TRANSITIONING TOWARDS A MORE SUSTAINABLE DIET: RED AND PROCESSED MEAT CONSUMPTION IN ITALIAN HOUSEHOLDS

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Abstract. Food-consumption habits are central to both the health and environmental debates. In particular, meat production and consumption are major concerns due to the impact of livestock on global warming and environmental degradation. The Food and Agriculture Organization (FAO) reports that livestock farming accounts for a significant share of anthropogenic greenhouse gas emissions, highlighting the need to shift diets to limit these emissions. Promoting healthier, more sustainable diets is seen as a way to mitigate climate change and global temperature rise, making red and processed meat a key factor. In this contribution, we measure changes in red and processed meat consumption in Italy over the decade 2012-2022 and examine the socio-demographic and household factors associated with these eating behaviours. We use data collected by the Italian National Institute of Statistics through the *Aspects of Daily Life* Multipurpose Survey. We first assess the effects of age and individual propensity on variation in red and processed meat consumption using the Kitagawa decomposition. We then define two indicators to capture the individual environmental sensitivity and explore how these, along with household and other behavioural factors, relate to individual propensity. We identify several significant household-level factors, such as household size, and individual-level characteristics, including environmental sensitivity.

1. Introduction

Food consumption habits are central to the current environmental and health-related debate. In particular, meat production and consumption have become significant concerns due to the impact of livestock on global warming and environmental degradation. The Food and Agriculture Organization (FAO) reported that livestock farming accounts for a significant proportion of anthropogenic greenhouse gas emissions (FAO 2017), highlighting the importance of shifting diets to reduce emissions. The importance of diets is also advocated by the Intergovernmental Panel on Climate Change, which recognises positive effects of diets which are high in coarse grains, pulses, fruits and vegetables, nuts and seeds, and low in energy-intensive animal-sourced foods (IPCC, 2019). Consequently, consumption of meat analogues such as imitation meat from plant

products, cultured meat, and insects is evoked as a means to contribute to the transition to healthier and sustainable diets (ICPP Special report, 2019, chapter 5).

Historically, nutrition played an important role in analysing survival patterns across European countries facing demographic crises (Livi Bacci, 1987). Today, nutrition remains relevant not only in the environmental context but also amid significant socio-demographic changes. The recent shift toward a longevity society is then emphasizing healthy ageing, which can be supported by proper diets (Suresh *et al*., 2022). The ageing population is reshaping family structures especially in Italy (Vitali *et al*., 2025) and influencing consumption patterns (Micheli, 2013; Mori and Clacson, 2004; Lagström *et al.*, 2025). At the same time, the growing focus on climate change and sustainability (PNRR - Mission 2, Green Deal, Repower EU) encourages more sustainable food and resource consumption (ISTAT, 2023b). In the Italian context, the Osservatorio Senior has linked food consumption to the concept of "silver ecology," highlighting the role of seniors in sustainable development (Osservatorio Senior, 2021). As a result, meat consumption is increasingly being studied at the intersection of environmental sustainability and demographic trends.

Building on these considerations, several countries, including Italy, monitor food consumption as part of regular multipurpose surveys. The Italian National Institute of Statistics (ISTAT), for instance, has traditionally included nutrition among its indicators related to health risks and lifestyle factors (ISTAT, 2023a). In this contribution, we use Italian data to explore the potential factors associated with the consumption of red and processed meat[1]. In particular, we aim to explore the trend in red and processed meat consumption, and break it down into structural vs. behavioural reasons, including environmentally conscious behaviours.

