Consumer characteristics and e-grocery services: the primacy of the primary shopper

Leo Van Hove

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Abstract
The literature does not agree on the precise role of socio-demographic characteristics in the adoption of online grocery shopping. This methodological note reviews the literature and shows that the differences in empirical results can to a large extent be explained by the data that is used. In particular, what matters is whether or not the survey that is exploited was targeted at the household member primarily responsible for the grocery shopping. I show that studies that use a non-targeted survey erroneously find that women are keener to adopt e-grocery services, in that the gender gap is simply due to women’s role as homemakers. I also show that such studies tend to underestimate the impact of education and income.

Keywords Online grocery shopping · e-grocery services · Technology adoption · Division of household labour · Surveys · Systematic literature review

1 Introduction

Two recent articles highlight—independently from one another and even in different domains—that the extant literature shows no consensus as to the impact of socio-demographic factors (such as gender, education, and income) on the adoption of online grocery shopping. At the same time these articles downplay the differences. Dominici et al. [1, p. 2] talk about “conflicting results” but suggest that this is (merely) because the studies “cover a wide timeframe and concern countries located in different geographical areas”. Zatz et al. [2, p. 4] emphasise that comparisons “should be interpreted with caution given that [their] study is more recent than prior studies” and in view of “differences in settings and variation in methodology”.

Leo Van Hove
Leo.Van.Hove@vub.be

1 Department of Applied Economics (APEC), Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium
There is, however, a less innocent explanation. Closer scrutiny shows that several of the papers—including [1]—suffer from a methodological problem, in that the sampling strategy of the surveys that they exploit did not take into account that grocery shopping is a household activity and, crucially, a task that is often allocated to a specific household member. As I will show, the upshot is that these studies mismeasure the causal impact of gender because the sample contains individuals who are not the ‘primary grocery shopper’ of their household and who are thus not personally faced with any technology adoption decision concerning e-grocery services.

Once one realises this, there is, in fact, no longer any contradiction to speak of in the results. Rather, the issue is that specific studies conflate two questions and end up answering neither correctly—the two questions being: ‘Who is the primary grocery shopper in the household?’ and ‘What drives households to use e-grocery services?’.

The remainder of this methodological note unfolds as follows. In the next section I first document the disagreement signalled by [1, 2]. In doing so, I focus on gender because this will allow me, in later sections, to demonstrate the methodological problem most intuitively. My demonstration is stepwise: in Sect. 3 I illustrate the issue based on the paper by Dominici et al., in Sect. 4 I show that several of the papers cited by [1, 2] suffer from similar problems, and in Sect. 5 I perform a systematic literature search. Section 6 then broadens the discussion to other consumer characteristics and Sect. 7 concludes.

2 Conflicting results

Table 1 lists ten studies that have looked into the impact of gender on the adoption of e-grocery shopping. In order to avoid falling prey to selection or confirmation bias, Table 1 only lists studies that Dominici et al. [1, p. 2] and Zatz et al. [2, p. 4] cite—the idea being that these are the papers that they deemed representative of the state of the literature. I did, however, add the papers by Dominici et al. and Zatz et al. themselves.

To highlight the (apparent) contradiction in the results I have grouped the studies according to whether they find that women are more, equally, or less likely than men to adopt online grocery shopping; see final column. Within each group, the papers are ranked according to the year in which the data were collected, as listed in column (3). Column (4) indicates whether the data collection was done by means of a ‘dedicated’ survey; that is, a survey mainly or exclusively about online grocery shopping (but not necessarily a self-administered survey nor one targeted at primary grocery shoppers). The relevance of column (6) will be made clear in Sect. 4.

Looking at Table 1, the results effectively appear contradictory. As mentioned, [1, 2] suggest that this is due to differences in the periods and/or countries studied. While inter-country differences cannot be excluded (as will become clear in Sect. 5),

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1 The two selections overlap: all four papers mentioned by [2] are also listed by [1].
## Table 1  Gender and adoption of online grocery shopping

| Reference (1) | Country (2)     | Year (3)  | Dedicated survey (4) | Number of respondents (5) | Primary shopper (6) | Impact of gender (female = 1) (7) |
|---------------|-----------------|-----------|----------------------|---------------------------|--------------------|----------------------------------|
| 1             | Naseri and Elliott [3] | Australia | 2002 | No | 574 | No | + |
| 2             | Wang and Somogyi [4] | China     | 2016 | Yes | 435 | No | + |
| 3             | Dominici et al. [1] | Italy     | 2016 | No | 34,488 | No | + |
| 4             | Zatz et al. [2] | US        | 2015–2017 | Yes | 863 | Yes | + |
| 5             | Saphores and Xu [5] | US        | 2017 | No | 2,934 | No | + |
| 6             | Hui and Wan [6]  | Singapore | 2004 | Yes | 211 | Yes/no | None |
| 7             | Goethals et al. [7] | France    | 2009 | Yes | 244 | Yes/no | None |
| 8             | Van Droogenbroeck and Van Hove [8] | Belgium | 2011 | Yes | 468 | Yes/no | None |
| 9             | Arce-Urriza and Cebollada [9] | Spain | 2002–2003 | Yes | 2742 | Yes | – |
| 10            | Finotto et al. [10] | Italy     | 2016 | Yes | 1361 | No | – |
Table 1 would not seem to support the first observation: it is not as if older studies yield one type of result and more recent studies another.

The studies also differ on aspects left unmentioned by [1, 2]. To mention a few, some studies focus on food shopping (papers 2 and 10) rather than the broader grocery shopping (all other papers); most are at least in part about home delivery, but two papers examine only the ‘click and collect’ business model (4, 8); and some have only socio-demographic explanatory variables (4, 5, 7–10) whereas other papers also include situational factors, innovation characteristics, or food choice motives (1, 2, 3, 6). However, in what follows I will argue that the key explanation for the differences in the results lies elsewhere; namely in a methodological issue.

3 It is a household activity

The root cause of the methodological problem that plagues several of the studies in Table 1 lies in the facts, first, that grocery shopping is a household rather than an individual activity and, second, that it is a task that is often largely or exclusively the responsibility of a single household member. In heterosexual couples, this is often the female partner. Hence, when a survey is not explicitly targeted at these ‘primary grocery shoppers’, many respondents are in fact questioned about an activity that they take no (or little) part in, and about a decision—whether or not to use e-grocery services—that they are not (or only indirectly) involved in.

