Journal of Rural Studies 97 (2023) 573–582

Contents lists available at ScienceDirect

Journal of Rural Studies

journal homepage: www.elsevier.com/locate/jrurstud

Improving the design of local short food supply chains: Farmers' views in Wallonia, Belgium

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ARTICLE INFO

Keywords:
Local food systems
Short food supply chains
Certification
Discrete choice experiment
Europe

ABSTRACT

While consumers' preferences and willingness to pay for local food have been widely explored, farmers' choice of marketing channels in high-income countries has received far less attention. This study identifies important factors affecting fresh vegetable farmers' decisions to participate in local short food supply chains in Wallonia, Belgium. We use quantitative data from a farmer survey comprising a discrete choice experiment complemented by qualitative data to conduct our research. We show that farmers are not eager to participate in newly established short food supply chains, especially if it involves selling large shares of their yield through these channels. Farmers are interested in internal certification systems with label, such as Participatory Guarantee Systems, and direct-to-consumer selling on-farm. Commitment from the buyer before planting is highly valued, even more than a high selling price. Preference heterogeneity is linked to farm size and current organic certification status. Our findings allow to evaluate the relevance and improve the design of local food initiatives, including newly established short food supply chains and certification systems.

1. Introduction

Over the past decades, policy-makers and civil society organisations have promoted local food systems (LFS) and short food supply chains (SFSC) based on their alleged economic, social and environmental benefits (Enthoven and Van den Broeck, 2021a). In Europe, the European Commission has set the 'Farm to Fork Strategy' in 2020, which states that "with a view to enhance resilience of regional and local food systems, the Commission in order to create shorter supply chains will support reducing dependence on long-haul transportation" (European Commission, 2020). Moreover, at their 141th plenary session in December 2020, the European Committee of the Regions called for "a European framework to be established for promoting and strengthening short supply chains, based on innovative practices adopted successfully at local level" (European Committee of the Regions, 2020). Recently, policy attention towards a lower dependence on global food supply chains has even more increased due to the COVID-19 pandemic and the crisis in Ukraine.

While many studies have investigated consumers' interest in, and willingness to pay for local food (e.g. Brown, 2003; Carpio and Isengildina-Massa, 2009; Chang et al., 2013; Fan et al., 2019; Grebitus et al., 2013; Vapa-Tankosić et al., 2020), farmers' choice of marketing channels and willingness to participate in local food initiatives in high-income countries has received less attention. Several studies have explored the reasons behind farmers' participation in SFSC based on qualitative farmer interviews. Mundler and Jean-Gagnon (2019) and Benedek et al. (2018) find that farmers selling directly to consumers in Quebec and Hungary, respectively, mainly do so to exchange with their buyers. Also, Charatsari et al. (2018); Demartini et al. (2017); Kirwan (2006); and Mancini et al. (2019) show that farmers in Europe (Greece, Italy and the UK) particularly value the sense of respect, recognition, and increased consumer awareness about food production associated with direct-to-consumer sales. In the USA, Izumi et al. (2010) and Ostrom (2007) report that farmers choose to participate in farm-to-school programmes and Community Supported Agriculture (CSA) schemes to contribute to broad social benefits. Yet, to our knowledge, no study has quantitatively assessed the relative importance of different factors in farmers' decision to adopt a specific marketing channel in high-income countries.

We contribute to the literature by investigating fresh vegetable farmers' preferences for different attributes of local SFSC in Wallonia (Belgium). This case study is highly relevant, as few data exist on this growing sector in the region, and many organisations have put in place local food initiatives, including internal certification systems such as

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https://doi.org/10.1016/j.jrurstud.2023.01.016
Received 2 May 2022; Received in revised form 6 December 2022; Accepted 18 January 2023
Available online 21 January 2023

Participatory Guarantee Systems (PGS). PGS represent an alternative to third-party certification, in which production methods are monitored internally by local intergroups of farmers, consumers and authorities, and the requirements are set by the intergroups themselves, making them more appropriate to the local context (López Cifuentes et al., 2018; Nelson et al., 2010; Sacchi et al., 2015). Thus, understanding which factors mostly affect farmers' marketing choices and trade-offs they are willing to make (e.g. selling price versus volume sold, certification required, contact with consumers, and commitment from the buyer) is essential to evaluate the relevance and improve the design of such initiatives. Although our research takes a case-study approach, our findings may be applicable to similar contexts, in particular to farmers' marketing choices in the fresh vegetable sector in other high-income regions or countries.

We address three main research questions.

1) Are Walloon fresh vegetable farmers interested in participating in newly established local SFSC and internal certification systems?
2) What are the attributes of local SFSC and certification systems that are favoured by farmers?
3) How are farm and farmer characteristics correlated to preference heterogeneity?

It is worth noting that, since there is no universal definition of LFS, in this study, we define the local scale as the Walloon Region, including its five provinces. Moreover, marketing channels in LFS may be organised in different ways, with various possible types of selling arrangements between producers and buyers, forms of interaction between producers and consumers, and levels of commitment from consumers (Enthoven and Van den Broeck, 2021a). Most authors assume SFSC to be the main form of marketing channels used in LFS, implying a limited number of intermediaries – generally maximum one – between producers and consumers. Still, it is important to distinguish between the concepts of LFS and SFSC, as SFSC may not be local, while LFS may not entail SFSC. Here, we focus on channels that are both local *and* short.

To answer our research questions, we primarily use quantitative data from an online survey comprising a discrete choice experiment (DCE). The DCE was designed based on a literature review and qualitative insights from semi-structured interviews with farmers. Performing a DCE is especially appropriate here, as DCEs deal with situations where trade-offs in real-world decision-making are of particular interest (Hanley et al., 2002; Wang et al., 2019). They represent a valuable tool for informing effective policy initiatives and are quite quick and cheap to implement (Hoyos, 2010; Lagarde and Blaauw, 2009). Over the past decade, DCEs have been increasingly used in the field of agricultural economics to understand farmers' marketing and certification preferences in low- and middle-income countries (Enthoven and Van den Broeck, 2021b; Gelaw et al., 2016; Ochieng et al., 2017; Pham et al., 2019; Schipmann and Qaim, 2011; Van den Broeck et al., 2017). On the contrary, no study has looked at farmers' marketing preferences in high-income countries, to our knowledge. Yet, it is important to address the issue in such countries too, as conclusions from low- and middle-income countries cannot be automatically extrapolated to high-income countries. While LFS and SFSC have gained importance in high-income countries in the past two decades, they remain a niche sector, as long 'modern' supply chains – including supermarkets and import-export chains – still predominate (Mount, 2012). This is in contrast to low- and middle-income countries, where the largest share of food is still traded on local markets through 'traditional' supply chains, typically relying on spot markets and direct-to-consumer sales (Feyaerts et al., 2020; Reardon et al., 2019). Therefore, farmers' views and preferences regarding marketing channels are not evaluated in the same context, and are hence not generalizable. Still, certain preferences (e.g. for a high price, a commitment from the buyer) are expected to be the similar. Finally, we complement our quantitative results with qualitative validation data from focus group discussions and additional semi-structured interviews with farmers, which allows us to interpret our findings more in-depth.