2. Literature Review and Research Hypotheses

The high production of red and processed meat is a function of its high consumption in many developed countries, which is itself highly dependent on population size and age composition. Relations between demographic change, environmental sensitivity, and individuals' prevention have been studied from different perspectives in several countries in the Northern world. However, the literature on the effect of population structure on meat consumption and environmental sensitivity is limited. Some studies have highlighted that individuals

[1]Red meat refers to unprocessed mammalian muscle meat—for example, beef, veal, pork, lamb, mutton, horse, or goat meat—including minced or frozen meat; it is usually consumed cooked. Processed meat refers to meat that has been transformed through salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation (IARC, 2018).

with greater environmental concern and awareness tend to engage in reduced red meat consumption and are more inclined toward sustainable purchasing choices (Boehm *et al*., 2019; Coker and van der Linden, 2022). Other studies using varied methods, ranging from 24-hour dietary recalls to cross-sectional surveys, consistently linked measures such as reduced meat consumption or a lower share of red meat spending with higher environmental awareness (Coker and van der Linden, 2022; Bimbo, 2023; Slotnick *et al*., 2023). These findings indicate that, when measured across diverse populations and methods, environmental consciousness relates quantitatively to lower red meat consumption and increased sustainable food purchasing behaviours.

Di Novi and Marenzi (2022) used Italian survey data from 1997 to 2012 to explore patterns of meat consumption across generations, cohorts and household types. They used an approach that involves age, period, and cohort effects to disentangle the effect of generations on adherence to the Mediterranean diet. In addition, Lo Riso (2021) showed that social networks (as TikTok or Instagram) can be considered a positive driver for combating the global excess of meat consumption, especially for veganism and vegetarianism. Using a 2017 Finnish study, Sares-Jaske *et al*., (2022) found red and processed meat consumption to be more common in men and in 35–54 year-olds, in those living in rural areas and in those with lower education.

Studies investigating the relationship between families with and without children and red meat consumption have produced contradictory results. Some studies reported that households with children consume less red meat or have more diverse protein sources, while others found that these households are less likely to exclude red meat (Merlino *et al*., 2017; Gunte *et al*., 2020).

Moving from the above-cited literature, we contribute by using more recent Italian data to investigate the following hypotheses.

Hypothesis 1: In Italy, the consumption of red and processed meat has decreased over the past years. Changes in individual behaviour drive this decline, while demographic changes have played only a marginal role.

Hypothesis 2: Changes in red and processed meat consumption are also linked to shifts in family structure. We hypothesize that households with children tend to consume more red meat, due to practical considerations, cultural traditions, and the nutritional needs associated with child growth and development.

Hypothesis 3: Individual environmental sensitivity is associated with reduced red meat consumption.

3. Data and Methods

We use data from the annual household survey, *Aspects of Daily Life*, conducted by ISTAT since 1993 as part of its Multipurpose Survey system. Each year, the survey interviews approximately 20,000 households, encompassing around 50,000 individuals. Given that food consumption habits tend to evolve gradually, we focus on two well-separated time points, namely 2012 and 2022, to capture meaningful changes. We consider only people aged 18+ who live in mononuclear households, amounting to a total sample size of 35,916 for 2012 and 38,751 for 2022. The survey includes several items related to dietary habits, and for the purpose of this study, we focus specifically on the consumption of cold cuts, pork and beef. The reduction in their consumption across the two considered years is evident in Figure 1. Starting from this, for each meat type, we construct a variable that takes the value 1 if the respondent reported consuming cold cuts, pork and beef, at least "some time a week" (regular consumption) and 0 otherwise, giving rise to three binary indicators. We note that, although dichotomization entails a loss of information, aggregations of categories are common in this context (Di Novi & Marenzi 2022) and facilitate the interpretability of the results and models.

