The current document describes the model following the recommendations of the ODD+D (Müller et al., 2013; Railsback & Grimm, 2011).

1 Overview

1.1 Purpose and overview

The agent-based model aims to reproduce the behaviour of British population in relation to meat consumption by replicating individual preferences and peer influence among consumers. The model is built with the goal to observe behavioural changes under the application of different marketing strategies.

1.2 Entities, state variables and scales

1.2.1 Agents

Agents represent adult consumers, each one characterized by an individual probability of eating meat. Agents are defined by sex, age, monthly income, employment status, individual perception of the living cost and whether they follow a meat-free diet, all of which are assumed constant over the simulation. In addition, each agent has personal concerns regarding the impact of meat consumption on health, the environment and animal welfare, which can change over time due to a process of social influence. All agents are part of an eating network comprising household members, while only some of them have a second eating network that connects co-workers eating at the workplace.

Table 1. List and brief description of agent's attributes.

Attribute	***Description***
Network related variables	
Family ID	Identify agent's family
Employment status	Define workers and non-workers
Work team ID	Identify agent's work team
Individual variables	
Survey serial number	Original respondent's ID from the survey
Sex	Sex of the agent
Age	Agent's age
Enviromental concern	Personal concerns related to meat and the environment
Health concern	Personal concerns related to meat and health
Animal welfare concern	Personal concerns related to meat and animal welfare
Living cost	Perception of living cost
Income class	Agent's income class
Elasticity	Meat price elasticity
Susceptibility to influence	Personal susceptibility toward family members/co-workers
Eating related variables	
Meat-free	Meat-free diet
Meat consumed	Amount of eaten meat (grams) per single meal
Eating meat intention	Likelihood of eating meat at time *t*

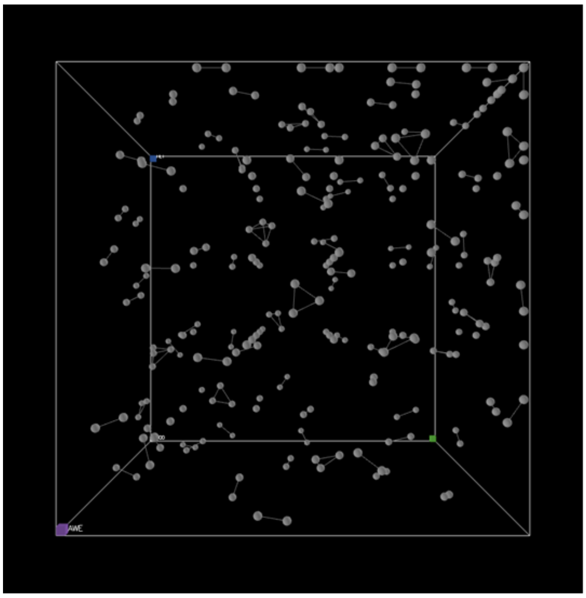
Eating context	Mark when the agent is eating at home or at the workplace
Probability of eating alone	Likelihood of an agent to eat alone (distinguished by breakfast, lunch, and dinner)

