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# Putting inadequate incomes at the heart of food insecurity. A Study of the financial constraints to access a healthy diet in Europe

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### **Abstract**

In Europe, food insecurity is still a serious concern for individual and public health. Although progress has been made in reducing undernourishment, other types of malnutrition such as obesity are on the rise. Policies that aim at improving healthy eating and addressing food insecurity tend to focus on public education, and financial incentives, such as a sugar tax. These policies start from the assumption that people have sufficient income to eat healthily. In contrast, food assistance through food banks is becoming more and more popular across European countries, suggesting that a significant share of the population experiences financial constraints to access a (healthy) diet. Unfortunately, indicators of food insecurity rarely focus directly on the lack of sufficient income as a driver of food insecurity and unhealthy eating. Therefore, in this paper, we try to assess the role of adequate incomes and minimum income policies in having access to a healthy diet. We make use of estimates of the minimum cost of a healthy diet in 24 European countries, in accordance with national food-based dietary guidelines. Food prices were collected in the capital city of each country during the Spring of 2015. We use these unique data to (1) estimate the proportion of people living in urban areas with insufficient income to access a healthy diet, before and after housing costs, based on representative income survey data (EU-SILC), and, (2) compare the cost of a healthy diet with the level of minimum income schemes for specific household types using microsimulation techniques. We find that in 16 out of 24 countries at least 10% of the population in (sub)urban areas is confronted with income-related food insecurity. Especially in Eastern and Southern Europe a large share of the (sub)urban population is lacking the economic resources needed to have access to a healthy diet. Our findings show that policies directed at tackling food insecurity should be embedded in a broader set of economic and social policies that facilitate the structural realisation of an adequate income.

**Keywords:** Food insecurity, healthy diet, reference budgets, food cost, adequate income, accessibility

# 1 Introduction

Food insecurity is a global and urgent problem and studies have found a rising trend, also in some high-income countries (FAO 2018; Davis and Geiger 2017). Although food insecurity is commonly defined as “not having access to safe, nutritious and sufficient food due to a lack of money or other resources” (FAO 2018, p.27), current studies generally fail to reveal the key role of adequate income. In this paper, we address food insecurity and its relation to income adequacy in Europe. Although all EU Member States provide minimum income support for people at active age, poverty remains high and minimum income schemes are proven to be largely, and in some countries increasingly, inadequate (Cantillon et al. 2019; Marchal et al. 2016; Van Mechelen and Marchal 2013). Against this background, the increasing number of people relying on food assistance across Europe (Galli et al. 2018; Caraher and Cavicchi 2014; Gentilini 2013) could be an indication that more and more people cannot afford adequate food intake.

In industrial welfare states, the problem of food insecurity is not so much an issue of undernourishment, but rather an issue of unhealthy and inadequate nutrition (FAO 2018; WHO 2014; Perez-Escamilla et al. 2018). Energy-dense but nutrient-poor diets cause a rising trend of overweight, obesity and related non-communicable diseases such as diabetes and cancer and can even coexist with forms of undernutrition, the so-called double burden of malnutrition (Gakidou et al. 2017; Roberto et al. 2015; Lock et al. 2005; FAO 2018; WHO 2014). The reasons for malnutrition are diverse, and do not all refer to food insecurity, including factors such as marketing, attitudes, socio-cultural pressures and physiological issues (Bublitz et al. 2019; Brambila-Macias et al. 2011; Leng et al. 2017). However, unhealthy eating patterns and diet-related health problems have a clear socio-economic gradient and are especially prevalent among the poor (Robertson et al. 2007; Forster et al. 2018; Perez-Escamilla et al. 2018; Vereecken et al. 2005; Nikolić et al. 2014). Nevertheless, the problem of unhealthy diets is often addressed as an individual problem caused by a lack of information and competences. Various policies focus on better food education (providing information and limiting advertisement of unhealthy products) and financial incentives, such as a so-called ‘sugar tax’. The number of health-related taxes on food seem to be on the rise (Teng et al. 2019; Backholer et al. 2017). Depending on their design, they do not necessarily adversely affect low-income households (Nordström and Thunström 2011). However, it can be expected that their impact on low-income households will be limited if the overall cost of a healthy diet remains too high in comparison with their income.

At the same time, another increasingly popular policy response to food insecurity in the European Union (EU) is food assistance, generally through supporting food banks organised by the voluntary sector (Caraher and Cavicchi 2014; Greiss et al. 2019). Several scholars (Dowler and O’Connor 2012; Riches and Silvasti 2014; Pollard and Booth 2019) have criticized this individualized and charity-based approach arguing in favour of a rights-based framework, which recognises the need for adequate economic resources to ensure access to a healthy diet. Such an approach requires empirical underpinning which takes into account the needs of households, the prices they face, the economic resources they have at their disposal and the societal and personal conditions they are confronted with (Burchi and De Muro 2016). However, there is a lack of (comparable) data and empirical evidence revealing the size and structural determinants of food insecurity to guide policy makers in Europe (Pollard and

Booth 2019; Davis and Geiger 2017). Current studies on food insecurity in affluent countries (e.g. Davis and Geiger 2017; Loopstra et al. 2015; Depa et al. 2018; Galli et al. 2018) have two main limitations: (1) they generally lack a conceptualisation of what is minimally needed to obtain a healthy and acceptable diet, and, (2) they fail to reveal the role of adequate incomes and social security policies in having access to a healthy diet.

