How much does it take? Willingness to switch to meat substitutes

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Abstract

Meat production and consumption have several negative environmental externalities and health impacts. Using a stated preference survey, this study identifies main barriers to and drivers of switching to the following meat substitutes: a plant-based veggie burger, a meat-like burger, and a lab burger. We find that price matters: given the right monetary incentives, many individuals express a willingness to switch to meatless alternatives. About a third of those who prefer meat would consider switching to a meat substitute if the price were two-thirds or less of the price of the meat option. However, almost half of the respondents would not choose a lab meat burger even if they would get it for free. Male individuals without university education and older than 30 years show a stronger resistance to substitute meat hamburgers, in particular if the substitute is a plant-based veggie burger that neither looks nor tastes like meat. Environmental and health consciousness and being familiar with the substitute are correlated with the willingness to substitute. Older individuals are less familiar with and less likely to choose meat substitutes compared with younger individuals. We also find that taste is a prominent barrier for people who prefer meat, indicating that there is room for improvements in the taste of the different meat substitutes.

Key-words: meat substitutes, stated preferences

JEL-classification: Q18, Q51

1. Introduction

On average, people in North America eat around 95 kg meat per person and year. The corresponding number for an average European citizen is about 65 kg (OECD/FAO; 2019). However, meat production and consumption cause several negative external effects on the environment and long-run negative impacts (internalities) on human health.[1] The raising of livestock also involves moral concerns over animal welfare and animal rights. There is an ongoing discussion in society on how we can make food consumption more sustainable and reduce meat consumption.

There are a number of policy instruments available to reduce meat consumption. One is to change the relative price of meat, for example through a tax (Säll and Gren, 2015; Springmann et al., 2018; Jarka et al., 2018) or a subsidy (An, 2012). Taxation, subsidies, and direct pricing to influence food prices have also been recommended by the World Health Organization to encourage healthy eating (WHO, 2004). Another option is to use educational information campaigns (Laestadius et al., 2013) or informative labels on aspects such as climate impact (Grunert et al., 2014; Van Loo et al., 2014; Shewmake at al., 2015; Leach et al., 2016; Muller et al., 2019; Carlsson et al., 2020). Yet another is to use nudges to influence people's purchasing and consumption behavior (Kurz, 2018).

From a policy point of view, here is a need for more evidence about the effectiveness of different policy instruments and interventions seeking to

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[1] Animal husbandry causes almost 15 percent of the anthropogenic climate impact worldwide, and among the different meat products, beef, lamb, and other ruminants are the worst greenhouse-gas emitters (Swedish Board of Agriculture, 2018). To be able to reach the climate target from the Paris Agreement, it could be necessary to reduce meat consumption. Moreover, while meat provides important protein, minerals, vitamins, and fat for human health, some components, such as saturated fats in processed meat, increase the risk for cancer and cardiovascular diseases, at least in the long run (Swedish Food Agency, 2014, 2015; Godfray et al., 2018). Another risk associated with meat production and consumption is that it might increase epidemic risks, either directly through increased contact with wild and farmed animals or indirectly through its impact on the environment (Espinosa et al., 2020).

influence people's conscious and unconscious food consumption practices (Godfray et al., 2018). To assess the potential effects of different policies and how the demand for meat might change with the introduction of meat substitutes, we need knowledge about individual preferences for meat substitutes. The main research question we address in this paper is what the drivers of and barriers to switching from meat to different kinds of meat substitutes are. More precisely, we investigate Swedish consumers' willingness to substitute their meat consumption with three types of substitutes using a stated preference survey. We use hamburgers as the default meat-based food item since it is a well-known product that most consumers eat. The first substitute is a traditional vegetable-based substitute, a veggie burger that serves as a meat substitute without looking or tasting like meat. The second is a meat-like substitute designed to look and taste like meat, and the third is a laboratory-created meat substitute. By measuring the willingness to pay (WTP) for the three substitutes, we are able to estimate the effect of a change in the price of meat substitutes on consumer behavior and demand. This is important since it gives us a better understanding of what would happen in the market with new substitutes, and what would happen if for example government polices such as a meat tax or subsidies that affect the relative prices of meat and meat substitutes were implemented to influence the prices. Investigating people's preferences is also of importance for food product development since product development in the food market is difficult. The failure rate for new products in the consumer food market has been found to be somewhere between 60 and 80 percent (Grunert et al., 2004).

Using a stated preference survey with a tailored design, we are able to identify both at what price a person would be willing to substitute if at all and who those willing and not willing to substitute are. The respondents are asked about how much cheaper their non-preferred burger must be in order for them to switch to it. The inspiration behind this comes from the "dollar metric" approach used in the market research literature (Xu, 2005).

The study is conducted in Sweden, where meat is an important part of the food culture. In 2013, Swedes consumed about 40 percent more meat than they did 30 years earlier (Swedish Board of Agriculture, 2013), although the meat consumption has declined somewhat in the last few years (Swedish Board of Agriculture, 2019).

