Chapter

The Geo-Demographics of European Consumers' Food Behaviour in the New Age of Disruption

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Abstract

The COVID-19 pandemic, unlike the 2007–2008 financial crisis, was a supply side shock, now sharply exacerbated by the Ukrainian war. Drawing on relevant sources, this chapter illustrates the resulting impacts on changes in consumers' food behaviour during the first wave of the pandemic, based on a large sample of households from 12 countries spread across Europe. Unlike most previous studies, this analysis takes place at European level revealing large scale general trends. Findings show that the food system, like many other strategic consumer markets, has experienced shortages, panic-buying, hoarding and a focus on products both with longer shelf-lives and that help to reduce stress. However, there have been wildly different outcomes related to socio-demographics, household income and location. As a result, and supported by digital technologies, new spatial dynamics and relationships are emerging that exemplify important lessons for all food system actors, in particular significant shifts towards more local-regional production and supply. This is accompanied by much greater consumer awareness of the importance of food and involvement in its preparation, mediated through geography and the socio-demographic characteristics of household consumption. A strong driver is the increasingly local orientation of work and business transformed by a resurgence of hybrid working.

Keywords: system disruption, consumer behaviour, food systems, socio-demographics, spatial change, digital technology, hybrid working

1. Introduction

1.1 COVID-19 and the war in Ukraine: Economic contraction, a less globalized world and the environmental crisis

In contrast to the 2007–2008 financial crisis characterized by a massive demand slump due to dramatically reduced consumer spending power, COVID-19 hitting Europe in early 2020 has caused a severe supply-side recession. This is itself being turbo-charged by the invasion of Ukraine during 2022, depositing a thick layer of

geo-political tectonic change on top. Underlying all this is the 'mother-of-all' crises that sees our natural environment stretched to near collapse, thereby putting the very survival of our species in peril. All this has disrupted both global and local supply chains as much of the workforce becomes used to virtual, remote and hybrid working, limitations on the movement of people and goods with transport and logistics put under severe pressure, at the same time as demand for many goods and services mushrooms.

The economic contraction caused by the COVID-19 pandemic in 2020–2021 left a heavy health and human toll, shrank the Eurozone economy by a record 12.1% and wiped out more than a decade of expansion during the largest economic shock the world has experienced in decades [1]. A further sharp tightening of the economic screw began in early 2022 with the Russian invasion of Ukraine. The International Monetary Fund (IMF) drastically downgraded its growth forecasts, predicting further global economic fragmentation, rising debt and social unrest [2]. The World Bank stated a "human catastrophe loomed" with an estimated unprecedented 37% rise in food prices, caused by war-related disruption to supplies, pushing millions into poverty, increasing malnutrition, and reducing funding for education and healthcare for the least well-off [3]. By April 2022, more than five million people had fled Ukraine in 2 months, with more likely to follow, exacerbating an international migration emergency that extends from Afghanistan to the Sahel [4]. In drought-hit east Africa, the World Food Programme says 20 million people face starvation during 2022. The war in Ukraine did not create the drought, but the UN warns it could hurt efforts to reduce global heating, thereby triggering further displacement and forced migration [5].

1.2 The new age of disruption: the move towards localization, strategic autonomy and resilience

It is clear that the twenty-first century has ushered in a new age of more or less continuous crisis and disruption and that these are not times for business-as-usual. There is a need to rethink many of our shibboleths, including around sustainable development and resilience, how we re-structure our economies and politics, as well as how we work, play and live on the earth's surface. These are huge changes, intimately inter-related, in which digital technology clearly plays an essential role. It enables people and organisations to work and operate locally whilst connecting globally on a huge scale, but also has downsides that threaten the spread of misinformation.

The deep recessions triggered by these shocks continue to leave lasting scars due to lower investment, an erosion of human capital through lost work and schooling, and the fragmentation of global trade and supply linkages. A longer-term re-evaluation of global value-chains and markets is taking place as the world moves beyond the decades-long period of massive globalization prior to 2020 towards significant de-globalization today. In the context of its 'Great Re-set', the World Economic Forum (WEF) in 2020 saw 'shifting tectonic plates' towards three main spheres of influence (the US, China and the EU), not necessarily leading to isolationism, but certainly entailing some shifts in economic and political power [6]. In the same year, the WEF looked forward to what the post COVID-19 world could look like [7]:

- "Governments will be much more involved in industry. This will especially be the case in critical infrastructure sectors such as utilities, travel, healthcare and food, and will mean increased regulation."

- "The relocalization of global supply chains will counter the previously unstoppable march of globalization. States and large companies will seek to gain more technological sovereignty, reducing dependence on others and improving the resilience of their operations to global shocks."

- "Digital technologies will see a major acceleration in adoption, especially those which enable business activity with less human contact, including e-commerce, virtual networking and robotization."

Since 2020, there has already been significant new onshoring of economic activity and employment with some re-focus back to more domestic markets in new forms of re-localization, also down to regional and city levels. However, the importance of retaining openness, connectivity and cooperation at all levels, including globally, is still recognized. This is likely to be seen especially in relation to 'strategic' manufactured goods, including in food, health and other vital goods, as well as in critical utilities and infrastructures like energy and water. This will increase focus on more domestic and regional sources in order to diversity supply towards greater resilience at times of future shock.

In response to these developments, and to complement the goal of becoming the first climate-neutral continent through its European Green Deal [8], in June 2020 the EU published a review of its trade and investment policy that examined the challenges it will face and how to promote its values and standards [9]. This assesses both how trade policy can contribute to a swift and sustainable socio-economic recovery that helps promote competitiveness in the post-COVID-19 environment, as well as to see how it can assist in building a stronger EU based on the model of 'Open Strategic Autonomy'. This will enable the EU as a bloc to become much more self-sufficient in strategic goods and services, like critical food and health products and strategic industrial goods like micro-chips and batteries. It is also seen as a way of deploying trade policy to reap the benefits of openness for EU businesses, workers and consumers, while protecting them from unfair practices and building up EU resilience to better face future challenges.

1.3 The impact of COVID-19 on European food behaviour

The impact of Covid-19 on European food systems and consumer behaviour has already been subject to several studies, including a household survey covering Denmark, Germany and Slovenia [10]. This showed that. During the first wave of Covid-19, between 15 and 42% of households changed their patterns of food consumption in response to the closure of physical places to eat away from home, mobility restrictions leading to reduced shopping frequency, the perceived health risks of Covid-19, pandemic-induced income losses, and socio-demographic factors including household composition. A German study showed that Covid-19 had a significant impact on consumers' eating habits leading to negative health consequences, especially amongst economically vulnerable groups. The purchase of ready meals and canned food increased, including the consumption of alcohol and confectionery, at the same time as there was a decrease in the consumption of high-quality and more expensive food like vegetables and fruit [11]. Many households lost income during the pandemic and became more likely to grow their own food and to obtain free food in food banks [12]. During 2020, compared to 2019, European food banks redistributed significantly

more food despite numerous social restrictions and other challenges associated with the pandemic [13].

On top of these experiences, the 2022 Ukrainian war saw sharp reductions in exports of energy, food products and artificial fertilisers from both Ukraine and Russia, leading to additional strong calls to move decisively to agricultural independence and increased EU food security. President Macron of France is calling for increased food production and quality, whilst recognising there are challenges of food availability and prices that impact Europe's poorest, as part of a new strategy for "agricultural, industrial and creative independence" [14].

2. Methodology

2.1 Population size and sample

The evidence presented in this chapter is drawn from an empirical study supplemented by an examination of extant sources that have relevance for changes in European consumers' food behaviour during the new age of disruption. **Table 1** shows the samples collected by a quantitative household survey at the start of the first wave of the COVID-19 pandemic (March to July 2020) via national researchers in each of 12 countries spread across Europe using a standard questionnaire.

