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 (SFSC) on local economies. To address this, the paper quantifies the impacts of SFSCs on local economies, using the Keynesian-based Local Multiplier (LM3) method, applied to a unique dataset of 122 farm businesses from five EU 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 socio-economic benefits to local development from selling through SFSCs should be considered.

Key words: Short Food Supply Chains (SFSCs), Local Economy, Local Multiplier Effect (LM3), Rural Development, EU Food Policy, Agricultural policy,

1. 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 (Ray, 1998; Bosworth *et al.*, 2016). 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 (European Evaluation Network for Rural Development, 2010; EIP-AGRI, 2015).

European farmers typically supply increasingly complex, concentrated and internationalized 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" (European Communities, 2013 p.13).

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 EU, 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 (RDP) (EU Regulation 1305/2013, European Commission, 2014 and 2020b). Most recently, the European Green Deal strategies highlight the ambition of shortening food supply chains (European Commission, 2020a).

While some regard SFSCs as an exemplary strategy for endogenous rural development (Benedek and Balázs, 2015), it remains "uncertain how the relocalisation of agri-food systems will contribute to endogenous rural development" (Ilbery *et al.*, 2004, p.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 paper 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 paper 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. Section three 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. Section four 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.

2. Literature Review

2.1. SFSCs and European agricultural policy

While ignored in the early decades of the Common Agricultural Policy (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, 2020a). Introducing the concept of SFSCs into the CAP permitted financial support from national Rural Development Programmes. Such support was offered, for instance, in Hungary (Benedek and Balazs, 2015a) 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 emphasized in the agricultural and food aspects of the European Green Deal (European Commission, 2020b). 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, 2020b, p.12). It is planned to "shift the emphasis from compliance and rules towards results and performance" (European Commission, 2020a, p.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, 2020a). 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 rural development programmes (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, 2020a), 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.

2.2. 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 (Malak-Rawlikowska et al., 2019; Vittersø et al. 2019; Pearson et al., 2011; Alonso, 2011; Chiffoleau and Dourian, 2020), 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. O'Neill, 2014, Peters, 2012, Galli and Brunori 2013). 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 characterized 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) (Marsden et al., 2000; EIP-AGRI, 2015; Mancini and Arfini, 2018, Mundler and Laughrea, 2016). Regional labels with a good reputation may generate positive spill over 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., 2011, p. 111). Consequently, EIP-AGRI (2015, p.26), identify 'understanding the systemic and territorial impacts' of SFSCs as a research need (p.26) as "little has been done to develop tools and data for understanding the effects…on a given territory" (p.26).

3. Methods and sample description

3.1. 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 short versus long food supply chains, with the use of the Local Multiplier 3 (LM3) tool developed by the New Economics Foundation. Several academic studies adopt the LM3 approach for measuring local multiplier effects

(McInroy;Jackson and Bramah, 2008; Thatcher and Sharp, 2008; Silovská and Kolaříková, 2016; Mitchell and Lemon, 2019)., 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):

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

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 (Meter and Ken, 2010; Bengo et al., 2016). 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).

3.2. 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, e.g., 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, 2021).