The implications are far-reaching. In this section I will illustrate this based on the paper by Dominici et al. [1], but in the next section I will show that other papers suffer from similar problems. To be clear: the Zatz et al. paper is not among these, as their sample does consist of primary grocery shoppers (see Sect. 4).

Dominici et al. take their data from the 2016 edition of the ‘Aspects of Daily Life’ survey that is conducted by the Italian National Institute of Statistics as part of the nationally representative Multipurpose Household Survey. Note, however, that Dominici et al.’s unit of analysis is (adult) individuals, rather than households. A first problem with this is that several households are represented by more than one adult. But even if this were not the case, the general nature of the survey would still be problematic. Indeed, given that, as stressed, grocery shopping is often delegated to a single member, in both conditions—households represented by, respectively, multiple members or one person—several of the respondents will not be the primary grocery shopper of their household. (The problem obviously does not occur in one-adult households.)

The result is biased estimates of the impact of many a variable, but, as I will show now, in particular for gender. Note in this respect that Finotto et al. [10, p. 5] report that “national polls” show “that 75% of women in Italian households take responsibility for the procurement of food and beverage[s]”. In other words, many of the Italian men in Dominici et al.’s sample will not be the primary grocery shopper and

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2 See [11], [12], and the references therein. This division of labour is also confirmed by several of the papers that are cited below.
will have answered ‘no’ to the question that inquired whether “the respondent had purchased food online at least once in the last 12 months” [10, p. 4, my emphasis]. Crucially, these men will, in principle, have answered ‘no’ even in situations where their female partner did make use of an e-grocery service. Conversely, many of the female respondents will be the primary shopper. Hence, for women the underestimation of household use of e-grocery services will be smaller. The bottom line is that even when households where the female partner is the primary shopper and households where this role is taken up by the male partner are, ceteris paribus, equally likely to adopt online food shopping, in non-targeted surveys female individuals will nevertheless show a higher likelihood to buy food online.

This is illustrated in Table 2. In this numerical example, the probability of being the primary grocery shopper—25% for men, 75% for women—is based on [10], as quoted above. The probability that the primary shopper opts for the online channel is set at 50% solely for ease of interpretation, but, crucially, is on purpose identical for the two genders. (Again the illustration does not apply to one-adult households, nor is it relevant for same-sex couples.)

| Gender | Primary grocery shopper | Answer to the question about online food shopping |
|--------|-------------------------|-----------------------------------------------|
| ☉      | yes 25%                 | yes 12.5%                                     |
|        |                         | no 12.5%                                      |
|        | no 75%                  | yes                                          |
|        |                         | no 75%                                       |
| ☀      | yes 75%                 |                                               |
|        |                         | yes 37.5%                                    |
|        | no 25%                  |                                               |
|        |                         | no 37.5%                                     |

As can be seen, even though the gender of the primary shopper has, by construction, no impact on the probability that the household is an adopter, female individuals do exhibit a substantially higher probability (37.5% = 0.5 * 75%) than male individuals (12.5% = 0.5 * 25%); cf. the values in italics—purely because women are more likely to be the primary grocery shopper.

One could maintain that the illustration is not fully realistic, in that the boxed cell in Table 2 should not be left empty. Indeed, one could argue, for one, that male respondents who have not ordered food online themselves but whose partner does use an e-grocery service, might reason in terms of the household when answering the question whether “the respondent had purchased food online”. These men might, after all, to some extent be involved in the process. A study for Belgium [12] shows that in a click-and-collect context quite often both partners are involved—with the ordering in most cases done by the female partner and the collecting more equally divided. However, it is not obvious to what extent a male partner who has picked
up the order—and nothing more—will consider that he has actually “purchased food online”. Also, in the home delivery model, which is the model examined by [1] (and by most other papers in Table 1), the opportunities for task division are more limited.

One could also argue that if the female partner does the big weekly shop, this does not preclude the male partner being involved in the ‘top-up shopping’—and thus in the use of an e-grocery service. However, few households become pure online users. A study for Belgium [13] finds that 68.8% of the users of e-grocery services are multichannel shoppers who regularly visit supermarkets and that 28.4% still go to a physical store when they have forgotten something. Only 2.8% claim to have stopped buying groceries offline altogether. In other words, only a small portion of the top-up shopping is done online.

Another argument is that Dominici et al.’s question inquires whether “the respondent had purchased food online at least once in the last 12 months” [1, p. 4, my emphasis], implying that one single order by the male partner suffices for a ‘yes’ answer. However, the qualitative research of Van Droogenbroeck and Van Hove [12, pp. 8–9] finds that when couples switch to online grocery shopping the roles of the partners tend to become decidedly more fixed (if they were not already): “In all couples where the task division for offline shopping used to be variable (in the sense that the partners took turns or alternated between one specific partner doing it or doing it together), at least one of the two subtasks has now been assigned exclusively to one partner”. In other words, the person who places the order tends to always be the same.

To return to Table 2, the intermediate conclusion is thus that with samples that comprise individuals who are not the primary shopper—as in [1]—one risks erroneously drawing the conclusion that female primary shoppers are keener on adopting the technology, whereas the observed gender gap is in fact largely due to women’s role as homemakers. In addition, it is not just a matter of correctly interpreting the results; it is impossible to isolate the two effects.

Note in this respect that Dominici et al. clearly intend to examine the technology adoption decision. To quote from their Discussion: “socio-demographic characteristics … significantly affect individuals’ choice to e-grocery shop. Therefore, it is meritorious to explore the determinants of this behaviour” [1, p. 6; my emphasis]. Where gender is concerned, they do qualify this by stating that “women have traditionally been responsible for buying household grocery, and [that] … online grocery shopping has not changed this habit” [1, p. 6]. They do not, however, attempt to quantify this explanation.

To wrap up the section—and drive home its title—it can be concluded that for a household activity such as food shopping, investigating “the factors that influence individuals’ likelihood to buy food online” [1, p. 1; my emphasis] is not the best possible approach—unless, that is, the survey is targeted at primary grocery shoppers.

