Article

EUROPEAN URBAN AND REGIONAL STUDIES

European Urban and Regional Studies
2024, Vol. 31(3) 281–301

DOI: 10.1177/09697764231201572
journals.sagepub.com/home/eur
Sage

What are the economic impacts of short food supply chains? A local multiplier effect (LM3) evaluation

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Abstract

Shortening food supply chains attracts increasing support from policymakers, to improve returns to farmers and stimulate rural development. However, there is a lack of empirical evidence regarding the impacts of short food supply chains on local economies. To address this, the article quantifies the impacts of short food supply chains on local economies, using the Keynesian-based Local Multiplier 3 method (LM3), applied to a unique dataset of 122 farm

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businesses from five European Union countries (France, Hungary, Italy, Poland and the United Kingdom). Estimations cover 305 market chains, comprising both short and long food supply chains, in which sampled farmers participate. The results indicate that the revenues from farm production remain largely within local economies, generating a substantial multiplier effect (LM3 > 2). This effect stems from purchases of farm inputs locally including, in the first instance, hiring local labour, as well as the expenditures of local suppliers that re-spend part of their revenues within the local area. The multiplier effects of short food supply chains are similar to long food supply chain equivalents as both use largely local labour and source tradable inputs locally. In shaping food chain policy a broader set of socioeconomic benefits to local development from selling through short food supply chains should be considered.

Keywords

Agricultural policy, EU food policy, local economy, local multiplier effect (LM3), rural development, short food supply chains (SFSCs)

Introduction

Globally, rural development policy has switched from exogenous strategies, focused on attracting external capital to rural areas, to endogenous and neo-endogenous perspectives, which place a greater emphasis on utilising indigenous resources and stimulating local networks (OECD, 2018). Proponents claim that endogenous- and neo-endogenous-based development approaches, because of their focus on local resources (e.g. land, labour, social and natural capital) and markets, lead to higher local multiplier effects (Bosworth et al., 2016; Ray, 1998). Policy initiatives such as the European Union's LEADER Programme (*Liaisons Entre Actions de Developpement de l'Economie Rurale*), with its focus on local action groups, a territorial lens and the use of local resources embody an endogenous approach to rural development (Gkartzios and Lowe, 2019). However, the multiplier effects of different rural development strategies and supply chain structures remain underexamined, which represents a major weakness in policy evaluation (EIP-AGRI Focus Group, 2015; European Evaluation Network for Rural Development, 2010).

European farmers typically supply increasingly complex, concentrated and internationalised food supply chains (Swinnen and Vandeplas, 2010). Policymakers and producers worry that farmers' engagement with 'long' food supply chains leads to a loss of control and a diminishing share of added value, in the face of more powerful, downstream actors (European Commission, 2016; Falkowski et al., 2017). This has led to increasing interest in short food supply chains (SFSCs), which are defined in the European Rural Development Regulation (1305/2013) as 'supply chains with a limited number of economic operators, committed to co-operation, local economic development, and close geographical and social relations between producers, processors and consumers' (Official Journal of the European Union L347 of 20 December 2013).

Evidence to date suggests that engagement in SFSCs increases farmers' margins, profitability and degree of control over market transactions (Malak-Rawlikowska et al., 2019). Advocates of SFSCs suggest that they also have important indirect benefits for local economic development, by embracing more geographically proximate production and consumption networks (Kneafsey et al., 2013; Vittersø et al., 2019). It is for this reason that in the European Union, SFSCs have been regarded as drivers of sustainable development and, as such, have been increasingly mentioned in rural and food policy, notably in the Common Agricultural Policy (CAP) and its Rural Development Programmes (RDPs; EU Regulation 1305/2013; European Commission, 2014, 2020a). Most recently, the European Green Deal strategies highlight the ambition of shortening food supply chains (European Commission, 2020b).

While some regard SFSCs as an exemplary strategy for endogenous rural development (Benedek and Balázs, 2015a), it remains 'uncertain how the relocalisation of agri-food systems will contribute to

endogenous rural development' (Ilbery et al., 2004: 332). Specifically, while it is widely believed that increasing farmer participation in SFSCs will bring considerable benefits to local economies, such effects are not convincingly documented empirically (Majewski et al., 2020). This article addresses this and contributes by measuring the multiplier effects of farm expenditure, considering differences between SFSCs and more conventional long food supply chains (LFSCs).

For this purpose, we measure local multiplier effects taking a Keynesian-based multiplier approach following the Local Multiplier 3 (LM3) methodology (Sacks, 2002). This multiplier was applied to a unique dataset of 122 farm businesses from five European countries (France, Hungary, Italy, Poland and the United Kingdom), and estimated for 305 market chains. To the best of our knowledge, this represents the first empirical attempt to estimate LM3 for farm expenditure cross-nationally, distinguishing between SFSC and LFSC effects.

The article is structured as follows. The next section introduces the debate regarding the role of SFSCs within European agricultural policy, their definition and impact on local economies, before introducing the LM3 approach. The 'Methods and sample description' section details the methodology, including the classification of LFSCs and SFSCs and local economies, as well as procedures for estimating LM3, data collection and sample characteristics. The 'Results' section details the LM3 estimations for LFSCs and SFSCs, with a discussion of policy implications, followed by the 'Conclusions' section, which includes a recognition of limitations and suggestions for future research.

Literature review

SFSCs and European agricultural policy

While ignored in the early decades of the CAP, SFSCs have become more prominent in European policy. The 2013 reform of the CAP, learning from the 2007–2008 economic crisis, paid greater attention to food availability and nutritional security, which resulted in an interest in 'sustainable intensification' (Majewski and Malak-Rawlikowska, 2018). At this point, CAP reform and the Omnibus Regulation sought to strengthen the position of farmers in the food supply chain (European Commission, 2020b). Introducing the concept of SFSCs into the CAP permitted financial support from national RDPs. Such support was offered, for instance, in Hungary (Benedek and Balázs, 2015b) and in Romania (Tanasă et al., 2015). The RDP measure 'Promoting food chain organization and risk management priority' has been given a relatively high priority, as a tool to strengthen the relatively weak position of farmers in the food supply chain through 'organizing themselves better as to improve revenue opportunities' and gaining from local markets and shortening of food supply chains (European Commission, 2014).