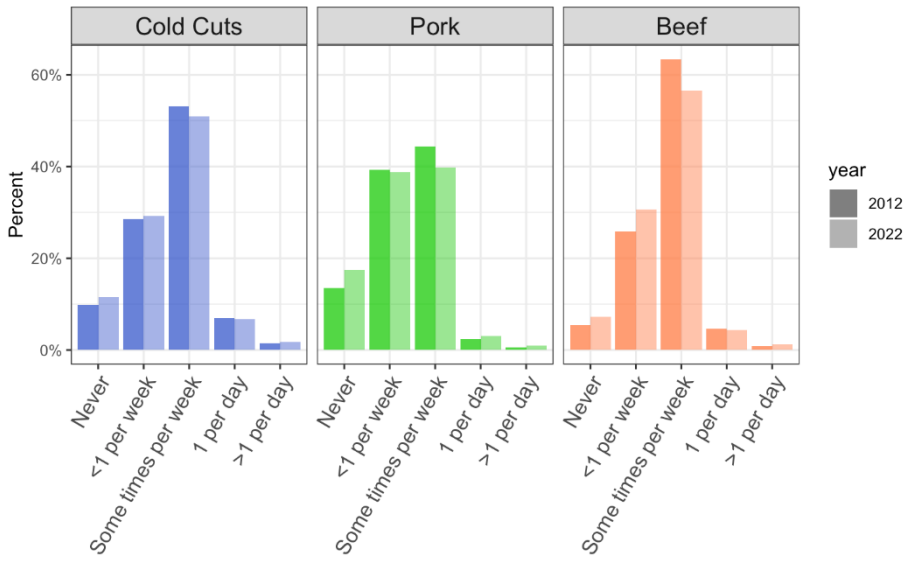
To disentangle the effects of age structure and individual propensity in eating behaviours, we follow an application of the seminal work of Kitagawa (1955), shown in Rivellini and Clerici (2013).

This decomposition method enables us to break up the amount of overall percentage variation observed in each type of meat consumption between 2012 and 2022 into components which reflect differences in specific rates of consumption of the eight age groups (propensity effect), differences in their age composition (structural effect) and differences in the interaction effects between age structure and propensity to consume (interaction effect).

Since we expect propensity to play a significant role (Hypothesis 1), we will then proceed to explore demographic and non-demographic factors associated with the consumption of cold cuts, pork, and beef using logistic regression models.

More specifically to explore our second hypothesis we consider, among the covariates, the household type (HT), classified as “Couple with no children”, “Couple with children”, “Single without children” and “Single with children”, and the role within a household (“parent” or “kid”). With reference to Hypothesis 3, we proposed two variables representing, respectively, two domains of individual environmental sensitivity: one which refers to behaviour when grocery shopping, named Grocery Environmental Behaviour (GEB), and the other one which measures the behaviour in other everyday activities, named Everyday Environmental Practices (EEP).

Figure 1 - *Frequency distribution of cold cuts, pork and beef consumption.*



The GEB is a composite indicator with four levels (0, 1, 2, and 3), which is based on answers to the following three questions: (i) how often do you read labels on food products? (ii) How often do you buy organic products? (iii) How often do you buy local products? The value "0" represents no attempt to grocery shop in an environmentally friendly way and it indicates someone who did not answer "Regularly" to all three questions; the value "1" is if they answered "Regularly" to only one of the three questions, the value "2" if the answered "Regularly" to two questions and the value "3" if they answered "Regularly" to all three questions. The EEP is a composite indicator with 5 levels (0, 1, 2, 3, 4) which is based on the answers on the following four questions: (i) how often do you pay attention to saving water?; (ii) how often do you pay attention to saving electricity?; (iii) how often do you use a means of transportation alternative to the car?; (iv) how often do you not use disposable products (plastic bags, paper towels, etc). Similarly to the previous indicator described, 0 represents an individual who does not engage in any of the above on a regular basis, and 4 represents someone who engages in all four activities on a regular basis. We note that the two indicators should remain separate since results on several dependence measures show there is very little dependence between the two.

4. Results

4.1 Kitagawa decomposition

Table 1 shows that the consumption of the three types of red meat varies by age, with older individuals consuming less. Table 1 also shows that, from 2012 to 2022, consumption decreased across all three meat products considered and across all age groups considered. This reduction is particularly noticeable among individuals aged 55 to 64. For the oldest age groups, consumption of red and processed meat remains approximately constant. Beef is the meat product for which we observe the largest decrease, although it was also the highest in both 2012 and 2022.