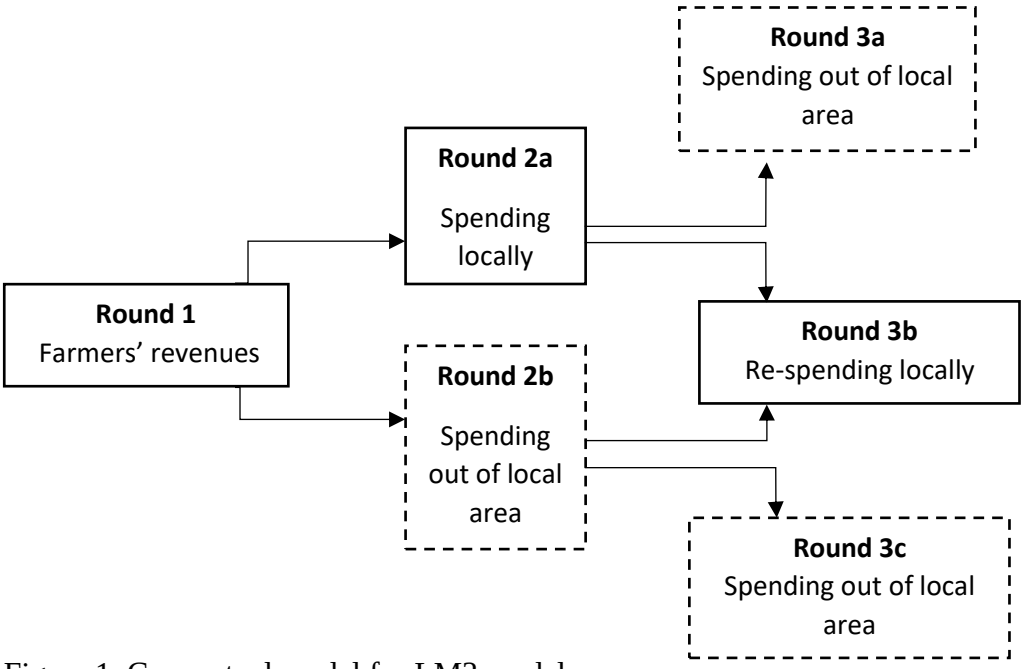


Figure 1. Conceptual model for LM3 model

Source: own elaboration.

Based on formula (3), the local multiplier is thus calculated as:

$$\text{LM3} = \frac{R1+R2a+R3b}{R1}$$

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.

3.1. Classifying SFSCs

There are three main criteria employed in the literature to classify SFSCs (Marsden et al., 2000; Renting et al., 2003; Ilbery and Maye, 2005; Aubry and Kebir, 2013, Kneafsey et al., 2013, Foodlinks, 2013; Galli and Brunori, 2013, Malak-Rawlikowska et al., 2019). The first relates to the 'physical (geographical) proximity' between the place of production and sale, while the second concerns 'organizational 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 (Ilbery and Maye, 2006; Brown and Miller, 2008; Hand and Martinez, 2010, Morris and Buller 2003).[1] Locality boundaries may be case or country specific. For example in the USA, a 400-mile radius designates local production[2], but such a radius designates a territory larger than the average European country.

As for 'organizational 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

[1] Some examples may be used as an illustration – distance of 30 miles (appr. 50 km) used for Certified Farmers' Markets in the UK (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 programs, 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, p. 245).

of the food, the farming methods employed, and even the ethical and social values associated with the production process (Galli and Brunori, 2013).

3.2. Typology of Short and Long Food Supply Chains

To assess the contribution of SFSCs to local economies, we developed a typology of 'short' and 'long' distribution channels, building on the categorization from Malak-Rawlikowska et al. (2019). The typology was based on the general structure of the food market (Bukeviciute, et al. 2009), categorizations of distribution channels present in the literature (eg. 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 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 Short Food Supply Chain[3].

Table 1. Types of short and long food supply chains

Short food supply chains (SFSCs):	Long food supply chains (LFSCs):
Direct on-farm sales: pick your own Direct on-farm sales: sales to individual consumers Direct off-farm sales: internet deliveries Direct off-farm sales: delivery to consumer Direct off-farm sales: farmers' markets (or fairs) Sales to small retail outlets (1 intermediary)	On-farm sales to intermediaries Sales to wholesalers or on wholesale markets Sales to retail chain (2 intermediaries) Sales for processing

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

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

[3] European Rural Development Regulation 1305/2013 [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" European Communities. Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on Support for Rural Development by the European Agricultural Fund for Rural Development (EAFRD) and Repealing Council Regulation (EC) No 1698/2005; European Communities: Luxembourg, 2013.

small retail outlets" includes various forms of deliveries through an off-farm retail point (e.g., hotels, restaurants, direct deliveries to local shops).

3.3. 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). In order 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 kilometres (km), marking the area of approximately 176.71 square km ($\pi*7.5^2 = 176.71$). 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 square km ($\pi*715^2 = 706.86$), which is akin to the size of a typical European NUTS 4 region, and four times larger than a municipality.[4]

[4] According to Eurostat classification NUTS 4 stands for samm local region Background - NUTS - Nomenclature of territorial units for statistics - Eurostat (europa.eu)

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.

3.4. 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% 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, the United Kingdom). Characteristics of the sample are presented in the section 'results'.

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.

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 Area I and II; proportions of local/ non-local workers employed at the farm, estimates of workers' spending in Local Area 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 5,000 separate projects. Aggregating across this dataset, provided a stable and consistent figure for suppliers situated outside of the local area, and

estimations of 33% for non-local suppliers with the remaining 67% spent locally. The combined empirical data for R1 and R2 with applied coefficients for R3 level data allowed us to calculate LM3 multipliers.