A survey at this time was deemed ideal given both that the lockdowns and restrictions were implemented very rapidly during March 2020, thus capturing the real time effects of the shock, and because respondents were more likely to remember their very recent food behaviour before the pandemic and make realistic comparisons with their actual behaviour during the pandemic. Rather than attempting to elicit data on difficult to assess absolute levels of food behaviour, the purpose was to capture the

Country	Sampling method	N
Czechia	Combined (representative quotas & convenience)	805
Denmark	Representative quotas	1281
France	Representative quotas	644
Germany	Representative quotas	1020
Greece	Convenience	539
Hungary	Convenience	720
Ireland	Convenience	595
Italy	Convenience	538
Netherlands	Convenience	122
Serbia	Convenience	107
Slovenia	Representative quotas	683
United Kingdom	Convenience	314
Total		7368

Table 1.
Sample of 12 European countries.

relative changes in household behaviour during COVID-19 compared to before the pandemic concerning food provision, preparation and consumption, as well as experiences of pandemic-related illness, regulations and closures. Ancillary information was also collected on household socio-demographics and household location.

Two approaches were used in sampling respondents: market research agency designed quotas using representative gender, age, education and regional distributions; and convenience sampling through social media targeted by the national researchers at all the main population groups in all parts of the country. The potential limitations of this mixed strategy was made necessary because the network of national researchers needed to be established rapidly as the first wave struck, so not all of them were able to quickly secure sufficient funding for representative sampling and data collection by market research agencies. In some countries, such agencies were hired but funding was restricted so the quota sampling and data collection were accompanied by convenience self-selection of respondents to boost the sample. However, most other surveys taken at this time were based only on convenience samples with data analysed at country level so that sample sizes were relatively small. In contrast, this survey's data analysis takes place at the European rather than the national scale thereby ensuring that each variable has relatively large samples with adequate variance so that any bias is kept to a minimum and can justify significant statistical analysis.

In Section 3 of this chapter, some relevant findings arising from a new analysis of the survey data is presented: pandemic-induced changes in food consumption, how food is obtained and prepared, food vulnerability in terms of the use of free food sources and food stress related to anxiety, missed meals and stocking-up food. For each of these topics, the influence of, first, socio-demographic and, second, geographic variables is explored as possible predictors of the food behaviour changes seen. How these variables are defined and constructed is summarised in sub-sections 2.2 and 2.3 below.

2.2 Socio-demographic analysis

Drawing on [15], three of the four most consistently powerful predictors of food behaviour change are the following three socio-demographic variables:

- Household composition, three internationally comparable composite categories derived from the standard Eurostat household composition definitions [16]:
    - households with children aged 0–19
    - single person households
    - households with 2 or more adults and no children.
- The highest education level of any household member, three internationally comparable composite categories derived from the International Standard Classification of Education (ISCED) [17] which is also used by Eurostat:
    - lower secondary: the first stage of secondary education building on primary education and marking the end of compulsory education in Europe

- upper secondary: the second/final stage of secondary education preparing for tertiary education and/or providing skills relevant to employment
- university: tertiary degree-level education

- Income change during COVID-19, two categories derived from the survey questionnaire:
  - Income loss during the pandemic compared to before the pandemic
  - No-income-loss during the pandemic compared to before the pandemic.

2.3 Geographical analysis

The fourth most powerful predictor of food behaviour change is the geographic location of the household measured along two spatial scales. First, sub-national regional differences adapted from ref. [12], and second differences between groups of countries in terms of their national consumption levels adapted from ref. [15].

The sub-national regional differentiation is shown in **Table 2** based on respondents' postcodes taken from the survey questionnaire, and then converted to specific European NUTS-3 regions using conversion data provided by Eurostat [19].

Table 3 shows the percentage of households in each socio-demographic category across the six regional types. For the categories in household composition and educational level this shows that the overall sample is somewhat skewed towards households with two or more adults with no children and with higher levels of education, as is typically the case with such surveys despite some representative sampling. However, as described above, we are not comparing the proportions of socio-demographic categories or of regional types with each other. Instead, the analysis examines the changes in food behaviour within each socio-demographic category and within each regional type, the samples of which are relatively large with adequate variance at European level to justify significant statistical analysis.

Region type	Regional type (as defined by ref. [18])
Metropolitan hierarchy	*Capital city metros*: NUTS level 3 regions where at least 50% of the population live in functional urban areas of at least 250,000 inhabitants.
	Second tier metros: the largest cities in the country excluding the capital.
	Smaller metros: fixed population threshold could not distinguish between second tier and smaller metros (as each country is different), so a natural break in metro population sizes is used in each country.
Urban-rural continuum	*Predominantly urban regions* (NUTS level 3 regions where at least 80% of the population live in urban clusters)
	Intermediate regions (NUTS level 3 regions where between 50 and 80% of the population live in urban clusters)
	Predominantly rural regions (NUTS level 3 regions where at least 50% of the population live in rural grid cells)

Note that the metropolitan hierarchy is a sub-set of the urban-rural continuum which includes all regions.

Table 2.
Regional typologies.

		Capital city (%)	2nd tier metro (%)	Smaller metro (%)	Urban (%)	Inter-mediate (%)	Rural (%)
Household composition	With children	16.9	22.3	27.1	20.5	22.6	25.5
	Single person	23.5	24.5	26.8	24.4	23.1	19.8
	2+ adults	59.7	53.2	46.1	55.1	54.3	54.6
Highest educational level in household	Lower secondary	6.8	8.4	6.4	5.3	8.6	9.0
	Higher secondary	32.9	46.7	37.2	33.8	46.8	46.0
	University	60.3	44.9	56.1	60.9	44.4	45.0
Income change during COVID	Income-loss	41.6	37.6	30.9	41.5	34.1	40.7
	No-income-loss	58.4	62.4	69.1	58.5	65.9	59.3

Data show the percentage of households in each socio-demographic category across the six regional types. All data are statistically significant at the $P < 0.05$ level.

Table 3.
The geography of socio-demographics.

Table 3 shows distinctive socio-demographic differences between the regions, demonstrating a clear spatial sorting of household types within our sample which aligns well with data from ref. [20] some of which are included in the following summary (ignoring the 'urban' type as an approximate average of all metros):

- Capital city metros have the lowest presence of children and the highest educational levels coupled with the largest proportion of income-loss households. They have the highest population densities and the highest mean incomes as part of their still dynamic though more recent slowing economies. They exhibit great socio-demographic heterogeneity with large differences manifesting in an uneven mix of both financially-stretched and very wealthy households.

- Second-tier metros compared with the other metros show the lowest educational levels, an average proportion of income-loss households but the lowest mean incomes. Many are former industrial areas that have been left behind economically with relatively high levels of unemployment, poverty and social exclusion.

- Smaller metros have the next highest educational levels after capitals, the highest presence of families with children and the lowest overall proportion of income-loss households. Generally, they exhibit very robust growing economies with the next highest income levels after capitals and show relatively high socio-demographic homogeneity with low levels of exclusion and poverty.

- Intermediate and rural regions have the lowest educational levels together with second tier metros, the next highest proportion of income loss households just after capitals, and overall the lowest population densities and mean incomes. Together they tend to be characterised by narrow labour market opportunities and poor access to a wide range of services.