The desire to shorten supply chains (with a particular focus on fresh and less processed food), as long chains are at greater risk to disruptions in logistics, is emphasised in the agricultural and food aspects of the European Green Deal (European Commission, 2020a). Among other statements, there is a will to 'strengthen the position of farmers (e.g. producers of products with geographical indications), their cooperatives and producer organisations in the food supply chain' (European Commission, 2020a: 12). It is planned to 'shift the emphasis from compliance and rules towards results and performance' (European Commission, 2020b: 3), giving greater flexibility to the Member States on how to achieve these goals. Among nine specific objectives, covering economic, social and environmental dimensions of sustainable rural development, three relate to food supply chains: to ensure a fair income for farmers, to increase competitiveness and to rebalance power in food chains. Consequently, there is a desire to strengthen the position of farmers in the value chain, mainly through income support as well as supporting cooperation among farmers and collective approaches (European Commission, 2020b). While within the latest policy documents there are no legal acts to support SFSCs directly (Galli et al., 2020), other relevant policy tools are available, such as RDPs (e.g. LEADER), territorial quality support, more flexible rules concerning localised food procurement and processing on small farms. The support

for SFSCs is thus fragmented within rural development initiatives, and it is governed at the regional level.

As all the tools and interventions undertaken within Member States should be based on well-established evidence (European Commission, 2020b), there is an increasing need for research on the impacts of different types of food supply chains, evaluating their economic effects on both farmers and local economies.

Impacts of SFSCs on local economies

Economic activities in rural areas, where agricultural commodities and foodstuffs are produced, are important for the economic development of these areas, which are often remote and subject to depopulation (OECD, 2018). The literature provides substantial evidence regarding the economic benefits of SFSCs to farmers, through achieving a price premium from the direct sale of quality foods (Alonso, 2011; Chiffoleau and Dourian, 2020; Malak-Rawlikowska et al., 2019; Pearson et al., 2011; Vittersø et al., 2019), or via the absorption of profit margins otherwise captured by intermediaries (Sage, 2003). However very few studies deal specifically with quantifying their impacts on local economies.

Several studies suggest that SFSCs have a positive impact on local economies and rural development (i.e. Galli and Brunori, 2013; O'Neill, 2014; Peters, 2012). Henneberry et al. (2009) summarise evidence for North America regarding the direct and indirect effects of expenditure at farmers' markets. This suggests that $1.7 million spent directly at farmers' markets in West Virginia generated $2.4 million in output (also considering opportunity costs of not buying in grocery stores). SFSCs can also generate jobs, albeit potentially characterised by a very low level of labour productivity (Mundler and Laughrea, 2016). In addition to sales roles, SFSCs create jobs in picking, packaging and labelling, as well as indirectly in suppliers' businesses (Kneafsey et al., 2013). There is also evidence for more jobs being created locally due to the SFSC in France and Quebec (Canada; Chiffoleau and Dourian, 2020).

Other studies, while not providing financial data, indicate that SFSCs enable the retention of money in local economies through strengthening other local industries (Ilbery and Maye, 2005). Several case studies describe local self-organisation resulting from a willingness to create and coordinate SFSCs, which led to the establishment of regional product labels and other businesses (including cooperatives; EIP-AGRI Focus Group, 2015; Mancini and Arfini, 2018; Marsden et al., 2000; Mundler and Laughrea, 2016). Regional labels with a good reputation may generate positive spillover effects on demand for all food products produced in the same area (Mancini and Arfini, 2018). Some SFSCs (such as direct on-farm sales and farmers' markets) when combined with engagement in other local initiatives, such as rural tourism, may also stimulate rural economies indirectly (Bessière, 1998). However, despite the numerous claims regarding their benefits there is 'little systematic, quantifiable evidence regarding the contribution of SFSCs to rural economies' (Kneafsey et al., 2013: 111). Consequently, EIP-AGRI Focus Group (2015: 26) identifies 'understanding the systemic and territorial impacts' of SFSCs as a research need as 'little has been done to develop tools and data for understanding the effects . . . on a given territory'.

Methods and sample description

Economic multipliers

Economists have long recognised that expenditures have effects beyond immediate transactions (Rochon and Gnos, 2008) and the study of multiplier effects is an important tradition within Keynesian economics. Keynes (1933) stated that an investment's economic effect is greater than the sum of the initial direct investment as indirect effects also occur. Specifically, continued or increased demand for raw materials, machines or labour resulting from the emergence of a new business or from the growth of an existing business is a direct effect of economic decisions. This, in turn, generates an indirect effect, by influencing surrounding entities in two ways: by increasing the income or purchasing power of workers of this business entity and by generating additional demand for the suppliers of this business (e.g. for land, labour, capital or their raw materials). These two types of demand effects stimulate further rounds of spending and increase the demand for new goods

and services, which is called the 'multiplier effect'. In other words, the multiplier effect refers to the proportional amount of increase, or decrease, in economic growth resulting from an injection, or withdrawal, in spending. While Keynes was most interested in the macroeconomic effects of investments, particularly government expenditure to counter the depressing effects of unemployment (Wright, 1956), subsequent work focuses on multiplier effects within local and regional economies (e.g. Moretti, 2010).

In this study we compare the multiplier effect of two ways of carrying out similar economic activities, that is, selling agricultural produce through SFSCs versus LFSCs, with the use of the LM3 tool developed by the New Economics Foundation. Several academic studies adopt the LM3 approach for measuring local multiplier effects (McInroy et al., 2008; Mitchell and Lemon, 2019; Silovská and Kolaříková, 2016; Thatcher and Sharp, 2008), but not yet to the study of SFSCs.

The LM3 approach considers three rounds of spending, to track money flows and associated contributions on the local economy. For each round, the tool measures the amount of spending that is retained within the local area and that which is 'lost' outside of the local area. The LM3 ratio is derived with a simple formula (Sacks, 2002):

$$\mathrm{LM3} = \frac{\mathrm{Round\,1} + \mathrm{Round\,2} + \mathrm{Round\,3}}{\mathrm{Round\,1}} \qquad (1)$$

The value of LM3 ranges between 1.00 and 3.00, where 1 equates to spending the whole initial sum outside of the local area, and 3 if all spending across the three rounds stays local (Sacks, 2002). Consequently, if economic actors decide to spend locally (which is partly a result of their own decisions, and partly reflects the accessibility of goods and the structure of the operating environment), the local economic impact of an initial sum of money rises (Bengo et al., 2016; Meter, 2010). Apart from measuring the ratio of money spent locally, LM3 calculations also enable tracking which types of suppliers (or staff) re-spend money within the target area (Sacks, 2002).

Application of the LM3 method for evaluating the impact of SFSCs

The LM3 approach was used to measure the impact of SFSCs on the local economy. The assessment is based on the comparison between farm businesses which sell more than a half of their produce via SFSCs versus those which use LFSCs to deliver most of their produce. The multiplier is thus calculated separately for these two groups.