We find that if the price of the meat burger is the same as the meat substitute, a large majority of those who eat meat, around 90 percent, choose the meat burger. About a third of those who prefer meat would consider switching to a meat substitute if the price were two thirds of the price of the meat option. On the other hand, almost half of the respondents would not choose a lab meat burger even if they would get it for free. The corresponding numbers for the other meat substitutes is around 30 percent. Thus, there is a clear divide among consumers, where some are rather open to meat substitutes, even lab meat, while others would not accept the substitutes even if they were given to them for free. Wilks and Phillis (2017) found, in a U.S. setting, that while most of the respondents were willing to try lab meat, only one-third were willing to replace farmed meat with it. Closest, but independently developed, to our study is the study by Van Loo et.al. (2020). They conducted a choice experiment study in the U.S. and investigated the WTP among consumers for three different hamburgers: a beef hamburger, a plant-based (pea protein) hamburger, and a lab-based alternative. They found a strong preference for meat since a large majority (over 70 percent) chose a burger with beef over the two meat substitutes. They also found that rather substantial price decreases of the substitute would still result in a considerable market share for the meat burger. We were able to corroborate these findings for the Swedish population and using a different methodology.

In our study, a number of individual characteristics affect the willingness to choose a meatless burger over a meat based one, and they are fairly consistent across substitute types. Women, younger and educated individuals are generally more likely to be willing to substitute, the exception being that women are more

skeptical of lab meat, which is consistent with what Wilks et al. (2017) and other have found previously. Moreover, corroborating the finding of Hoek et al. (2011), familiarity with the substitutes is an important predictor of future use of them. Finally, we find that a set of attitudinal characteristics are positively correlated with the willingness to substitute.

The rest of the paper is organized as follows. In Section 2 we present the survey design and survey sampling. In Section 3, results are presented. Section 4 contains a discussion about the implications of our results.

2. Survey design

2.1. Survey design

The survey started with a screening question since the targeted sample consisted of respondents who eat meat and in particular hamburgers. Since the objective of this paper is to investigate at what price people are willing to substitute a meat burger with a meatless alternative, those who did not eat meat and hamburgers were dropped from the sample immediately after the screening question.

We initially described three alternatives to a meat-based hamburger: veggie burger, a meat-like burger, and a burger made of lab meat. The whole text is presented in Appendix A.

Respondents were told they would be making three pair-wise choices between a meat burger and these three substitute alternatives. So, the first alternative was always a meat burger and the other alterative was a substitute of some sort. The substitutes were always presented in the same order: first veggie burger, then meat-like burger, and finally a lab burger. We will here only describe the first pair-wise decision (meat versus veggie burger) as the other decisions were structured in the exact same way. Respondents were told to imagine a situation where they were at a restaurant and had decided to eat a hamburger. We asked which one out of two available alternatives they would choose: a meat-based and a vegetable-based burger. We then asked those who chose the meat burger at what price of the substitute they would instead choose

the veggie burger. The initial price was 150 SEK,[2] and they could choose from a list with descending prices (5 SEK intervals) all the way down to 0 SEK. The respondents could also state that they would never buy the substitute, regardless of price. Similarly, those who chose the veggie burger were asked at what price they would instead choose the meat burger. The price list was the same and contained the same option to state that one would never choose a meat burger. An example of a choice situation is presented in Table A1 in the appendix.

2.2. Survey sampling

The study was conducted as a web survey in April 2020. Before the main study, one pilot study was conducted with satisfactory results. The respondents were recruited randomly from a representative panel of the Swedish population. However, to be eligible to participate, a respondent had to consume meat-based hamburgers on a regular basis. The final survey yielded 1,096 respondents. Descriptive statistics are presented in Table 1, together with responses to a set of attitudinal questions.

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[2] At the time of the study 1 SEK = 0.1 euro.

Table 1. Descriptive statistics of respondents

Variable	Description	Mean
Female	=1 if female	0.55
Age 18–29 years	= 1 if between 18 and 29 years old	0.20
Age: 30–49 years	= 1 if between 30 and 49 years old	0.36
Age: 50–67 years	= 1 if between 50 and 67 years old	0.31
Age: 68 years–	= 1 if 68 or more years old	0.13
University	=1 if a university education ≥3 years	0.40
Kids < 10	= 1 if at least one child in household is age 10 or under	0.19
Kids: < 18	= 1 if at least one child in household between 11 and 18	0.16
Income	Income in thousands SEK per month	4.10
No response income	= 1 if not willing to respond to question on income	0.17
Big city	= 1 if household is in Stockholm, Gothenburg, or Malmö	0.33
City	= 1 if household is in a city with more than 50,000 inhab.	0.25
Small city	= 1 if hh is in city with 20,000–50,000 inhabitants	0.15
Rural	= 1 if hh is in a city with less than 20,000 inhabitants	0.27
Meat: Bad for env.	= 1 if believe that meat is bad for the environment	0.14
Mixed diet is healthy	= 1 if believe that a mixed diet is good for health	0.53
Animal: Treated badly	= 1 if believe that animals are not treated well in Sweden	0.05
Animal: Suffers at slaughter	= 1 if believe that animals suffer at slaughter	0.28
Regular meat burger	= 1 if regularly (at least weekly) eat meat burgers	0.45
Has eaten veggie burger	=1 has eaten a veggie burger	0.43
Has eaten meat-like burger	=1 if has eaten a meat-like burger	0.33
Number of respondents		1,096