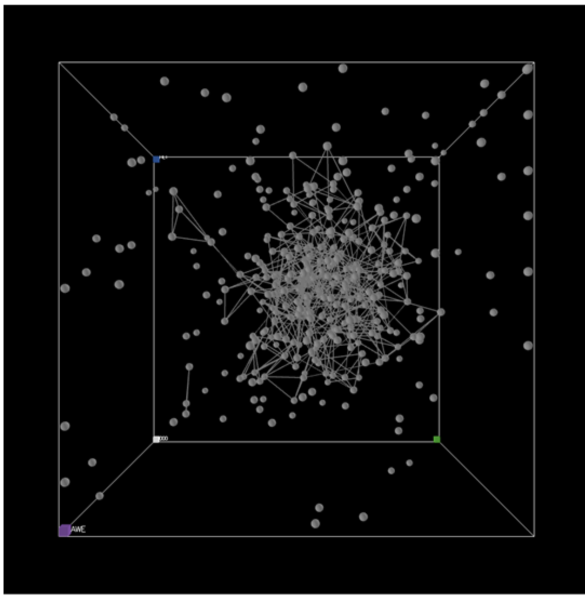
1.2.2 Networks

In our model, two personal networks partially overlap simulating relationships among household members and co-workers. While every agent is part of a household, some agents are not part of the network of co-workers. To the purpose of the simulation, both links of the household members and co-workers are supposed unidirectional (i.e. two agents exercise the same power of influence on each other's). The links of the networks are implemented in NetLogo as different breeds. Households are represented in the model as cliques. Since we do not have information about the actual network, families are randomly generated at the beginning of the simulation, nevertheless the distribution of adults per household observed in 2014 in the UK is recreated (Office for National Statistics, 2016). Organizational network gathers together those agents marked as workers. For the purpose of the simulation we fixed the average number of co-workers eating together based on the study by Bell and Pliner (2003).

Links in the simulation provide the structure for the spread of social influence in relation to meat related concerns. An active link between two agents indicates they are consuming a meal together. Since research demonstrated that family members exercise the largest effects on eating behaviour and food choice compared to others companions (see, above all de Castro, 1994), the links among household members owns a greater weight than those among colleagues.

Figure 1. Different topologies are employed to create the personal networks. The household network (on the left) is comprised by cliques, while the work teams' network (on the right) uses a random configuration. Only workers are simultaneously part of the co-workers network team and a family.





1.2.3 Temporal framework

The model includes a time management subroutine. The series of eating episodes is constant over the simulation (i.e. breakfast, lunch, dinner) and one tick of the simulation corresponds to a single eating episode. Therefore, 3 ticks in the simulation corresponds to 1 day in real world. The simulation is set to end after a period of 3 years.

1.2.4 *Spatial resolution*

Agents' position in the 3D space is chosen on the base of their concerns. X-axis corresponds to health concern, y-axis to environmental concern, and z-axis to animal welfare concerns. Position is updated at each tick of the simulation to display changes in agents' concerns.

1.2.5 *Exogenous factors*

The test of specific policies/interventions is related to the exogenous factors, which can be adjusted by the interface of the model. The current model considers two general types of interventions: price increase and social-norm interventions (an approach drawn from social marketing). The first refers to an increase of meat price up to 200% (by 5%). Marketing campaigns can be planned by combining different factors. First, the messages content can be altered to be focused on the health, the environment, or the animal welfare aspects associated with meat consumption. Second, the target population of the campaign can be chosen among a wide range of options, like age, sex, or existing concerns. Next, campaigns can be restrained to different contexts: to households, to the workplace, or both. Finally, an intervention is defined by a hypothetical success (low/medium/high), which affect the effect a campaign has on targeted agents.

1.3 Process overview and scheduling

The setup procedure first reads the csv file containing consumers' data and creates a population of virtual agents, then build the networks structure, and finally initializes the time framework.

Table 2. Setup and main model pseudocode.

SETUP

```
Begin
  Read-Data
  Create-Agents
  Create-Networks
  Create-Layouts
  Initialize-Time
End
```

MAIN CODE

```
Begin
  Move-Forward-Time
  Update-Meat-Price-Index
  #DEFINE CONTEXT BASED ON DAY AND PHASES OF THE DAY.
  #During breakfast and dinner every agent will eat at home.
  If ((current-meal = breakfast) OR (current-meal = dinner))
     [ask agents
        Eat-At-Home
        If (campaign? = TRUE) [Campaign-Influence]
        Household-Peer-Influence
        Eating-Behaviour]
  #During weekdays workers will eat the workplace,
  #while non-workers will eat at the same time at home.
  #During weekends every agents will eat at home.
  If (current-meal = lunch)
      [ifelse (current-day ∈ weekdays)
           [ask agents
              ifelse (worker? = TRUE)
```

```
                        [Eat-At-Work
                        If (campaign? = TRUE) [Campaign-Influence]
                        Workplace-Peer-Influence
                        Eating-Behaviour]
                        [Eat-At-Home
                        If (campaign? = TRUE) [Campaign-Influence]
                        Household-Peer-Influence
                        Eating-Behaviour]]
             [ask agents
                 Eat-At-Home
                 If (campaign? = TRUE) [Campaign-Influence]
                 Household-Peer-Influence
                 Eating-Behaviour]
 #Other sources of influences.
 Ask agents
    External-Influence
 #Updates plots, monitors, etc.
 Outputs-Update
End
```