Table 1 - *Incidence of cold cuts, pork and beef by age group in the Italian population aged 18+, 2012 and 2022 (%) (weighted data).*

	Cold Cuts		Pork		Beef	
Age class	2012	2022	2012	2022	2012	2022
18-24	72.1	67.8	57.4	50.4	72.8	69.5
25-34	66.4	62.1	51.3	48.8	71.4	64.8
35-44	66.0	61.9	50.2	46.1	72.0	64.7
45-54	64.0	62.0	47.5	44.3	69.7	61.9
55-59	60.7	58.2	43.8	41.5	67.6	57.9
60-64	58.9	55.1	44.3	39.1	64.4	57.4
65-74	55.5	56.2	44.0	42.2	65.4	61.3
75 and more	45.3	52.1	37.7	38.5	63.6	59.4
Total (18 +)	61.5	59.4	47.3	43.8	68.8	62.1

From a demographic perspective, significant disparities in the age structure have emerged over the observed decade, reflecting the combined effects of persistently low fertility and increasing longevity (AISP, 2021, Chapters 1 and 4; AISP, 2025, Chapters 1 and 5). Although meat consumption has declined across all age groups, in 2022, older individuals, who generally consume less red and processed meat, represented a larger share of the population than in 2012. Thus, we use the Kitagawa decomposition to investigate whether the overall reduction in consumption between 2012 and 2022 is primarily due to changes in the population's age structure or to shifts in individuals' propensity to consume these meat products.

The results in Table 2 show that the total variation in cold cuts, pork and beef consumption is almost entirely attributable to the propensity. More specifically, for beef, the overall 6.67% drop is primarily driven by a decrease in consumption propensity (-6.3%), with smaller contributions from demographic changes (-0.39%) and a slight opposing interaction effect (+0.02%). Cold cuts exhibit a 2.08% reduction, primarily due to a decrease in propensity (-1.67%) and demographic changes (-0.73%), offset slightly by the interaction between the two effects (+0.32%). Pork consumption fell by 3.40%, with the decrease attributed mainly to lower propensity (-2.99%) and demographic shifts (-0.55%), partly balanced by a small interaction effect (+0.14%).

Table 2 - *Kitagawa decomposition of the overall variation (2012-2022) in cold cuts, pork and beef consumption rates (weighted data).*

Type of meat	Total variation (%)	Structural effect (%)	Propensity effect (%)	Interaction effect (%)
Cold cuts	-2.08	-0.73	-1.67	0.32
Pork	-3.4	-0.55	-2.99	0.14
Beef	-6.67	-0.39	-6.3	0.02

4.2 Logistic regression

The lower propensity to consume red meat products raises important questions about the factors associated with this behaviour. To this end, we focus on 2022, as it is the year with the lowest observed meat consumption. We run three logistic models using each of the three meat consumption indicators on regular consumption. We controlled for age, sex, perceived economic status, residential area, perceived health, physical activity, and education.

The main results of the three models are represented in Table 3. Both environmental sensitivity indicators (GEB and EEP) are statistically significant in all three models, with the highest categories being the most significant. However, there seems to be differences between the types of meat, with beef being less subject to environmental sensitivity. In terms of household structure, couples with children tend to consume more red meat products than couples without children. Considering couples without children as the baseline, singles tend to eat less meat, especially less beef, while single parents who live with their children tend to have a meat consumption more similar to that of couples without children. It therefore seems that household composition is a relevant predictor of food habits and may be used to explain the observed decrease throughout time (*Hypothesis 2*). In contrast to this result, the coefficient estimated for an individual's role in the household indicates

that children tend to eat fewer red meat products than their parents. While this result could explain the contrasting findings in the literature, it could also suggest a generational shift.