4. Results

4.1. Characteristics of the sample

Based on the share of the product volume sold, we distinguished 82 farms in the category "selling ≥50% to SFSCs" and 59 farms in the category "selling > 50% 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% 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-farms sales and famers' markets were the most popular market channels (Table 3). Specifically, on-farm sales to individual consumers was used by approximately one half (48%) of the sampled agri-food producers. One of the key reasons for this might be that almost 55% 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% to SFSCs” sold on average 70% of their production volume via SFSCs, compared to producers “selling >50% to LFSCs”, which sold on average 96% of their production volume through long chains (Table 3).

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% of volume to SFSCs	Selling >50% 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	**1,072.8**	**12.7**	**70.0**	**4.1**	**180**	**59.0**
LFSCs	g. On-farm sales to intermediaries	2,177.4	25.7	6.2	28.6	29	9.4
	h. sales to wholesalers / wholesale market	1,082.3	12.8	20.7	11.6	44	14.4
	i. Sales to retail chain	1,615.5	19.1	1.3	21.7	23	7.5
	j. sales for processing	2,530,6	29.8	1.8	34.0	29	9.5
	Total	**7,405.8**	**87.3**	**30.0**	**95.9**	**125**	**41.0**
	Total sample	**8,478.5**	**100.0**	**100**	**100**	**305**	**100**

Source: own elaboration.

Producers classed as "selling ≥ 50% to SFSCs" had an agricultural land area almost twice as large than those "selling > 50% to LFSCs" (63 ha vs. 33 ha), however, their turnover was 35% lower (Table 4). A key reason for this difference lies in farms' production specialisation – in the "selling ≥ 50% 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% 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.

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

	Total sample [n]	**Selling ≥50% of volume via SFSCs** [n]	**Selling >50% 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 LU/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*:			
- 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

* based on ISCED/Eurostat classification

Source: own elaboration.

Total labour resources, expressed in Annual Work Units per business unit (AWU/business), were on average 2.7 and 24% 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).

4.2. 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. Local Multiplier (LM3) for farms Selling ≥50% of volume to SFSCs vs. to LFSCs, Local Area I within 7.5 km radius

Farms selling ≥50% of volume to SFSCs		Local Suppliers/Payroll		Non-Local Suppliers/Payroll	
	Round Totals €	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% of volume to LFSCs		Local Suppliers/Payroll		Non-Local Suppliers/Payroll	
	Round Totals €	In Area €	Out Area €	In Area €	Out Area €
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.

Table 5 shows that producers "selling to SFSCs" generated a total revenue of approximately €11.8 million. They spent 26.4% of revenue locally (Local Area I <7.5km) on supplies of tradable inputs (such as fertilisers, seeds, pesticides, etc). 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 respending in area (2 026 334.8) (Round 3b)

+ Nonlocal suppliers spend in area (2 856 637.6) (Round 3b)

= 19 853 533.8 (total spending impact)

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

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

The LM3 of 1.68 means that each euro of farmers' revenue has resulted in spending 1.676 euro 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 euro of revenue resulting in 1.684 euro in the local economy, versus the previous 1.676 for SFSCs. This arises because spending in the local area is about 26.4% of their total revenue for SFSCs, similar to 27.0% for LFSCs (Figure 2). It is worth mentioning that labour costs on SFSCs accounted for 65% of total expenditure, compared to about 62% 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.

Table 6. Local Multiplier (LM3) for farms Selling ≥50% of volume to SFSCs vs. to LFSC, Local Area II within 15 km radius

Farms selling ≥50% of volume to SFSCs		Local Suppliers/Payroll		Non-Local Suppliers/Payroll	
	Round Totals €	In Area €	Out Area €	In Area €	Out Area €