Bold words report NetLogo primitives. Italic words are used to categorise homogenous groups of elements (e.g. "*weekdays"* indicates the days of the week apart from Saturday and Sunday). Capitalised words indicate procedures, while lowercase words indicates variables. Words ending with a question mark indicates a Boolean variable

The main code first moves forward the time and updates the price of meat. If the eating episode corresponds to breakfast or dinner, the simulation activates the household network, computes the effects of the social marketing campaign (when active), and then a process of peer-influence between household members is run. For lunch, the model considers the day of the week and which agents are workers. The change between weekdays and weekends is regulated: workers eat at the workplace during weekdays, while all other non-workers keep eating at home; on the weekends everyone eats at home. If agents are eating at the workplace peer influence is spread through co-workers rather than household members. Subsequently, the model computes the effect of other potential sources of influence besides peer influence on agents' concerns. Finally, the position of agents in the 3D space and plots are updated.

2 Design concept

2.1 Theoretical and empirical background

The model draws on and integrates basic principles of several scientific theories.

Agent's behaviour is grounded in the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The TRA states that human behaviour is determined by the person's intention to perform the behaviour, which is in turn predicted by the individual attitude and the influence derived from the person' social network. Based on the TRA, we modelled the individual antecedents of intention separately from the social one. As stated by Feunekes et al. (1998), eating behaviours is influenced by social factors given that attitudes and habits develop by interacting with other people. Accordingly, we created a bridge between the personal attitude and the social dimension to allow a dynamic interplay between these components, such that over time processes of social influence affects some of the attitude components. Intention is assumed to be the best predictor to use as a proxy for actual behaviour and it is computed via logistic regression.

Concepts from the design of social networks in ABM (Hamill & Gilbert 2010) were used to design and connect the two distinct eating networks (household and co-workers) in a network graph. The use of a network facilitates the formalisation of social influence and the regulation of the latter through different meals across the day. Moreover, networks were built following homophily principles (Mcpherson, Smith-lovin, & Cook, 2001): households are homogeneous within them and heterogeneous between them with respect to the probability of eating meat. Homogeneity within households with respect to food consumption has been observed in previous research (Feunekes et al., 1998; Pachucki, Jacques, & Christakis, 2011).

Interventions based on social influence have been conceptualised starting with their application in real life e.g. to promote fruit and vegetable intakes, to reduce alcohol intake (Haines & Spear, 1996), decrease electricity consumption (Horne & Kennedy, 2017) and promote pro-environmental behaviour (Farrow, Grolleau, & Ibanez, 2017). (Stok, De Ridder, De Vet, & De Wit (2014) showed that a simple one-line descriptive norm message was able to positively influence fruit consumption up for to up two days. The translation of the effects of marketing campaigns into the current model is based on other ABM (Zhang, Giabbanelli, Arah, & Zimmerman, 2014). Finally, regards the susceptibilities towards household and colleagues influence, the design of the model is informed by the previous work on food choice and networks (de Castro, 1994; Feunekes et al., 1998; Pachucki et al., 2011). Additional concepts embedded in the model are shown in Table 1.

2.2 Individual decision-making

2.2.1 Subjects and objects of decision

Agents in the simulation represent actual consumers. All agents owns the chance to independently decide to have a meat-based or meat-free meal. Each agent makes a choice each day, three times a day (at breakfast, lunch, and dinner). With a certain probability an agents can eat alone and not be influenced by others. For sake of simplicity, the chance to skip a meal is not considered. Agents' do not follow a strict success criteria.