With this paper we provide new evidence on the role of adequate income in the ability to access a healthy diet across Europe. Although scholars have inquired the effect of diet costs on dietary habits (e.g. Pechey and Monsivais 2016; Aggarwal et al. 2011), only a few national studies (e.g. in Australia (Ward et al. 2013) and in the UK (O'Connell et al. 2019)), studied the relation between the cost of healthy food and household income. To the best of our knowledge, we are the first to do this in a cross-nationally comparable way. This study makes use of a data set of comparable food baskets representing a healthy diet for a large number of European countries (Carrillo-Álvarez et al. 2019b), and compares this to disposable household incomes using both representative survey data and hypothetical household simulations. The paper provides a conservative measurement of people with an income, before and after housing costs, below the cost of a healthy diet. Even though our measurement of food insecurity should be improved when more data become available, we consider this a valuable first attempt to estimate a lower bound of the size and distribution of income-related food insecurity in (semi)urban areas of Europe. Finally, by comparing the cost of a healthy food basket with the level of minimum income protection across Europe, we show how many welfare states fail to protect the right to an adequate diet for the most vulnerable.

The paper is structured as follows. First, we briefly discuss some of the main insights from the literature and current measures on food insecurity in Europe. Secondly, we elaborate on the methodology we employ in this paper to assess the level and distribution of income-related food insecurity. In the results section, we estimate the number and profile of people in urban areas in Europe with an income that does not allow to eat a healthy diet in accordance with the national food-based dietary guidelines. In a second step, we compare the cost of the food basket with minimum income protection levels in Europe. We conclude with a summary of the main findings and a discussion on policy implications.

## 2 Food insecurity in Europe

Access to an adequate diet is an essential part of the right to an adequate living standard and a life in human dignity (Article 11 in the International Covenant on Economic, Social and Cultural Rights). General Comment 12 of the UN Committee on Economic, Social and Cultural Rights (CESCR 1999) emphasizes that, in order to maintain and enhance a good health, not only sufficient, but also *adequate*, socially and culturally acceptable, nutritious and quality food must be *available* and *sustainable* for everyone in the long term. Importantly, the right includes the importance of economic and physical *accessibility* to a healthy diet, in particular for vulnerable groups (CESCR 1999). Similarly, scholars and advocacy organisations generally recognise four main dimensions of food insecurity (FAO 2018; Barrett 2010; Bublitz et al. 2019): *availability* (i.e. adequate food supply of good quality), *accessibility* (i.e. the nutritious food choices open to person(s), given their income, prevailing prices, and formal or informal safety net arrangements), *utilization* (i.e. whether persons are able to prepare and consume a healthy diet, given the societal and individual context) and

*stability* (securing the other three dimensions on the long-term). Riches and Silvasti (2014) also stress the importance of food *sovereignty* as an essential part of food security, i.e. the ability to acquire food in socially acceptable ways.

Over time, the availability of food has largely improved in developed countries, but this has not been sufficient to ensure access to a healthy diet (Barrett 2010). *Accessibility* in this sense, depends not only on income and prices, but also on the societal and individual context and on the full set of assets available to a person (see Burchi and De Muro 2016). However, in urbanised contexts in affluent welfare states, the most important factors that determine access to healthy food are the household's financial resources, the price of food and the cost of other essential goods and services (in other areas this is often defined as 'affordability' see e.g. Vanhille et al. 2018; Haffner and Heylen 2011). Research in various developed countries has revealed that healthy, well-varied and quality food products come at a higher cost compared to energy-dense and nutrient-poor food products (Perez-Escamilla et al. 2018; Darmon and Drewnowski 2015; Pechey and Monsivais 2016; Schröder et al. 2006). The cost of healthy foods is found to be especially high in disadvantaged neighbourhoods with smaller grocery stores (Barosh et al. 2014; Horning and Fulkerson 2015). This has an important impact on the access to a healthy diet and on food choices, especially for people with a limited income (Steenhuis et al. 2011; Smed et al. 2007; Pechey and Monsivais 2016; Aggarwal et al. 2011). Given the many essential and fixed costs (e.g. housing costs) households face to fulfil their needs (See e.g. Goedemé et al. 2015b), food expenses are a relatively flexible budget category that is often cut down (Riches and Silvasti 2014; Kirkpatrick and Tarasuk 2007; Van Thielen and Storms 2013). However, there is a lack of studies that adequately measure whether people have sufficient resources to access a healthy diet and how this differs between households and across countries. In what follows, we briefly discuss the three most important indicators of food insecurity in Europe: the food deprivation measure, the subjective experience scale and indicators of food bank usage.

One of the three key indicators to measure progress in the fight against poverty and social exclusion at European level is the severe material deprivation index, with one dimension referring to food insecurity: "the inability to afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day". According to this measure, about 8% of EU (EU-28) citizens is defined as 'food deprived' (Eurostat, 2019 based on EU-SILC data for 2018). Although this gives an indication of the problem and trend of food insecurity across European welfare states (e.g. Davis and Geiger 2017; Loopstra et al. 2015), the measure does not inform policy makers whether people have access to a healthy diet (See also the more general critique of deprivation measures e.g. Bradshaw and Mayhew 2010). "[A] meal with meat, chicken, fish (or vegetarian equivalent) every second day" is a poor proxy of a healthy diet as defined in dietary recommendations across EU member states (Carrillo-Álvarez et al. 2019a), given that access to fruit, vegetables and whole grains are a more prominent problem (WHO 2014; Nikolić et al. 2014).

Another group of comparative studies (e.g. Jones 2017; Depa et al. 2018) makes use of the subjective 'Food Insecurity Experience Scale' (FIES) developed by the FAO (Ballard et al. 2014). The scale includes eight questions that focus on experiences of financial access to sufficient and adequate food. According to this measure, in Europe 16% of the population experiences mild food insecurity, while 6.3% and 3.5% is identified as moderate, respectively

severe, food insecure (Jones 2017). Both the food deprivation measure and the FIES face problems of comparability since concepts such as ‘affordability’ and ‘nutritious’, ‘enough’ or ‘healthy’ food do not have a uniform interpretation among the public, differing across economic and socio-cultural contexts (Davis and Geiger 2017). Moreover, given that these indicators do not reflect the actual resources people have and the out-of-pocket costs they need to pay to access a healthy diet, they are less useful to guide policies targeted at increasing the accessibility of a healthy diet.