The second spatial scale is at the national level and compares two groups of European countries based on their national Actual Individual Consumption (AIC)

Country	Actual Individual Consumption per head in PPPs ($)	Allocation to AIC group	Mean (SD) AIC per head in PPPs ($)
Germany	36,509	High	32, 843 (2871)
Denmark	34,601		
Netherlands	34,103		
United Kingdom	33,866		
France	29,545		
Ireland	28,435		
Italy	25,935	Low	22,376 (3764)
Czechia	25,377		
Slovenia	24,608		
Greece	23,129		
Hungary	20,075		
Serbia	15,132		

Notes: The mean AIC in each group is calculated by weighting each country's contribution to the total by its 2020 population; SD = standard deviation. (For source of data see ref. [21] and, although new calculations have been made to take account of the specific countries used in this chapter and the creation of different groups, for full details of how countries are allocated to groups see ref. [15]).

Table 4.
The two AIC country groups.

using Purchasing Power Parity (PPP) at standardized current prices ($) [21] (see **Table 4**). AIC is the sum of the total value of all household final consumption expenditure and is arguably more relevant to food consumption than per capita income or GDP data [15].

3. Findings

3.1 The socio-demographics of food behaviour change

3.1.1 Food consumption changes

Table 5 presents data on changes in four categories of food consumption:

- Fresh everyday food: fruit, vegetables, bread and dairy products
- Fresh meat and fish
- Processed food: frozen and canned food, ready-made meals
- Comfort food: cake, biscuits, sweets, chocolate and alcohol.

Table 5 reveals dramatic changes in the types of food consumed during the pandemic. All components of fresh food declined, whilst processed food increased in most

Food consumption change		Fresh every-day food (%)	Fresh meat & fish (%)	Processed food (%)	Comfort food (%)
Household composition	With children	−7.1	−8.5[X]	−1.8	10.4
	Single person	−4.6	−7.3[X]	2.3	5.8
	2+ adults	−4.8	−7.4[X]	0.9	6.8
Highest educational level in household	Lower secondary	−5.8	−7.4	−2.3	2.5
	Higher secondary	−4.5	−7.2	−0.1	5.0
	University	−3.7	−5.3	2.0	9.2
Income change during COVID	Income-loss	−7.7	−11.7	2.7	7.8
	No-income-loss	−4.7	−7.1	0.6	5.7

Data show the net percentage of households which increased/decreased their consumption from before to during COVID-19. All data are statistically significant at the $P < 0.05$ level except when marked with [X].

Table 5.
The socio-demographics of food consumption change.

household types, and comfort foods increased dramatically in all. This was probably due to greater opportunities for snacking at home during lockdowns as well as helping to reduce stress. The reduction in fresh food is also likely to be related to supply constraints during COVID-19, given their much shorter shelf lives compared to most non-fresh foods in the context of fewer opportunities to shop. This is also at a time when most households actually increased their overall food intake and the money they spent on food [12].

However, **Table 5** also shows significant differences in household types. Those with children reduced both fresh and processed food intake whilst increasing comfort food consumption more than other households. The presence of children probably boosted the consumption of sweet foods. Households with children also tend to be the largest households with the greatest range of food tastes and needs, so are likely to be the most sensitive to food system shocks. In terms of education, lower secondary level households saw the largest reductions in both fresh and processed foods, as well as the smallest increase in comfort food. Clearly education in this context reflects income levels where saving money during COVID-19 is the priority in terms of the types of food consumed.

Households that lost income during the pandemic, due to losing their job, being laid-off or reduced work activity, changed all types of food consumed much more than no-income-loss households. This study found a significant positive correlation between whether or not households lost income and the PPP per inhabitant of the region in which they live. Thus, it is likely that many income-loss households were also relatively weak financially before COVID-19, which then increased this vulnerability even more. In general, it seems that such households are more sensitive to a shock like COVID-19, and thus need to adapt and change more, whilst non-income-loss households are likely to have much greater resilience to shock with a correspondingly reduced need to change behaviour.

3.1.2 How food is obtained

Table 6 provides data on some aspects of the way households changed how they obtained food from before to during COVID-19. Overall, there was a significant move

Food behaviour change: how obtain food		Local producers (more-less) (%)	Travel distance to shops (more-less) (%)	Home delivery (before-during) (%)
Household composition	With children	11.7	−20.5	11.9
	Single person	−2.4	−14.0	10.3
	2+ adults	0.1	−10.3	12.2
Highest educational level in household	Lower secondary	−3.6	−9.4	5.0
	Higher secondary	4.7	−8.8	7.2
	University	6.9	−17.9	17.0
Income change during COVID	Income-loss	4.0	-16.7^{X}	13.5
	No-income-loss	0.2	-16.1^{X}	7.7

Data show the net percentage of households which increased/decreased their behaviour from before to during COVID-19. All data are statistically significant at the $P < 0.05$ level except when marked with ^{X}.

Table 6.
The socio-demographics of food behaviour change: How obtain food.

to buying from shops that sold locally produced food, such as farmers' markets, cooperative producers and traditional outlets that also sell local food. This is probably due to the increased interest in food, how it is produced and its quality, during COVID-19, coupled with enhanced awareness of health and of how this links to food (see Sections 3.1.4 and 3.1.5). The two exceptions are single persons who tend to be younger and less concerned with health, and the least educated households which may not have the same level of health and food awareness. It is also noteworthy that households with children and with a university education are most likely to switch to local producers during the pandemic. Similarly with income-loss households although here it is perhaps related to their need to adapt most during a shock (as above), and that their appreciation of food increased at this time more than no-income-loss households in a context where the latter were likely already to have a high appreciation so their measured increase would be less (see Section 3.1.4).

Changes in travel distance to shops show a steep reduction in all household types, as would be expected during the lockdowns, closures and restrictions on people's physical movement and social mixing, and perhaps also reflects the move to buying from local producers. The use of more local shops was greatest amongst households with children, which were more likely to need to work from home during COVID-19 when schools were closed, and those with a university education, which were more likely to be able and willing to engage in hybrid work between locations to the extent permitted by regulations. Interestingly, there is no difference related to income change, perhaps because in the context of the pandemic and its restrictions, financial status has little relevance for travel distance to shops.

The home delivery of food, ordered online or by phone during COVID-19, has increased across all types of household. Although differences are not great, those most likely to be at home most of the time during the pandemic (those with children who were not able to attend school, and with two or more adults who are more likely to be much older and retired) used home delivery more than single households which tend to be by far the youngest and mobile. This probably also applies to households that lost income, typically because they lost their job or were put on furlough during lockdown, so were more often at home most of their time. There is also a very clear tendency for

households with a higher level of education to order home delivery, perhaps because (as above) these tend to be able and willing to engage in hybrid work between locations to the extent permitted by regulations.

3.1.3 Food handling and quality

Aspects of food handling and quality are examined in **Table 7**. Apart from a small decrease in using unpackaged foods by households with a lower secondary education, there was a strong switch to this type of food handling during COVID-19. This is loose food for which customers provide their own bag or which is provided separately by the shop. It mainly relates to fresh everyday food, though some shops sharply increased providing other foodstuffs in bulk for customers to bag themselves during the pandemic, such as rice, pasta, cereals and even drinks. Apart from clear environmental benefits with less packaging, the advantage for the customer is the ability to much better check the quality of individual food items and to precisely calibrate the amount of food they need or can afford. This also relates to heightened health concerns during the pandemic as well as to increased interest in food generally (see Section 3.1.4).

Despite this greater interest in health and its relationship with food during COVID-19, there was a general decrease in the consumption of organic food. However, many of the comments made by survey respondents referred to reduced availability due to supply chain issues and related price increases. Interestingly, the only exceptions were households with children, where parents are likely to have even greater health concerns, as well as in households with higher educational levels, where it is likely health and food awareness is greater and that incomes are higher. This perhaps also explains why income-loss households had the greatest decrease in organic food consumption across all types of household.