2.2.2 Decision rules

At each time step an agent evaluates the personal likelihood to consume a meal based on meat based on its personal concerns regarding the impact of meat consumption, sex, and perception of change in prices. If the probability is higher than a random value than the agent will choose to eat meat. Variables and associated weight are selected on the analyses conducted on the responses of participants to the BSA survey 2014 (NatCen Social Research, 2016). Section 3.3.1 describes how agents make a decision about their meal in details.

2.2.3 Social influence and effects of social marketing campaigns

Following the approach proposed by Zhang et al. (2014), influence is implemented as a weighted average depending on the weight γ and the relative concerns of an agent i compared to those of its relatives or colleagues. When γ equals zero, peers influence occurs without any effect of the social marketing campaign.

$$C_{i,t} = (1-\alpha_i)C_{i,t-1} + \alpha_i \frac{\sum_{\substack{j \in peers(i) \\ C_{j,t-1} > C_{i,t-1}}} (1+\gamma)C_{j,t-1} + \sum_{\substack{j \in peers(i) \\ C_{j,t-1} \le C_{i,t-1}}} (1-\gamma)C_{j,t-1}}{\sum_{\substack{j \in peers(i) \\ C_{j,t-1} > C_{i,t-1}}} (1+\gamma) + \sum_{\substack{j \in peers(i) \\ C_{j,t-1} \le C_{i,t-1}}} (1-\gamma)}$$

C represents the value of an agent's concern regarding a specific aspect of meat consumption (health, environment, or animal welfare) at time *t*; parameter γ denotes interventions based on social marketing campaigns; α indicates the agent's susceptibility towards household members and co-workers. This process is applied separately for each agent's concern and as a result, an agent can be simultaneously influenced by agents in relation to health, and being influenced by some others about animal welfare. Gamma (γ) is used to bias agents' attention towards those peers with higher concerns than them (Zhang et al. 2014).

The degree a campaign affects the agents is simulated by varying the value of γ (a low, medium, or high campaign success can be hypothesised). Parameter gamma can be manipulated from the interface of the model and its value decays over time to simulate lower attention to marketing campaigns by agents (see next section). Again, different values can be specified separately for each campaign.

Finally, parameter α represents others' power of influence over agent *i*. Social modelling of eating behaviour suggests family are the primary source of influence on food choices (de Castro, 1994). Hence, the average value of susceptibility towards household members is higher than the susceptibility towards co-workers. Since to our knowledge no specific data exists on the probability distribution of consumers' susceptibility, we followed the suggestion by Bruch & Atwell (2015) and assumed a normal distribution such that some agents will be more easily influenced compared to others.

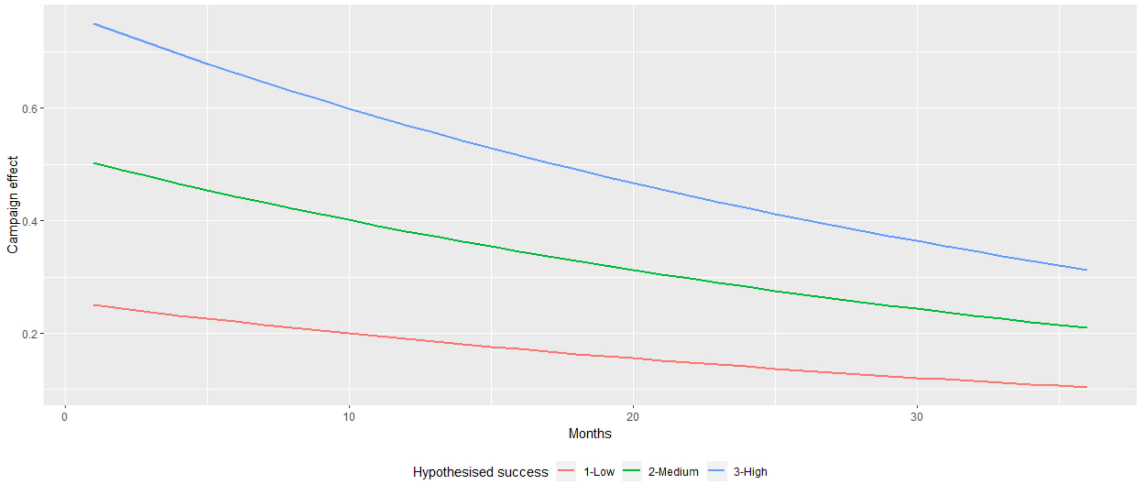
Decay of the effects of social marketing campaigns