The application of the LM3 model follows the LM3Online version, which has been refined and improved by Impact Measurement Ltd. (2021). This varies in two specific ways from the original model. The first difference is that the original model calculated only the money that was retained within the local area. Any money that left the area in any round was discarded. LM3 not only tracks money that leaves the local area, but also tracks where that money subsequently goes. Some of this may return to the local economy in a second round, so that these additional spending inflows are also considered. However, the major benefit with this extension is that it allows for a comparison of the difference between spending money with local suppliers and non-local suppliers. This is critical in informing public policy, particularly as it forms a mechanism for measuring public value.

The conceptual framework of LM3 calculation used for this study is presented in Figure 1. The expenditure analysis begins in Round 1, with farm revenues. Based on primary farm survey data, the money spent by farmers is tracked, taking into account its use, for example, farm expenses related to all purchases and workers' wages, and whether incurred in or out of the local area. In Round 3, assumptions are made regarding spending of both local and non-local suppliers, as well as farm workers who spend a part of their money within the delimitated local area, and another part beyond the locality (Impact Measurement Ltd., 2021).

Based on Formula (2), the local multiplier is thus calculated as:

$$\mathrm{LM3} = \frac{\mathrm{R1} + \mathrm{R}2a + \mathrm{R}3b}{\mathrm{R1}} \qquad (2)$$

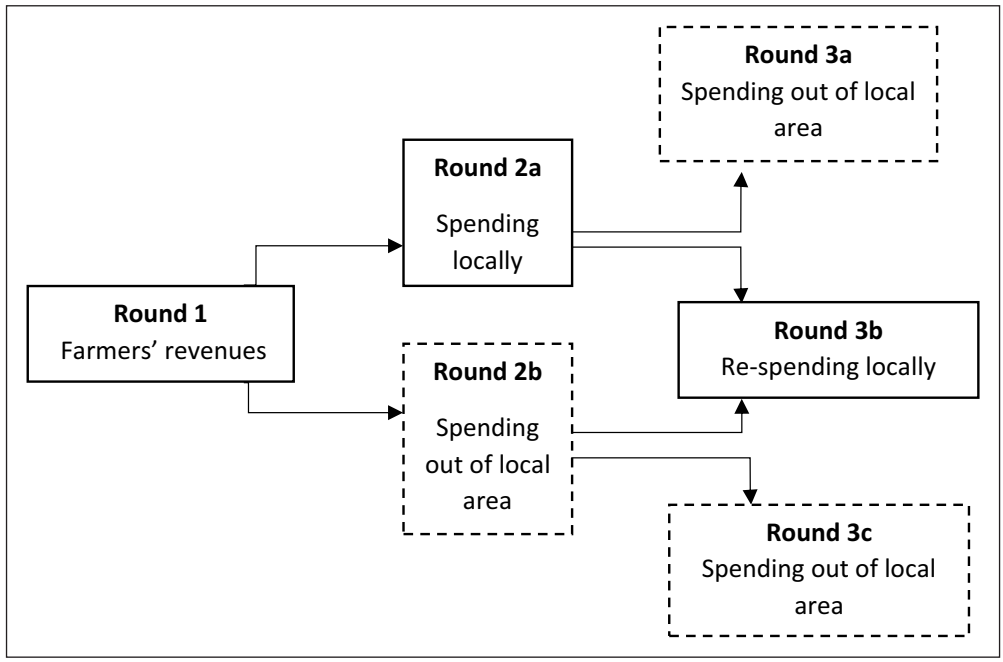

Figure 1. Conceptual model for LM3 model.
Source: Own elaboration.

where R1 is farm revenues, R2 is local expenditures of farmers and R3 is money re-spent locally by the farm's workers as well as the goods and services suppliers.

Classifying SFSCs

There are three main criteria employed in the literature to classify SFSCs (Aubry and Kebir, 2013; Foodlinks, 2013; Galli and Brunori, 2013; Ilbery and Maye, 2005; Kneafsey et al., 2013; Malak-Rawlikowska et al., 2019; Marsden et al., 2000; Renting et al., 2003). The first relates to the 'physical (geographical) proximity' between the place of production and sale, while the second concerns 'organisational proximity' measured by the number of intermediaries involved in the food chain, and the third 'social proximity' refers to the 'relationship' between producer and consumer of food based on mutual trust and closeness in the transfer of information (Malak-Rawlikowska et al., 2019).

Regarding 'physical proximity', SFSCs are often associated with a small administrative unit (Stanley, 2018), delimitated within administrational boundaries (community, municipality, county) or by a simple proximity measure – an agreed physical distance between primary producers and consumers (Brown and Miller, 2008; Hand and Martinez, 2010; Maye and Ilbery, 2006; Morris and Buller, 2003).[1] Locality boundaries may be case or country specific (Martinez et al., 2010). For example in the United States, a 400-mile radius designates local production,[2] but such a radius designates a territory larger than the average European country.

As for 'organisational proximity', it is usually measured by the number of intermediaries involved in the food chain. SFSCs typically have no intermediary between the producer and the consumer or only a maximum of one intermediary, for instance a local retail shop, online shop/platform or restaurant (Malak-Rawlikowska et al., 2019).

The concept of 'social proximity' encompasses exchanging information between producers and

consumers (Foodlinks, 2013). This exchange allows producers to control the information conveyed to end consumers and creates an opportunity to receive feedback from them. This feedback encompasses various aspects, including the producer's identity, the quality attributes of the food, the farming methods employed and even the ethical and social values associated with the production process (Galli and Brunori, 2013).

Typology of SFSCs and LFSCs

To assess the contribution of SFSCs to local economies, we developed a typology of 'short' and 'long' distribution channels, building on the categorisation from Malak-Rawlikowska et al. (2019). The typology was based on the general structure of the food market (Bukeviciute et al., 2009), categorisations of distribution channels present in the literature (e.g. Kneafsey et al., 2013) as well as a pilot survey performed in Poland and France. In our study the main criterion to distinguish between 'short' and 'long' chains was the organisational proximity, understood as number of intermediaries between the producer and the consumer. Thus, 'short' chains encompass all channels with no, or one single, intermediary between the producer and consumer, while chains selling through more than one intermediary are classified as 'long' (Table 1) This approach reflects the EU definition of a SFSC.[3]

Although some of the designated chain types may include various forms, a degree of simplification was unavoidable to conduct the analysis. For instance, the category 'sales to small retail outlets' includes various forms of deliveries through an off-farm retail point (e.g. hotels, restaurants, direct deliveries to local shops).

