number of deaths attributable to red and processed meat consumption and save health costs globally (Springmann et al., 2018). Another study, however, concluded that meat consumption is difficult to influence through direct policy intervention. “Acting indirectly on consumers’ preferences and consumption habits (for instance through information, education policy and increased availability of ready-made plant-based products) could be of key importance for mitigating the rise of meat consumption per capita all over the world” (Milford et al., 2019).

People in high-income countries have become more concerned about the impact of meat production on the environment. The FAO study provided evidence that meat produces more emissions per unit of energy than plant-based agriculture (Gerber et al., 2013). Ruminant production produces more emissions than that of nonruminant mammals and poultry. In contrast, intensive rearing tends to produce fewer GHG emissions than more extensive systems per unit of output despite having other environmental disadvantages (Godfray et al., 2018). Livestock production is also associated with water consumption. The study on livestock production’s water footprint showed that beef farming is more water demanding than chicken production per kilogram of meat (Mekonnen and Hoekstra, 2012). Alternatively, replacing cropland with permanent pasture is one practice promoted for its potential to sequester soil carbon, i. e. particularly in hill farming or farming on marginal land. There is an argument that continued permanent pasture even where there are ruminants present a carbon zero scenario. Overall, public interventions in the form of nutrient tax to reduce red meat consumption would positively impact greenhouse gas emissions (Farchi et al., 2017; Harding and Lovenheim, 2017).

Finally, there is a growing concern within the younger generation concerning husbandry practices and animal welfare. Positive attitudes towards animal welfare are associated with consuming less meat and greater ‘higher welfare’ meat purchases (Clonan et al., 2015). There is an increasing trend of veganism, vegetarianism, and flexitarians. The research on the association of animal health concerns with diet choice provided evidence that contrast between flexitarians and vegetarians is greater than the contrast between

flexitarians and full-time meat-eaters (De Backer and Hudders, 2015).

Conclusion

The article’s purpose was to point out the difference in consumer behaviour between ten different income levels (deciles) across two countries: the Czech Republic and the UK. The two countries have different consumer preferences and income level. Meat consumption has been widely discussed because of environmental and health impacts, especially in the case of red meat.

The most influential finding is a big difference in the income elasticity of natural consumption between the two countries. The income elasticity of meat consumption is positive in the Czech Republic, while the UK has negative income elasticity. In other words, the natural consumption of meat increased with incomes grew in the Czech Republic. In contrast, there appears to be a diametric relationship between meat and income had in the UK. Nonetheless, the income elasticity of net money expenditures is positive in both countries. The chief cause of the discrepancy between income elasticity of natural consumption and net monetary expenditures is the higher unit price found in the UK. There was a higher price increase in the UK than in the Czech Republic in all income deciles.

The meat consumption patterns differ between the Czech Republic and the UK. Britons prefer beef, veal and sheep meat while pork meat is much more popular in the Czech Republic. Moreover, the UK’s meat consumption is nearly saturated, and consumers in higher-income deciles are looking for high-quality meat much more than the same groups in the Czech Republic. The demand for quality has been increasing in all income groups in the Czech Republic and lower-income groups in the UK, which is an important signal for meat processors.

The results provide evidence that consumers in the UK are close to consumption saturation prefer high-quality meat which could have positive nutritional effects. Moreover, high-income countries discuss taxation of unhealthy food, which could lead to significant health and environmental benefits, particularly in high and middle-income countries, as recent studies found it.

In the Czech Republic, the income elasticity in terms of natural consumption and net monetary

expenditures is higher in first-decile households than in top-decile households. The Czech case explains the popularity of discount campaigns in low-income households, especially households of seniors. On the contrary, the inter-deciles differences have no evident trend in the UK, which indicates the overall downward trend of household meat consumption. The article indicates completely different trends of human diet between the two countries. It supports the theory of nutrition transitions when the UK as a high income country is gradually changing consumer behaviour toward a healthy, high-quality and balanced diet.

The article's main limitation is that it doesn't include the food outside the home in food service

operations. Then the consumption of meat has risen in the UK. This is because more and more consumption takes place outside the home. Further research could follow this trend.

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