The effects of a social marketing campaign decays over time are introduced using a time-decay function:

$$\gamma_t = \gamma_0 * e^{(-\lambda t)}$$

Where gamma indicates the effects on the marketing campaign on the agents' concern, λ represent the exponential decay constant, and *t* reports the current month in the simulation. Note that λ was chosen on the base of the literature available about the "persistence" of the effects of social marketing campaigns based only on norm-based messages (Allcott, 2011; Allcott & Rogers, 2012; Ferraro, Miranda, & Price, 2011; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008; Robinson, Fleming, & Higgs, 2014). Note also that a different decay constant can be specified for the effects of each campaign: however, for sake of simplicity we assumed the same rate of decay independently by the intervention. Figure 2 represents the effects of social marketing campaigns during the simulation depending on the assumption of a low, medium, or high success of the campaign.

Figure 2. Decay of the effects of social marketing campaign on agents over 3 years.



2.3 Learning

No individual or collective learning is included in the model.

2.4 Interaction

The interaction is explicitly modelled as a direct exchange of influence between two agents regarding the concerns of meat consumption. Interactions are possible only within members of the same household or co-workers. Moreover, the interaction between couples of agents occurs only when their mealtimes overlap.

2.5 Collectives

Families and work teams represent social groups considered by the simulation. They are explicitly defined at the beginning of the simulation and they are maintained constant during each run of the simulation. Each household is structured as a clique (i.e. each member is connected with every other members of the household). Households are used to define from whom an agent can be influenced and whom it can influence when eating at home. Similarly, the workplace network defines the boundaries of social influence among co-workers. Each worker is connected to every other member of the same work team, and work teams are randomly connected to represent a hypothetical organisation.

2.6 Heterogeneity

The main source of heterogeneity in the current model derives from the different concerns that virtual consumers exhibits in relation to the reduction of the consumption of meat. Specifically, each agent represents a consumers extracted from the BSA databased and it stores the responses given by a participants regarding the impact of meat consumption on the environment (“*Eating no meat or less meat is better for the environment?*”), personal health (“*Eating no meat or less meat is healthier?*”), and animal welfare (“*Eating no meat or less meat is better for animal welfare?*”). Agents’ also own a personal susceptibility towards social influence effects increase the heterogeneity of consumers. Moreover, each agents has its own probability of eating alone depending on the time of the day and employment status. Finally, agents differ in the amount of meat consumed which is associated with their sex and time of the day.

2.7 Stochasticity

Besides peer influence, it is fair to assume concerns might be subject to variations due to other sources of influence: indeed, consumers are daily exposed to a variety of information and experiences that might affect their personal concerns for the environment, health, and animal welfare. Accordingly, at the end of day some random oscillations that are equally distributed over time occurs to simulate changes in agents’ concerns due to sources of influence not explicitly modelled. A parameter sweep was conducted to select optimal values and inspected during the validation process.

2.8 Observation

The following observations are collected:

- grams of eaten meat/week per consumer;
- likelihood to consume meat (excluding consumers following a meat-free diet).

Each of these outcomes are recorded for the overall population. However, each of them can be distinguished by the following additional factors:

- low income *vs* rest of the population;
- young (18-29 y.o.) *vs* adults (30-60 y.o.)
- males *vs* females;
- workers *vs* non-workers.