This article is structured as follows: after this introduction (section 1), we provide a description of the research area and the fresh vegetable sector in Wallonia (section 2). In section 3, we detail our methodology, including data collection methods, DCE design, and econometric analysis. Section 4 presents our empirical results, and is followed by a discussion in section 5. We conclude and make recommendations to policymakers and researchers in section 6.

2. Context: The Walloon vegetable sector

Our research area comprises the five provinces of the Walloon Region in Belgium. While the agricultural sector of the Walloon Region has historically specialised in cereal and livestock production, the development of vegetable production is more recent and has grown steadily over the past decades (Dumont, 2017). The sector is divided into two sub-sectors based on produce destination: the processing industry or the fresh market, with the latter representing about 20% of the total area cultivated with vegetables in Wallonia (Riera et al., 2020).

In this study, we focus on the fresh vegetable market for two reasons. First, local food initiatives, including SFSC for fresh food produce, have been mushrooming in the region over the past two decades (Dumont, 2017). Due to their perishable nature, fresh vegetables are particularly suitable for local sales and SFSC. Second, more recently, the government has started to actively promote LFS and SFSC. For example, the programme "*Soutenir la relocalisation de l'alimentation en Wallonie*" (in English, "Supporting the relocation of food in Wallonia") that was launched in September 2020, financed 46 projects for a total amount of nearly 11.7 million euros over three years (Service public de Wallonie, 2020a). Hence, fresh vegetable farmers are not only familiar with these channels, but are increasingly exposed to new initiatives.

There is no official data available on the total number of Walloon farms producing vegetables for the fresh market. However, in 2017, Dumont (2017) estimated their number to reach 364. The main vegetables grown for the fresh market are carrots and onions, which together accounted for more than 60% of the volume produced and 78% of the area cultivated with vegetables for this sub-sector in 2017 (Riera et al., 2020). On a smaller scale, farmers produce a large diversity of vegetables such as cabbage, chicory, courgette, green asparagus, lettuce, parsley, parsnips, squash, etc. There is a large variety in farmers' technical orientation or business model, which largely depends on gross vegetable production area and organic certification status (Dumont and Baret, 2017). Farmers are classified as either small-scale (less than 2.5 ha), medium-scale (between 2.5 and 10 ha) or large-scale (more than 10 ha), with a large majority classified as small-scale. Organic certification is relatively common, with 201 farmers certified in 2017 (i.e. 55% of farms), and has increased to 308 in 2020. As data on the total number of farmers is not available, we do not know whether this increase is associated with a net growth in the total number of vegetable farms producing for the fresh market, and/or with an increase in the proportion of organic-certified farms within the total number of farms.

National statistics show that in 2017, almost one out of ten farms in Belgium used at least one SFSC to sell part of their production (not just for vegetables). Of these, around 85% sold their produce on-farm and 12% at a farmers' market. Within the Belgian organic sector, the share of producers selling their produce through SFSC is substantially higher (44%) (Mailleux et al., 2019). Unfortunately, more precise data on the extent of the use of SFSC in the fresh vegetable sector in Wallonia could not be found (e.g. most important channels, regional differences).

3. Methods

3.1. Data collection

We combined qualitative and quantitative data collection methods to

conduct our research. To obtain prior qualitative insights into the fresh vegetable sector in Wallonia, we reviewed relevant literature, performed semi-structured interviews with four farmers, and participated in a networking event for organic-certified vegetable farmers and key actors of the sector (regrouping about 200 participants). Next, we conducted an online survey[1] including a DCE and obtained a final sample of 82 farmers. The survey gathered data on farmer and farm characteristics, and on current marketing practices. To administer the survey, we reached out to 16 Walloon organisations working in the agricultural and rural development sector,[2] who forwarded the link to our survey to farmers registered as members. The survey took place between March and June 2021 and was administered in French. Following the analysis of the quantitative data, we organised two validation focus group discussions with a total of six farmers, and additional semi-structured interviews with two farmers to better interpret and nuance our quantitative findings. Finally, we presented our results at a farmers' workshop (with about 40 participants) organised by a grouping of organisations to receive additional feedback from farmers.

3.2. Discrete choice experiment

Discrete choice experiments, founded in Lancaster's economic theory of value and random utility theory, are particularly appropriate to deal with situations where trade-offs in decision-making processes are of special interest. DCEs have the ability to separately estimate the value of individual characteristics (attributes) combined in a proposed scenario (alternative). The discrete choice method is considered to reflect the nature of many real-world decisions better than contingent valuation methods (CVM), which ask respondents their willingness-to-pay or accept directly. In addition, DCEs are more informative than CVM, as preferences for separate attributes are assessed. Thus, they are ideally suited to evaluate the relevance and inform the design of multidimensional initiatives or programmes (Hanley et al., 2002; Wang et al., 2019).

3.2.1. Experimental design

In our DCE, we asked farmers to choose between two newly established local SFSC that could be added to their current marketing channel (s), and not adding any (status quo option). The attributes and levels (Table 1) of the new hypothetical SFSCs were chosen based on the insights gathered from the literature and from interviews with farmers.

The first attribute is the share of vegetable production sold through the newly established channel. It takes on three levels: 20, 50, and 80% of the yield. The remaining volume would still be retailed through the respondent's current marketing channels. This attribute was chosen because studies reveal that farmers often favour channels allowing them to sell large volumes, and consider selling typically low volumes through SFSC as a challenge (Malak-Rawlikowska et al., 2019; Renting et al., 2003). This is in line with the opinion of interviewed farmers in our study, stating that they would not consider using a newly established marketing channel unless 20–30% of their yield could be sold through it. On the contrary, other authors find that farmers may choose to diversify their marketing channels as a risk management strategy, implying smaller volumes sold per channel (Benedek et al., 2021, 2021de Roest et al., 2018; Hardesty and Leff, 2010). It is worth noting that farmers' preferences towards the volume of vegetables sold through a newly established channel may depend on the considered time scale. Intuitively, they may favour selling small volumes at first and increase the share sold via the newly established channel once it has proven to be beneficial to them. However, in our DCE, we hypothesise that the perceived effort (in time and money) required to enter a new channel may still encourage farmers to sell large volumes through it from the start.