Table 1 shows that the share of respondents with at least three years of university education is 40 percent in our sample, which is higher than the share of 28 percent at the national level (Statistics of Sweden, 2020). The share of females is 55 percent in our sample, which is fairly close to the share of 50 percent at the national level. Table 1 also shows that clearly less than half of our respondents, all of whom eat meat hamburgers, have tasted a veggie and a meat-like burger, respectively.[3]

3. Results

3.1 Descriptive results

In Table 2, we present summary results for the three different choices between a meat-based and a meatless burger.

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[3] Lab meat is not included since it is not yet available in the market.

Table 2. Summary of respondent behavior in the experiment: shares choosing meat burger at different prices, and mean and median WTP for substitute in euro

Price substitute	Meat vs. veggie	Meat vs. meat-like	Meat vs. lab
150	0.92	0.89	0.87
100	0.53	0.56	0.61
50	0.36	0.39	0.48
0	0.31	0.33	0.49
Mean WTP for substitute for those that switch at some price	9.7 (3.6)	9.4 (3.6)	9.5 (3.8)
Mean WTP for substitute all individuals	6.5 (54)	6.0 (5.4)	4.8 (5.5)

Note: Standard errors in parentheses.

As expected, a large majority chose the meat burger if the prices were the same (€15). The share who chose meat was somewhat larger when the substitute was a veggie burger (92 percent) and lowest when it consisted of lab meat (87 percent), but the differences in shares were small. On the other hand, the share of subjects who did not choose the meat substitute even when the price of it was zero was considerably higher when the substitute was lab meat: almost half of the sample (49 percent) did not choose a lab meat burger even if it was given to them for free.

The mean willingness to pay (WTP) for those who at some point substituted away from a meat burger are rather similar for the three substitutes, between €9.4 and €9.7, corresponding to around two-thirds of the price of the meat burger. When looking at the whole sample, we can see that the major difference between the three substitutes is the fraction of subjects who were not willing to pay anything at all for the product in question. This implies that the mean WTPs for the whole sample were lower: €6.5 for a veggie burger, €6 for a meat-like burger, and only €4.8 for a lab burger. There are thus differences in behavior depending on the type of substitute, in particular for the lab burger. Using a Wilcoxon signed rank test, we cannot reject the hypothesis of equal distributions of WTP between veggie burger and meat-like burger (p-value = 0.696), while we can reject the hypothesis of equal distributions of WTP for the lab burger compared with the two other substitutes (p-value < 0.000 for both burgers).

3.2 Econometric analysis

In this section we explore the heterogeneity in the willingness to switch to a meat substitute in the three choice situations. There are, as we have seen, large differences in this willingness, where some are willing to switch even when the alternatives are priced the same while others would never switch to a meat substitute regardless of price. In order to explore the characteristics of the subjects who would switch, we estimate three probit models for each choice situation (meat versus a substitute, respectively), where the dependent variable is one if a respondent would buy the meat substitute. In the first model, we set the price of both the meat and the meat-like burger to €15, i.e., we explore the characteristics of those who are willing to switch to the meat-like substitute even if doing so will not save them any money. In the second model, the price of the meat substitute is €10 and in model 3, it is €0. The last model allows us to identify those who are most reluctant to switch from the meat burger. We choose the price €10 since it is at this point that a large fraction of the subjects choose to switch. Thus, we can investigate the characteristics of those who are willing to pay at most €10 for the substitute. To begin with, we estimate models where we only include a set of individual characteristics. The results are presented in Table 3.

Table 3. Marginal effects from a probit regression. Decision to switch to a meat substitute at different prices of the meat substitute. Dependent variable is one if the respondent chooses the meat substitute. Standard errors in parentheses.