A third common way of getting more insight in the level and profile of the people who are food insecure, is relying on food assistance data (Galli et al. 2018; Caraher and Cavicchi 2014). The 2018 annual report of the Federation of European Food Banks (FEBA) indicates that 9.3 Million people are supported through 421 Food Banks across 24 EU countries (FEBA 2018). Importantly, this is a rather conservative estimate since there is a large variation of food assistance initiatives operating without the support of the European Commission (Galli et al. 2018). The changing profile of food bank beneficiaries indicates that food insecurity is becoming more of a wide-spread problem across the population including single parent households, working poor and young people (Commission 2019; Gentilini 2013; Depa et al. 2018). However, data on food aid remain scarce and are generally not cross-nationally comparable. Moreover, it remains an indirect and uncomplete measure. The rising trend of food assistance across Europe can be driven by many factors which are not all related to the size of the problem, including supply-side changes (increase in policy support, food donations, number and access of food banks), and demand-side changes (e.g. increased public acceptability of food aid). Also at a single point in time, not all households that make use of food banks are necessarily food insecure and vice versa, not all food insecure households will turn to food banks, due to stigma or other coping strategies such as adhering to inadequate and unhealthy diets (Davis and Geiger 2017; Riches and Silvasti 2014; Lambie-Mumford 2019).

A useful method to assess the cost and availability of food needed to maintain a good health, is the reference budget method. Compared to the previously mentioned indicators, reference food baskets have the advantage of providing a context-specific benchmark of what people minimally need to eat healthily. Several national or local studies developed healthy food baskets to measure the cost of a healthy diet e.g. in Scotland (Dawson et al. 2008), Australia (Ward et al. 2013) and the UK (Ginn et al. 2016; O'Connell et al. 2019). However, in order to better understand food insecurity and the extent to which households have access to nutritious food, information about the households’ disposable incomes, and ideally also about their other essential costs, need to be brought into the picture. Only a very limited number of these studies (e.g. O'Connell et al. 2019; Ward et al. 2013) addressed the interrelation between the cost of a healthy food basket and the level of income, and none of them did so in a cross-nationally comparable framework, which is exactly what we aim to do in this study.

### 3 Data and method

In this section we consecutively (1) explain how we estimated the minimum cost of a healthy diet; (2) discuss the three indicators of income-related food insecurity that we use; (3) elaborate on how we implemented these indicators in representative samples of the population; (4) and explain how we estimated the level of minimum income protection in each country.

#### 3.1 *Estimating the cost of a healthy diet*

In this paper, we make use of 24 food baskets<sup>1</sup> developed in the ‘pilot project for the development of a common methodology on reference budgets in Europe’ (Goedemé et al. 2015a; Carrillo-Álvarez et al. 2019b). In this project, country teams developed food baskets that should allow people to eat a healthy diet, in accordance with the national food-based dietary guidelines. Although food-based dietary guidelines vary in quality and level of detail (Carrillo-Álvarez et al. 2019a), the national food-based dietary guidelines are science-based recommendations to promote healthy eating while taking into account the member states’ cultural and health context (EFSA NDA Panel 2010). Each country team collaborated with a nutritionist to translate the dietary guidelines into a concrete list of food items. The completeness and acceptability of the food baskets was evaluated in three focus groups in each country. All items were priced in March/April 2015 in a well-spread, accessible shop in the capital city following a standardized pricing procedure (For more information on the method, see Goedemé et al. 2015a; Carrillo-Álvarez et al. 2019b).

Reference food budgets were developed for the following set of hypothetical household types: a single-person household (male / female), a single parent household with two children and a couple with two children. The adults were assumed to be at working age (about 40 years old) and the children are a boy in primary education (about 10 years old) and a girl in secondary education (about 14 years old). Furthermore, to estimate a lower bound on the cost of a healthy diet, we assume that all household members are in good health, are well-informed about prices and have the necessary competences to purchase economically and to prepare their meals at home. The version of the food baskets that we use in this study only include food products and no other essentials, such as the kitchen equipment for storing, preparing, serving, consuming and conserving food. Similarly, food items and related products that are needed to fulfil other functions besides a healthy diet (e.g. social, or psychological functions of food), are not included for the purposes of this paper.

In comparison with the original food baskets, we restricted the food prices to the lowest prices collected in the price survey. The original food baskets were developed to allow for healthy, tasty, well varied and acceptable meals of good quality (See Goedemé et al. 2015a; Carrillo-Álvarez et al. 2019b). Therefore, in countries (AT, BE, FR, HR, HU, IT, LU, LV, MT) where all products were priced in the cheapest supermarket which might not be accessible for everyone, the total budget was increased with 5% to 10% in order to ensure more freedom of choice. Similarly, all countries followed a weighted pricing procedure to allow for more

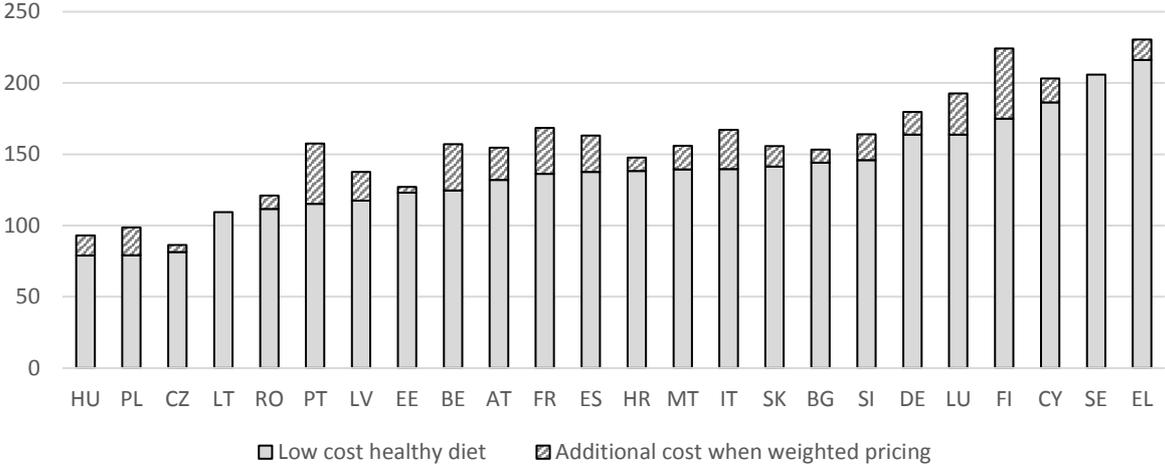
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<sup>1</sup> In the project, food baskets have been developed for 26 EU Member States. However, in this paper, we exclude Denmark and the Netherlands since they used a somewhat different method and, hence, are not fully comparable.