Table 1
DCE attributes and levels. Note: BL stands for base level.

Attribute	Levels
Share of production sold	• 20% (BL) • 50% • 80%
Selling price	• Market price −10% • Market price (BL) • Market price +10% • Market price + 20%
Control and label	• No control (BL) • Internal control without label • Internal control with label • External control with label
Relation to consumers	• No direct-to-consumer commercial activity (BL) • Direct selling on-farm • Direct selling off-farm
Commitment from the buyer	• No commitment from the buyer (BL) • Commitment ensured by the buyer

The second attribute is the price received for vegetables in the newly established channel and consists of four levels: the market price (MP),[3] MP-10%, MP+10%, and MP+20%. The levels are based on realistic price premiums – or discounts – that may be received; for example, organic-certified vegetables are currently sold at MP plus a premium of 10%. During interviews, farmers mentioned that they sometimes choose to sell their vegetables at a lower price, either to make sure they sell the entire yield, or to enter a specific channel offering a lower price (e.g. a social cooperative shop). Thus, the price attribute level at MP-10% is considered realistic and relevant.

The third attribute relates to the type of control or certification required to enter the newly established channel, and takes on the four following levels: no control of production practices,[4] internal control of production practices with or without label, or third-party certification (with label). This attribute was selected as it may influence farmers' willingness to enter a newly established channel. Concerns regarding the sustainability of food production are often addressed using strict standard requirements and control by third-party organisations leading to certification. However, these requirements are often complex and entail high costs from conformity assessments by external auditors, thus often excluding small-scale farmers (German et al., 2020; Maskus et al., 2005; McCullough et al., 2008). In Wallonia, the most widespread certification scheme for vegetables is organic farming, which is based on the European organic charter set out in Regulation (EU) 2018/848. To get certified, farmers must be audited annually, implying a cost of between 70 and 130 EUR/ha, which may be (partially) compensated by subsidies. On the other hand, internal certification systems (including PGS) have recently been promoted by civil-society organisations as alternative locally-focused control mechanisms (Binder and Vogl, 2018; López Cifuentes et al., 2018). They differ from third-party certification as

[1] The choice of data collection through an online survey rather than through face-to-face interviews is mainly based on the difficulties to meet up with farmers due to Covid-19 restrictions at the time of research.

[2] The organisations are Biowallonie; Le Centre Interprofessionnel Maraîcher (CIM); Le Mouvement d'Action Paysanne (MAP); La Fédération Wallonne de l'Agriculture (Commission Productions Végétales); La Coopérative Bio de Hesbaye (CETA); Paysans Artisans; La Province de Liège; Le Centre provincial de l'agriculture et de ruralité du Brabant wallon; Hainaut Développement; L'Office Provincial Agricole de la Province de Namur; La Ruche Qui Dit Oui; Accueil Champêtre Wallonie; La Fédération Rurale Wallonne; Le GAL Culturalité; Maraicherensemble-pro (Facebook group); and Agri-Info (Facebook group).

[3] We opted for a generic market price to reflect the diversity of fresh vegetables sold by farmers and to consider the high price volatility associated with these produce.

[4] For instance, agroecological or organic practices. The point here is not to focus on the specific requirements but rather on how they are monitored.

groups of farmers and local actors set standards internally and control production among themselves, thus theoretically reducing the complexity and costs associated with certification. While certification (external or internal) may allow farmers to sell their produce through certain channels, some may not see the benefit of being certified, for instance in the case of direct-to-consumer channels, where trust may outweigh the need for a formal control mechanism (Angella, 2016; Enthoven and Van den Broeck, 2021a; Malak-Rawlikowska et al., 2019). In addition, some studies have highlighted the potential scepticism of consumers regarding certification schemes, which may even discourage farmers from getting certified (Eden et al., 2008; Higgins et al., 2008; Thorsøe and Kjeldsen, 2016).

The fourth attribute represents the type of relation that farmers may have with consumers, and consists of three levels: no direct contact (i.e. an intermediate takes care of sales to consumers), direct-to-consumer selling on-farm (e.g. pick-your-own schemes or on-farm shop), or direct-to-consumer selling off-farm (e.g. farmers' market or certain vegetable boxes schemes). This attribute aims to describe different types of local channels based on the possibility of exchanging with consumers and on the selling location. It was chosen based on previous research showing that farmers selling through SFSC often do so to interact with consumers (Benedek et al., 2018; Mundler and Jean-Gagnon, 2019). It also proxies farmers' transaction costs (mostly from individual sales to consumers and transport), including time investments required, which may discourage farmers from entering certain channels, in particular DTC channels.

The fifth attribute considers whether the buyer – intermediary or consumer – commits to purchasing vegetables before planting at predetermined conditions (i.e. price, volume and frequency). Prior commitment from the buyer may reduce financial risks by establishing a viable production plan in advance, but farmers are also legally obliged to adhere to the contract even if produced volumes are insufficient or other buyers offer higher prices (Otsuka et al., 2016).

We developed cards presenting three scenarios to farmers (Fig. 1), on which the combination of attribute levels for each scenario was assigned using a D-efficient design technique in Ngene software, with priors[5] of the parameters derived from the literature and farmer interviews (whose results were considered even more important in defining the priors, as they are specific to our case study). We excluded the possibility of having a negative price premium when the third attribute took on a level involving internal control, and a negative price premium or no premium when the level of the third attribute was third-party certification. The cards were grouped into two blocks and each farmer was randomly assigned to one block comprising six cards, which were shown in a random order to account for possible order and starting point effects (Lizin et al., 2022). The choice of two blocks allows us to overcome issues originating from small sample sizes (i.e. each block needs to be evaluated by a reasonable number of respondents), typically seen in surveys among farmers in high-income countries (Beharry-Borg et al., 2013; Chèze et al., 2020; Hudson and Lusk, 2004; Latacz-Lohmann and Breustedt, 2019; Schulz et al., 2014).

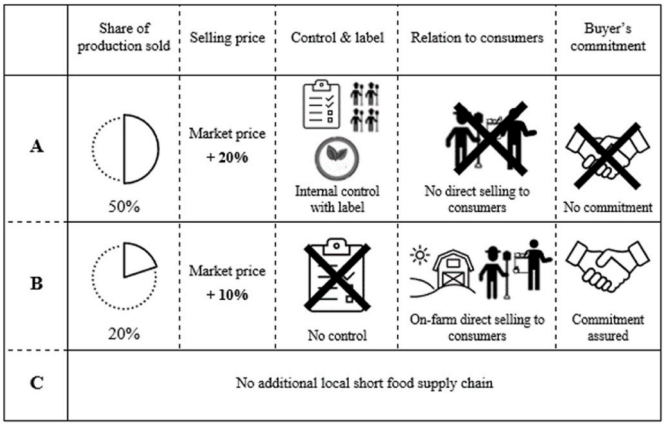

Fig. 1. Example of a choice card (translated from French).