Dramatic reductions in food waste were seen across all types of household, most tellingly in households with children and with higher education levels. Here, it is probable there was heightened awareness about the environmental and health problems caused by food waste, as well as more motivation not to throw good food away

Food behaviour change: Food handling and quality		**Unpackaged food (more-less) (%)**	**Organic (more-less) (%)**	**Food waste (more-less) (%)**
Household composition	With children	18.0	1.3	−29.8
	Single person	6.3	−4.2	−23.5
	2+ adults	8.3	−3.3	−22.3
Highest educational level in household	Lower secondary	−2.0	−4.8	−19.2
	Higher secondary	5.5	3.2	−22.1
	University	19.0	2.2	−26.0
Income change during COVID	Income-loss	13.0	−5.0	−30.3
	No-income-loss	2.4	−3.0	−21.8

Data show the net percentage of households which increased/decreased their behaviour from before to during COVID-19. All data are statistically significant at the $P < 0.05$ level.

Table 7.
The socio-demographics of food behaviour change: Food handling and quality.

for both economic and ethical reasons. The fact that income-loss households had the greatest reduction in food waste of all household types is likely to relate to their greater financial concerns given that wasted food is also wasted money.

3.1.4 Food preparation and importance

Table 8 shows various aspects of the preparation of food revealing dramatic increases across almost all types of household in meal planning and in the range of food types, ingredients and recipes used in preparing meals. This is also directly reflected in the steep rise of households' understanding of the importance of food.

As would be expected given their generally greater sensitivity to food and health, households with children show the largest increases of any household type across all these variables. When looking at educational level, the higher this is the greater is the interest in food preparation and importance. It may also be relevant to note that households on the lowest level were the only household type that marginally lost interest in any of these issues. The fact that income-loss households increased interest in food preparation and importance more than no-income-loss households probably reflects their greater food sensitivity and more free time due to the increased chance they were confined at home during COVID-19. This must be seen in a context where no-income-lost households already had relatively high food awareness and interest before the pandemic, so the change these households report is not so great.

3.1.5 Food vulnerability

The pandemic led to different types of food vulnerability, and/or exposed pre-existing food challenges, as depicted in **Table 9**. In terms of household composition, the use of free food from food banks or elsewhere is greatest by households with two or more adults which, as noted above, tend to be the oldest and least financially well-off. Households with children were more likely to grow their own food, perhaps due to their need to feed a larger family and activate children not able to attend school.

Food behaviour change: food preparation and importance		**Plan meals (more-less) (%)**	**Range of food types (more-less) (%)**	**Recipes & ingredients (more-less) (%)**	**Overall food importance (more-less) (%)**
Household composition	With children	50.8	23.6	47.4	44.7
	Single person	32.3	3.5	21.2	27.4
	2+ adults	40.1	9.5	29.4	28.9
Highest educational level in household	Lower secondary	24.3	−1.5	4.1	10.5
	Higher secondary	36.5	11.4	17.7	24.7
	University	49.4	17.6	40.9	43.6
Income change during COVID	Income-loss	50.4	16.0	42.2	40.3
	No-income-loss	36.3	7.4	23.9	22.3

Data show the net percentage of households which increased/decreased their behaviour from before to during COVID-19. All data are statistically significant at the $P < 0.05$ level.

Table 8.
The socio-demographics of food behaviour changes: Food preparation and importance.

Food vulnerability		Often use food banks (during) (%)	Once week or more free meals (during) (%)	Often grow own food (during) (%)	High COVID risk anxiety (during) (%)
Household composition	With children	1.6	0.8	21.6	27.2
	Single person	1.9	0.7	9.5	19.3
	2+ adults	2.9	1.3	16.7	24.7
Highest educational level in household	Lower secondary	6.4	2.9	10.0	23.6[X]
	Higher secondary	6.3	2.1	17.5	27.3[X]
	University	2.5	0.9	16.1	25.9[X]
Income change during COVID	Income-loss	2.0	1.0	23.5	30.1
	No-income-loss	1.2	0.4	12.3	21.4

Data show the percentage of households experiencing food vulnerability during COVID-19. All data are statistically significant at the $P < 0.05$ level except when marked with [X].

Table 9.
The socio-demographics of food vulnerability.

In **Table 9**, note, that the rates of both free food use and growing own food, although greater during the first wave of COVID-19, when this survey was undertaken, by respectively 27% and 12% compared to before the pandemic, also grew substantially after the first wave. On average, European food banks redistributed 68% more food in the whole of 2020 than in 2019 [13].

Educational level also seems to be related to the use of free food with the lowest level having the highest usage, although they grew their own food less. There are clear differences between households that lost income during the pandemic and those that did not, with the former much more likely to use free food and grow own food, almost certainly due to their greater financial vulnerability.

In the context of food vulnerability, it is useful to look at households' COVID anxiety, i.e. whether any household member felt anxious about infection. **Table 9** shows that both households with children and those with two or more adults, typically those with respectively much younger and much older people, had the greatest anxiety. No clear pattern is visible in terms of education but one can be seen in households' income change with those that lost income having significantly more levels of COVID anxiety than those that did not.

3.1.6 Food stress

Table 10 provides data on food stress and shows that, like food vulnerability and for probably similar reasons, both households with children and with two or more adults had the greatest anxiety regarding acquiring food during COVID-19. These were also the households that stocked-up most and had greater special dietary needs, both of which are more likely as there are more persons than in single households.

In terms of education, and although the data for anxiety about acquiring food is inconclusive, a similar pattern of more missed meals at lower levels with fewer at higher levels is very clear. The data also show that food stocking-up increases with higher educational levels, which perhaps reflects the ability to do so related to typically larger incomes and more opportunity. Special dietary needs also increase with

Food stress		Some anxiety acquiring food (during) (%)	Some meals missed (during) (%)	Stock-up on food (during) (%)	Special dietary needs (during) (%)
Household composition	With children	24.7	7.0	43.7	18.1
	Single person	18.5	9.9	30.7	14.6
	2+ adults	23.6	11.6	33.8	19.0
Highest educational level in household	Lower secondary	20.2[X]	13.9	16.7	12.8
	Higher secondary	22.3[X]	10.4	30.0	18.1
	University	22.3[X]	8.5	42.4	19.4
Income change during COVID	Income-loss	29.7	12.4	46.7	23.2
	No-income-loss	16.5	6.9	26.7	13.0

Data show the percentage of households experiencing food stress during COVID-19. All data are statistically significant at the $P < 0.05$ level except when marked with [X].

Table 10.
The socio-demographics of food stress.

educational level which is more difficult to explain, but may be related to greater health and food awareness in households with more education and thus increased likelihood that diet is prioritized. Cutting across this latter point are the data for income change that consistently show the almost doubling of each stress variable amongst income-lost households. This is almost certainly related to these households' sudden reduction of financial stability regardless of their income, education and household type prior to the pandemic.

3.2 The geography of food behaviour change

3.2.1 Food consumption changes

Table 11 shows how food consumption changed during COVID-19 across the regions defined in Section 2.3. All regions saw large decreases in fresh food, but with significantly lower decreases in capitals amongst the metros and in urban regions generally for fresh meat and fish, probably due to the relatively better logistics and supply infrastructures there. Processed and comfort food consumption also increased more in urban regions due to their better logistics and higher incomes, whilst processed foods actually slightly reduced in rural regions. Examining the metro hierarchy shows that capitals changed the types of food consumed significantly less than other metros, almost certainly due to their better food supply logistics. Capitals also have the highest mean incomes than other regions so their purchasing power is higher. However, this is not reflected in differences between urban and rural areas which are more mixed, with the latter reducing fresh everyday foods less than the former perhaps related to better in-situ supply, whilst reducing fresh meat and fish more maybe because supplies tend to rely on longer supply chains.