variation of fresh products such as vegetables, fruit, meat, fish and cheese (see Goedemé et al., 2015a). The weighted price was calculated as follows:  $5/7 \times (\text{average price of the } x \text{ cheapest products}) + 2/7 \times (\text{average price of the other products (excluding the 10\% most expensive items)})$ , with:  $x = 7$  for fruit,  $x = 14$  for vegetables, and  $x = 5$  for meat, fish and cheese. This should allow households to be able to eat on average 5 days a week a cheap meal and two days a week a more expensive dish. In case the number of available items in the shop was lower than  $x$ , an average price of all items (excl. 10% most expensive) was calculated. In order to reflect a more conservative estimation of a cross-nationally comparable minimum benchmark for adequate food intake, this paper uses food budgets without the 5% to 10% budget increase that was applied in some countries. In addition, instead of a weighted average, we took the average of the cheapest  $x$  products ( $x= 14$  for vegetables,  $x=7$  for fruits,  $x=5$  for meat, fish and cheese). The result is a more restricted low cost food budget that does not take into account the more expensive food items within a certain category. For the purpose of measuring income-related food insecurity, we want to make sure that the level of the food baskets represents a reference bottom line under which it is nearly impossible or at least very difficult to eat a healthy diet in accordance with food-based dietary guidelines.

Figure 1 shows the monthly low cost budget (expressed in EUR, see Appendix, Table 1 for exchange rates) of a healthy diet for a single person (average man and woman) following the reference budget method in 24 EU capital cities. We observe a large cross-national variation across EU Member States due to price differences, and to a lesser extent to differences in quantities due to institutional and cultural differences, reflected in the food-based dietary guidelines and expressed by opinions in focus group discussions (see Carrillo-Álvarez et al. 2019). The Figure also shows the difference with the original food baskets. For most countries, the level of the budget decreases when the weighted pricing procedure is abandoned, especially for countries who listed a large number of products to weight their minimal prices such as Belgium, Portugal, Spain, France and Finland. For Sweden and Lithuania no changes occur since their list of products was too limited to weight prices. We can also see that the overall ranking between countries changes somewhat when this non-weighted pricing procedure is adopted.

Figure 1. The ‘low cost food basket’ in comparison with the ‘original food basket’ for a single person in the capital city in 2015, expressed in EUR/month.



Note: Prices 2015. Results refer to the capital city of each country. DK and NL are not included since the pricing procedure is not fully comparable.

Source: Food baskets from EU pilot project on Reference Budgets (Carrillo-Álvarez et al. 2019b; Goedemé et al. 2015a).

### 3.2 Three measures of income-related food insecurity

We estimate three income-based indicators of food insecurity, which vary by the extent to which they take other human needs into account.

The first indicator is the most restrictive one. It simply compares people’s disposable household income to the cost of a healthy diet for that household. Persons living in a household with an income below the cost of a healthy diet are considered food insecure. Obviously, this is a very conservative estimate, as households have also other essential expenses to make. At the same time there might be some measurement error, given our focus on the bottom of the distribution (cf. Van Kerm 2007). From a substantive point of view, it is important to keep in mind that we measure income, while some people might be low on income, but have considerable savings or other assets (Burchi and De Muro 2016). Yet, there can be little doubt that for the largest share of those with an income below the cost of a healthy diet, achieving a healthy diet is as good as impossible.

Focusing just on the cost of a healthy diet risks to result in a strong underestimation of the number of people confronted with income-related food insecurity. The biggest household expenditure category in many countries is housing. Housing is a relatively fixed cost that is for obvious reasons usually prioritised by families, while food expenses are more flexible (Van Thielen and Storms 2013; Stewart and Blisard 2006). Further, at least for Canada, Kirkpatrick and Tarasuk (2007) found that high housing costs are negatively correlated with the adequacy of food spending of low income households. Therefore, the second indicator we use assesses whether disposable income after deducting housing costs (including rent, mortgage repayments, maintenance costs and utilities) exceeds the cost of a healthy diet.

Quite obviously, this is still a very restrictive measure of food insecurity, as persons also have other needs to fulfil, including clothing, health care, personal care, mobility, communication, education, etc. (cf. Doyal and Gough 1991). For a given disposable income, the higher the cost of these additional expenses, the higher the risk of being food insecure. To allow for these additional essential expenses, our third indicator of food insecurity assesses whether disposable income after housing costs exceeds twice the cost of a healthy diet. This is a very rough approximation of the cost of these other essential goods and services that are required for a decent living standard. Unfortunately, for most countries we do not know how much people have to spend to fulfil their needs. Goedemé et al. (2015b) estimated the minimum cost of accessing a broad range of essential goods and services related to housing, food, clothing, health care, personal care, rest and leisure, education, maintaining social relations and mobility in six large European cities, including Antwerp, Athens, Barcelona, Budapest, Helsinki and Milan. For these cities, the minimum cost of accessing these goods and services, excluding housing and including a healthy diet, amounted to between 2.1 and 3.6 times the minimum cost of a healthy diet, with somewhat higher rates for single-person households as compared to multi-person households. Therefore, it is safe to say that also this third indicator is still a conservative measure of the degree of income-related food insecurity. When more data become available on the cost of essential goods and services across Europe, it would be possible to fine-tune this indicator to the situation in each country.