3.2.2. Econometric analysis

We used mixed logit (MXL) models with and without interaction terms to identify farmers' preferences and sources of preference heterogeneity.[6] MXL models have the advantage of allowing for random taste variation, meaning that they do not only estimate the mean value of each attribute level's coefficient, but also the standard deviation of the coefficient's distribution around its mean value. When this standard deviation is significant, preference heterogeneity for its respective attribute exists. Moreover, MXL models do allow for unrestricted substitution patterns – relaxing the assumption of independence of irrelevant alternatives (IIA) – and for correlation in unobserved factors over time (Schipmann and Qaim, 2011; Train, 2003).

Using MXL models, the probability of farmer i selecting alternative j (among Ji alternatives) on choice card t is given by:

$$P_{ijt} = \frac{\exp(\beta_i X_{jt})}{\sum_{j=1}^{Ji} \exp(\beta_i X_{jt})};\ \beta_i = \beta + \Delta s_i + \varepsilon_i$$

where β_i represents a vector of coefficients associated with preferences for attributes X_{jt}, s_i a vector of standard deviations, and εi the error term (Greene and Hensher, 2003; Train, 2003).

In our models, we included an alternative-specific constant (ASC), coded 0 for the status quo option and 1 for the two other scenarios, to capture unobservable influences beyond attributes present in choice sets (Meyerhoff and Liebe, 2009). A positive ASC coefficient thus indicates an interest in selling through a newly established local SFSC, while a negative coefficient shows that farmers are not in favour of doing so.

In a first model specification (base model), we assumed that farmers' preferences are uncorrelated with farmer and farm characteristics. Yet, preferences for marketing channels may vary among farmers based on socioeconomic characteristics and current production and marketing practices. Therefore, we specified other models with interaction terms between the ASC or specific attribute levels that display preference heterogeneity and various farmer and farm characteristics to explore some of the factors that may generate differences in preferences.

For all estimations, we used 2000 Halton draws and coded all attribute levels and the ASC as random dummy variables, and the interaction terms as fixed dummy variables in STATA 16.1 software. We controlled for ordering effects, which stem from the simulation noise inherent in the numerical procedure (Palma et al., 2020) and concluded that they are not significant below three interaction terms added. Moreover, we controlled for attribute-non-attendance (ANA), which arises when respondents do not consider all attributes when making choices between scenarios, using self-reported data on attributes ignored (Hensher et al., 2005). To do so, we set the coefficients for the self-reported ignored attributes at zero during the estimation.

[5] Positive priors for larger shares of production sold through the new channel, higher selling prices (premiums), direct-to-consumer commercial activities (on-farm higher than off-farm), and commitment from the buyer; negative priors for a price discount, and control mechanisms (external control lower than internal control).

[6] We did not opt for a latent class model, as Nylund-Gibson and Choi, 2018, and Weller et al., 2020do not recommend using latent class models with small sample sizes (less than 300 respondents).

4. Empirical results

4.1. Farmer and farm characteristics

Table 2 shows descriptive statistics for our sample, with a distinction between organic-certified (n = 62) and non-organic-certified (n = 20) farmers. The majority of participants are men (72%), which corresponds to official regional statistics on agricultural workers in Wallonia (Service public de Wallonie, 2020b). Women are significantly more present in the non-organic-certified sub-sample. The average age of respondents is 45 years old, with a significant difference between organic-certified farmers (47 years old) and non-certified farmers (38 years old). About 80% of respondents obtained a higher education degree, underlining that farmers in the sample are well-educated. A third of our sample has an additional off-farm job, which is in line with official regional statistics (Service public de Wallonie, 2020b).

The average experience with vegetable farming is rather limited (11 years), with organic-certified farmers having more experience (12 years) than non-organic-certified farmers (6 years) on average; and comprising fewer new farmers (i.e. with less than 5 years' experience) (18 vs 55%). Cooperative membership is relatively common (41% of respondents), but with a significant difference between organic-certified (48%) and non-organic-certified farmers (20%). The majority of farmers cultivates a large variety of vegetables – over 30 species for 56% of respondents. With regard to other agricultural activities (besides vegetable production), 40%, 21%, and 16% of respondents are involved in fruit production, cereal production, and animal husbandry, respectively. Seventy-seven percent of our sample employs less than 3 FTE; including all non-certified farmers. Significantly more organic-certified farmers employ between 4 and 10 FTE employees. A low annual farm turnover is mostly reported by non-organic-certified farmers in the sample (85% earning less than 70,000 EUR/year), while organic-certified farmers report a larger array of turnover categories. Finally, the average share of vegetable production in total farm turnover is 69%, with no significant difference between organic-certified and non-organic-certified farmers. Overall, organic-certified farmers seem to be more experienced and more commercially oriented in managing their business (i.e. higher likelihood of cooperative membership, more employees, a higher turnover).

Regarding cultivated areas with vegetables, our sample consists of 72% small-scale vegetable farms (less than 2.5 ha), 11% medium-scale farms (between 2.5 and 10 ha), and 17% large-scale farms (over 10 ha).[7] Fig. 2 disaggregates organic-certified and non-organic-certified farms into finer area size categories. In addition to the data for our sample, the figure presents statistics for all organic-certified vegetable farms cultivating for the fresh market in Wallonia. As the figure shows, our sample is representative of organic-certified vegetable farms cultivating for the fresh market in the region – with around 70% of farms with vegetable areas below 3 ha (Biowallonie, 2021). However, the lack of national or regional data on non-organic-certified farms does not allow us to make the same statement for non-organic-certified fresh vegetable farms.

4.2. Marketing channels

The different marketing channels used by farmers are shown in Table 3, describing the percentage of respondents using a specific channel, and the average share of vegetables sold by farmers through that channel, conditional on participation.[8] The average number of channels used is three, with 62% of respondents using three or more channels. We find that 74% of farmers in our sample use one main channel to sell half or more of their yield. According to interviewed farmers, a commonly adopted marketing strategy is to specialise in one channel and use others for smaller volumes or seasonal surpluses. We note that SFSC are widely used (with no significant difference between organic-certified and non-certified farmers), with 89% of farmers participating in direct-to-consumer (DTC) channels (on-farm sales, farmers' markets, food box schemes) and 80% in direct-to-retail (DTR) channels (cooperatives, local shops, restaurants, local institutions). On the contrary, only 17% of the farmers in our sample use conventional channels such as auctions, distribution companies, or supermarkets.