The geography of consumption change is also distinctive when looking at the national level using AIC data. The Low group of countries with the lowest consumption expenditure decreased all food types during COVID-19, with the marginal exception of only a very small increase in comfort food, probably indicating their

Food consumption change: before-during		Fresh everyday food (%)	Fresh meat & fish (%)	Processed food (%)	Comfort food (%)
Regional geography: metro hierarchy	Capital metro	−4.4	−4.7	1.0	6.9
	2nd tier metro	−6.6	−8.9	2.0	7.4
	Smaller metro	−5.3	−10.8	2.7	7.8
Regional geography: urban-rural continuum	Urban	−5.5	−6.3	2.9	7.1
	Intermediate	−5.0	−8.1	0.4	6.8
	Rural	−4.7	−7.4	−0.9	6.3
National geography: Actual Individual Consumption (AIC)	Low	−9.1	−18.7	−3.0	0.5
	High	−8.3	−15.2	7.3	13.5

Data show the net percentage of households which increased/decreased their consumption from before to during COVID-19. All data are statistically significant at the $P < 0.05$ level.

Table 11.
The geography of food consumption change.

greater financial strain. In contrast the High group experienced lower fresh food decreases and much higher processed and comfort food increases, indicating their relative financial resilience. This supports the view that national AIC does seem to impact important aspects of an individual household's financial situation and that the High group is more financially resilient, less subject to stress and thereby also more able to withstand the food shock of COVID-19.

3.2.2 How food is obtained

Examining aspects of how households changed their acquisition of food during COVID-19 in **Table 12** also shows important differences between the regional types but, unlike with food consumption, reveals important and significant contrasts between the three metros that reflect the characteristics presented in Section 2.3. Capitals and smaller metros, as relatively wealthy regions, both increase their move to local producers whilst second-tier metros, typically as relatively more socio-economically challenged, slightly decrease this behaviour. This is only one aspect that both reflects capitals' economic predominance as well as the increasing population and economic growth of the smaller metros, mainly at the expense of the second-tier metros and rural regions, which is also seen in many of the data presented below. (See also Section 4.2) A similar distinction amongst the metros is also seen in the increase in home delivery ordered online or by phone, whereas here this is likely to be related more to the state of the market in terms of the density of suitable shops. There are, however, no significant differences in travel distance to shops probably because this variable is likely to be directly dependent on the status of movement restrictions in different areas rather than geo-demographic factors.

Looking at the urban-rural continuum also shows a stronger move to local producers and to home delivery in urban regions, given their greater wealth and higher population densities providing better market opportunities for these outlets. Again, the reduced distance to shops is hardly significant due both to local movement regulations and the existing spacing of shops. In terms of national AIC differences, similar

Food behaviour change: how obtain food		Local producers (more-less) (%)	Travel distance to shops (more-less) (%)	Home delivery (during-before) (%)
Regional geography: metro hierarchy	Capital metro	1.4	−5.8	15.0
	2nd tier metro	−0.1	−11.4	9.1
	Smaller metro	6.9	−23.7	10.8
Regional geography: urban-rural continuum	Urban	3.0	−11.2[X]	15.9
	Intermediate	2.2	−11.9[X]	8.4
	Rural	1.3	−11.5[X]	8.2
National geography: Actual Individual Consumption (AIC)	Low	2.7	−18.2[X]	20.3
	High	11.5	−16.7[X]	10.8

Data show the net percentage of households which increased/decreased their behaviour from before to during COVID-19. All data are statistically significant at the $P < 0.05$ level except when marked with [X].

Table 12.
The geography of food behaviour change: How obtain food.

conclusions can be drawn from the much greater move to local producers by the High group but much less use of home delivery. The latter is difficult to explain but is perhaps related to the much stricter lockdown and closure rules in the Low AIC group, that mainly consists of the more southern and eastern European countries, during the first wave thereby increasing the need for home delivery.

3.2.3 Food handling and quality

As shown in **Table 13** there was a strong move to unpackaged food in all regions, again in capitals and smaller metros much more than second-tier metros and in urban more than rural regions, probably linked to the patterns of increased interest in health and food shown in **Table 14**.

Comparing the two AIC groups, the countries in the Low AIC group made a much bigger switch to unpackaged food than the High group, perhaps as a form of catch-up but also, as with the income-loss households in **Table 7**, a great increase in health-food awareness. Regarding the overall decrease in the purchase of organic food, capitals and High AIC countries do best, probably mainly due to more acute supply and price issues elsewhere.

In terms of the dramatic decrease in food waste in all regions and countries, the likely reasons for which are explained in Section 3.1.3, smaller metros stand out. As described in Section 3.2.2, this is the regional type with, overall, relatively high wealth coupled with the most cohesive socio-demographic which is also growing relatively fast in both population and economic terms. These characteristics lend themselves to high awareness of both health and food, as well as the links between them, and this is reflected in many of the food behaviour changes during COVID-19. Where there are exceptions (such as organic food) there are likely to be very specific reasons. Capital city regions, of course, have many households that fit this description, but most capitals tend to house significant low-wage as well as high-wage sectors, so are much more diverse and often less cohesive, unlike the smaller metros.

Food behaviour change: food handling and quality		Unpackaged food (more-less) (%)	Organic (more-less) (%)	Food waste (more-less) (%)
Regional geography: metro hierarchy	Capital metro	12.1	4.9	−21.9
	2nd tier metro	6.4	−3.0	−22.3
	Smaller metro	14.2	−8.2	−30.0
Regional geography: urban-rural continuum	Urban	13.9	0.1[X]	−23.6[X]
	Intermediate	6.2	−1.4[X]	−24.9[X]
	Rural	8.7	0.1[X]	−23.7[X]
National geography: Actual Individual Consumption (AIC)	Low	27.0	−3.1	−24.4
	High	13.9	−0.2	−28.0

Data show the net percentage of households which increased/decreased their behaviour from before to during COVID-19. All data are statistically significant at the P < 0.05 level except when marked with [X].

Table 13.
The geography of food behaviour change: Food handling and quality.

Looking at food waste reduction in the two country AIC groups, the High group is a little ahead of the Low group, perhaps because the countries in this group overall had slightly greater awareness of the problem.

3.2.4 Food preparation and importance

There were also huge increases in households' engagement in, and the awareness and thus assessment of, the importance of food in all regions and countries during COVID-19, as shown in **Table 14**. Both capitals and the smaller metros again have significantly greater positive changes than the second-tier, with smaller metros markedly ahead of capitals in terms of new recipes and ingredients and overall food

Food behaviour change: food preparation and importance		Plan meals (more-less) (%)	Range of food types (more-less) (%)	Recipes & ingredients (more-less) (%)	Overall food importance (more-less) (%)
Regional geography: metro hierarchy	Capital metro	41.3	11.7	28.1	32.8
	2nd tier metro	38.5	9.4	26.3	29.6
	Smaller metro	39.0	10.4	35.7	35.9
Regional geography: urban-rural continuum	Urban	42.0	12.3	34.2	35.8
	Intermediate	36.2	7.5	22.1	27.1
	Rural	42.8	13.9	23.9	31.3
National geography: Actual Individual Consumption (AIC)	Low	46.7	21.8	40.0	39.2[X]
	High	40.3	11.5	33.8	38.1[X]

Data show the net percentage of households which increased/decreased their behaviour from before to during COVID-19. All data are statistically significant at the P < 0.05 level except when marked with [X].