4 Is there a pattern across the studies?

The previous section has demonstrated that one specific paper—by Dominici et al. [1]—overestimates the impact of gender on the adoption of online food shopping when the latter is analysed, as the authors do, as a technology or channel choice. The
present section examines whether more of the studies listed in Table 1 suffer from this problem, and whether there is any pattern.

If we start at the top, Naseri and Elliott [3]—who, next to ‘food and groceries’, also examine 13 other product categories—draw their data from the 2002 General Social Survey carried out by the Australian Bureau of Statistics. Just like [1] they thus rely on a general-purpose survey, implying that their analysis is subject to similar criticisms. Note in this respect that when deriving their hypothesis concerning gender, Naseri and Elliott [3, p. 71; my emphasis] clearly frame it primarily as a technology/channel decision:

Prior research examining the effect of gender on willingness to shop online revealed that men are more likely to conduct online transactions than women. […] Several explanations have been advanced in the literature for the gender differences, including risk perception, a general attitude towards technology and differences in role specializations.

Also telling is that when presenting their results, they treat ‘food and groceries’ in the same way as any other product category [3, p. 78]:

… the sign of regression coefficients for gender changes across the product categories. More specifically, adopters of ‘food and groceries’, ‘clothing and shoes’, ‘ticket[s] to entertainment, cinema’ and ‘other goods and services’ were more likely to be woman than man.

In other words, no attention is paid to the household nature of grocery shopping and the associated ‘role specialisation’ that Naseri and Elliott initially list as a possible explanation.

The research in [4] is of an altogether different nature. Wang and Somogyi collected primary data through an online survey among individuals who had consumed food from Alibaba’s Fresh Hema grocery stores in three Chinese cities. Fresh Hema offers a ‘three-in-one’ service: consumers can pick fresh food and have it cooked (to dine in the store or to go), they can simply purchase food on the spot, or they can order it online and have it delivered [4, p. 3].

Unlike in [3], Wang and Somogyi’s survey was thus squarely targeted at food consumers. However, in view of the ‘three-in-one’ service, this does not imply that they have identified the primary grocery shopper of the household, as a respondent may simply visit the store to have a meal. So, here too, the coefficient on gender would appear to be biased. As an aside, the dependent variables of Wang and Somogyi’s linear regression analyses are not centered on online food shopping alone. Rather they inquire about food consumption from Fresh Hema (that is, any of the three modes); see [4, p. 7].

Study #4 in the list, by Zatz et al. [2], performs a secondary analysis of scanner data for households enrolled in randomised trials of a 2-for-1 discount on fruits and vegetables in two US supermarkets. Subjects were consumers who shopped in the stores regularly and lived with at least one child. In one of the trials, “being the primary shopper in the household” was also an eligibility criterion [14, p. 1558]; in the other apparently not [15, p. 219].
Zatz et al. find that households that shopped online during the study period were more likely to have a female primary grocery shopper than households that shopped only in-store. Given that Zatz et al.’s sample consists (mainly) of primary shoppers and that 84.1% is female [2, p. 3], this is surprising. Unlike in the studies discussed so far, women’s role as homemakers should not have an impact. Perhaps the explanation lies in the fact that the sample is not representative. As mentioned, to be included in the experiment the household had to have at least one child under the age of 18. One of the attractions of online grocery shopping is that it allows caregivers to shop without children [2, p. 2; 8]. Perhaps this is more of an advantage for female than for male primary shoppers. It can also be noted that the study stores—in Portland, Maine—were selected based on the lower income of the clientele [14, p. 1558]. And Zatz et al. themselves point out that “[s]ince participants were enrolled in store, shoppers who predominantly shopped online would be less likely to be in [their] sample” [2, p. 5].

The final paper in Table 1 that finds a positive impact of gender also relies on existing research. In particular, Saphores and Xu [5] use data from the 2017 American Time Use Survey (ATUS), which they, sensibly, pare down to households likely to have had access to e-grocery shopping at the time. (They do so by focusing on areas where at least one ATUS respondent bought groceries online.) Their dependent variable indicates whether a respondent shopped for groceries online during his or her ATUS survey day.

Crucially, Saphores and Xu’s sample is thus not restricted to primary grocery shoppers. The authors apparently realise that this has drawbacks: “Although grocery shopping is a household activity, our basic unit of analysis here is the individual because only one person per household participates in ATUS” [5, p. 4; my emphasis]. Also, in the first part of their article, where they analyse deliveries from online shopping in general (based on a different dataset), they note: “We aggregated individual answers […] by household to create the dependent variable […]. We focused on households here because it is not uncommon for one household member to order goods for other household members, especially if they are children”.

Unfortunately, Saphores and Xu do not interpret their e-grocery results from this perspective. They simply note that “the only socio-economic characteristics (sic) that is statistically significant for people who shopped online for groceries is gender: women are more likely to shop online for groceries” [5, p. 10]. However, the coefficient on gender is not ‘clean’, as it is also affected by the circumstance that women are typically more involved in grocery shopping (see Sect. 3).

At first sight the comparison of this coefficient (0.879 **) with the coefficient on gender in the regression for in-store shopping (0.413 ***) would seem to neutralise the impact of the task division between men and women, as the sample, and thus also the proportion of primary shoppers, is the same. The bigger gender gap in the regression for online thus suggests that gender does affect channel choice.

However, the nature of the ATUS survey—a survey on how Americans allocate their time—raises severe doubts as to whether it correctly identifies respondents as being online, offline or non-shoppers. As mentioned, the survey only asks whether the respondent shopped for groceries during their ATUS survey day. Saphores and Xu [5, p. 4] report that, in their initial sample, 13.9% had shopped in-store and
0.57% online. This implies that no less than 85.5% are classified as non-shoppers, simply because they did not shop for groceries on a particular day. This must be a substantial underestimate. Still, this would not be a problem if the margin of error were the same for both channels. However, the frequency with which people shop for groceries in-store is typically higher than for online.\(^3\) In other words, the probability that a user of an e-grocery service placed an order on their ATUS survey day, and is thus identified as a user, is lower compared to in-store. One should also realise that the ATUS survey makes no distinction between the big weekly (or monthly) shop and the top-up shopping. This could help explain why there is less of a gender gap for in-store shopping. Offline, the male partner may do some of the top-up shopping; online such a task division is less likely, as the top-up shopping is most often still done in-store (see above).