The channel that is most widely used by farmers in our sample is on-farm sales (76%), through which on average 48% of the vegetable yield is sold, when used. Significantly more non-organic-certified respondents sell vegetables using on-farm channels (90%) than their certified counterpart (69%), through which the former also sell a larger share of their yield on average (60% vs 43%, respectively). The next most often used channels are local shops (54% of respondents), box schemes (45%), and restaurants (40%). Food box schemes and local institutions are significantly more used by organic-certified farmers than non-organic-certified farmers (52% vs 25%, and 15% vs 0%, respectively). The least exploited channel are auctions (1% of respondents). This is likely due to the fact that auctions for fresh vegetables only exist in Flanders, the northern region of Belgium (thus less practical due to distance and language barriers), and because they require large volumes to be sold at once (which impedes small-scale farmers to participate).

Our survey also collected data on the impact that the Covid-19 sanitary crisis has had on farmers' vegetable marketing practices (Table 4). We find that during the first lock-down in Belgium (March–June 2020), 49% of farmers in our sample sold a higher share of vegetables through SFSC, and 46% the same amount as before. Following the lock-down, 30% of respondents reported a remaining increased share, while 63% of the sample returned to their pre-lockdown situation.

4.3. Farmers' preferences for local SFSC

The estimates of the basic MXL model and MXL model corrected for ANA are shown in Table 5. About a third of our sample (32.9%) stated that they ignored an attribute during the scenario selection process, but ANA is relatively equally distributed over the attributes. We observe that the value, sign and significance of the coefficients estimated by the basic MXL model and the model corrected for ANA are very close, suggesting that the MXL model is robust to ANA. Therefore, we proceed the rest of this section based on the MXL model results.

Overall, we find that fresh vegetable farmers in Wallonia are not eager to add a new marketing channel to their current portfolio. Moreover, farmers are averse to selling large shares of their yield through a new channel. We observe a positive preference for internal control systems with label over no control, but no significant preference for internal control without label, or third-party certification. Direct selling on-farm is preferred over no direct contact with consumers, but farmers are indifferent to direct selling off-farm. Farmers are very keen to get a commitment from the buyer before planting, while they are not significantly drawn to higher prices.

We find that preference heterogeneity among farmers exists for all attributes (based on significant standard deviation estimates), except for internal control without label and commitment from the buyer. As we are mostly interested in understanding how farm business models are linked with farmers' preferences, we test interactions between these attribute levels and the ASC, and the following variables: large farm (>10 ha), current organic certification status, off-farm job, new farmer (<5 years' experience), cooperative member, large share of vegetable yield in yearly turnover (>50%), use of DTC, DTR or conventional channels, and location (per province). We find statistically significant interactions only for large farm size and certification status, as shown in Table 6. Large-scale vegetable farmers are more eager to participate in

[7] The cultivated area size categories are based on the classification established by Dumont and Baret (2017), presented in section 2.

[8] The classification of marketing channels is based on Enthoven and Van den Broeck (2021a).

Table 2
Descriptive statistics on organic-certified vs non-certified farmers in the sample.

	All farmers (n = 82) Mean	(se)	Organic (n = 62) Mean	(se)	Non-organic (n = 20) Mean	(se)	
Female (dummy)	0.28	(0.05)	0.23	(0.05)	0.45	(0.11)	*
Age (years)	45.06	(1.19)	47.29	(1.31)	38.15	(2.01)	***
Higher education (dummy)	0.79	(0.05)	0.79	(0.05)	0.80	(0.09)	
Off-farm job (dummy)	0.34	(0.05)	0.31	(0.06)	0.45	(0.11)	
Experience with vegetable farming (years)	10.52	(0.99)	11.84	(1.16)	6.45	(1.60)	**
New farmer (<5 years' experience) (dummy)	0.27	(0.05)	0.18	(0.05)	0.55	(0.11)	***
Cooperative member (dummy)	0.41	(0.05)	0.48	(0.06)	0.20	(0.09)	**
Small vegetable area: <2.5	0.72	(0.05)	0.68	(0.06)	0.85	(0.08)	
Medium-sized vegetable area: [2.5–10.0] ha	0.11	(0.03)	0.13	(0.04)	0.05	(0.05)	
Large vegetable area: >10.0 ha	0.17	(0.04)	0.19	(0.05)	0.10	(0.07)	
Cultivates 1–10 vegetable species (dummy)	0.16	(0.04)	0.15	(0.05)	0.20	(0.09)	
Cultivates 11–33 vegetable species (dummy)	0.28	(0.05)	0.27	(0.06)	0.30	(0.11)	
Cultivates >30 vegetable species (dummy)	0.56	(0.06)	0.58	(0.06)	0.50	(0.11)	
Cultivates fruit (dummy)	0.40	(0.05)	0.44	(0.06)	0.30	(0.11)	
Cultivates cereal (dummy)	0.21	(0.05)	0.21	(0.05)	0.20	(0.09)	
Raises animals (dummy)	0.16	(0.04)	0.18	(0.05)	0.10	(0.07)	
Number of FTE employees: 0–3 (dummy)	0.77	(0.05)	0.69	(0.06)	1.00	(0.00)	***
Number of FTE employees: 4–10 (dummy)	0.20	(0.04)	0.26	(0.06)	0.00	(0.00)	**
Number of FTE employees: >10 (dummy)	0.04	(0.02)	0.05	(0.03)	0.00	(0.00)	
Annual turnover: <70,000 EUR (dummy)	0.46	(0.06)	0.34	(0.06)	0.85	(0.08)	***
Annual turnover: 70–150,000 EUR (dummy)	0.22	(0.05)	0.27	(0.06)	0.05	(0.05)	**
Annual turnover: 150–300,000 EUR (dummy)	0.11	(0.03)	0.15	(0.05)	0.00	(0.00)	*
Annual turnover: 300–600,000 EUR (dummy)	0.02	(0.02)	0.03	(0.02)	0.00	(0.00)	
Annual turnover: >600,000 EUR (dummy)	0.09	(0.03)	0.11	(0.04)	0.00	(0.00)	
Annual turnover: no answer (dummy)	0.10	(0.03)	0.10	(0.03)	0.10	(0.05)	
Share of vegetables in yearly turnover (%)	67.60	(3.13)	67.13	(3.70)	69.05	(5.93)	
Large share of vegetables in yearly turnover (>50%) (dummy)	0.71	(0.46)	0.71	(0.46)	0.70	(0.11)	

Note: Significant difference between groups are indicated with * p < 0.1, **p < 0.05, ***p < 0.01.