	Veggie burger			Meat-like burger			Lab burger		
	P=15	P=10	P=0	P=15	P=10	P=0	P=15	P=10	P=0
Female	0.057***	0.097***	0.053*	0.026	0.025	-0.027	-0.045**	-0.088***	-0.142***
	(0.016)	(0.031)	(0.029)	(0.018)	(0.031)	(0.029)	(0.020)	(0.031)	(0.031)
Age: 30–49 years	0.016	-0.111**	-0.086*	-0.045**	-0.107**	-0.103**	-0.024	-0.116***	-0.156***
	(0.024)	(0.045)	(0.045)	(0.022)	(0.045)	(0.047)	(0.026)	(0.043)	(0.048)
Age: 50–67 years	0.001	-0.154***	-0.075*	-0.086***	-0.236***	-0.199***	-0.090***	-0.269***	-0.287***
	(0.023)	(0.044)	(0.044)	(0.020)	(0.041)	(0.046)	(0.023)	(0.037)	(0.045)
Age: 68 years–	-0.022	-0.174***	-0.187***	-0.076***	-0.273***	-0.292***	-0.061**	-0.240***	-0.315***
	(0.025)	(0.050)	(0.056)	(0.019)	(0.043)	(0.056)	(0.024)	(0.040)	(0.051)
University	0.021	0.040	0.081***	0.023	0.089***	0.081***	0.007	0.077**	0.086***
	(0.017)	(0.033)	(0.029)	(0.020)	(0.033)	(0.030)	(0.021)	(0.032)	(0.032)
Children 0–10 years in hh	0.024	0.080*	0.113***	0.058**	0.048	0.078**	0.009	-0.012	0.018
	(0.024)	(0.043)	(0.035)	(0.029)	(0.043)	(0.039)	(0.027)	(0.041)	(0.043)
Children 11–18 years in hh	-0.035*	0.009	0.030	-0.037	-0.099**	-0.002	-0.067***	-0.118***	-0.090**
	(0.018)	(0.046)	(0.040)	(0.023)	(0.044)	(0.043)	(0.023)	(0.041)	(0.046)
Income	-0.003	-0.006	-0.006	-0.005	-0.003	-0.006	0.000	0.002	-0.010
	(0.004)	(0.007)	(0.007)	(0.004)	(0.007)	(0.007)	(0.005)	(0.007)	(0.007)
No resp. income	0.011	0.023	0.009	-0.036	-0.027	-0.025	-0.039	0.000	-0.027
	(0.029)	(0.056)	(0.051)	(0.026)	(0.055)	(0.053)	(0.030)	(0.055)	(0.056)
Big city	0.018	0.108***	0.047	0.056***	0.050	0.014	0.046**	0.071**	0.031
	(0.018)	(0.033)	(0.030)	(0.021)	(0.034)	(0.031)	(0.022)	(0.033)	(0.033)
Observations	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096
Pseudo R2	0.047	0.037	0.037	0.062	0.050	0.043	0,044	0,059	0,058

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

To begin with, the effect of personal characteristics is fairly consistent across both prices and substitutes. However, one important exception is gender. Women are more likely than men to choose a veggie burger over a meat burger, but they are less likely to choose a lab burger over a meat burger. The latter is consistent with earlier research (see, e.g., Wilks and Phillis 2017; Slade, 2018; Mancini and Antonioli, 2019; Van Loo et al., 2020). Respondents in the youngest age category (below 30 years) are consistently more likely than the other age groups to choose the meat substitute, and the differences compared with the older age groups are considerable. For example, those in the oldest age category, i.e., 68 years or older, have a 19 percentage point lower likelihood than those who are younger than 30 to choose a veggie burger, even when it is given to them for free. Respondents with a university education, living in a big city, and with young children are often more likely to choose the meat substitute.

Unfamiliarity with a product has previously been seen as an important barrier to switching to a meat substitute, and the acceptance of meat substitutes has been found to be largely determined by food neophobia and negative beliefs about such products (Hoek et al., 2011). To explore whether there is a correlation between previous experience and behavior in the experiment, we next include a variable capturing whether they have ever eaten a veggie or meat-like burger before. In addition, we include a number of attitudinal variables and additional behavioral variables related to meat consumption. Table 4 reports the results for marginal effects of these additional variables; all other control variables from Table 3 are included but not reported. Clearly, the results in Table 4 are exploratory, and it is difficult to argue for a causal relationship. However, they do provide information about what type of individual behavior and attitudes correlate with the willingness to substitute in the experiment.

Table 4. Marginal effects from a probit regression. Decision to switch to a meat substitute at different prices, including attitudinal and behavioral variables. Dependent variable is one if the respondent chooses the meat substitute. Standard errors in parentheses.

	Veggie burger			Meat-like burger			Lab burger		
	P=15	P=10	P=0	P=15	P=10	P=0	P=15	P=10	P=0
Has ever eaten veggie /meat-like burger	0.099***	0.339***	0.284***	0.181***	0.357***	0.287***			
	(0.017)	(0.031)	(0.026)	(0.025)	(0.033)	(0.026)			
Meat is bad for the environment	0.037*	0.202***	0.114***	0.044*	0.253***	0.178***	0.093***	0.161***	0.186***
	(0.023)	(0.050)	(0.041)	(0.025)	(0.051)	(0.040)	(0.036)	(0.049)	(0.045)
A mixed diet is healthy	-0.023*	-0.082**	-0.090***	-0.032**	-0.076**	-0.082***	-0.029	-0.041	0.011
	(0.012)	(0.033)	(0.028)	(0.015)	(0.033)	(0.029)	(0.020)	(0.031)	(0.032)
Animals treated badly in Sweden	0.053	0.065	-0.054	0.015	-0.062	-0.055	0.075	-0.020	-0.021
	(0.037)	(0.079)	(0.077)	(0.031)	(0.078)	(0.083)	(0.051)	(0.069)	(0.076)
Animals suffer at slaughter	0.042*	0.046	0.057*	0.051***	0.078**	0.107***	0.072***	0.033	0.059
	(0.017)	(0.038)	(0.033)	(0.020)	(0.039)	(0.032)	(0.025)	(0.036)	(0.036)
Regular meat burger consumer	-0.058*	-0.143***	-0.053*	-0.066***	-0.155***	-0.027	-0.020	-0.046	-0.031
	(0.013)	(0.034)	(0.030)	(0.015)	(0.034)	(0.031)	(0.020)	(0.032)	(0.033)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096
Pseudo R2	0.218	0.148	0.139	0.234	0.173	0.151	0.092	0.072	0.072