As an intermediate wrap-up, it is striking that the four studies discussed so far that do not target primary grocery shoppers all find a positive effect of gender on the adoption of e-grocery services. The final two columns of Table 1 highlight this pattern. The next step in my argument is to demonstrate that, with the exception of [2], surveys that focus (more) on primary grocery shoppers do not find such a positive impact. This suggests that studies that disregard women’s role as homemakers not only overestimate the impact of gender, but that there is, in fact, no impact.

Hui and Wan [6], in their early study, approached customers of two Singaporean supermarkets upon leaving the store. They thus did not specifically target primary grocery shoppers, but as their sample consists of individuals who had just visited a supermarket, they clearly come closer than studies 1–3 and 5. In Table 1 I have therefore put ‘yes/no’ in the one-but-final column. Note that as e-grocery services had, at the time, only just been launched in Singapore, respondents were mainly questioned about their intention to use rather than actual usage. (Only two of the 211 respondents were users.) For a good understanding let me also note that Hui and Wan only administered their questionnaire to shoppers who had Internet access at home. Interestingly, chi-square tests show that intention to use is not associated with gender (\(p\)-value = 0.710), and the variable is therefore not retained for the discriminant analysis.

Goethals et al. [7, p. 135], for their part, do not provide much detail about their sampling strategy other than the following:

We conducted a structured survey among French consumers […]. The survey was conducted partially offline and face-to-face (…) and partially online (…). […] The face-to-face surveys took place over several days at different times of day in different parts of a big city in the north of France.

From this, it is not clear whether the authors asked potential participants if they were responsible for the grocery shopping. However, while speculative, the presence of substantially more women than men (58% vs. 42%) might indicate that the sample

\(^3\) Saphores and Xu [5, p. 4] mention that “by August 2018, of the 16% of US adults who had ever ordered groceries online, 7 out of 10 did so twice a month or less”.

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does comprise a fair number of primary shoppers; hence the ‘yes/no’ in Table 1. It is indeed not implausible that men who are not involved in the grocery shopping declined to participate in the survey when approached on the street.\(^4\) Also, the survey contained questions—for example on the time typically spent shopping in the supermarket—that non-shoppers will have found difficult to answer. As indicated in Table 1, Goethals et al. find no significant difference between women (18\%) and men (16\%) in their use of e-grocery services (\(\chi^2 = 0.353; p = 0.553\)).

To continue, the data collection strategy of Van Droogenbroeck and Van Hove \([8]\) is not dissimilar from that of Hui and Wang, in that shoppers were surveyed at the exit of four Colruyt stores, Belgium’s largest supermarket chain. A difference is that, in parallel, questionnaires were also handed out at the stores’ pickup point for Collect & Go, Colruyt’s online offering—the aim being to have a sufficient number of users of the service in the sample. Interestingly, at 65.0\%, women are overrepresented, which, the authors remark, “would seem to indicate that doing the groceries is still a task that is mainly performed by women” \([8, p. 268]\). Gender proves insignificant in all of their models for the adoption of Collect & Go.

The pattern that so far emerges from Table 1 is that studies that do not rely on a dedicated survey and/or do not adequately identify the primary grocery shopper of the household (references 1–3, and 5) find that women are more likely to adopt e-grocery services, whereas studies that do make use of a dedicated survey and thus have more primary shoppers in their sample (4 and 6–8) do not find such a link—with one exception. The exception is Zatz et al. (reference 4), who, as explained, exploit a sample that is not representative.

This said, there are also two articles in Table 1 which find that men are more likely to use e-grocery services. However, as I will now explain, these studies should, in fact, not have been included in the first place.

Arce-Urriza and Cebollada \([9]\) cooperated with a leading Spanish grocery chain and obtained a full year of purchase data for 2742 households in Barcelona. To be included in the panel, a household needed to have made at least one online purchase from the grocer during the prior year. Arce-Urriza and Cebollada’s dependent variable is thus not whether the household uses the e-grocery service. Rather households are divided into ‘online prone’ and ‘offline prone’, depending on whether they do more than 50\% of their purchases online. T-tests show that households with a male primary shopper (proxied by who registered for the loyalty card) are more likely to be ‘online prone’. This is an interesting finding, but not really comparable with the other studies in Table 1.

Finally, Finotto et al. \([10]\) conducted a web-based survey among Facebook users in the North-East of Italy. They find that only 15\% had already bought food or drinks online, but that—in contrast to much of Table 1—men are more likely to have done

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\(^4\) In a Dutch study on the relationship between on-line and in-store shopping for non-daily products, Farag et al. \([16]\) observe that women form the majority (61\%) in their sample—even though in the first stage of the data collection households were selected randomly. Farag et al. explain this as follows: “A possible explanation [… ] is that shopping appeals more to women than to men. Hence, women would be more willing to fill out a questionnaire about shopping than men” \([16, p. 130]\).
so. However, not only is Finotto et al.’s sample a convenience sample [1, p. 6], their setup is substantially different. For one, they focus on food and beverages (rather than groceries). Second, they ask whether respondents have ever purchased such items online. In other words, a man who once in a blue moon purchased a bottle of wine on a website would qualify. Also, the coefficient on gender is only significant at 10%.

In short, the results of [9] and [10] do not, after all, spoil the pattern identified earlier.

5 A systematic literature review

As explained in Sect. 2, Table 1 on purpose lists only studies cited by Dominici et al. [1] and Zatz et al. [2]. However, because their selection is not necessarily the best possible, I performed a systematic literature review to identify other relevant studies. Concretely, I first conducted a search in the Web of Science (WoS) and then repeated it in Scopus—with the same keywords (see Table 6). In both databases I opted for the default search option. As the literature on online grocery shopping is quite vast,5 most (combinations of) keywords focussed explicitly on the adoption aspect. Initial keywords were drawn from articles that I was already aware of, and new ones were added whenever a new source used a different terminology.

To cast as wide a net as possible, I did not impose any restrictions in terms of the year of publication. In light of the remarks by [1], 2 about the importance of timing (see Introduction), this can be criticised. I come back to this in the Conclusion. I also decided not to exclude conference papers (nor book chapters, for that matter). As argued by [17], inclusion of unpublished research is important to reduce publication bias. This might matter: studies that find no significant impact of gender are key for my analysis but might be underrepresented in the published literature.