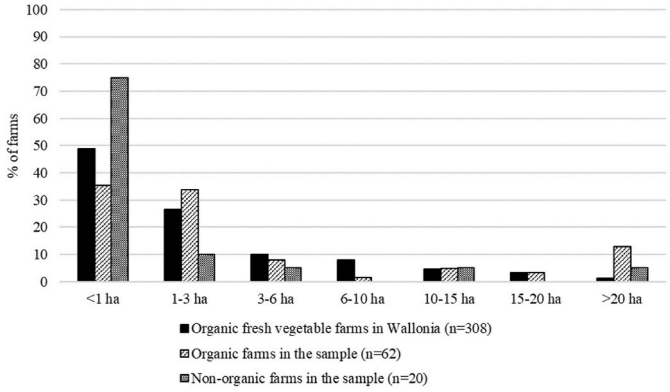

Fig. 2. Percentage of fresh vegetable farms by size in the sample and for organic farms in Wallonia in 2020 (Source (Biowallonie, 2021):

newly established local SFSC, and more attracted to internal control with label and third-party certification than small-to medium-scale farmers. Organic-certified farmers are less interested in selling vegetables through a new channel than non-certified farmers, and are particularly in favour of third-party certification.

5. Discussion

We discuss and interpret our quantitative results based on insights from the literature and discussions with farmers and key actors of the sector. Farmers' aversion to participating in a newly established local SFSC may be explained by the fact that searching for and entering a new channel implies important organisational challenges and transaction costs – as per the literature on firm capabilities and learning (Gereffi et al., 2005; Penrose, 1959; Prahalad and Hamel, 1990; Teece, 2019). Among others, interviewed farmers highlight the difficulty of adapting to different packaging, delivery, and produce diversity requirements of each buyer.

Farmers' reluctance to selling large shares of their yield through a new channel mainly reflects the risk of losing regular buyers who purchase through an already in-use channel. This aversion is also in line with the 'classic' business model of fresh vegetable farmers in Wallonia, with one main marketing channel (in which they specialise) and several additional channels used for smaller volumes (i.e. surpluses). This model reflects a marketing diversification strategy used to minimise risks associated with the commercialisation of perishable produce (LeRoux et al., 2010). Still, according to the interviewed farmers in Wallonia, attention needs to be paid not to use too many channels involving low volumes, which leads to organisational complications. This is in line with Malak-Rawlikowska et al. (2019) who find that farmers generally see it as a challenge to sell small volumes through several channels.

Regarding control and certification mechanisms, farmers' positive preference for internal control with label can be attributed to their interest in exchanging with their peers and learning from each other during farm visits. This is also shown by Cuéllar-Padilla and Ganuza-Fernandez (2018); and Sacchi et al. (2015) who investigate farmers' motivations to participate in PGS in Spain and Italy, respectively. The authors find that farmers value PGS because such internal certification systems foster knowledge exchange and mutual support among producers. We find that a label is considered a plus allowing to raise consumer awareness – thus boosting the market –, but based on farmers' sayings, it is not the most important factor, especially in the case of direct-to-consumer sales which inherently foster trust (Angella, 2016; Enthoven and Van den Broeck, 2021a; Malak-Rawlikowska et al., 2019). While farmers seem to be neither in favour nor averse to third-party certification, it may be required to participate in certain channels (e.g. some local shops, food box schemes, local institutions), and thus perceived as necessary or 'unavoidable'. Therefore, according to farmers, internal certification cannot replace third party certification, but can be used as a tool to strengthen mutual support. Furthermore, several farmers consider standards and requirements set by certification schemes (both with internal or external control) useful to provide a frame to aim for sustainable production practices. This may explain why farmers are not averse to control in general.

Table 3
Marketing channels used by organic-certified vs non-certified farmers in the sample and average share of total vegetable production sold through that channel, conditional on participation (italics).

	All farmers (n = 82) Mean	(se)	Organic (n = 62) Mean	(se)	Non-organic (n = 20) Mean	(se)	
Number of channels (#)	3.05	(0.15)	3.16	(0.18)	2.70	(0.25)	
Uses 1 channel for 50% or more of the yield (*dummy*)	0.74	(0.05)	0.74	(0.06)	0.75	(0.10)	
Sells through direct-to-consumer SFSC	0.89	(0.03)	0.89	(0.04)	0.90	(0.07)	
Sells through direct-to-retail SFSC	0.80	(0.04)	0.84	(0.05)	0.70	(0.11)	
Sells through conventional supply chains	0.17	(0.04)	0.16	(0.05)	0.20	(0.09)	
Direct-to-consumer SFSC							
On-farm sales (dummy)	0.74	(0.05)	0.69	(0.06)	0.90	(0.07)	*
Share sold on-farm (%)	*48.33*	*(3.36)*	*43.60*	*(3.78)*	*59.61*	*(6.64)*	*
Farmers' markets (dummy)	0.27	(0.05)	0.27	(0.06)	0.25	(0.10)	
Share sold at farmers' markets (%)	*32.91*	*(2.84)*	*34.71*	*(3.45)*	*26.80*	*(4.73)*	
Food box schemes (dummy)[a]	0.45	(0.06)	0.52	(0.06)	0.25	(0.10)	**
Share sold through box schemes (%)	*40.17*	*(2.92)*	*42.52*	*(3.45)*	*25.60*	*(3.60)*	
Direct-to-retailer SFSC							
Cooperatives (dummy)	0.32	(0.05)	0.34	(0.06)	0.25	(0.10)	
Share sold through cooperatives (%)	*24.50*	*(2.49)*	*27.38*	*(3.05)*	*12.40*	*(1.71)*	
Local shops (dummy)	0.54	(0.06)	0.58	(0.06)	0.40	(0.11)	
Share sold to local shops (%)	*24.61*	*(2.44)*	*23.19*	*(2.53)*	*31.00*	*(6.97)*	
Restaurants (dummy)	0.40	(0.05)	0.40	(0.06)	0.40	(0.11)	
Share sold to restaurants (%)	*17.30*	*(1.44)*	*15.52*	*(1.45)*	*22.88*	*(3.75)*	
Local institutions (dummy)	0.11	(0.03)	0.15	(0.05)	0.00	(0.00)	*
Share sold to local institutions (%)	*10.89*	*(1.27)*	*10.89*	*(1.46)*	.	.	
Conventional supply chains							
Auctions (dummy)	0.01	(0.01)	0.00	(0.00)	0.05	(0.05)	*
Share sold at auctions (%)	*50.00*	.	.	.	*50.00*	.	
Distribution companies (dummy)	0.11	(0.03)	0.13	(0.04)	0.05	(0.05)	
Share sold to distribution companies (%)	*42.50*	*(4.80)*	*37.29*	*(5.60)*	*79.00*	.	
Supermarkets (dummy)	0.10	(0.03)	0.08	(0.03)	0.15	(0.08)	
Share sold to supermarkets (%)	*37.88*	*(3.63)*	*52.00*	*(4.27)*	*14.33*	*(3.05)*	

Note: Significant difference between groups are indicated with * p < 0.1, **p < 0.05, ***p < 0.01.