Table 14.
The geography of food behaviour change: Food preparation and importance.

importance, almost certainly for similar reasons as in Section 3.2.3. Along the urban-rural continuum it difficult to see any real pattern in changes in meal planning and the types of food used, perhaps because these aspects are likely to be less dependent on market dynamics. However, clear differences between urban and rural regions emerge again in terms of new recipes and ingredients and overall food importance. Perhaps here market dynamics play a bigger role through higher densities of supply and demand leading to greater diversity of ingredients and recipes, in turn promoting increased interest in food.

Looking at the two AIC country groups, the Low group has consistently greater changes than the High group. This is almost certainly for reasons similar as for the two income change groups in Section 3.1.4, i.e. their greater sensitivity to food during a shock related to their smaller available consumption income. However, it is clear that both groups significantly increased across all variables and it is noteworthy that the difference in their assessment of food importance is not significant.

3.2.5 Food vulnerability

Table 15 shows data that, in many ways, rests on similar explanations as in **Table 9**, but this time in terms of geography rather than only socio-demographics given that these two factors are clearly related.

In **Table 15**, the use of free food is lowest in the smaller metros as the most cohesive socio-demographic regional type. As seen in Section 2.3, both capitals and second-tier metros have many more low-wage jobs as well as pockets of poverty. In contrast the smaller metros have a higher incidence of growing own food, perhaps related to their greater physical space due to lower population densities amongst the metros and the likelihood of more modern town planning. Some similar reasons seem to apply along the urban-rural continuum. Rural areas often tend to have lower incomes and greater poverty, although this is only seen in terms of food banks rather than free meals, perhaps because the logistics for the latter are more demanding than for the former. In the case of growing own food, however, rural areas saw much

Food vulnerability		**Often use food banks (during) (%)**	**Once week or more free meals (during) (%)**	**Often grow own food (during) (%)**	**High COVID risk anxiety (during) (%)**
Regional geography: metro hierarchy	Capital metro	3.4	2.3	9.7	26.0
	2nd tier metro	2.4	1.7	13.3	22.0
	Smaller metro	1.9	1.2	15.1	23.6
Regional geography: urban-rural continuum	Urban	2.3	1.8	10.7	26.8
	Intermediate	3.9	2.1	17.3	22.0
	Rural	5.7	1.0	22.7	24.9
National geography: Actual Individual Consumption (AIC)	Low	7.0	2.1	34.6	15.2^{X}
	High	1.4	1.1	23.7	14.9^{X}

Data show the percentage of households experiencing food vulnerability during COVID-19. All data are statistically significant at the $P < 0.05$ level except when marked with ^{X}.

Table 15.
The geography of food vulnerability.

greater increases than the other regions, given the substantially greater opportunities in these areas.

Similar explanations are likely for the differences between the two AIC groups in relation to free food and growing own food. The Low group has much less consumption income, it has been impacted more by the COVID-19 shock, and there is often more physical space for food growing in these countries. It is of interest that there are only small significant geographic distinctions in COVID-anxiety, maybe because this tends to be engendered by the media more than actual infections which have been higher in regions of greater population density. However, capitals, urban regions and Low AIC countries score a little higher than the other regions. This is almost certainly due to the impact greater population densities have in the two former regional types as well as the overall higher likelihood of contracting COVID-19 in the Low AIC countries during the first wave [22].

3.2.6 Food stress

Again, in some reflection of Section 3.1.6 and well as food vulnerability above, the geographic expressions of food stress in **Table 16** show some similar patterns. Despite logistics ensuring more stable food supplies, anxiety acquiring food and the incidence of missed meals seems to be greatest in capitals and urban regions generally, although in the latter it is only marginally significant. It is also in these regions that other data from the survey show there are more income-loss households than average, thus adding a financial element to this anxiety. This is probably also related to the actual incidence of COVID-19 infection which is higher in more densely populated areas and reflects the COVID-19 risk anxiety in **Table 15**.

In terms of stocking-up food, a similar pattern is seen, although there is no apparent difference between capitals and smaller metros, probably because households in the latter have equally sufficient financial resources and food awareness as the former. The increase in special dietary needs up the metro hierarchy is, however, more difficult to explain though may again reflect the greater incidence of COVID-19

Food stress		**Some anxiety acquiring food (during) (%)**	**Some missed meals (during) (%)**	**Stock-up on food (during) (%)**	**Special dietary needs (%)**
Regional geography: metro hierarchy	Capital metro	24.2	14.5	36.2	19.8
	2nd tier metro	22.6	8.3	30.6	16.3
	Smaller metro	20.7	5.7	36.2	15.1
Regional geography: urban-rural continuum	Urban	23.6	11.4	39.5	18.4^{X}
	Intermediate	22.1	8.9	30.0	18.2^{X}
	Rural	22.2	10.8	35.1	19.6^{X}
National geography: Actual Individual Consumption (AIC)	Low	30	14.5	46.1	20.8
	High	21.1	5.1	35.0	17.2

Data show the percentage of households experiencing food stress during COVID-19. All data are statistically significant at the $P < 0.05$ level except when marked with ^{X}.

Table 16.
The geography of food stress.

infections. Examining the data for the two AIC groups shows very significant differences across all variables and is again probably related to differences in their expenditure incomes and higher rates of COVID-19 infection during the first wave [22].

4. Discussion

Food is arguably our most vital strategic commodity. It is central to our existence, not just for sustenance and survival but as a huge contributor to our cultural, social and economic lives. The food industry also has huge environmental impacts. So, when food systems and patterns of food preparation, consumption and diet are disrupted by large scale social and economic shocks like the financial crisis, COVID-19 and the war in Ukraine, this is of utmost importance. This research shows that the majority of European households significantly changed important aspects of their food behaviour, many of which are likely to persist into the future. It is also clear that, although this chapter has taken food consumption as its example, the lessons are likely to apply to most, if not all, types of consumption in the age of disruption.

This chapter clearly shows that the food system is multidimensional, that both socio-demographic determinants and geography strongly affect both food behaviours and changes in food behaviours, and that there is a highly significant alignment and interaction between geography and society. It has confirmed that the most important predictors of food behaviour change during a significant disruption are household composition, education, income and geography, and that these are closely inter-dependent. In times of food system disruption during a crisis, both socio-demographics and geography are increasingly transforming the market system heretofore based on large centralized organizations, long supply chains and ever-increasing globalization.

4.1 Socio-demographics

There are very many highly significant differences in changes to food consumption during COVID-19 between different types of household, especially in terms of household composition, educational level achieved and income change. Households with children tend to be the largest households with the greatest range of food tastes and needs, so are likely to be the most sensitive to food system shocks. They have typically changed their food behaviour much more than other households. Their size often means tighter budgets and this shows in their relatively large reduction of fresh food but also largest increase in comfort food consumption, no doubt because of their children's demand for sugary foods whilst stuck at home during school shutdowns. Household with two or more adults were also relatively responsive to the shock, although these households tend to consist of much older, often retired, people many of whom are living on small incomes and are very concerned about their health and, especially since COVID-19, about the impact of food on this. Both households with children and with two or more adults also generally suffer much more than single households from food vulnerability and stress and this was magnified if the household lost income during the pandemic.

Somewhat similar patterns are seen in relation to the educational level of the household, so that the higher levels are the most resilient and least likely to change their food behaviours during the pandemic. The less educated the household, the more

likely it is to decrease fresh food consumption and increase processed food consumption, although the university educated households did increase their consumption of comfort food more, probably because of their typically higher incomes and access to shops. The less educated households also switched less to local producers, used home delivery, unpackaged and organic food much less and engaged less often in enhanced food preparation behaviours, as well as decreasing their food waste the least. It seems likely that awareness of the links between food and health were less clear to these households, a supposition reinforced by their much lower increase in evaluating the overall importance of food. These households were also more likely to revert to foodbanks during the pandemic as well as obtain free food from other sources, a situation reinforced by the fact that many more of their households lost income during the pandemic.