As can be seen in Table 6 and Fig. 1, the search initially yielded 278 records. Elimination of duplicates reduced the number to 131. I then read the abstracts of all 131 papers and, when needed, also other parts. To be classified as relevant, studies needed to be of a quantitative nature, had to make use of survey data (not limited to a specific population), the sample needed to include both men and women, the dependent variable had to be either adoption of online grocery shopping or the intention to do so, and gender needed to be part of the model.

The most frequent reason for exclusion was simply that the study was off topic (i.e., not in consumer research but in fields as diverse as medicine, logistics, sustainability, and information systems; 44 cases). This was followed by the absence of gender in the model (33 cases), the use of data collection methods other than a survey (experiments, focus groups, etc.; 19 cases), a non-suitable composition of the sample (only users, only non-users or only women; also 19 cases), or a dependent

5 A search on “online grocery shopping” in Google Scholar yielded 5,460 hits.
| Reference (1) | Country (2) | Year (3) | Theoretical background (4) | Dedicated survey (5) | Number of respondents (6) | % females in sample (7) | Primary shopper (8) | Impact of gender (female = 1) (9) |
|---------------|-------------|----------|---------------------------|----------------------|---------------------------|-------------------------|-------------------|--------------------------------|
| 1 Naseri and Elliott [3] | Australia | 2002 | Socio-demo + web experience + social connectedness | No | 574 a | 50.5 | No | + |
| 3 Dominici et al. [1] | Italy | 2016 | Socio-demo + situational factors | No | 34,488 | 52.2 | No | + |
| a Hood et al. [18] | UK | 2015–2016 | Socio-demo + geography | No | 19,033 | 53 | No | + |
| 5 Saphores and Xu [5] | US | 2017 | Socio-demo | No | 2934 | 54.5 | No | + |
| b Hamad and Schmitz [19] | UK | unknown | Socio-demo + shopping orientations | Yes | 501 | n.a | No | + |
| c Nguyen et al. [20] | Vietnam | 2020 | Socio-demo + shopping attitudes + COVID-19-related variables | No | 355 | 50.1 | No | + |
| d Hiser et al. [21] | US | 1998 | Socio-demo + shopping behaviour | Yes | 390 | 59.6 | Yes | None |
| e Raijas [22] | Finland | 1999 | Socio-demo | Yes | 91 | 73 | Yes/no | None |
| f Hansen [23] | US | 2002 | Innovation characteristics | Yes | 1516 | “majority” | Yes | None |
| g Adamides et al. [24] | Cyprus | 2006 | Socio-demo | Yes | 70 | 56 | Yes/no | None |
| 6 Hui and Wan [6] | Singapore | 2006 | Socio-demo + Technology Acceptance Model | Yes | 211 | 48.8 | Yes/no | None |
| 7 Goethals et al. [7] | France | 2009 | Socio-demo + distance + shopping pleasure | Yes | 244 | 58 | Yes/no | None |
| h Suel et al. [25] | UK | 2011 | Socio-demo + basket characteristics | No | 452 | 54.6 | Yes/no | None |
| 8 Van Droogenbroeck and Van Hove [7] | Belgium | 2011 | Personal and household characteristics | Yes | 468 | 65.0 | Yes/no | None |
| i Zheng et al. [26] | China | 2015 | Socio-demo | Yes | 1016 | 65 | Yes/no | None b |
| Reference | Country | Year | Theoretical background | Dedicated survey | Number of respondents | % females in sample | Primary shopper | Impact of gender (female = 1) |
|-----------|---------|------|-------------------------|------------------|----------------------|-------------------|----------------|-------------------------------|
| j Frank and Peschel [27] | Denmark | 2016 | Socio-demo + innovation characteristics | No | 1580 | 47.0 | No | – |
| k Jensen et al. [28] | US | 2020 | Socio-demo + COVID-19-related variables | Yes | 1558 | 64.6 | Yes | – |

*a 287 users and 287 non-users randomly selected from a total sample of 15,510

b Gender has a significant positive impact at the 10% level, but in line with the other studies in the table I have used 5% as the cut-off level. Also, Zheng et al.’s dependent variable is an ordinal ranking variable with five values that, in fact, combines adoption (value = 0) and shopping frequency (values 1–4)
variable other than adoption or intention to use (for example, shopping frequency or satisfaction; 16 cases). I also eliminated studies that focused only on (fresh) food and/or meals (9 cases) or on a specific population (6 cases).⁶ Note that, as a result, the studies in Table 3 differ on fewer dimensions than in Table 1. Also important in this respect is that only one of the papers examines the click-and-collect model alone.

Eventually 11 references matched all criteria, 5 of which already appeared in Table 1.⁷ In other words, the systematic search yielded (only) 6 new references. In a second stage, I perused the reference lists and citations of the 11 selected studies. This snowballing exercise generated 5 additional references.

Table 3 below is essentially Table 1 with the 11 new references inserted (and additional information added), and with 4 of the existing references removed. The new references appear in bold and are identified by means of letters. The references that were removed are: [4, 10], [9], and [2]—the first two because of their focus on food (and beverages), [9] because their sample consists of users, and [2] because the sample is not representative; see Sect. 3.

Table 3 is organised in the same way as Table 1. Columns (4) and (7) are new. Column (4) summarises the theoretical background of the papers and column (7) reports on the proportion of women in the sample.

As can be seen, with two exceptions—references j and k, at the bottom of the table—the papers that were added confirm the pattern that was already present in Table 1: studies that do not target primary grocery shoppers find that women are more likely to adopt e-grocery services, whereas studies that have more primary shoppers in their sample do not find such a correlation.⁸

The newly added information also reveals two other patterns, which help understand the main finding. For one, on a technical level, studies that do not employ a dedicated survey—see column (5)—typically do not zoom in on primary grocery shoppers. This is not surprising. As can be gleaned to some extent from the number of respondents, these studies tend to make use of existing government surveys or of internet panels, which are, by definition, not restricted to primary shoppers. Hood et al. [6, pp. 3–4], for example, use subsamples drawn from a one-million strong panel maintained by YouGov, a market research company [1], and [3] take their data from (annual) official surveys; see, respectively, Sects. 3 and 4.