### **3.3 Implementation in the sample**

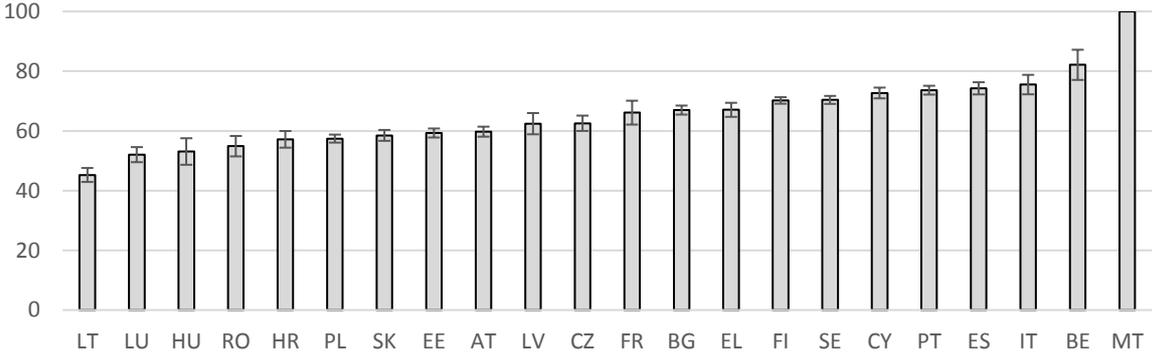
We estimate the incidence and distribution of food insecurity on the basis of EU-SILC 2016 data. The EU Statistics on Income and Living Conditions (EU-SILC) is the main source for comparative studies on income and living conditions in Europe, coordinated by Eurostat, the EU's statistical agency. EU-SILC is a yearly household survey, which contains detailed and comparable information on disposable household incomes for representative samples of the population living in private households in each country (See Atkinson et al. (2017) for an introduction to the survey data). We compute 95% confidence intervals that take account of the complex sample design that is used in most EU-SILC countries (cf. Goedemé 2013). For the purposes of this paper, we make use of EU-SILC 2016, which contains information on disposable income in 2015, the year for which we have data on the cost of a healthy diet.

To estimate the cost of a healthy diet for each household in the data, we start from the low cost food budget for a single adult (average man-woman) as presented above, and the average cost for a child between the age of 7 and 17 (as available from the food baskets). Given that young children need less food in order to be healthy, we assume that the cost of a healthy diet for children below the age of 7 is half of that for children above that age. This corresponds to the results of more detailed food basket calculations for Belgium (Storms et al. 2015), Finland (Lehtinen and Aalto 2014) and Spain (Carrillo Alvaréz et al. 2019). Disposable household income includes all potential sources of income (from wages, self-employment income, capital income, alimony, regular gifts from family or friends, social benefits, tax refunds), after deducting taxes and social security contributions, for all household members.

When estimating the number and profile of people confronted with income-related food insecurity, we restrict ourselves to densely and intermediately populated areas, and exclude rural areas (i.e. areas classified as *thinly* populated areas, defined as “grid cells outside urban

clusters”)<sup>2</sup>. This limitation is necessary because the original price survey for the cost of a healthy diet was carried out in the capital city, and in some countries prices vary considerably between regions (See Janský and Kolcunová 2017). Also, there may be more widespread practices of producing food for own consumption as well as informal exchanges of food products in rural than in urban areas. As can be observed from Figure 2, urban areas account for between 45 and 100 per cent of the population in the countries under study. In other words, the results presented below cannot simply be generalised to the entire population of each country, and the representativeness differs across countries.

Figure 2. Percentage of the population living in a densely or intermediate populated areas.



Note: 95% confidence intervals taking into account sample design (cf. Goedemé 2013). Degree of urbanisation not available for Germany and Slovenia.

Source: EU-SILC 2016, ver1, own calculations.

### 3.4 Simulating minimum income benefits

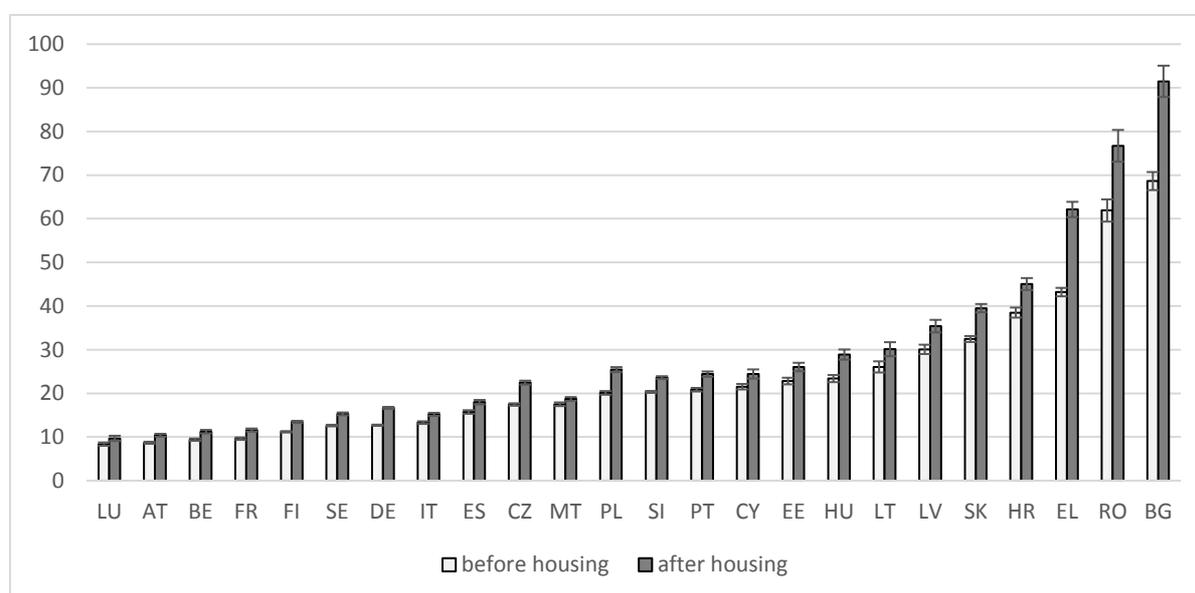
In addition, we compare the cost of the food basket with the disposable income that welfare states provide as a last safety net. To do so, we start from the household types that were used to estimate the minimum cost of a healthy diet, and simulate minimum income support with the Hypothetical Household Tool (HHoT) (Hufkens et al. 2016; Marchal et al. 2018). HHoT is a flexible tool that is part of the European tax-benefit microsimulation model EUROMOD (cf. Sutherland and Figari 2013). It allows the user to specify a large variation of hypothetical households for which the net income, given a pre-specified gross income, can be simulated. We simulate the net incomes for social assistance recipients and single earners working full-time on a minimum wage for the year 2015, taking into account social assistance benefits, and additional relevant housing benefits and child benefits (For an overview, see Marchal et al. 2018). In the case of couples, we assume that the second partner is inactive.