Designating a geographical boundary for local areas

According to Weisbrod and Weisbrod (1997) as well as Domanski and Gwosdz (2010), a decision concerning the geographical radius is particularly important, as it determines which effects will be internal or external to the local economy. However, this was not straightforward in the case of food supply chains, because, as the literature review details, there is no official definition of 'local' either within Europe or globally. In this study the size of local areas was based on consumer perceptions of localness (Rural Network NI, 2014), previous mapping of local food networks (Ling and Newman, 2011), expert opinion (including farmers' opinion in the pilot study in Poland and France) and the authors' own observations and experiences. The latter indicated that most economic activities (including purchases for households) concentrate within municipalities (Local Area I) and larger, county type or NUTS 4 areas (Local Area II). To set a clear boundary between local and non-local areas, we decided to set two geographical radii to capture alternatively two 'local' dimensions in this study:

- Local Area I – a radius of 7.5 km, marking the area of approximately 176.71 km^2 ($\pi \times 7.5^2 = 176.71$). In most European countries this equates to the size of an average municipality.
- Local Area II – a radius of 15 km, covering an area of circa 706.86 km^2 ($\pi \times 715^2 = 706.86$), which is akin to the size of a typical European Local Administrative Unit (LAU), and four times larger than a municipality.[4]

Table 1. Types of short and long food supply chains.

Short food supply chains	Long food supply chains
Direct on-farm sales: pick your own	On-farm sales to intermediaries
Direct on-farm sales: sales to individual consumers	Sales to wholesalers or on wholesale markets
Direct off-farm sales: internet deliveries	Sales to retail chain (two intermediaries)
Direct off-farm sales: delivery to consumer	Sales for processing
Direct off-farm sales: farmers' markets (or fairs)	
Sales to small retail outlets (one intermediary)	

Source: Malak-Rawlikowska et al. (2019).

Farmers' expenditures within the Local Area I or II radii were considered 'local', and beyond such boundaries 'non-local'. To allow for cross-comparison, the size of the designated local areas were the same for all studied countries.

Research design and the sample

The research employed a case study methodology, following the procedure suggested by Tellis (1997). As our empirical interest relates to the contribution and thus impacts of SFSCs on local economies, the sampling approach consisted in selecting farms which participate in at least one type of SFSC. Since we observed that farmers engage simultaneously in multiple market chains, the assignment of a particular agri-food business to the 'selling to SFSCs' category was based on selling over 50 per cent of product volume via SFSCs.

Farm surveys across the five countries were conducted between November 2017 and November 2018, following pilot testing conducted in France and Poland in 2016. To capture the diversity of product chains and specialisation patterns, as well as distribution through different market chains, we decided to cover at least two product categories per country. The final sample covered 122 farms supplying to 305 chains including: fruits, vegetables, meat and cheese (Table 2). The research was carried out in five European countries (France, Hungary, Italy, Poland and the United Kingdom). Characteristics of the sample are presented in the 'Results' section.

It should be noted that this sample is not representative for the whole population of farms across the analysed countries. Ensuring a fully representative sample would require using a database of food producers participating in at least one SFSC – which does not exist currently. While noting limitations in data availability, our sample of 305 chains provides a substantial dataset, particularly considering much of the SFSC literature depends on single case studies.

Given the absence of suitable secondary data, researchers in each country collected data through face-to-face or telephone interviews with farmers. Practically there were no missing data. For the interviews a detailed questionnaire was prepared. The survey questionnaire covered the following themes:

- business description (production structure, turnover, labour);
- sales (quantities sold via different supply chains, prices, locations and distances to final destinations);
- specific product distribution information (amounts transported in single deliveries, labour inputs, costs of packaging, other distribution costs);
- LM3 data and farm expenditures (value of farm expenditures for pesticides, fertilisers, seeds and seedlings), materials for production (specifying the type and source), animal feed (specifying the type and source), veterinary medical services, other services (specifying the type), insurance, fuel, local taxes and payments, electricity, water, machinery repairs, garbage collection and other expenses and their respective shares of these expenditures in Local Areas I and II; proportions of local/non-local workers employed at the farm, estimates of workers' spending in Local Areas I, II and beyond.

R1 and R2 coefficients were obtained empirically from each case investigated. Due to common difficulties in acquiring R3 empirical data (supplier re-spend), the model follows others in using accumulated R3 data from the main LM3 database which, at time of writing, consisted of 35,489 responses, compiled from in excess of 5000 separate projects. Aggregating across this dataset, provided a stable and consistent figure for farm workers and goods and services suppliers situated outside of the local area. The estimation was that they re-spend 33

Table 2. Number of farms in the research sample by country.

Country	France	Hungary	Italy	Poland	United Kingdom	Total
Number of agri-food producers	15	24	11	57	15	122

Source: Own elaboration.

per cent for non-local suppliers (Figure 1. R3c) with the remaining 67 per cent spent in local area (Figure 1. R3b). The combined empirical data for R1 and R2 with applied coefficients for R3 level data allowed us to calculate LM3 multipliers.

Results

Characteristics of the sample

Based on the share of the product volume sold, we distinguished 82 farms in the category 'selling ⩾50 per cent to SFSCs' and 59 farms in the category 'selling >50 per cent to LFSCs'. These farmers were found to participate in 305 market chains in total, out of which 180 (59%) were SFSCs and 125 (41%) were LFSCs (Table 3). However, 87.3 per cent of the sales (in volume) were sold through LFSCs – mainly to processing (29.8%) and other intermediaries (25.7%). This reflects that SFSCs are largely locally oriented and cannot absorb large quantities of produce. Although SFSC sales account for a smaller share in total volume (12.7%), almost half of the farmers (43.4%) were found to engage simultaneously in both short and long market chains. This suggests that farmers diversify their revenue streams by using different types of market chains for selling their produce. On average, each farm used about 2.5 chains, with a maximum of five different market channels.

Among SFSCs, on-farm sales and famers' markets were the most popular market channels (Table 3). Specifically, on-farm sales to individual consumers were used by approximately one half (48%) of the sampled agri-food producers. One of the key reasons for this might be that almost 55 per cent of those sampled farms (Table 4) produce/sell organic or other food quality-certified products (e.g. geographical indications) that attract local customers, as well as tourists (e.g. PGI Kaszubska strawberries and PGI Suska sechlońska dried plums in Poland, PDO Parmiggiano Reggiano cheese in Italy). Farmers' markets, by the same token, were indicated by 59 producers (48% of the full sample). Overall, the farmers 'selling ⩾50 per cent to SFSCs' sold on average 70 per cent of their production volume via SFSCs, compared to producers 'selling >50 per cent to LFSCs', which sold on average 96 per cent of their production volume through long chains (Table 3).

Producers classed as 'selling ⩾50 per cent to SFSCs' had an agricultural land area almost twice as large as those 'selling >50 per cent to LFSCs' (63 vs 33 ha); however, their turnover was 35 per cent lower (Table 4). A key reason for this difference lies in farms' production specialisation – in the 'selling ⩾50 per cent to SFSCs' subsample there were more meat and cheese producers with large farming area devoted for cattle. These farms were focused on selling most of their produce to short chains (farmers' markets, local retail shops and directly to consumers). On the other hand, farms in 'selling >50 per cent to LFSCs' subsample were more likely to specialise in fruits and vegetable production (strawberries, apples, plums, vegetables) – being usually smaller farms but with more intensive production.