Among the control variables, Sex appeared crucially interesting and in line with the literature, where women consumed significantly less red and processed meat.

Table 3 - *Logistic regression models: coefficient estimates and significance level. (*p-value <0.05, ** p-value < 0.01, *** p-value < 0.001).*

Variable		Model 1: Cold cuts	Model 2: Pork	Model 3: Beef
Age (ref: 35-59)				
	20-34	0.221***	0.267***	0.232***
	60+	-0.259***	-0.211***	-0.125***
Sex (ref: M)				
	Female	-0.429***	-0.321***	-0.295***
Perc. Econ. Status (ref: High)				
	Low	0.105	0.02	-0.026
Territorial area (ref: NW)				
	NE	-0.022	0.198***	-0.264***
	Centre	-0.117**	0.406***	0.114**
	South	0.182***	0.583***	0.140***
	Islands	-0.191***	0.358***	0.172***
Perc. Health (ref: Neither good nor bad)				
	Good	-0.022	-0.035	-0.014
	Bad	-0.333***	-0.172**	-0.192**
Physical activity (ref. No)				
	Yes	-0.125***	-0.173***	-0.139***
Education (ref: College or more)				
	High School	0.156***	0.298***	0.129**
	Middle School	0.268***	0.507***	0.246***
	Less than Primary School	0.267***	0.594***	0.363***

Table 3 (cont.)- *Logistic regression models: coefficient estimates and significance level. (*p-value <0.05, ** p-value < 0.01, *** p-value < 0.001).*

Variable	Model 1: Cold cuts	Model 2: Pork	Model 3: Beef
HT (ref: Couple without kids)			
Couple with kids	0.241***	0.161***	0.122**
Single without kids	-0.081*	-0.115**	-0.214***
Single with kids	0.130*	0.101	-0.083
Role (ref: parent)			
Kid	-0.085	-0.022	-0.043
GEB (ref. Very low)			
1-Low	-0.112**	-0.068*	-0.027
2-High	-0.205***	-0.139**	-0.108*
3-Very High	-0.344***	-0.073	-0.110*
EEP (ref: Very low)			
1-Low	-0.294**	-0.141	-0.157
2-Medium	-0.328**	-0.265**	-0.220*
3-High	-0.425***	-0.335***	-0.260**
4-Very High	-0.635***	-0.526***	-0.470***

5. Discussion

This study contributes to the growing literature on sustainable diets by highlighting the demographic and behavioural drivers of red meat products consumption in Italy. The findings of this study confirm a significant decline in red (beef and pork) and processed meat consumption in Italy between 2012 and 2022, aligning with Hypothesis 1. The Kitagawa decomposition reveals that this reduction is primarily driven by changes in individual consumption propensities rather than shifts in the population's age structure, consistently across all three types of red meat considered. This suggests behavioural changes, possibly influenced by growing environmental awareness, health concerns, and evolving dietary norms.

The logistic regression analysis supports Hypothesis 2, showing, in all types of red meat products considered, that household composition plays a key role in shaping dietary habits. Couples with children are more likely to consume red and

processed meat, possibly due to traditional meal planning practices or nutritional beliefs related to child growth. The fact that children tend to consume less meat than their parents could suggest a generational shift in dietary preferences, and it may also help to explain the conflicting findings in the literature regarding the relationship between household structure and red and processed meat consumption.

With regards to Hypothesis 3, the results show that individuals with higher environmental sensitivity are significantly less likely to consume red and processed meat. This is more evident in cold cuts consumption which is also the least healthy of the three types of red meat considered. Our results reinforce the idea that sustainable consumption patterns are closely tied to broader lifestyle choices and values.

A limitation of this study is the binary construction of the consumption indicators, which may obscure more nuanced dietary behaviours such as vegetarianism or veganism. Additionally, while the environmental sensitivity index is informative, it may not fully capture the complexity of motivations behind food choices. Future research could benefit from a more refined choice of this indicator.

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