<sup>2</sup> In EU-SILC, densely populated areas are defined as “Contiguous grid cells of 1km<sup>2</sup> with a density of at least 1 500 inhabitants per km<sup>2</sup> and a minimum population of 50 000”, and intermediate areas as “Clusters of contiguous grid cells of 1km<sup>2</sup> with a density of at least 300 inhabitants per km<sup>2</sup> and a minimum population of 5000”. Unfortunately, for Germany and Slovenia the variable on degree of urbanisation is not available, so we include the total population.

## 4 Prevalence and profile of households with insufficient income to access a healthy diet

In Figure 3, we depict the median share of the cost of a healthy diet in the disposable household income over all individuals living in densely and intermediately populated areas. In the richer EU Member States, the cost of a healthy diet amounts to about 10 per cent of disposable income. The median share of food in total income reaches 15 per cent and more for Southern and Eastern European countries, up to about 45 per cent in Greece. Romania and Bulgaria are clear outliers, with the median share of food in net disposable income accounting for about 67 per cent in urban areas. If we subtract housing costs (as reported in the data) from disposable household income, the median share of the cost of a healthy diet increases in all countries, reaching more than 60% in Greece, Romania and Bulgaria.

Figure 3. Median of the share of the cost of a healthy diet in the total net disposable income (before and after housing costs) of individuals living densely and intermediately populated areas.

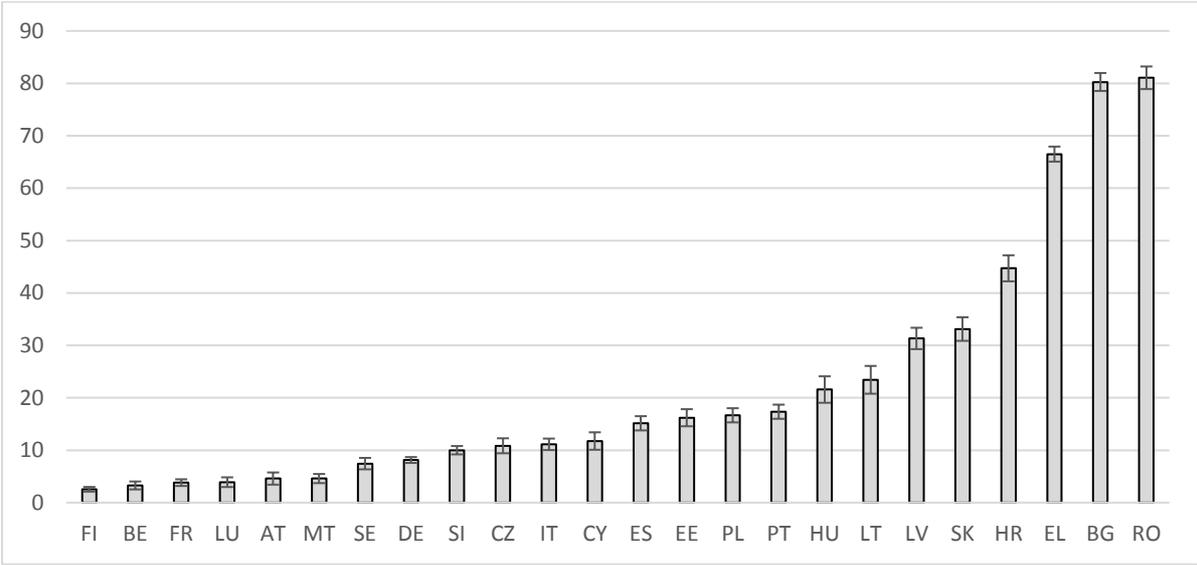


Note: 95% confidence intervals taking into account sample design.

Source: EU-SILC 2016, ver1, own calculations.

Even though this might point to financial constraints for eating healthily, it remains to be seen how the cost of a healthy diet co-varies with income and other essential expenses. This is further illustrated in Figure 4, which shows the percentage of people for whom disposable household income after deducting housing costs amounts to less than twice the cost of a healthy diet. Measured in this way, food insecurity ranges from 2.5 % in Finland to about 80% in Bulgaria and Romania (Figure 4). In 16 out of 24 countries at least 10 per cent of the population in (sub)urban areas can be considered to be confronted with food insecurity due to insufficient income. Note that the level of income-related food insecurity will be probably underestimated for single person households. Therefore, we believe it is safe to say that for a significant share of the population in many countries, food insecurity can only be solved if the overall adequacy of household income is improved.