[a] Some food box schemes may also be considered as direct-to-retail SFSC in case of home delivery by an intermediary. Still, here we classify box schemes as direct-to-consumers channels, as many of these schemes in Wallonia imply producer-consumer interactions at a pick-up point.

Table 4
Change in the share of vegetables sold through SFSC following the Covid-19 pandemic; Note: Significant difference between groups are indicated with * p < 0.1, **p < 0.05, ***p < 0.01.

	All farmers (n = 82) Mean (se)		Organic farmers (n = 62) Mean (se)		Non-organic farmers (n = 20) Mean (se)	
March–June 2020 lockdown						
More	0.49	(0.06)	0.52	(0.06)	0.40	(0.11)
Less	0.05	(0.02)	0.03	(0.02)	0.10	(0.07)
Equal	0.46	(0.06)	0.45	(0.06)	0.50	(0.11)
Post-June 2020lockdown						
More	0.30	(0.05)	0.34	(0.06)	0.20	(0.09)
Less	0.06	(0.03)	0.03	(0.02)	0.15	(0.08) *
Equal	0.63	(0.05)	0.63	(0.06)	0.65	(0.11)

Direct contact with consumers seems to be appreciated by farmers, provided that it is logistically easy and viable – hence, a higher preference for on-farm sales than off-farm. This is similar to Albrecht and Smithers (2018); and Kirwan (2006) who find that farmers only value exchanging with consumers as long as practical limitations can be overcome and profitability is ensured. It is important to note that some farmers are affected by external factors that exclude some direct marketing options. For instance, poor road access to the farm may hinder the possibility of establishing an on-farm shop. Location (urban, peri-urban or rural) may also affect possible marketing channels based on local consumers' socio-economic profile (Milford et al., 2021). Thus, even though some farmers may wish to exchange directly with consumers, it may not always be possible.

The importance of commitment over price is likely due to the perishable nature of vegetables (Kopp and Mishra, 2021; Mason and Villalobos, 2015; Milford et al., 2021). Yet, it is important to mention that while there is a general preference for commitment in our case,

Table 5
MXL basic model and MXL model corrected for ANA.

Mean parameters	Basic MXL model			MXL model corrected for ANA		
ASC	−3.57	(2.01)	*	−3.13	(1.10)	***
Selling price	1.30	(1.69)		0.87	(0.93)	
50% sold through SFSC	−0.88	(0.42)	**	−0.74	(0.38)	**
80% sold through SFSC	−2.31	(0.64)	***	−2.00	(0.60)	***
Internal control without label	0.53	(0.36)		0.50	(0.35)	
Internal control with label	1.02	(0.48)	**	0.82	(0.46)	*
External control with label	0.91	(0.77)		0.74	(0.74)	
Direct selling on-farm	0.62	(0.34)	*	0.61	(0.34)	*
Direct selling off-farm	−0.33	(0.49)		−0.51	(0.50)	
Commitment from the buyer	1.24	(0.37)	***	1.37	(0.35)	***
Standard deviation parameters						
ASC	2.67	(0.66)	***	−1.68	(0.60)	***
Selling price	−1.14	(0.62)	*	2.59	(0.59)	***
50% sold through SFSC	1.46	(0.58)	**	1.39	(0.50)	***
80% sold through SFSC	1.50	(0.82)	*	1.69	(0.80)	**
Internal control without label	0.02	(1.61)		0.36	(0.91)	
Internal control with label	−1.54	(0.68)	**	−1.76	(0.72)	**
External control with label	3.79	(1.37)	***	3.59	(1.24)	***
Direct selling on-farm	−1.11	(0.63)	*	−1.15	(0.48)	**
Direct selling off-farm	2.51	(0.95)	***	2.28	(0.69)	***
Commitment from the buyer	−0.76	(0.59)		0.75	(0.46)	
Observations	1476			1476		
Log likelihood	−397			−397		

Note: MXL stands for mixed logit; ANA for attribute non-attendance; and ASC for alternative specific constant. Standard errors are in brackets. Significant coefficients are indicated with * p < 0.1, **p < 0.05, ***p < 0.01.

discussions with farmers also revealed that 'over-commitment' should be avoided, especially due to climatic hazards impacting yields. For example, farmers may take a risk by promising vegetable boxes to (too) many consumers on a regular basis, while being exposed to climatic risks such as droughts or floods. This is in line with LeRoux et al. (2010); and

Table 6
MXL models with interaction terms.

Mean parameters	(a)			(b)			(c)		
ASC	−2.00	(1.89)		−4.25	(2.47)	*	−3.07	(1.81)	*
Selling price	0.84	(1.61)		1.48	(2.04)		0.90	(1.60)	
50% sold through SFSC	−0.77	(0.35)	**	−1.23	(0.56)	**	−0.76	(0.37)	**
80% sold through SFSC	−2.03	(0.60)	***	−3.22	(1.13)	***	−1.93	(0.63)	***
Internal control without label	0.43	(0.33)		0.67	(0.47)		0.49	(0.33)	
Internal control with label	0.87	(0.44)	**	0.83	(0.68)		0.40	(0.70)	
External control with label	0.54	(0.78)		0.30	(1.37)		−2.01	(1.25)	
Direct selling on-farm	0.46	(0.31)		0.66	(0.47)		0.52	(0.31)	*
Direct selling off-farm	−0.20	(0.44)		−0.71	(0.65)		−0.37	(0.50)	
Commitment from the buyer	1.06	(0.31)	***	1.60	(0.61)	***	1.09	(0.31)	***
Large farm x ASC	2.20	(1.02)	**						
Organic-certified x ASC	−1.68	(0.91)	*						
Large farm x internal control with label				2.94	(1.58)	*			
Large farm x external control with label				4.77	(2.08)	**			
Organic-certified x internal control with label							0.70	(0.79)	
Organic-certified x external control with label							3.74	(1.42)	***
Standard deviation parameters									
ASC	1.61	(0.97)	*	2.94	(1.00)	***	1.74	(0.67)	***
Selling price	1.86	(0.85)	**	−1.38	(0.64)	**	2.08	(0.62)	***
50% sold through SFSC	1.13	(0.48)	**	2.29	(0.96)	**	1.16	(0.53)	**
80% sold through SFSC	1.26	(0.70)	*	2.69	(1.26)	**	0.96	(0.76)	
Internal control without label	−0.52	(0.81)		−0.52	(0.92)		−0.36	(0.92)	
Internal control with label	−0.85	(0.99)		−1.98	(1.15)	*	−1.15	(0.73)	
External control with label	3.51	(1.25)	***	5.14	(1.99)	***	2.72	(1.03)	***
Direct selling on-farm	1.13	(0.52)	**	−1.87	(0.80)	**	−1.05	(0.50)	**
Direct selling off-farm	2.09	(0.78)	***	3.47	(1.22)	***	1.92	(0.70)	***
Commitment from the buyer	0.93	(0.67)		1.31	(0.79)	*	−0.75	(0.55)	
Observations	1476			1476			1476		
Log likelihood	−396			−392			−395		