Households' income change is a good surrogate for household income which, in turn, is significantly correlated with Actual Individual Consumption (AIC) data even though this is generalised to the national level. The results presented above clearly show that households losing income during Covid-19 were likely to be fragile even before the pandemic which then made their situation worse. They nearly always experienced food behaviour changes arising from Covid-19 much more than no-income-loss households. Interestingly, the proportion of such households is also significantly lower in the smaller metros than in other regional types.

Overall, there are often quite stark food behaviour inequalities between household types. These show up, for example, in a significant trend to less healthy eating during the pandemic away from fresh food to more processed and sugary foods and alcohol, especially amongst households with children and income-loss households whose vulnerability has been further exposed. These differences existed before COVID-19, but the system shock has further exacerbated them. On the positive side, however, the pandemic has also dramatically accelerated the previous slow trend towards more local and seasonal food delivered along short supply chains, a move to smaller independent retail outlets, and much greater food awareness and interest in trying new types of food and recipes.

4.2 Geography and hybrid work

There is a strong tendency for more or less regular changes in food behaviour outwards from a country's capital city center to its rural periphery, i.e. down the metropolitan hierarchy and along the urban-rural continuum. These changes are directly related to decreasing population density and of economic activities which symbiotically both attracts and is dependent upon each region's distinctive socio-demographic characteristics. However, there is also an important counter trend with some movement of population out of both the largest, typically capital, metropolitan areas and from the so-called second-tier, typically older industrial, metro cities towards smaller metros in or beyond the suburbs and in peri-urban and adjacent rural areas. These smaller metros are also growing in size, also fed by some rural depopulation as more desirable destinations than the larger metros with their higher rents and living expenses.

This is a spatial dynamic, long recognized by geographers (for example refs. [23, 24]), as the current counter-urbanization phase of urban development in more economically developed countries. It has been ongoing since the 1990s and has been given added impetus by the disruptions of the early twenty-first century. For example, in Denmark there is an ongoing movement of population out of the five largest

Danish Cities, including Copenhagen, to fast-growing smaller provincial cities in their hinterlands as part of a development that is likely to continue to 2040 and beyond, also propelled by movements from rural areas [25]. This trend towards the growth of smaller metros has been ongoing for about 30 years but has now been sharply intensified by the accelerated adoption of digital technology during the pandemic. This is dramatically increasing online shopping, working from home and hybrid work in general, as well as online gatherings rather than meeting in person.

It is clear that the COVID-19 pandemic has already led to a strong overall increase of the digitalisation of society, and there are predictions that people are unlikely to return to the old ways of doing things. With fewer people coming into very large cities to work and shop, that leaves a big space in areas that were once characterised by bustling shops and offices. Consumption is now shifting significantly to these smaller cities and suburban centres. Those places that are most at risk are those that have little else to attract locals and visitors from further afield. According to a UK report [26], there has been a loss of commuter flow into these cities of between over a tenth to almost a third of commuter footfall seen pre-COVID-19. Apart from the largest, mainly capital, cities like London [26], contends that it is unlikely there will be a return to old commuting habits in most very large cities. Those able to telework from home are now doing so for at least part of the week or shifting to hybrid-working that mixes working from home, working closer to home in more convenient local suburban centres with much less frequent commuting to the large city. This is already leading to further significant reductions in office space in large cities and some collapse in their central retail areas.

This pandemic-induced 'zoomshock transformation' has magnified the existing counter-urbanization trend that, during COVID-19, led to a major shutdown of city and suburban centres with plummeting city-centre commercial real-estate values. Now, largely beyond the pandemic, 'zoomshock' seems likely to see an acceleration of the spatial mixing of population, consumption and work especially away from the very large city centres that questions the benefits of agglomeration [27].

The main mechanism seems to be that, although tele- and hybrid-work only increased slowly from 5.4% of the EU-27's employed population in 2009 to about 9% in 2019, since the outbreak of COVID-19 this rose so that over 40% of those currently working in the EU began to telework fulltime [28]. Almost all experience since the 1990s has shown multiple benefits of these new ways of working that directly impact socio-economic and consumption geographies, such as better compatibility between work and family obligations, more flexibility, more recreation and leisure time, increased local community activity, saving costs on commuting, and increased performance and employee satisfaction. However, difficulties include pressure to work more intensely and longer hours when employees are always online, collaboration and communication with colleagues and co-workers can be difficult, employees find it hard to separate work and private life, poorly equipped workplaces may lead to health impairments and psychological problems and organisations become highly dependent on technical equipment which does not always function well [29]. These problems impact vulnerable populations in general, and this polarization remains the main challenge, as clearly seen in many of the food consumption results reported in this chapter.

Notwithstanding this issue, the newer, smaller but growing metros tend to be the most socio-economically vibrant and, from this evidence, the sociability of smaller cities does seem to provide some solutions. They are arguably at the 'sweet-spot' between being too large and too small whilst retaining significant political and

economic resources. Compared to all other regional types, their populations show the greatest egalitarian and cohesive profiles in terms of income, age, education and family size, as well as the lowest proportion of households that lost income during the pandemic. Across nearly all types of food behaviour, these smaller metros directly reflect this regional geography by displaying many of the advantages of capital metros while foregoing some of the disadvantages. Capital cities often contain significant enclaves of poverty as well as very wealthy households, whilst second-tier metros tend to be former industrial cities now economically retarded with the lowest metro incomes and relatively high levels of social exclusion, unemployment and poverty.

This overall dynamic is being driven by a better quality of life in smaller metros that are able to balance urban and rural advantages with high service levels, as well as continued good connectivity to the larger metros when desired. Their relative lack of physical connectivity compared to the larger metros has been decisively countered by the dramatically increased take up of digital technology during the pandemic, including the strong moves to online shopping and working from home. For example, smaller metros typically change their food behaviour significantly less than all other regional types during Covid-19, showing them to be the most resilient to the disruptions of the pandemic. They also exhibit much smaller food behaviour differences between households that lost income during the pandemic and those that did not. This means that their overall food vulnerability is much lower.

5. Conclusion

Overall, more vulnerable households (however measured) suffered more during the COVID-19 shock, but this also meant that both their behaviour and awareness around the health-food relationship also improved significantly, though clearly from a low base. Less vulnerable and stressed households already had relatively high levels of behaviour change and awareness around the health-food relationship and, although this increased during the pandemic, this increase tended to be less given it was starting from a higher level. So, in many ways, the COVID-19 food shock pushed more vulnerable households to catch-up to some extent with the already relatively high levels of food-health awareness in less vulnerable households, despite the serious difficulties they encountered. Indeed, data from ref. [12] also indicates that more vulnerable households say their changed food behaviour is more likely to continue beyond COVID-19 than do less-vulnerable households. This includes, for example, greater increases in shopping with local producers and in more local shops, growing own food, using a wider range of food dishes and recipes, greater use of unpackaged food and much less food waste. Thus, a useful policy guide during this age of disruption would be to put in place measures to support the positive food behavioural changes of all households with a specific focus on the more vulnerable households and with lower incomes.

How all these impacts will play out over the longer term is a critical issue and needs focused research and policy action, especially because the likelihood of other shocks in future with similar effects is high. These could include new pandemics, the ongoing and increasingly alarming climate crisis, new disruptive technologies, geo-political and economic-trade tensions, etc. The recent Russian invasion of Ukraine and the growing disruption of both energy and food systems is but the latest example.