Figure 4. Percentage of people living in a household with disposable income (after housing costs) below twice the cost of a healthy diet for their household, densely and intermediately populated areas.

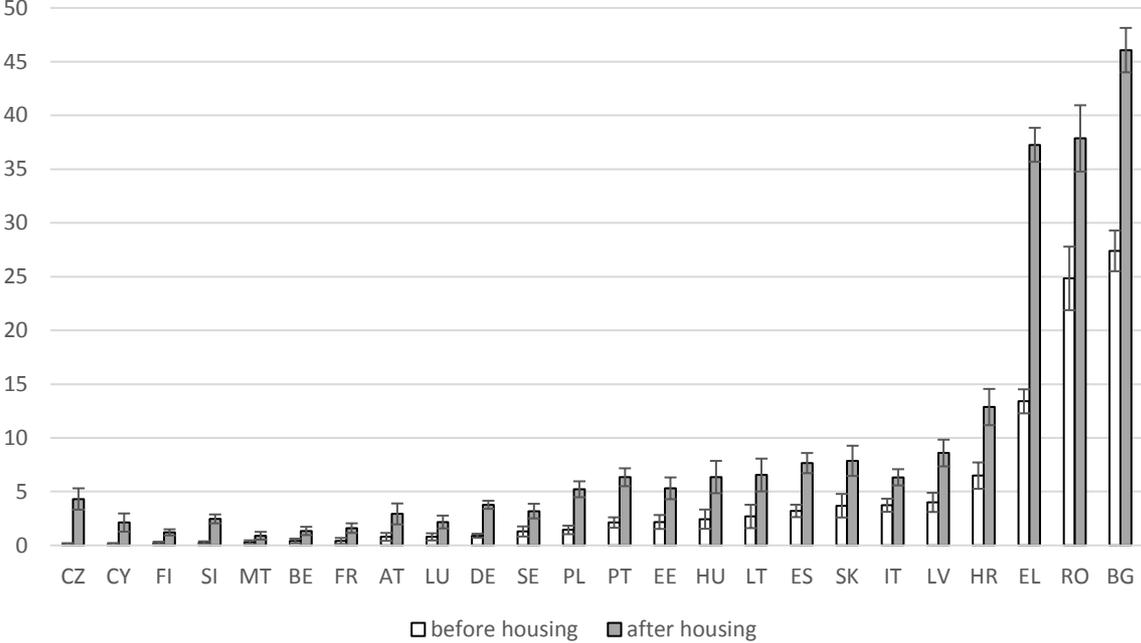


Note: 95% confidence intervals taking into account sample design.

Source: EU-SILC 2016, ver1, own calculations.

To get a better understanding of the degree of inadequacy of incomes to afford a healthy diet, in the figure below we assume that all income (after housing costs) is spent on food. Quite obviously, this results in a (rather extreme) lower bound on the number of people confronted with income-related food insecurity. We take this approach to underscore the fact that even with such a restrictive approach, it is clear that food insecurity in quite a few countries definitely is also a story of having insufficient access to economic resources. In Figure 5 we depict the percentage of people living in a household with their *total* disposable income below the cost of a healthy diet. Even in the case that the cost of a healthy diet would somewhat be over-estimated (even though we have no indication that this is the case), it is clear that in some European countries people are confronted with severe financial constraints to eat healthily. Especially in Greece, Romania and Bulgaria, the level of extreme food insecurity as defined here is high, reaching respectively 13%, 25% and 27% of the population in densely and intermediately populated areas, without taking into account housing costs. In contrast, in the richest member states, as well as some Mediterranean countries (MT and CY) and the Czech Republic very few households would have to spend their entire income on food to have access to a healthy diet. However, when looking at net income after paying for housing costs, which is often a fixed, prioritized and a large cost for households, the picture deteriorates significantly in all countries. This shows how food insecurity is affected in important respects by the cost of other essential goods and services, of which housing is in many countries (among) the most important.

Figure 5. Percentage of people living in a household with a net disposable income (before and after housing costs) below the cost of a healthy diet for their household, densely and intermediately populated areas.

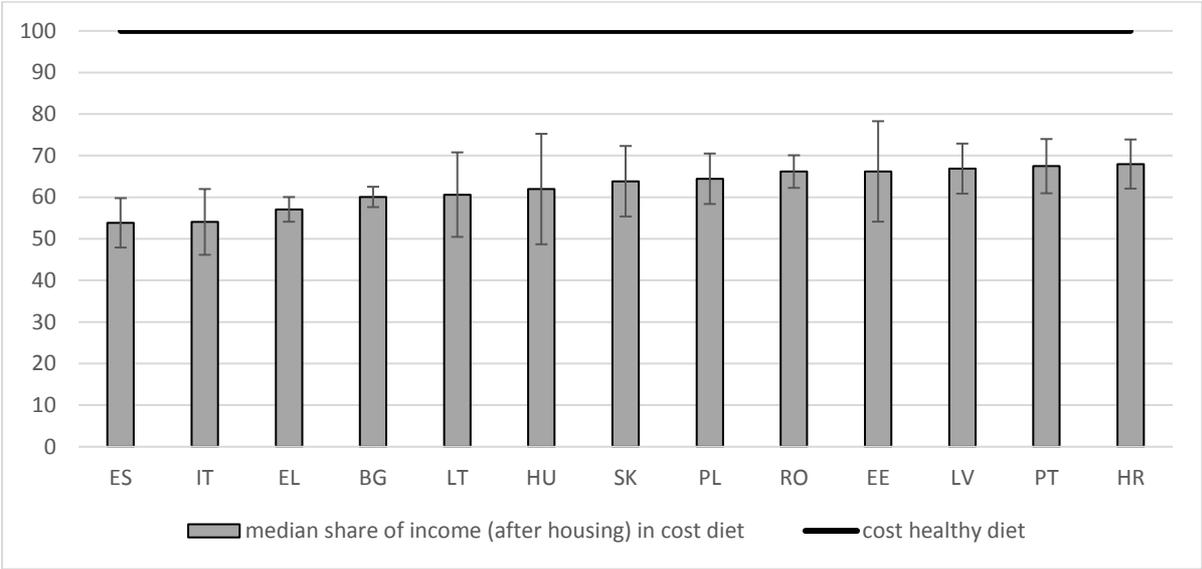


Note: 95% confidence intervals taking into account sample design.