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Socioeconomic variables from Table 3 are included but not reported.

We find that those who have previously eaten the substitute are much more likely to choose that substitute in the experiment. For example, when the price of a veggie or a meat-like burger decreases to €10, it is 34–36 percentage points more likely that a person who has previously tasted that kind of hamburger will choose it, compared with those who have not tasted it. We also find that environmental, health, and animal welfare concerns are correlated with the willingness to choose a meat substitute. Those who believe that meat production is bad for the environment are more likely to choose the substitute at all prices for all three of the substitutes. The effects are sizeable and largest of all attitudinal variables: The probability to choose a substitute at the €10 price level is 20–25 percentage points higher for those who are concerned about the environmental impact. Those who believe that a mixed diet is healthy are less likely to choose a veggie or a meat-like burger at all price levels. For both veggie and meat-like burgers, those who believe that animals suffer at slaughter are more likely to choose the substitute at almost all prices. They are also more likely to choose a lab burger at the €15 price level. Interestingly, those who are classified as regular meat burger consumers (i.e., eat meat burgers at least once a week) are less likely to choose the substitute veggie burger or meat-like burger at all prices, but for lab meat burgers there are no differences compared with other consumers.

3.3. Familiarity with veggie burgers and meat-like burgers

Next, we investigate how familiar different individuals are with veggie and meat-like hamburgers. Since lab-meat burgers are not yet available in the market, we cannot analyze how familiar people are with them. We begin by presenting in Table 6 the shares of individuals in the four age groups who have eaten the two substitutes before and the shares of those who do not know what the substitutes taste like.

Table 6. Shares of respondents familiar with a substitute burger in different age groups.

	18-29 years	30-49 years	50-67 years	68 years
Has eaten veggie burger	0.50	0.51	0.37	0.21
Has eaten meat-like burger	0.50	0.40	0.23	0.12
Not sure what a veggie burger tastes like	0.24	0.28	0.42	0.57
Not sure what a meat-like burger tastes likes	0.24	0.28	0.44	0.57
No. of obs.	214	399	336	147

The share of respondents who have tasted a veggie burger decreases with age from 50 percent to 21 percent. The participants were even more unfamiliar with meat-like burgers; only 12 percent in the oldest age group had ever eaten one. Moreover, the share of respondents claiming to not know what a veggie or meat-like burger tastes like increases with age.

In order to better understand what types of consumers are familiar with these substitutes, we also present the results of a probit model where the dependent variable is one if a person has ever eaten a veggie burger or a meat-like substitute, respectively. Table 7 reports the results.

Table 7. Marginal effects from Probit models on the likelihood to have eaten a veggie burger and meat-like burger, respectively. Standard errors in parentheses.

	Veggie	Meat-like
Female	0.068**	-0.053*
	(0.033)	(0.032)
Age: 30–49 years	0.026	-0.049
	(0.046)	(0.042)
Age: 50–67 years	-0.045	-0.142***
	(0.047)	(0.040)
Age: 68 years–	-0.217***	-0.264***
	(0.049)	(0.033)
University	0.075**	0.088***
	(0.033)	(0.032)
Children 0–10 years in hh	0.052	0.021
	(0.043)	(0.040)
Children 11–18 years in hh	0.033	-0.003
	(0.046)	(0.042)
Income	-0.010	-0.006
	(0.008)	(0.007)
No response income	-0.066	-0.026
	(0.054)	(0.052)
Big city	0.114***	0.024
	(0.034)	(0.032)
Meat is bad for the environment	0.066***	0.076***
	(0.018)	(0.017)
A mixed diet is healthy	-0.019	-0.037***
	(0.015)	(0.014)
Animals treated badly in Sweden	0.016	-0.001
	(0.010)	(0.009)
Animals suffer at slaughter	0.013*	0.010
	(0.007)	(0.007)
Regular meat burger eater	0.045	0.072**
	(0.033)	(0.031)
Observations	1,096	1,096
Pseudo R2	0.073	0.116

We find that being a female, having a university education, living in a big city, believing that meat is bad for the environment, and believing that animals suffer at slaughter are all aspects that increase the likelihood that a person has ever eaten a veggie burger. In contrast, belonging to the oldest age category (68 years or older) significantly decreases that likelihood. The impact of socioeconomic characteristics is larger than the impact of the assessed attitudinal statements.