Total labour resources, expressed in annual work units per business unit, were on average 2.7 per cent and 24 per cent higher for those selling via LFSCs. Overall, hired labour makes a substantial contribution to total labour resources (on average 71%). The importance of hired labour might be a result of labour-intensive types of production systems within our sample (e.g. fruit and vegetable growers, cheese and processed meat producers).

LM3 estimates

This section outlines the application of the LM3 approach to estimate local economic multiplier effects. Results for Local Area I, defined with the 7.5 km radius, are provided in Table 5 for short and long chains, respectively.

Table 5 shows that producers 'selling to SFSCs' generated a total revenue of approximately €11.8 million. They spent 26.4 per cent of revenue locally (Local Area I <7.5 km) on supplies of tradable inputs (such as fertilisers, seeds, pesticides). The LM3 coefficient was calculated as follows:

+ Farmers' revenues (11,842,567.6) (Round 1)
+ Local spend for suppliers in area (3,127,993.9) (Round 2a)
+ Local suppliers re-spending in area 2, 26,334 8 (Round 3b)
+ Non-local suppliers spend in area (2,856,637.6) (Round 3b)
= 19,853,533.8 (total spending impact)

Table 3. Structure of sales by distribution channel.

Supply chains	Total volume sold and share by market chain		Structure of total volume by market chain (%)		Producer participation across market chains	
	(tonnes)	(%)	Selling ⩾50 per cent of volume to SFSCs	Selling >50 per cent of volume to LFSCs	Market chains (*N*)	Structure (%)
SFSCs						
a. Pick your own	0.00	0.0	0.0	0.0	0	0.0
b. On-farm sales to individual consumers	408.4	4.8	15.8	3.2	59	19.3
c. Sales to retail shops	206.2	2.4	15.8	0.4	37	12.1
d. Direct sales – internet deliveries	95.0	1.1	7.4	0.2	14	4.6
e. Direct sales – delivery to consumer	81.5	1.0	7.4	0.0	11	3.6
f. Direct sales on farmers' markets	281.7	3.3	23.6	0.3	59	19.3
Total	1072.8	12.7	70.0	4.1	180	59.0
LFSCs						
g. On-farm sales to intermediaries	2177.4	25.7	6.2	28.6	29	9.4
h. sales to wholesalers/wholesale market	1082.3	12.8	20.7	11.6	44	14.4
i. Sales to retail chain	1615.5	19.1	1.3	21.7	23	7.5
j. Sales for processing	2530.6	29.8	1.8	34.0	29	9.5
Total	7405.8	87.3	30.0	95.9	125	41.0
Total sample	8478.5	100.0	100	100	305	100

Source: Own elaboration.
SFSCs: short food supply chains; LFSCs: long food supply chains.

Table 4. General characteristics of agri-food producers in the sample.

	Total sample (*n*)	Selling ⩾50 per cent of volume via SFSCs (*n*)	Selling >50 per cent of volume via LFSCs (*n*)
Number of producers	122	67	55
Area of agricultural land (ha)	49.6	63.4	32.8
Average turnover (€)	206,311.9	165,868.0	255,579.9
Share of farms with livestock (%)	61.5	58.2	65.5
Number of LSU/farm with livestock	78.2	51.6	107.1
Food quality certification (geographical indications or organic; %)	54.9	43.3	69.1
Total employment (AWU per business)	2.7	2.5	3.1
Share of hired workers in AWU (%)	70.7	69.2	72.0
Education level of farmers[a]			
Primary and secondary (%)	52.4	52.2	52.7
Tertiary (%)	47.5	47.8	47.3
Number of years as a business manager	24.3	25.1	25.6

Source: Own elaboration.
SFSC: short food supply chain; LFSC: long food supply chain; AWU: annual work units; LSU: livestock unit.
[a]Based on International Standard Classification of Education (ISCED)/Eurostat classification.

Total spending impact divided by the initial revenue of farmers gives the following result:

$$\frac{19,853,533.8}{11,842,567.6} = 1.676$$

The LM3 of 1.68 means that each euro of farmers' revenue has resulted in spending €1.676 within the local economy.

The LM3 coefficient for 'selling to LFSCs' producers indicates almost the same impact (0.5% higher) on the local economy (1.684; Table 5), with €1 of revenue resulting in €1.684 in the local economy, versus the previous €1.676 for SFSCs. This arises because spending in the local area is about 26.4 per cent of their total revenue for SFSCs, similar to 27.0 per cent for LFSCs (Figure 2). It is worth mentioning that labour costs on SFSCs accounted for 65 per cent of total expenditure, compared to about 62 per cent in the case of LFSCs. In both cases, about one third of workers were hired within the 7.5 km radius of Local Area I (Figure 3). The difference in local spending mainly concerns the purchase of direct (tradable) inputs, which in case of LFSCs were more often bought in the farm neighbourhood (19% of inputs were purchased locally in case of farmers selling to LFSCs vs only 14% in the case of farmers selling to SFSC; Figure 3).

The second assessment takes into consideration a larger radius of 15 km, denoting Local Area II (Table 6), distinguishing between SFSCs and LFSCs.

The larger share of local expenditure is a direct consequence of the larger area of analysis (NUTS 4 region). In this scenario, producers selling to SFSCs purchased about 55 per cent of all inputs and labour locally compared to about 66 per cent for producers selling to LFSCs (Figure 2). In both SFSCs and LFSCs, about two thirds of workers were hired from the local area with 15 km radius (Figure 3). The difference in local spend was mainly in the purchases of direct inputs, which in the case of producers selling to LFSCs were more often bought in the farm neighbourhood (73% of purchased locally by LFSC vs 39% in case of SFSC, Figure 3).

The LM3 for producers selling to SFSCs in this case equals 2.06 (cf 1.68 in the smaller Local Area I economy; Table 5), which means that the impact of generating €1 of revenue is multiplied up by 2.06 times within Local Area II. The LM3 for producers selling to LFSCs is 2.20 (Table 6). This means that when we consider the impact on the economy of NUTS 4 size, farms selling via LFSC have a slightly

Table 5. Local multiplier (LM3) for farms selling ⩾50 per cent of volume to SFSCs vs LFSCs, Local Area I within 7.5 km radius.