3 Details

3.1 Implementation details

The model is implemented in NetLogo 3D 5.3.1 (Wilensky, 1999). Due to copyright restriction the original dataset extracted from the British Social Atttiude survey cannot be publicly shared. However, a document is provided to retrieve and reproduce the dataset for the simulation.

3.2 Initialization/input

At the beginning the model reads an input file containing the empirical data from the BSA survey prepared for the simulation. This means that every agent represents exactly one of the respondents in the survey. Besides demographic information, the input file contains the perception of living cost and personal concerns about the impact of meat consumption. Additional data to inform agents' behaviour comes from the National Diet and Nutrition Survey (NDNS; Bates et al., 2016). The NDNS collects information on food consumption of a representative sample of the UK population. Sources of inputs and range of values are reported in Table 3.

Table 3. Inputs, sources, and range of values.

Input	Dynamic	Source¥	Range
Sex	No	BSAS	{1; 2}
Age	No	BSAS	[18, 99]
Employment status	No	BSAS	{true; false}
Susceptibility to influence (α)	No	Endogenous	[0, 0.30] w.r.t. household members [0, 0.15] w.r.t. co-workers
Income class	No	BSAS	[0, 10]
Living cost	Yes	BSAS	[1, 5]
Meat-free diet	No	BSAS	{0; 1}
Enviromental concern	Yes	BSAS	[1, 5]
Health concern	Yes	BSAS	[1, 5]
Animal welfare concern	Yes	BSAS	[1, 5]
Eating meat intention	Yes	Endogenous	[0, 1]
Meat consumed	Yes	NDNS	[1,)
Probability of eating alone	Yes	NDNS	[0, 1]
Elasticity	No	Tiffin et al. (2011)	{0.839 if low income; 0.804 otherwise}
Average work team size	No	Bell & Pliner (2003)	4

¥ "Dynamic?" means the value of the variable are allowed to change during the simulation. "Range" shows the potential values the variable can assume. "Endogenous" indicates variables values are determined in the model. "BSAS" indicates the British Social Attitude Survey (NatCen Social Research, 2016). "NDNS" refers to the UK National Diet And Nutrition Survey (from 2008/9 to 2013/14; Bates et al., 2016).

3.3 Submodels

3.3.1 Meal selection

A preliminary study was conducted prior to the modelling phase. The responses collected by the BSA survey (NatCen Social Research, 2016) were analysed using a logistic regression model to identify the significant predictors of the likelihood to consume meat. Consumers' sex, age and concerns associated about meat are all significant predictors of eating meat. Despite not being a statistically significant predictor of meat consumption likelihood, perception of living cost is included as the proxy for consumers' price sensitivity. At each time step an agent evaluates their own likelihood to consume a meat-based meal based on the aforementioned factors. The resulting regression model for an agent *i* at time *t* corresponds to:

$$y_i = \beta_0 + \beta_1(sex_i) + \beta_2(age_i) + \beta_3(env_{i,t}) + \beta_4(hlt_{i,t}) + \beta_5(awe_{i,t}) + \beta_6(plc_i)(meat.price_t)$$

Table 4. Parameter values associated with the likelihood to consume meat.

Parameter	Value	Description
β_0	-6.321	Constant of the equation
β_1	0.655	Weighting for consumer's sex
sex_i	{1; 2}	Agent *i*'s sex (1=female)
β_2	0.016	Weighting for agent's age
age_i	[18, 99)	Agent *i*'s age
β_3	0.287	Weighting for environmental concerns
$env_{i,t}$	{1, 5}	Agent *i*'s concerns for the environment at time *t*
β_4	0.623	Weighting for health concerns
$hlt_{i,t}$	{1, 5}	Agent *i*'s concerns for his/her health at time *t*
β_5	0.178	Weighting for animal welfare importance
$awe_{i,t}$	{1, 5}	Agent *i*'s concerns for animal welfare at time *t*
β_6	0.101	Weighting for perception of living cost
plc_i	{1, 5}	Agent *i*'s perception of living cost
$meat.price_i$	[1, 2]	Price of meat at time *t.* Equal 1 for the standard cost of meat.