When it comes to the meat-like burger, we find that being a female, believing that a mixed diet is healthy, and being 50 years or older are variables that make

it less likely that a person has ever tasted a meat-like burger before. In contrast, higher education, living in a smaller city, regularly eating meat burgers, and believing that meat is bad for the environment make it more likely. Thus, a university education, age, and concerns about the environment are factors that have positive and significant impacts on whether a person has ever tasted any of these two substitutes.

Table 7 also reveals some differences between the two substitutes. Males are less likely than females to have eaten a veggie burger, but for the meat-like burger, we find the opposite pattern. Moreover, in the case of a meat-like burger, the age at when an individual is less likely to have eaten a burger is lower compared with a veggie burger. In the next section, we will in more detail investigate the attitudes concerning the taste, smell, texture, appearance, and cost of veggie and meat-like burgers.

3.4 Attitudes to meat, veggie, and meat-like burgers

In Figure A1 in Appendix B, we present histograms of the responses to the follow-up questions on attitudes to the meat and veggie burgers where taste, smell, texture, and appearance were assessed on a 5-level scale ranging from *strongly dislike* to *strongly like* and the price of the burgers was assessed from *very cheap* to *very expensive*. Again, the lab-burger alternative is not included since lab meat is not yet available in the market. Clearly, there are large differences in attitudes, but there is also a considerable share of subjects who do not know much about the meat substitutes. Between 30 and 40 percent of the subjects do not know what the meat substitutes taste and smell like, what texture or appearance they have, or how much they cost.

Finally, we explore how attitudes correlate with behavior in the experiment using probit models that include taste, smell, texture, and appearance as covariates. Table 5 shows the results. Note that this is not a causal analysis and one needs to be cautious when making the interpretations. For example,

cognitive dissonance could make people develop negative beliefs about characteristics of meat substitute in order to justify their meat consumption.

Table 5. Marginal effects from a probit regression, effects of attitudes and knowledge about the substitute on the decision to switch at different prices. Standard errors in parentheses.

	Veggie burger			Meat-like		
	P=15	P=10	P=0	P=15	P=10	P=0
Smell: low score	0.015	-0.115**	-0.103**	0.003	-0.023	-0.014
	(0.020)	(0.047)	(0.049)	(0.023)	(0.046)	(0.046)
Appearance: low score	0.000	-0.105**	-0.159***	0.000	-0.081*	-0.116***
	(0.018)	(0.044)	(0.045)	(0.022)	(0.043)	(0.044)
Texture: low score	-0.039**	0.004	0.066	-0.033	-0.042	0.028
	(0.017)	(0.058)	(0.056)	(0.027)	(0.059)	(0.059)
Taste: low score	-0.064***	-0.305***	-0.277***	-0.086***	-0.186***	-0.091
	(0.015)	(0.049)	(0.061)	(0.024)	(0.057)	(0.063)
Smell: Do not know	-0.037	-0.163***	-0.201***	0.042	0.018	-0.072
	(0.024)	(0.060)	(0.059)	(0.034)	(0.060)	(0.058)
Appearance: Do not know	0.048	-0.156**	-0.149**	-0.088***	-0.193***	-0.204***
	(0.049)	(0.063)	(0.060)	(0.025)	(0.060)	(0.063)
Texture: Do not know	-0.126***	-0.189	-0.008	-0.046	-0.136	0.019
	(0.045)	(0.133)	(0.116)	(0.050)	(0.095)	(0.089)
Taste: Do not know	0.014	-0.135	-0.239**	-0.083**	-0.156*	-0.130
	(0.052)	(0.131)	(0.121)	(0.041)	(0.084)	(0.083)
Observations	1,096	1,096	1,096	1,096	1,096	1,096
Pseudo R2	0.166	0.169	0.172	0.123	0.091	0.071

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Taste seems to be the by far most important attitude. Individuals who assigned a low score (1–3 on a scale from 1 to 5) for taste were consistently less likely to choose a meat substitute. Those who assigned a low score for appearance were also consistently less likely to choose a meat substitute. For veggie burgers, smell is also a factor that correlates with behavior. Those who assigned a low score for the smell of a veggie burger were about 10 percentage points less likely to choose a veggie burger even if the burger would be given to them for free compared with those who assigned a higher score for this attribute.

Among those who claimed to be unfamiliar with the burger characteristics, again appearance seems to be the factor that most often correlates with behavior. Those who said they did not know how to rate the appearance were much less likely to choose the meat substitute. For veggie burgers, those who were unable to rate smell were also consistently less likely to choose a veggie burger. Moreover, those who did not know what a veggie burger tastes like had a 24 percentage point lower probability of choosing a veggie burger even if they would be given one for free.