There is one exception to the rule. Suel et al. [25] compile their data from the 2011 Living Costs and Food Survey (LCF), undertaken on a continuous basis by the UK Office of National Statistics, with an annual sample size of approximately

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⁶ A spreadsheet detailing all records, together with the reasons for their exclusion, is available from the author. Note that many records were excluded for more than one reason.

⁷ Conversely, [3] and [10] did not show up in the literature search. The former because they examine 14 different product categories (so that ‘grocery/ies’ does not appear in either title or abstract); the latter because it is a working paper. [2], [4] and [9] did show up but did not survive the selection process; see below.

⁸ A Mann–Whitney U test confirmed that the estimated impact of gender (coded as +1, 0, -1) is significantly higher in studies that do not target primary shoppers (Md = 1, n = 7) than in studies that do (Md = 0, n = 10), U = 12.5, p = .05.
6,000 households. The LCF collects data on respondents’ spending via an expenditure diary. From this dataset, Suel et al. select residents of London who recorded any food purchases in their two-week diary \((n=452)\). This does not ensure that they have only primary grocery shoppers in their sample, but the proportion of such respondents should be higher compared to the general-purpose surveys of references 1, 3, a, 5, and c; hence the ‘yes/no’ qualification in Table 3.

Another pattern in Table 3 is that studies that target primary shoppers tend to have a higher proportion of females in their sample (on average 60.5% vs. 51.2%). Again this is not surprising. Hansen’s study for the US is a good example of a targeted survey: “when a household consisted of more than one person, the respondent chosen was the household-member most often responsible for carrying out the household’s grocery shopping” [23, p. 108]. As Hansen notes, “this resulted in a majority of women participating …—a commonly detected tendency in studies of household grocery-shopping behavior”.

This overrepresentation of women is also a feature of papers that collect their data by interviewing people upon leaving a supermarket.9 Hiser et al. [21], in their exploratory research for the US, administered a survey in which customers of four grocery stores were greeted at the door and queried about their willingness to use an online service. Women comprise 59% of the sample. As Hiser et al. [21, p. 79] point out, it is only “logical that women would be the majority of a sample taken in grocery stores since women are primarily the major shoppers”.

Bringing these three patterns together yields the following overall picture: (1) studies that do not exploit a dedicated survey typically do not (and often cannot) target primary grocery shoppers, (2) as a result, their sample is fairly evenly balanced in terms of gender, and (3) they typically find that women are more likely to adopt online grocery shopping—but this is simply because the women in their sample are more likely to be the primary shopper of the household.11

This said, as already hinted at, there are two studies that do not fit the picture. For one, Jensen et al. [28] use results from an original survey, they explicitly target primary household food shoppers, their sample consists primarily of women (64.6%), and yet they find a significant negative impact of gender. At the same time, their research is distinctive in several respects. First, there is the unusual setting: their survey was conducted in June 2020 with the aim to examine the impact of food supply chain disruptions as well as risk perceptions about COVID-19. Clearly, during the pandemic some people changed their shopping routines—as also appears from Jensen et al.’s study. (Note that their dependent variable is whether the respondent shopped for groceries online in June 2020.) Second, the authors would seem to

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9 At 48.8% women, Hui and Wan [6] is a notable exception. Perhaps the explanation lies in the fact that respondents were questioned only about their intention to use. Perhaps male non-primary shoppers were thus less intimidated than in [7]; see Sect. 4.

10 [24, p. 62] and [28, p. 419–420] make similar remarks – for the case of Cyprus and the US.

11 There is another pattern in the literature. In line with the argument in the main text, studies that consider only users of e-grocery services (and that for this reason do not appear in Table 3) end up with samples that are dominated by women. An example is [29], for the case of Thailand, whose sample is 69.3% female.
equate grocery shopping with food shopping. When they present their results, they consistently talk about groceries (rather than food), but when they explain their data collection it is the opposite: “The survey instrument consisted of several sections including methods of acquiring food in June 2020 (online or in-person grocery store, in-person or takeaway from restaurants, and other sources), food expenditures, …” [28, p. 420, my emphasis]. As can be seen, their definition of food would seem to include meals. If the research of Finotto et al. [10]—see Sect. 4—is anything to go by, for meals there might not be the same gender bias as for groceries, maybe even on the contrary. A third possible explanation lies in the presence in Jensen et al.’s regression model of pandemic-related variables such as Concerned Becoming Ill and Concerned Food Shortages—both of which prove very significant. If compared to their male counterparts more of the female primary shoppers were, say, concerned that COVID-19 would cause food shortages, 12 this might help explain the negative sign on Female.

A second dissenting piece of research is the study for Denmark by Frank and Peschel [27], who revisit (and extend) Hansen’s [23] study for the US. To that end, they use a representative sample of 1580 online shoppers collected in 2016 as part of a larger study. They find that female respondents, who represent 47.0% of the sample, are less likely to adopt online grocery shopping.

This is surprising, given that the survey that they use would not seem to have targeted primary shoppers—unlike, incidentally, the research that they revisit (see above). Frank and Peschel think the explanation is technology aversion: they refer to earlier research which “shows that men tend to be more prone to adopting IT innovations” [27, p. 541].

A technology-aversion explanation is counterintuitive for a sample that consists solely of online shoppers. However, one has to factor in that Denmark is “one of the most gender egalitarian societies” [30, p. 1597], so that Frank and Peschel’s results are likely less biased by women’s traditional role as homemakers, if at all. Indeed, if in Table 2 one replaces the 75%/25% female/male probability of being the primary grocery shopper by a 50%/50% probability, the percentages in the final column accurately (read also: only) reflect the probability that the primary shopper opts for the online channel. The implication is that in an (almost) gender egalitarian society there is little or no need for surveys to target primary shoppers.

In line with this, the research of Marcucci et al. [31] for Norway yields signs of a less gendered division of housework.13 Indeed, in their sample the proportion of the respondents who are primary shoppers is the same for both genders, at 82.7%. 14 Moreover, women have a significant higher probability to belong to Class 1 of the Latent Class model that is estimated, which is the class that is “strongly oriented to

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12 Note that Jensen et al. [28, p. 424] report a mean variance inflation factor of 1.34, which “suggests no statistically problematic multicollinearity”. They do not, however, expound on any bivariate correlations.