To estimate the likelihood to consume meat, the result of the previous equation was used in the reverse formula of the logistic function. A dummy variable is included (*veg*) to account for consumers' following a meat-free diet. The variable is computed from the BSA original survey responses (0 = meat-free diet; 1 = meat-eater). Due to the original phrasing of the BSA survey questions, the regression model returns the probability of reducing meat rather than its consumption. As a result, the likelihood to eat meat for an agent *i* at time *t* equals to:

$$p_{i,t}(consume.meat) = \left(1 - \frac{e^{y_i}}{(1 + e^{y_i})}\right) * veg_i$$

3.3.2 Estimation of the amount of meat consumed per consumer

A submodel is used in the simulation to estimate the amount of meat eaten by each agent at every eating episode where a meat-based meal is chosen. The NDNS (2012-14) (Bates et al. 2016) is used as a reference to create a model within the simulation to generate values of quantity of meat that is similar to the original data. Meat intake depends on sex, time, and context (Horgan, Scalco, Craig, Whybrow, & Macdiarmid, 2019). In line with this, the model generates the amount of eaten meat by an agent depending on its sex and time of the day drawing a value from a distribution which approximate empirical data.

3.3.3 Price elasticity and quantity consumed

While the probability of eating meat is affected by the changes in agents' concerns, the amount of meat eaten is also affected by the price elasticity of demand. The analysis conducted by Tiffin, Balcombe, Salois, & Kehlbacher (2011) using the Living Costs and Food Survey 2001-2009 showed that when the cost of meat increases by 1% low income households decreases consumption by 0. 839%, whereas the rest of population decreases consumption by 0.804%. Accordingly, to model price elasticity the grams of eaten meat by each consumer are corrected by a factor ω, which is equal to:

$$\omega = 1 - (ped * ((meat.price/100) - 1))$$

where *meat.price* indicates the current price of meat and *ped* corresponds to the price elasticity associated with the agent income class.

4 References

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics*, *95*(9–10), 1082–1095. https://doi.org/10.1016/j.jpubeco.2011.03.003

Allcott, H., & Rogers, T. (2012). *How Long Do Treatment Effects Last? Persistence and Durability of a Descriptive Norms Intervention's Effect on Energy Conservation* (HKS Faculty Research Working Paper Series RWP12-045). Harvard, MA.

Bates, B., Cox, L., Nicholson, S., Page, P., Prentice, A., Steer, T., & Swan, G. (2016). *National Diet and Nutrition Survey Results from Years 5 and 6 (combined) of the Rolling Programme (2012/2013–2013/2014)*. London, UK. Retrieved from https://www.gov.uk/government/statistics/ndns-results-from-years-5-and-6-combined

Bell, R., & Pliner, P. L. (2003). Time to eat: The relationship between the number of people eating and meal duration in three lunch settings. *Appetite*, *41*(2), 215–218. https://doi.org/10.1016/S0195-6663(03)00109-0

Bruch, E., & Atwell, J. (2015). Agent-Based Models in Empirical Social Research. *Sociological Methods & Research*, *44*(2), 186–221. https://doi.org/10.1177/0049124113506405

de Castro, J. M. (1994). Family and friends produce greater social facilitation of food intake than other companions. *Physiology and Behavior*, *56*(3), 445–455. https://doi.org/10.1016/0031-9384(94)90286-0

Farrow, K., Grolleau, G., & Ibanez, L. (2017). Social Norms and Pro-environmental Behavior: A Review of the Evidence. *Ecological Economics*, *140*, 1–13. https://doi.org/10.1016/j.ecolecon.2017.04.017

Ferraro, P. J., Miranda, J. J., & Price, M. K. (2011). The persistence of treatment effects with norm-based policy instruments: Evidence from a randomized environmental policy experiment. *American Economic Review*, *101*(3), 318–322. https://doi.org/10.1257/aer.101.3.318