4. Discussion

4.1 Conclusions

Meat is an important part of many people's food consumption. Our study confirms this. Meat production and meat consumption also cause several negative externalities on the environment and negative impacts on human health. Using fiscal instruments, one could modify people's dietary behavior. In this paper, we show that the price of a substitute clearly matters. We found that given the right monetary incentives, many individuals express a willingness to switch to alternatives to meat. We also found that a substantial share of respondents are reluctant to do so.

Many aspects of the substitute products, however, were unknown to our respondents: Between 30 and 40 percent of the subjects did not know what the meat substitute tastes, smells, feels, and looks like, or how much it costs. Taste seems to be the by far most important factor: those who do not know what a meat substitute burger tastes like or who was assigned a low score for the taste of a veggie or meat-like burger have a clearly lower probability of choosing a veggie burger even if they would receive one for free.

We have also identified a subset of individuals who would basically never substitute away from meat, even if the price of the substitute were zero. The typical characteristics of these would be an older man without university education living in a small city. Characteristics such as gender, education, living in a large vs. a small city, and especially age are important determinants of the extent of people's willingness to reduce their meat consumption and instead increase their consumption of meat substitutes. In addition to young age, university education and concern about the environment are factors that have positive and significant impacts on whether a person has ever tasted a veggie or a meat-like burger. Considering gender impact, males are less likely to ever have eaten a veggie burger but more likely to ever have eaten a meat-like burger compared with females. The typical consumer who demands a meat substitute is a young female with a university education who lives in a bigger city and is concerned about the environment.

4.2 Policy implications

The most important policy implication of our study is in one way simple: Price matters. Subsidizing a meat substitute would significantly affect the demand for meat. Given the right monetary incentives, many individuals express a willingness to switch to alternatives to meat. At the same time, we also identify knowledge and experience as important barriers for the willingness to switch to meatless alternatives. Finally, the groups of consumer who are extremely reluctant to switch should perhaps not be the primary target of any policy.

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Appendix A Scenario

A host of different meat replacement products have become available to consumers, each of which tastes and looks like real meat to varying degrees. Some people appreciate the availability of meatless alternatives in the market, while others have little interest in them. Nobody's preference is right or wrong in this respect – in this survey we are only interested in learning more about your personal opinions.

We will present three different alternatives to using beef in hamburgers.

Veggie burgers
Veggie burger patties are based on various vegetables, such as carrots, corn and zucchini. There are clear differences in texture, color and taste between veggie burgers and conventional meat-based burgers.

Plant-based meat-like burgers
Manufacturers of these burgers mix plant-based products (such as peas and soy) with ingredients such as starch and oil to produce a patty that is very meat-like in terms of texture, color and taste.

Cultured, or lab-based, meat
Cultured, or lab-based, meat is not yet available in the market, but several companies have managed to produce it and say they will soon be able to deliver products to supermarkets. It will initially be very expensive to buy. Cultured meat is grown in a laboratory using cells from animals, which when mixed with blood plasma from unborn calves and chickens start to divide and turn into muscle tissue. Cultured meat tastes very much like conventionally produced meat.

Imagine being at a restaurant. You have just decided you would like to order a burger and now need to choose one of two types:

A. Beef-based burger
B. Veggie burger

The two types are of equal size and only differ in what the patties are made of.

Which type would you choose? Both burgers, including condiments and French fries/a salad, cost SEK 150. Your preferred choice may of course vary from day to day. We ask you to state what type of burger you believe you would choose most times.

☐ Beef-based burger
☐ Veggie burger

[For those who choose beef-based burger]

In order for you to choose a veggie burger instead of a beef burger, how much cheaper would it need to be?

For me to choose a veggie burger instead of a beef-based burger, the veggie burger may not cost more than:

       □ SEK 145 (SEK 5 cheaper than the beef burger)
       □ SEK 140 (SEK 10 cheaper than the beef burger)
       □ SEK 135 (SEK 15 cheaper than the beef burger)
       □ SEK 130 (SEK 20 cheaper than the beef burger)
       □ SEK 125 (SEK 25 cheaper than the beef burger)
       □ SEK 120 (SEK 30 cheaper than the beef burger)
       □ SEK 115 (SEK 35 cheaper than the beef burger)
       □ SEK 110 (SEK 40 cheaper than the beef burger)
       □ SEK 105 (SEK 45 cheaper than the beef burger)
       □ SEK 100 (SEK 50 cheaper than the beef burger)
       □ SEK 95 (SEK 55 cheaper than the beef burger)
       □ SEK 90 (SEK 60 cheaper than the beef burger)
       □ SEK 85 (SEK 65 cheaper than the beef burger)
       □ SEK 80 (SEK 70 cheaper than the beef burger)
       □ SEK 75 (SEK 75 cheaper than the beef burger)
       □ SEK 70 (SEK 80 cheaper than the beef burger)
       □ SEK 65 (SEK 85 cheaper than the beef burger)
       □ SEK 60 (SEK 90 cheaper than the beef burger)
       □ SEK 55 (SEK 95 cheaper than the beef burger)
       □ SEK 50 (SEK 100 cheaper than the beef burger)
       □ SEK 45 (SEK 105 cheaper than the beef burger)
       □ SEK 40 (SEK 110 cheaper than the beef burger)
       □ SEK 35 (SEK 115 cheaper than the beef burger)
       □ SEK 30 (SEK 120 cheaper than the beef burger)
       □ SEK 25 (SEK 125 cheaper than the beef burger)
       □ SEK 20 (SEK 130 cheaper than the beef burger)
       □ SEK 15 (SEK 135 cheaper than the beef burger)
       □ SEK 10 (SEK 140 cheaper than the beef burger)
       □ SEK 5 (SEK 145 cheaper than the beef burger)
       □ SEK 0 (SEK 150 cheaper than the beef burger)
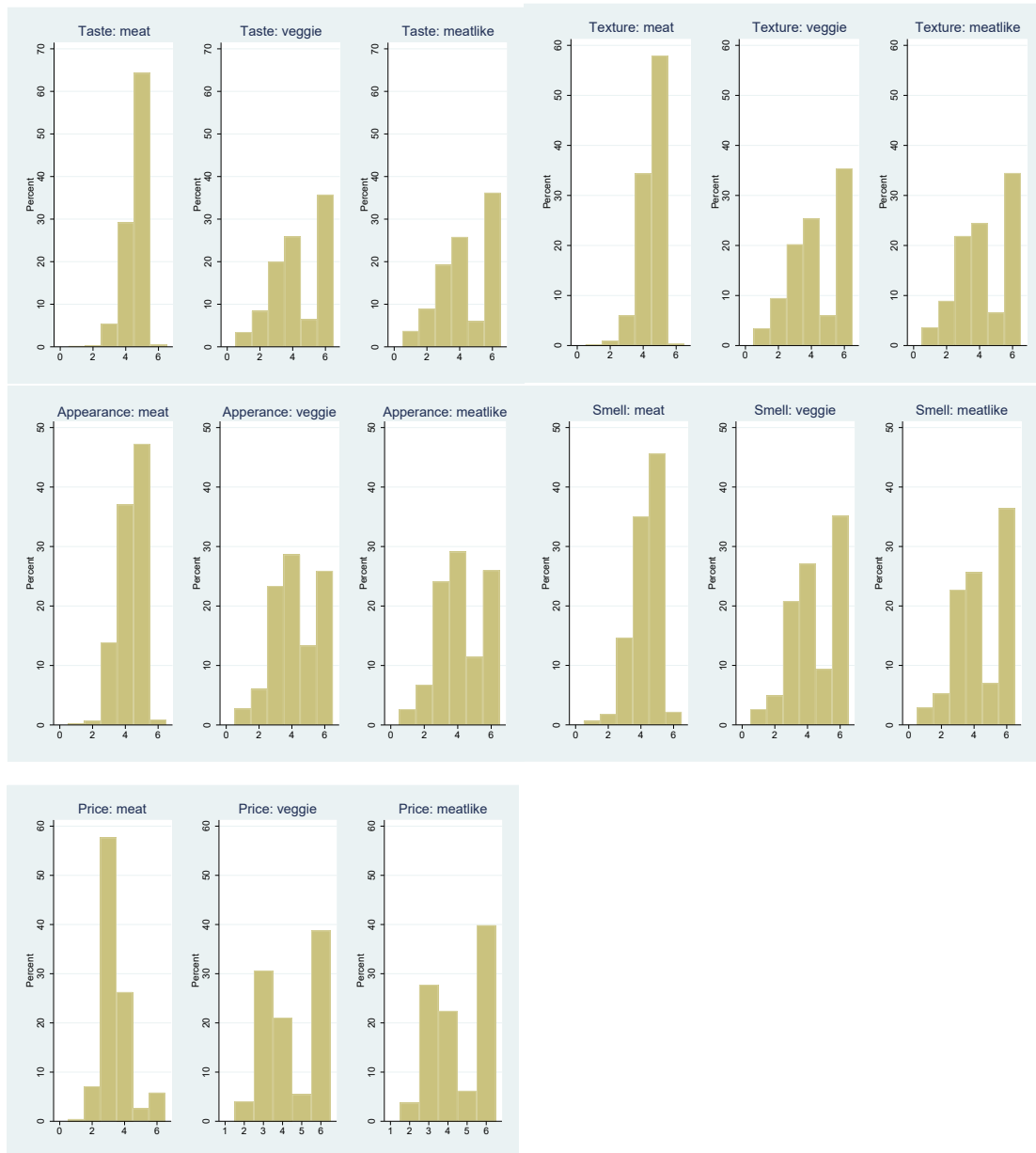   □ I would never choose a veggie burger

Appendix B Additional figures

Figure A1. Histograms, attitudes. (Note: 6 is "do not know")