Farms selling ⩾50 per cent of volume to SFSCs	Round totals (€)	Local suppliers/payroll		Non-local suppliers/payroll	
		In Area I (€)	Out Area I (€)	In Area I (€)	Out Area I (€)
Producers' revenues (R1)	11,842,567.6				
Direct spend (R2)		548,044.6			3,490,039.8
Payroll + other direct costs (R2)		2,579,949.3			5,224,533.9
Total local spending in area (R2)	3,127,993.9	3,127,993.9			8,714,573.7
Total local spending in area (R3)	4,882,972.3	2,026,334.8	1,101,659.1	2,856,637.6	5,857,936.2
Total spending impact	19,853,533.8				
LM3	1.676				
Farms selling >50 per cent of volume to LFSCs	Round totals (€)	Local suppliers/payroll		Non-local suppliers/payroll	
		In Area I (€)	Out Area I (€)	In Area I (€)	Out Area I (€)
Producers' revenues (R1)	14,386,686.6				
Direct spend (R2)		1,053,363.5			4,437,383.8
Payroll + other direct costs (R2)		2,830,030.6			6,065,908.6
Total local spending in area (R2)	3,883,394.1	3,883,394.1			10,503,292.5
Total local spending in area (R3)	5,958,667.6	2,515,688.0	1,367,706.2	3,442,979.6	7,060,312.8
Total spending impact	24,228,748.3				
LM3	1.684				

Source: Own calculation.
SFSCs: short food supply chains; LFSCs: long food supply chains.

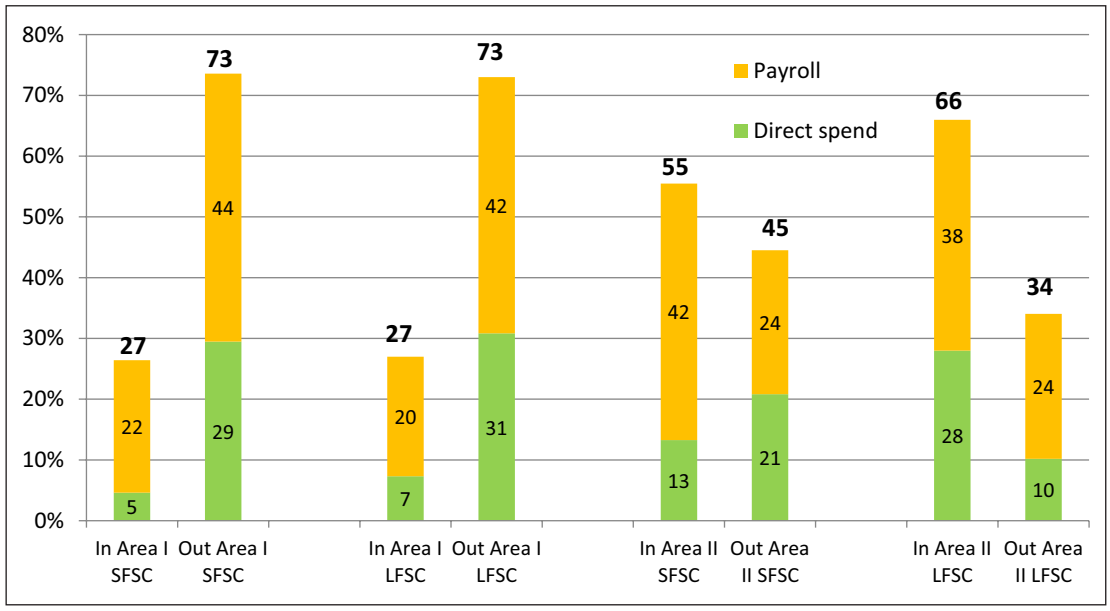

Figure 2. Structure of producers' spending (Round 2) in Local Areas I and II, according to producers selling to SFSCs vs LFSCs (%).
Source: Own calculation.

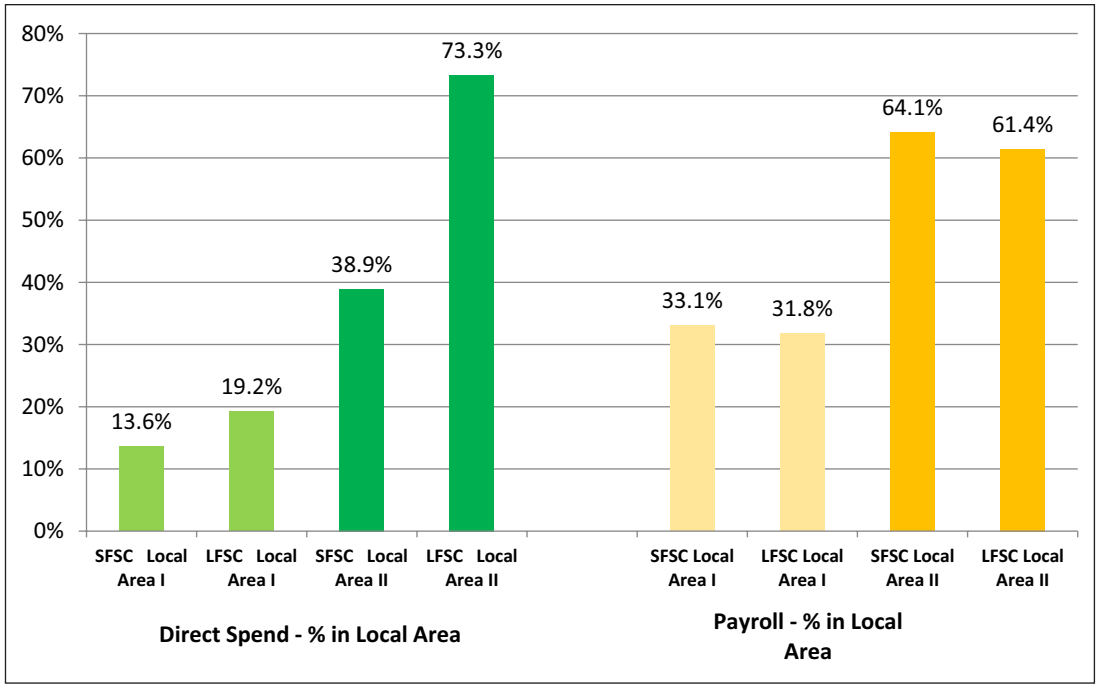

Figure 3. Share of producers' spending (Round 2) within Local Areas I and II, according to producers selling to SFSCs vs LFSCs (%).
Source: Own calculation.

Table 6. Local Multiplier (LM3) for farms selling ⩾50 per cent of volume to SFSCs vs LFSCs, Local Area II within 15 km radius.