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Conflict of interest

The author declares that the research was conducted, and the chapter prepared and written, in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

[1] The Guardian. Eurozone Economy Shrinks by Record 12.1% Due to Coronavirus. 2020. Available from: https://www.theguardian.com/business/2020/jul/31/eurozone-economy-shrinks-by-record-121-due-to-coronavirus-crisis [Accessed: March 16, 2022]

[2] IMF. War Sets Back the Global Recovery, World Economic Outlook, Full Report. 2022. Available from: https://www.imf.org/-/media/Files/Publications/WEO/2022/April/English/text.ashx [Accessed: April 26, 2022]

[3] BBC. Ukraine War: World Bank Warns of 'Human Catastrophe' Food Crisis. 2022. Available from: https://www.bbc.com/news/business-61171529 [Accessed: April 26, 2022]

[4] Aljazeera. WFP: 20 Million Risk Starvation as Horn of Africa Drought Worsens. 2022. Available from: https://www.aljazeera.com/news/2022/4/19/20-million-risk-starvation-as-horn-of-africa-drought-worsens-un [Accessed: April 26, 2022]

[5] The Guardian. Ukraine War Threatens Global Heating Goals, Warns UN Chief. 2022. Available from: https://www.theguardian.com/environment/2022/mar/21/ukraine-war-threatens-global-heating-goals-warns-un-chief [Accessed: April 26, 2022]

[6] The WEF. The Great Reset. 2020. Available from: https://www.weforum.org/great-reset [Accessed: September 15, 2020]

[7] The WEF. Lessons from CEOs: Leading through the COVID-19 Crisis and Beyond. 2020. Available from: https://www.weforum.org/agenda/2020/06/ceos-reflections-on-leading-through-covid-19-so-far/ [Accessed: September 15, 2020]

[8] European Union. A European Green Deal. 2020. Available from: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en [Accessed: September 15, 2020]

[9] European Union. A Renewed Trade Policy for a Stronger Europe. 2020. Available from: https://trade.ec.europa.eu/doclib/docs/2020/june/tradoc_158779.pdf [Accessed: September 15, 2020]

[10] Janssen M, Chang BPI, Hristov H, Pravst I, Profeta A, Millard J. Changes in food consumption during the COVID-19 pandemic: Analysis of consumer survey data from the first lockdown period in Denmark, Germany, and Slovenia. Frontiers in Nutrition. 2021;**8**:60. DOI: 10.3389/fnut.2021.635859

[11] Profeta A, Siddiqui SA, Smetana S, et al. The impact of Corona pandemic on consumer's food consumption. Journal of Consumer Protection and Food Safety. 2021;**16**:305-314. DOI: 10.1007/s00003-021-01341-1

[12] Millard J, Sturla A, Smutná Z, Duží B, Janssen M, Vávra J. European food Systems in a Regional Perspective: A comparative study of the effect of COVID-19 on household and city-region food systems. Frontiers in Sustainable Food Systems. 2022;**6**:844170. DOI: 10.3389/fsufs.2022.844170

[13] Capodistrias P, Szulecka J, Corciolani M, Strøm-Andersen N. European food banks and COVID-19: Resilience and innovation in times of crisis. Socio-Economic Planning Sciences. 2021;**82**:101187. DOI: 10.1016/J.SEPS.2021.101187

[14] Euractiv. Macron Wants to 'adapt' EU Farm to Fork to the Post-Ukraine War World. 2022. Available from: https://www.euractiv.com/section/agriculture-food/news/macron-wants-to-adapt-eu-farm-to-fork-to-the-post-ukraine-war-world/ [Accessed: April 26, 2022]

[15] Hristo H, Millard J, Pravst I, Janssen M. European household spending and socio-economic impacts on food behaviour during the first wave of COVD-19. Frontiers in Nutrition. 2022;**9**: 869091. DOI: 10.3389/fnut.2022.869091

[16] Eurostat. Household Composition Statistics. 2022. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Household_composition_statistics [Accessed: May 13, 2022]

[17] Wikipedia. International Standard Classification of Education, Developed and Maintained by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and Used by Eurostat. 2022. Available from: https://en.wikipedia.org/wiki/International_Standard_Classification_of_Education [Accessed: March 30, 2020]

[18] Eurostat. Regional Typologies Overview. 2020. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:Regional_typologies_overview#Urban-rural_typology_including_remoteness. [Accessed: November 3, 2020]

[19] Eurostat. Postcodes and NUTS. 2021. Available from: https://ec.europa.eu/eurostat/web/nuts/correspondence-tables/postcodes-and-nuts [Accessed: December 15, 2021]

[20] Eurostat, European Commission. Statistical Office of the European Union, Eurostat Regional Yearbook. Luxembourg: European Union; 2021. p. 20. Available from: https://ec.europa.eu/eurostat/documents/3217494/13389103/KS-HA-21-001-EN-N.pdf/1358b0d3-a9fe-2869-53a0-37b59b413ddd?t=1631630029904 [Accessed: December 15, 2021]

[21] OECD. National Accounts of OECD Countries, 2021 Issue 1, OECD Publishing, Paris. https://www.oecd.org/publications/national-accounts-of-oecd-countries-2221433x.htm [Accessed: January 11, 2022]

[22] World Health Organisation. WHO Coronavirus Disease (COVID-19). Dashboard. 2020. Available from: https://covid19.who.int/ [Accessed: November 7, 2020]

[23] Aleksandrzak K. Urbanization—Components and Stages of Urbanization, i.e. the City's Life Cycle. 2019. Available from: https://geographicforall.com/en/urbanization-components-and-stages-of-urbanization-i-e-the-citys-life-cycle/ [Accessed: December 15, 2021]

[24] Mitchell CJA, Bryant CR. Counter Urbanization, in International Encyclopaedia of Human Geography. Second ed. Amsterdam: Elsevier; 2020

[25] Danish Knowledge Centre for Housing Economics (Boligøkonomisk Videnscenter (2021). Demografi, socioøkonomi og boligstrukturer i danske kommuner. 2021. Available from: https://www.bvc.dk/faglige-udgivelser/demografi-sociooekonomi-og-boligstrukturer-i-danske-kommuner/ [Accessed: December 15, 2021]

[26] KPMG. The Future of Towns and Cities Post COVID-19. January 2021, UK. 2021. Available from: https://home.kpmg/uk/en/home/insights/2021/01/future-of-towns-and-cities-post-covid-19.html [Accessed: December 15, 2021]

[27] Millard J. How 'zoomshock' is transforming work, geography and society. Webinar presentation, Third Global Forum 2021 Webinar Series, 9 June 2021, "Sustainable Smart, Cognitive Cities, Regions & Communities and Tech for Good" and "From Industry 4.0 (merging of virtual, physical and biological) to Industry 5.0 (interaction and collaboration between humans and machines)". 2021. Available from: http://globalforum.items-int.com/gf/gf-content/uploads/2021/06/Jeremy-Millard-GF2021-webinar-9-6-21.pdf. [Accessed: March 14, 2022]

[28] JRC. Telework in the EU before and after the COVID-19: where we were, where we head to. The European Commission's Joint Research Centre, JRC120945. 2020. Available from: https://ec.europa.eu/jrc/sites/jrcsh/files/jrc120945_policy_brief_-_covid_and_telework_final.pdf [Accessed: April 19, 2021]

[29] Edelmann N, Millard J. Telework development before, during and after COVID-19, and its relevance for organizational change in the public sector. In: Procedings of the 14th International Conference on Theory and Practice of Electronic Governance. ICEGOV; 2021. pp. 436-443. DOI: 10.1145/3494193.3494252