Feunekes, G. I. J., De Graaf, C., Meyboom, S., & Van Staveren, W. A. (1998). Food choice and fat intake of adolescents and adults: Associations of intakes within social networks. *Preventive Medicine*, *27*(5 I), 645–656. https://doi.org/10.1006/pmed.1998.0341

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Haines, M., & Spear, S. F. (1996). Changing the Perception of the Norm: A Strategy to Decrease Binge Drinking among College Students. *Journal of American College Health*, *45*(3), 134–140. https://doi.org/10.1080/07448481.1996.9936873

Hamill, L., & Gilbert, N. (2010). Simulating large social networks in agent-based models: A social circle model. *Emergence: Complexity and Organization*, *12*(4), 78–94.

Horgan, G. W., Scalco, A., Craig, T., Whybrow, S., & Macdiarmid, J. I. (2019). Social, temporal and situational influences on meat consumption in the UK population. *Appetite*, *138*(November 2018), 1–9. https://doi.org/10.1016/j.appet.2019.03.007

Horne, C., & Kennedy, E. H. (2017). The power of social norms for reducing and shifting electricity use. *Energy Policy*, *107*(April), 43–52. https://doi.org/10.1016/j.enpol.2017.04.029

Mcpherson, M., Smith-lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, *27*, 415–444. https://doi.org/10.1146/annurev.soc.27.1.415

Müller, B., Bohn, F., Dreßler, G., Groeneveld, J., Klassert, C., Martin, R., … Schwarz, N. (2013). Describing human decisions in agent-based models - ODD+D, an extension of the ODD protocol. *Environmental Modelling and Software*, *48*, 37–48. https://doi.org/10.1016/j.envsoft.2013.06.003

NatCen Social Research. (2016). *British Social Attitudes Survey, 2014* (2nd Ed.). Colchester, UK: UK Data Archive. Retrieved from http://dx.doi.org/10.5255/UKDA-SN-7809-2

Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2008). Normative social influence is underdetected. *Personality and Social Psychology Bulletin*, *34*(7), 913–923. https://doi.org/10.1177/0146167208316691

Office for National Statistics. (2016). *Statistical bulletin: Families and households in the UK: 2016*. Retrieved from https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/families/bulletins/familiesandhouseholds/2016

Pachucki, M. A., Jacques, P. F., & Christakis, N. A. (2011). Social network concordance in food choice among spouses, friends, and siblings. *American Journal of Public Health*, *101*(11), 2170–2177. https://doi.org/10.2105/AJPH.2011.300282

Railsback, S. F., & Grimm, V. (2011). Describing and formulating ABMs: The ODD protocol. *Agent-Based and Individual-Based Modeling: A Practical Introduction*.

Robinson, E., Fleming, A., & Higgs, S. (2014). Prompting healthier eating: Testing the use of health and social norm based messages. *Health Psychology*, *33*(9), 1057–1064. https://doi.org/10.1037/a0034213

Stok, F. M., De Ridder, D. T. D., De Vet, E., & De Wit, J. B. F. (2014). Don't tell me what i should do, but what others do: The influence of descriptive and injunctive peer norms on fruit consumption in adolescents. *British Journal of Health Psychology*, *19*(1), 52–64. https://doi.org/10.1111/bjhp.12030

Tiffin, R., Balcombe, K., Salois, M., & Kehlbacher, A. (2011). *Estimating Food and Drink Elasticities*. *University of Reading*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/137726/defra-stats-foodfarm-food-price-elasticities-120208.pdf

Wilensky, U. (1999). *NetLogo*. Evanston, IL: Center for Connected Learning and Computer-Based Modeling, Northwestern University. Retrieved from http://ccl.northwestern.edu/netlogo/

Zhang, D., Giabbanelli, P. J., Arah, O. A., & Zimmerman, F. J. (2014). Impact of different policies on unhealthy dietary behaviors in an urban adult population: An agent-based simulation model. *American Journal of Public Health*, *104*(7), 1217–1222. https://doi.org/10.2105/AJPH.2014.301934