13 Their paper was not selected in the systematic literature review because of their use of a stated preferences experiment rather than a straightforward survey.

14 Marcucci et al. [31, p. 5–6] claim that, compared to the Norwegian population, the coverage of their sample of 202 respondents is “quite good, especially in terms of gender distribution (approximately half women/men) and average monthly income”.
go shopping in physical stores” [31, p. 7]. This is in line with the negative sign on gender found by Jensen et al. The Nordic countries may thus well be a special case.

To wrap up this section, a final remark is that not all studies which fail to target primary grocery shoppers and find that gender has a positive impact on the adoption of online grocery shopping ignore the role of women as homemakers. For example, Nguyen et al. [20, p. 12], in their paper on Vietnam, find that women were more likely to shop more frequently online during the COVID-19 pandemic and observe: “One reason might be that females in Vietnam often take primary responsibility for doing household chores and providing care for other family members. Therefore, when facing difficulty in going to stores, they would be pioneers of implementing online shopping as an alternative”. This obviously does not do away with the criticism that their coefficient on gender is most probably not ‘clean’.

6 What about other consumer characteristics?

The analysis so far has concentrated on gender. However, working with samples that are not targeted at primary grocery shoppers can result in a biased view of the role of other socio-demographic characteristics too. This is illustrated in Table 4 for the case of education (but the reasoning for, say, income is similar).

In the table, education is, for simplicity, a variable with three generic categories (low, medium, high). It is assumed that the better educated are more likely to adopt e-grocery services: of the primary shoppers in the highest category 30% are adopters vs. only 10% in the lowest. Respondents who are not the primary shopper are assumed to answer ‘no’ to the question whether they make use of an e-grocery service, irrespective of whether the household does or does not. This may be too strong an assumption—see the discussion of Table 2 in Sect. 2—but even if some do reason in terms of household adoption the argument is not invalidated.

As can be seen, the presence of non-primary shoppers—for whom there is no correlation between education and adoption—dilutes the relationship that does exist for the primary shoppers and, if the former represent a substantial share of the sample, may even make it disappear. In statistical terms, the result may be a coefficient that is lower than in reality or even non-significant.

| Table 4 Hypothetical impact of education | Primary grocery shopper | Education | % adopters (%) |
|------------------------------------------|-------------------------|-----------|----------------|
| Yes                                      | Low                     | 10        |
|                                          | Medium                  | 20        |
|                                          | High                    | 30        |
| No                                       | Low                     | 0         |
|                                          | Medium                  | 0         |
|                                          | High                    | 0         |

Source Own construction
To test this argument, in Table 5 I have brought together the results for education (one-but-final column) and income (final column) obtained by all studies of Table 3. In Table 5 they are now grouped in two categories, depending on whether the underlying survey (explicitly or implicitly) targeted primary grocery shoppers. The idea is to see whether the latter category of studies effectively finds more non-significant results. This is obviously a rough test, as the studies also differ in other respects (method used, specification of the education or income variable, etc.). The picture is also blurred by the fact that not all studies include education and/or income in their models.

Nevertheless, where education is concerned, only 2 of the 6 relevant studies in the upper panel of Table 5 find a significant impact, compared to 5 out of 6 in the
bottom half. In addition, it is possible that Dominici et al.'s [1] education variable also picks up the impact of income (which is absent in their logit regression) and, conversely, that in Hansen’s [23] discriminant analysis education is overpowered by income. Let me also stress that Hamad and Schmitz [19] find opposite signs for different product categories—see the notes to Table 5—and that it is not impossible that the impact for groceries in general would be insignificant.

For income, the picture is less clear: 3 out of 5 of the studies that did not target primary shoppers find a significant impact vs. 4 out of 7 for those that did. However, where the former are concerned, it should be pointed out that Frank and Peschel [27] again find a counterintuitive negative impact (see Sect. 5). The authors themselves “urge further research to investigate the reasons for this” [27, p. 541]. Also, the remark made earlier about the results of Hamad and Schmitz [19] applies here too. If correct, this would reduce the score for the studies that did not target primary shoppers from 3 out of 5 to 2 out of 5.

Where the studies in the bottom panel are concerned, it should be stressed that Hiser et al.’s [21] first logit regression shows that income has a (sizeable) significant positive impact on the familiarity with the concept of online food shopping. This prior knowledge, in turn, is a “very good indicator” of willingness to use [21, p. 87]. In other words, indirectly income does have an impact. If one takes this into account, the score for the studies that did target primary shoppers becomes 5 out of 7.

7 Conclusion

This note presents a meta-analysis of the empirical research about the impact of (selected) consumer characteristics on the adoption of online grocery shopping. It sheds new light on—read: criticises—large parts of the literature, but at the same time offers an avenue to reconcile the conflicting results.

7.1 Practical implications

The key criticism is that many studies use samples that contain a substantial share of individuals who are not the primary grocery shopper of their household and who are thus not personally faced with any technology adoption decision concerning e-grocery services. The result is that these studies mismeasure the causal effects of several sociodemographic characteristics. They erroneously give the impression that the willingness to shop online for groceries is greater among women and they underestimate the impact of, for example, education and income.

If this is taken into account, the apparent contradictions in results all but disappear—with the possible exception of Nordic countries (which clearly deserve further study). Where gender is concerned, the overall picture that emerges is one where

15 This is the explanation that they proffer: “It might be that households with higher income, prefer grocery stores and markets, which carry products in a higher price tier, which are not represented online” [27, p. 541].
female primary shoppers are no keener on adopting e-grocery services and where
the gender gap observed by studies that rely on broader samples is due to women’s
role as homemakers. At the same time, studies that do not fall in the methodologi-
cal trap leave little doubt as to the positive impact of education and income—as for
many a technology.

7.2 Theoretical implications

In terms of methods, the lessons are, first, that dedicated surveys trump publicly
available, multi-purpose datasets—unless, that is, one can adequately restrict the
data further. For example, as explained in Sect. 5, from broader expenditure sur-
vey data Suel et al. [25] select those respondents who recorded food purchases in
their dairy. But even then researchers need to be clear(er) about the limitations of
their identification strategy. Another option to disentangle the impacts of technol-
yogy aversion and gender roles would be to concentrate on single-adult households,
where there simply is no task division between partners. A second lesson is that in
surveys among (single- and) multi-adult households, even if they are dedicated, it
is best to explicitly screen respondents on their (primary) responsibility for grocery
shopping decisions—as in, amongst others, [37, p. 36] and [13, p. 9]. A possible
exception is gender egalitarian societies.