Note: MXL stands for mixed logit; SD for standard deviation; and ASC for alternative specific constant. Standard errors are in brackets. Significant coefficients are indicated with * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Mason and Villalobos (2015) who highlight that moral hazard problems may arise from farmers who commit to production for a secure price, but may overstate their yields. Hence, the way commitment is defined (i.e. quantity and frequency of delivery) matters a lot. The question of price was also raised by several interviewed farmers: how to define a fair price for both farmers *and* consumers? The price of fresh vegetables in conventional and DTR channels in Wallonia is typically based on a market price plus premium under organic third-party certification. Depending on the intermediaries, the price that farmers receive is usually lower than when selling through DTC channels, where the farmers can charge a higher price if they wish to do so. In the latter case, according to farmers, a balance must be found between covering their costs and ensuring affordable access to vegetables for local consumers.

Differences in preferences between large-scale and small-to medium-scale farmers – the former being more interested in participating in new SFSCs, and in favour of internal and external control with label – may be explained by two main factors. First, diversifying their marketing portfolio may allow large-scale farmers to sell all their yield more easily, due to high vegetable volumes that must be sold. Conversely, smaller farmers may not need to do so to sell all their production. Second, large-scale farmers may participate more frequently in channels requiring control and a label than smaller farmers (German et al., 2020; Milford et al., 2021). For instance, third-party certification allows to participate in contracts at a bigger scale, which may be more relevant to large-scale farmers. On the contrary, small-scale farmers in Europe have been shown to use direct-to-consumer channels more often, in which food safety and quality assurance is rather based on trust, thus not needing a label *per se* (Cerrada-Serra, 2018; Demartini et al., 2017; Kneafsey et al., 2013).

Finally, the fact that organic-certified farmers are less in favour of using a new channel, and have a higher preference for external control with label than non-organic-certified farmers is likely associated with the former being already used to the functioning and benefits of third-party certification, including accessing certain marketing channels and receiving a price premium for their vegetables.

More broadly, our results highlight that farmers do not only manage crops, but also aim to run a viable business, adapted to their production model, geographical situation and ideology. This requires experience and coping skills – as farming is inherently an operation exposed to many risks (Harwood and Serviceof, 1999) – that may not be innate. Although local SFSC are often presented as a 'solution' to farmers' marketing issues, each newly established channel cannot be tailored to all farmers' needs. Some farmers may not even perceive marketing as a problem as such, but may need support in other areas, especially in countering production costs, including seeds, fertilizers, pesticides, irrigation, equipment, employees' salary, land rent etc. During discussions with farmers, it was frequently mentioned that small-to medium-scale vegetable farmers did not fit into a category that could truly benefit from European funding (especially from the Common Agricultural Policy subsidies). This puts into perspective what and to whom public funds should be allocated.

It is important to note certain limitations of our study. First, due to our relatively small sample size, we may not have captured all sources of preference heterogeneity. As discussed in section 3.2.1, a small sample size is a common drawback in DCE targeting farmers in high-income countries. By only using two blocks in our experimental design, leading to a reasonable number of respondents per block, we partly overcome this issue (Chèze et al., 2020). In addition, we use a D-efficient experimental design, which requires a smaller sample size than more traditional orthogonal design (Bliemer and Rose, 2011). Second, as few data on the fresh vegetable sector in Wallonia exist – especially on non-organic-certified farms –, it is difficult to establish whether our sample is representative of all farmers of the sector. We are therefore careful to not overgeneralise our results.

6. Conclusions

This study uses a DCE complemented by qualitative data to investigate Walloon fresh vegetable farmers' preferences for local SFSC and different types of control and certification mechanisms. Our findings

indicate that there is little interest among farmers to participate in newly established local SFSCs, which is mostly due to the organisational challenges and additional transaction costs implied to do so (de Roest et al., 2018). Moreover, farmers are not eager to sell large shares of their yield through a new channel, as the 'classic' strategy adopted by farmers in the region is the use of one main specialty channel, complemented by several others for surpluses. Hence, selling a large share of their vegetables through a new channel would force them to adapt their whole business model, as production and marketing strategies are intertwined (Nuthall, 2011). Farmers are generally in favour of internal control mechanisms, such as PGS, due to the opportunity it brings to exchange with their peers. However, they do not believe it would replace third-party certification, which may be required to participate in certain channels, such as food boxes schemes or local organic food shops. Direct contact with consumers is valued by farmers, but only if it does not lead to significant logistical complications (Albrecht and Smithers, 2018; Kirwan, 2006). Obtaining a high price for vegetables appears to be less important to farmers than a pre-planting commitment from the buyer, which is mostly linked to perishability issues. We observe that preference heterogeneity mostly stems from differences between large and medium-to small-scale farmers, and organic-certified and non-organic-certified farmers.

These results have implications for policy-makers in the Walloon agricultural sector and other similar contexts. While the government aims to promote LFS and SFSC, local food initiatives should be tailored towards farmers' preferences. In this case, this means fostering pre-planting commitment from buyers in existing channels, rather than developing new ones. Our findings encourage both researchers and policy makers to not only focus on consumers' interest in local food, but also on farmers' requirements to participate in local SFSC and certification systems in order to better design relevant local food initiatives. Further research is needed to investigate other actors' views on local SFSC in the region (including intermediaries, retailers, local institutions, and restaurants), to understand under which conditions commitment and internal certification systems may be established effectively.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgments

We acknowledge funding from the Fond National de la Recherche Scientifique (Belgium), through a FRIA Doctoral Grant.

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