Farms selling ⩾50 per cent of volume to SFSCs	Round totals (€)	Local suppliers/payroll		Non-local suppliers/payroll	
		In Area II (€)	Out Area II (€)	In Area II (€)	Out Area II (€)
Producers' revenues (R1)	11,842,567.6				
Direct spend (R2)		1,572,217.9			2,465,866.5
Payroll + other direct costs (R2)		4,998,882.5			2,805,600.7
Total local spending in area (R2)	6,571,100.4	6,571,100.4			5,271,467.2
Total local Spending in area (R3)	5,984,788.7	4,256,801.6	2,314,298.8	1,727,987.1	3,543,480.1
Total spending impact	24,398,456.7				
LM3	2.06				
Farms selling >50 per cent of volume to LFSCs	Round totals (€)	Local suppliers/payroll		Non-local suppliers/payroll	
		In Area II (€)	Out Area II (€)	In Area II (€)	Out Area II (€)
Revenues (R1)	14,386,686.6				
Direct spend (R2)		4,025,906.1			1,464,841.3
Payroll + other direct costs (R2)		5,464,075.6			3,431,863.5
Total local spending in area (R2)	9,489,981.8	9,489,981.8			4,896,704.8
Total local spending in area (R3)	7,752,811.9	6,147,671.9	3,342,309.9	1,605,140.0	3,291,564.8
Total spending impact	31,629,480.3				
LM3	2.20				

Source: Own calculation.
SFSCs: short food supply chains; LFSCs: long food supply chains.

Table 7. Local multiplier (LM3) results depending on the locality size and length of supply chains.

	Local Area I (7.5 km radius)	Local Area II (15 km radius)
Farms selling ⩾50 per cent of volume to SFSCs	1.68	2.06
Farms selling >50 per cent of volume to LFSCs	1.68	2.20

Source: Own calculation.
SFSCs: short food supply chains; LFSCs: long food supply chains.

higher (7%) local multiplier effect (2.20 compared to 2.06).

The overall results are further summarised in Table 7. The magnitude of coefficients confirms study by Godfrey and Beutler (1993: 125), according to which income multipliers rarely exceed 2, with values >2 mostly found 'when the personal income in a sector is small and it purchases a large portion of its inputs from other local producers'. In the case of both SFSCs and LFSCs, local multiplier ratios are substantial, indicating that both contribute directly and indirectly to their local economies. In our study we do not observe the multiplier effects of farmers' expenditure to be significantly higher in SFSCs, compared against LFSCs. Generally, the LM3 ratio for SFSCs is lower than that for LFSCs as the former's relative expenditure on local tradable inputs is lower.

In addition, we calculated results for individual countries. While noting the small sample sizes which hamper cross-country comparisons, similar results were obtained for all the studied case study countries (Tables 8 and 9 in Appendix 1). It can be observed (Appendix 1, Table 9) that in each of the surveyed countries the multiplier effects of SFSCs and LFSCs are similar. However, in some countries the level of LM3 was slightly higher for SFSCs, and in others lower. It is thus not possible to say that SFSCs will always generate higher multiplier effects than LFSCs.

As a general rule, basic sectors (including agriculture) generally have larger multipliers, as they purchase a high portion of the inputs (i.e. labour) from locally owned producers (Godfrey and Beutler, 1993). For instance, farmers' markets in the United States are found to produce multiplier effects of about 1.58 (Kneafsey et al., 2013). This tendency is strengthened by the fact that local supply-side effects are stronger if the companies have been doing business in a certain area for a longer period of time (Godfrey and Beutler, 1993), which is the case for family farms. Larger LM3 values for wider local areas reflect the fact that multipliers for larger regions have smaller leakages, due to higher self-sufficiency of the region (Godfrey and Beutler, 1993; which is a general rule). Just to compare, LM3 for an organic farm in Cornwall reached the level of 2.00, for a 15-mile (approximately 24 km) radius (Sacks, 2002).

Discussion

There is considerable interest in the effects of agricultural policy and the structure of food supply chains on rural economies (ENRD, 2012; OECD, 2020). However, there is a lack of cross-national comparative analysis of the multiplier effects of agricultural production, with a research need to understand the territorial impacts of LFSCs and SFSCs (EIP-AGRI Focus Group, 2015). This article addresses this gap, applying the LM3 approach to measure the multiplier effects of farm production, distinguishing between LFSCs and SFSCs. Compared with branch plants, which have traditionally been seen by policymakers as a means of stimulating exogenously rural economies (Grimes, 1993; McInroy et al., 2008; Mitchell and Lemon, 2019), the local multiplier effects of farms' expenditure are higher. The latter reflects that most farms buy tradable inputs and source labour locally. Most farm inputs are bought within a 15-km radius, that is, usually in the nearest town (centre of NUTS 4 district). Overall, the multiplier effect of farms on local economies may be considered significant (LM3 above 2.0), which is the result of not only farmers purchasing inputs locally, but also of hiring local employees that re-spend their pay locally or of local re-spend by suppliers.

SFSCs are widely regarded as more economically beneficial for rural economies than farmers' engagement in LFSCs (ENRD, 2012; Mundler and Laughrea, 2016). However, the empirical analysis indicates that farmers' engagement in SFSCs fails to lead to significantly higher economic multiplier effects. Rather, farmers' engagement in LFSCs generates modestly higher local multiplier effects. This reflects differences in the purchases of direct inputs (73% of purchased locally for LFSCs versus 39% in the case of SFSCs). SFSCs often serve niche markets for quality food products (Tregear, 2011) and not all inputs may be available locally, hence expenditure on local inputs is lower. Another reason may be, as our survey evidence shows, that farmers supplying SFSCs travel with their produce to farmers' markets or other retail outlets, or directly to their customers, and source their inputs in locations other than just the local area. In LFSCs, which deal in larger volumes and 'mainstream' markets, where a greater number of other local farmers are producing the same product, inputs may be more likely to be available locally through established suppliers. This highlights that to maximise the local economic benefits of SFSCs, requires attention on the local infrastructure that supports farmers supplying to SFSC, including the availability of their local input suppliers.

When analysing the economic effects of selling through SFSCs, one should also not forget that SFSCs serve many additional socioeconomic functions. By connecting consumers directly with local food sources, these chains stimulate local economic activity and generate employment opportunities (Chiffoleau and Dourian, 2020; Kneafsey et al., 2013) potentially contributing to the overall development of local communities. SFSCs also usually prioritise quality and freshness. With reduced handling and re-packaging, food can be harvested closer to the optimal ripeness and delivered to consumers promptly.

In addition, SFSCs typically offer greater transparency, allowing consumers to know the origin and production practices of the food they consume. By stimulating direct relations between producers and consumers, SFSCs also promote a sense of community, trust and mutual understanding (Vittersø et al., 2019). For instance at a farmer's market, consumers can meet and engage with the people who grow their food, learn about their farming practices and develop a closer relationship with the agricultural landscape. This connection can lead to increased awareness of farming methods, support for local food traditions and a stronger appreciation for the value of local food systems (EIP-AGRI Focus Group, 2015; Mancini and Arfini, 2018; Marsden et al., 2000; Mundler and Laughrea, 2016; Vittersø et al., 2019).