A qualification is that while studies that do not target (or do not identify) the pri-
mary grocery shoppers may not provide accurate causal insights, they can neverthe-
less be of practical value. To quote an anonymous reviewer: “in terms of actionable
research results, a [provider of e-grocery services] may still benefit from catering
more to women’s preferences, even if it is not their gender that makes them the rel-
evant target market”.

7.3 Limitations

A possible criticism on my note is that the systematic literature review covers a long
period (namely 1998–2020), whereas, with the passing of time, the behaviour of
consumers may well have changed—and the supply side definitely has. However,
this only makes the clear pattern in Table 3 all the more striking. Perhaps the expla-
nation lies in the fact that gender roles change only slowly.

Another limitation of my analysis is that I have been unable to factor in the pres-
ence of single-adult households and same-sex couples—the reason being that the
studies that I review do not present (sufficient) statistics on the relative importance
of such respondents in their samples. Again my finding is stronger because of it
(provided, that is, that the differences across studies are not too large): I still find
evidence of a bias in spite of the attenuating influence of these respondents. Indeed,
for single-adult households and same-sex couples the estimation of the causal effect
of gender on the adoption of e-grocery services can, by definition, not be disturbed
by a gendered task division within the household.
7.4 Suggestions for future research

Looking ahead, it would be interesting to examine whether the methodological problem identified in the present paper may also apply to a wider domain; that is, to other situations where it is common for one household member to procure goods or services, or perform tasks, not just for themselves but for the household. One such situation that comes to mind is internet banking. Studies into the adoption of this technology often find that more males than females tend to use it; see, for example, [32, 33], and [34].\textsuperscript{16} In light of the findings in the present paper, it is tempting to link this with the observation that in many countries men are more often primarily responsible for household financial matters; for the case of the US, see [35, 36].

But there is also room for improvement in the literature on online grocery shopping itself. In particular, researchers might consider moving away from the purely binary ‘primary shopper’ concept, as it fails to capture the variety of task divisions in real life. In the 2017 edition of its U.S. Grocery Shopping Trends survey, the Food Marketing Institute found that 29% of the respondents in multi-person households engaged in “equal shopping” [38, p. 9]. In another survey for the US [39], conducted in April 2020, of 721 respondents who indicated that they were cohabiting 35% answered that before the lockdown they shared the grocery shopping equally (vs. 44% “mostly self” and 18% “mostly partner/flatmate”).\textsuperscript{17}

Clearly, the ‘primary shopper’ approach is ill-suited for such arrangements. The problem is that the household member who, in a two-person setting, performs no more than 49.9% of the shopping drops out of consideration completely, whereas he or she may well have their say in, for example, the switch to the online channel. Controlling for grocery-shopping responsibility by means of a metric variable ranging from 0 to 100% thus may well be a better approach—particularly in a world where men gradually tend to take on a greater share of the responsibility, at least in certain countries. The use of such a metric would allow to take into account that grocery shopping is not only, as emphasised in Sect. 3, a household activity but also, in no small number of cases, a household responsibility. Perhaps the primacy of the primary shopper should thus not be absolute after all.

\textsuperscript{16} Note that the cited studies do not provide an explanation for this finding.

\textsuperscript{17} Own calculations based on data made publicly available by [39]. Percentages do not sum up to 100 because of missing observations and “Doesn’t apply to me” answers.
Appendix

Fig. 1 Overview of systematic literature review process. Notes: sources used for literature review at top; stages of process on the left. Numbers refer to number of records. Detailed description can be found in Sect. 5.
Table 6  Summary of systematic literature search

| Database  | Keywords                        | Records | New records | Selected |
|-----------|--------------------------------|---------|-------------|----------|
| Web of Science | “Online grocery shopping” “adoption” | 29      | 29          | 4        |
|           | “Online grocery shopping” “acceptance” | 17      | 6           | 0        |
|           | “e-grocery” “adoption”         | 10      | 6           | 1        |
|           | “e-grocery” “acceptance”       | 7       | 3           | 1        |
|           | “e-grocery retailing”          | 6       | 6           | 0        |
|           | “Mobile grocery shopping”      | 3       | 3           | 0        |
|           | “Grocery” “channel choice”     | 8       | 7           | 0        |
|           | “Groceries” “channel choice”   | 4       | 0           | 0        |
|           | “e-grocery” “channel choice”   | 14      | 7           | 0        |
|           | “Online grocery buying”        | 4       | 2           | 0        |
|           | “Online food shopping”         | 18      | 17          | 0        |
|           | “Online food purchasing”       | 7       | 6           | 1        |
| Scopus    | “Online grocery shopping” “adoption” | 26      | 6           | 1        |
|           | “Online grocery shopping” “acceptance” | 12      | 2           | 0        |
|           | “e-grocery” “adoption”         | 11      | 4           | 0        |
|           | “e-grocery” “acceptance”       | 5       | 2           | 0        |
|           | “e-grocery retailing”          | 10      | 2           | 1        |
|           | “Mobile grocery shopping”      | 5       | 2           | 0        |
|           | “Grocery” “channel choice”     | 13      | 6           | 1        |
|           | “Groceries” “channel choice”   | 13      | 0           | 0        |
|           | “e-grocery” “channel choice”   | 21      | 6           | 1        |
|           | “Online grocery buying”        | 7       | 2           | 0        |
|           | “Online food shopping”         | 18      | 4           | 0        |
|           | “Online food purchasing”       | 10      | 3           | 0        |
| Total     |                                | 278     | 11          | *        |

Searches were performed between October 22nd and 25th, 2021. Detailed results available from the author. Searches are listed in chronological order. New records = records not present in any of the preceding searches. Selected = records that fitted the inclusion criteria and did not appear in any of the earlier searches

*Selected records include references already discussed in Sects. 2 and 4

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Declarations

Conflict of interest  The author states that there is no conflict of interest.
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