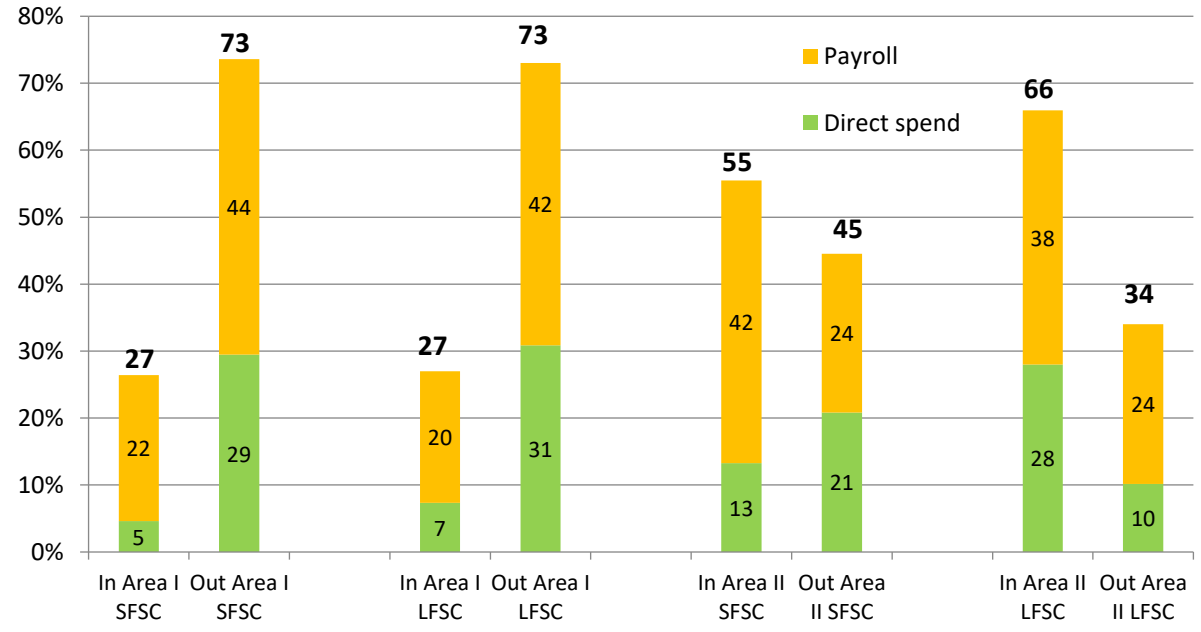
Producers revenues (R1)	**11 842 567.6**				
Direct Spend (R2)		1 572 217.9			2 465 866.5
Payroll + other direct costs (R2)		4 998 882.5			2 805 600.7
Total Local spending in Area (R2)	**6 571 100.4**	6 571 100.4			5 271 467.2
Total Local Spending in Area (R3)	**5 984 788.7**	4 256 801.6	2 314 298.8	1 727 987.1	3 543 480.1
Total Spending Impact	**24 398 456.7**				
LM3	**2.06**				
Farms selling >50% of volume to LFSCs		Local Suppliers/Payroll		Non-Local Suppliers/Payroll	
	Round Totals €	In Area €	Out Area €	In Area €	Out Area €
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.

The larger share of local expenditure is a direct consequence of the larger area of analysis (NUTS4 region). In this scenario, producers selling to SFSCs purchased about 55% of all inputs and labour locally compared to about 66% for producers selling to LFSCs (Figure 2). In both SFSCs and LFSC', 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).