Finally, the results suggest that sharp distinctions between LFSC and SFSC 'sectors' may be overplayed. The empirical evidence indicates the prevalence of hybridisation – a single farmer can belong to various food supply chains differing in the number and types of intermediaries (e.g. wholesalers, small retail outlets, large hypermarket chains). The finding that single farmers 'belong' to multiple types of chains suggests a more varied and complex trading environment than is often assumed.

Conclusions, limitations and further research

In response to debates concerning the effect of agricultural policy and the structure of food supply chains on rural economies, this article estimates the local economic multiplier effects of producer-level expenditure for a large, cross-national sample, applying the LM3 approach. Compared with manufacturing plants and public expenditure (Grimes, 1993; McInroy et al., 2008; Mitchell and Lemon, 2019), producer-level expenditure multiplier effects are higher and considered significant (LM3 above 2.0 for both SFSCs and LFSCs), thanks to the concentration of farmers' expenditure on tradable inputs and sourcing labour locally, within the radius of 15 km. Multiplier effects in our results are similar for SFSCs and LFSCs reflecting that both use local labour and tradable inputs. Surveyed farmers typically 'belong' to multiple types of chains, both short and long, and will typically use the same employees and tradable inputs when producing for different types of chains. In shaping food chain policy, a broader set of socioeconomic benefits to local development from selling through the SFSC should be considered. This aspect has not been explored in our study.

While shedding new light on multiplier effects, the analysis is not without limitations, which can guide future research. First, the analysis focuses on the farm level and food production may have additional, non-food-related local economic impacts (through, for instance, tourism), which may be higher when artisan based (Oledinma and Roper, 2021). Future work could seek to measure these effects and capture differences in multiplier ratios for downstream supply chain actors. Second, the article estimates multiplier effects both within a small radius (7.5 km, NUTS 5 size) and for a larger geographical territory (15 km, NUTS 4 size). However, as the literature review demonstrates, there is no official definition of local either within Europe or globally. Future analysis of policies operating at different geographical scales may wish to employ alternative measures of locality when measuring multiplier effects. Finally, local multiplier analysis could be extended to consider other aspects of European policy. For instance, the Farm to Fork strategy (European Commission, 2020b) envisages a large expansion in organic farming and substantial decreases in pesticide and antimicrobial use (which the analysis here suggests are likely to be sourced by farmers predominantly from local suppliers). Currently, there is a lack of comparative evidence regarding the multiplier effects of organic and conventional farming and how changes in input use will affect rural economies. Such analysis could contribute to ongoing debates regarding the expected impacts of the Farm to Fork strategy on rural economies. Notwithstanding these limitations, it is hoped that through the analysis of a cross-national dataset of varied producers, understanding of local multiplier effects and interest in further work in this field are increased.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study received funding from the European Union's Horizon 2020 research and innovation programme as part of the STRENGTH2FOOD project under grant agreement (grant no. 678024).

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Notes

1. Some examples may be used as an illustration – distance of 30 miles (approximately 50 km) used for Certified Farmers' Markets in the United Kingdom (Pearson et al., 2011), 50 miles (80 km) as suggested by the former National Association of Farmers' Markets (Morris and Buller, 2003) or even 400 miles (640 km) from the point of food origin as proposed in the US Congress documents (Food, Conservation, and Energy Act of 2008). In Hungary, small-scale producers can deliver their product for sale at farmers' markets within a 40-km radius (52/2010 Ministry of Rural Development Regulation). In Italy, 70 km is the typical radius defining 'local' food.
2. For certain Federal rural development loan programmes, a 'locally produced agricultural food product' is 'any agricultural food product that is raised, produced, and distributed in (1) the locality or region in which the final product is marketed, so that the total distance the product is transported is less than 400 miles from the origin of the product, or (2) the State in which the product is produced'. In a country where some counties in the West are larger than some states in the East, the concept of 'local' must accommodate a wide range of perspectives and definitions (Food, Conservation, and Energy Act of 2008: 245).
3. Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 [15] where a 'short supply chain' means a 'supply chain has a limited number of economic operators, committed to co-operation, local economic development, and close geographical and social relations between producers, processors and consumers'; (Official Journal of the European Union L347 of 20 December 2013).

4. According to Eurostat classification, Local Administrative Unit - LAU stands for small local region (formerly NUTS 4); NUTS – Nomenclature of territorial units for statistics – Eurostat (europa.eu).

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Appendix 1

Table 8. Local multiplier (LM2 Round 1 + 2) results depending on the locality size and length of supply chains.

	Local Area I (7.5 km radius)	Local Area II (15 km radius)
Farms selling ⩾50% of volume to SFSCs	1.26	1.55
Farms selling >50% of volume to LFSCs	1.27	1.66

Source: Own calculation.
SFSCs: short food supply chains; LFSCs: long food supply chains.

Table 9. Local multiplier (LM3 Round 1 + 2 + 3) results depending on the locality size, length of supply chains and the country.

General (n = 122)	Local Area I (7.5 km radius)	Local Area II (15 km radius)
Farms selling ⩾50% of volume to SFSCs	1.68	2.06
Farms selling >50% of volume to LFSCs	1.68	2.20
Poland (n = 57)	**Local Area I (7.5 km radius)**	**Local Area II (15 km radius)**
Farms selling ⩾50% of volume to SFSCs	1.66	2.09
Farms selling >50% of volume to LFSCs	1.68	2.05
Italy (n = 11)	**Local Area I (7.5 km radius)**	**Local Area II (15 km radius)**
Farms selling ⩾50% of volume to SFSCs	1.68	2.06
Farms selling >50% of volume to LFSCs	1.68	2.20
Hungary (n = 24)	**Local Area I (7.5 km radius)**	**Local Area II (15 km radius)**
Farms selling ⩾50% of volume to SFSCs	1.70	2.00
Farms selling >50% of volume to LFSCs	1.60	1.85
France (n = 5)	**Local Area I (7.5 km radius)**	**Local Area II (15 km radius)**
Farms selling ⩾50% of volume to SFSCs	1.67	2.07
Farms selling >50% of volume to LFSCs	–	–
United Kingdom (n = 15)	**Local Area I (7.5 km radius)**	**Local Area II (15 km radius)**
Farms selling ⩾50% of volume to SFSCs	1.73	2.05
Farms selling >50% of volume to LFSCs	1.87	2.34

Source: Own calculation.
SFSCs: short food supply chains; LFSCs: long food supply chains.