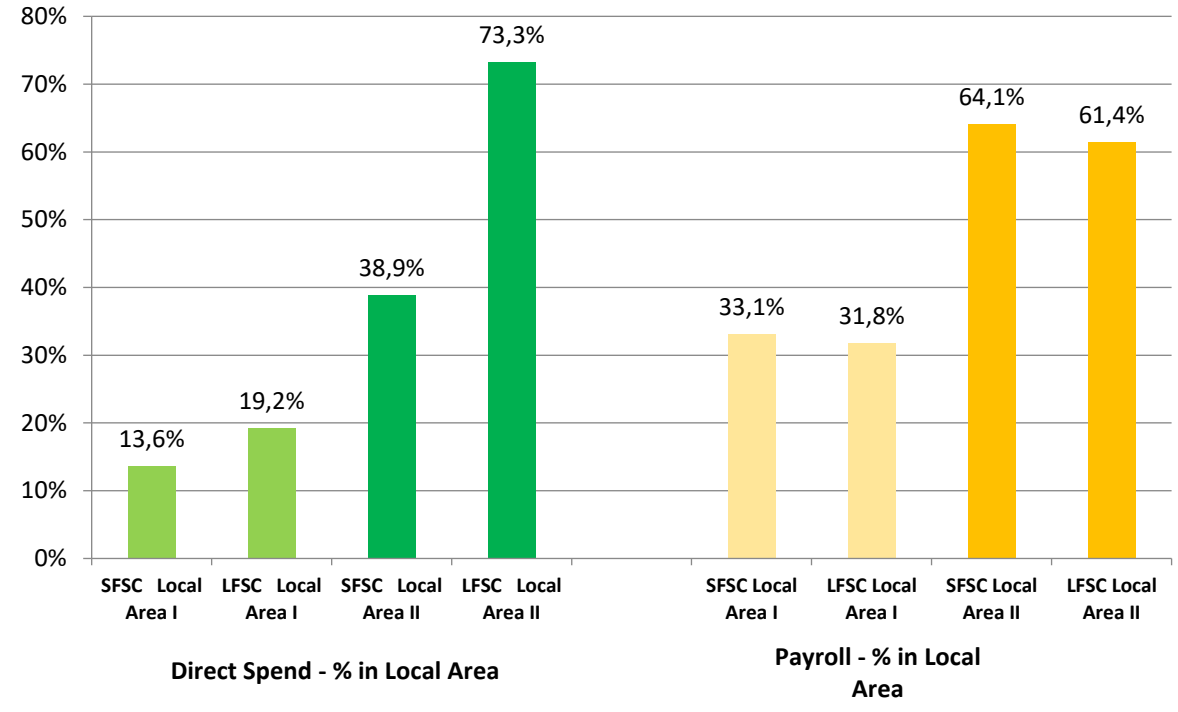
The LM3 for producers selling to SFSCs in this case equals 2.06 (cf 1.68 in the smaller Local Area I economy) (Table 5), which means that the impact of generating 1 euro of revenue is multiplied up by 2.06 times within the LA II. The LM3 for producers selling to LFSCs is 2.20 (Table 6). This means that when we consider the impact on the economy of NUTS4 size, farms selling via LFSC have a slightly higher (7%) local multiplier effect (2.20 compared to 2.06).

Figure 2. Structure of producers' spending (Round 2) in Local Area I and II, according to producers selling to SFSCs' vs. LFSCs [%]



Source: own calculation.

Figure 3. Share of producers' spending (Round 2) within the Local Area I and II, according to producers selling to SFSCs' vs. LFSCs' [%]



Source: own calculation.

The overall results are further summarised in Table 7. The magnitude of coefficients confirm study by Godfrey and Beutler (1993, p.125), according to which income multipliers rarely exceed 2, with values greater than 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" (Godfrey and Beutler, 1993, p.125). 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.

Additionally, we calculated results for individual countries. While noting the small sample sizes which hampering cross-country comparisons, similar results were obtained for all the studied case study countries (Table 1 in the Annex). It can be observed (Annex, Table 1b) that in each of the surveyed countries the multipler effects of SFSCs and LFSCs is 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 mutlipler effects than LFSCs.

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% of volume to SFSCs	1.68	2.06
Farms selling >50% of volume to LFSCs	1.68	2.20

Source: own calculation.

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 USA 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 miles (approx.24 km) radius (Sacks, 2002).

5. 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, 2015). This paper addresses this gap, applying the LM3 approach to measure the multiplier effects of farm production, distinguishing between long and short food supply chains. Compared with branch plants, which have traditionally been seen by policymakers as a means of stimulating exogenously rural economies (Grimes, 1993; McInroy, Jackson and Bramah, 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. 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 infrastructure that supports them, including their 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 (Kneafsey et al., 2013; Chiffoleau and Dourian, 2020) potentially contributing to the overall development of local communities. SFSCs also usuallyprioritize quality and freshness. With reduced handling and re-packaging, food can be harvested closer to the optimal ripeness and delivered to consumers promptly.

Additionally, 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 farmers' 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 (Marsden et al., 2000; EIP-AGRI, 2015; Mancini and Arfini, 2018, Mundler and Laughrea, 2016, Vittersø et al., 2019).

Finally, the results suggest that sharp distinctions between long and short food supply chain "sectors" may be overplayed. The empirical evidence indicates the prevalence of hybridization - 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 it is often assumed.

6. 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 paper 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; Jackson and Bramah, 2008, Mitchell and Lemon, 2019), producer-level expenditure multiplier effects are higher and considered significant (LM3 above 2.0 both for 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 SFSC 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 socio-economic 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. Firstly, 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. Secondly, the paper estimates multiplier effects both within a small radius (7.5 km, NUTS5 size) and for a larger geographical territory (15 km, NUTS4 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, 2020) 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, is increased.

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ANNEX

Table 1a. 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.

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

GENERAL 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	-	-
UK 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.