Source: EU-SILC 2016, ver1, own calculations.

In what follows, we zoom in more closely on the latter group, namely the people living in a household with a net income (after housing costs) below the minimum cost of a healthy diet. Given data problems at the bottom of the income distribution (See Van Kerm 2007) and in order to have a sufficiently large sample, we include only the countries where the population with an income (after housing costs) below the cost of a healthy diet is higher than 5%. Figure 6 shows the median gap between the net disposable income (after housing costs) and the cost of a healthy diet for persons we have identified as food insecure. We observe that for those who have an income (after housing costs) below the cost of a healthy diet, the median income (after housing costs) reaches about 50 to 70% of the cost of a healthy diet. In other words, the gap to access a healthy diet, after paying for housing costs, is quite large (30 to 50%) for those confronted with this severe form of income-related food insecurity. It is remarkable that the gap is the largest in Spain and Italy, countries with a relatively low share of the population with an after-housing-cost income below the cost of a healthy diet.

Figure 6. Median of the share of total net disposable income (after housing costs) in the cost of a healthy diet for people with an income (after housing costs) below the cost of a healthy diet, densely and intermediately populated areas.

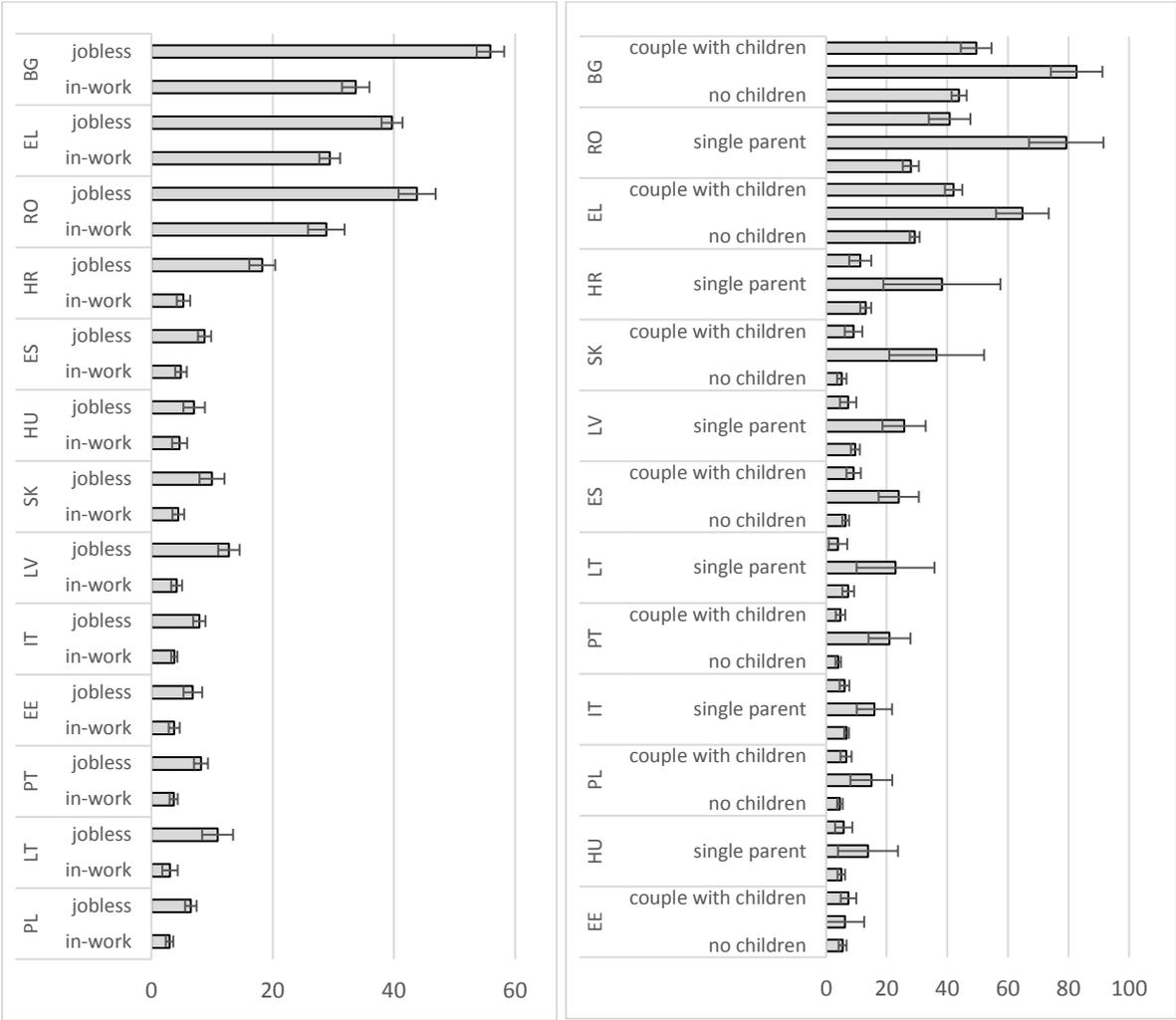


Note: Excluding countries where <5% of the population has an income (after housing costs) below the cost of a healthy diet. 95% confidence intervals taking into account sample design.

Source: EU-SILC 2016, ver1, own calculations.

In a next step, we try to assess a risk-profile of having financial constraints to access a healthy diet in Europe. First of all, in all countries crossing the 5% threshold, the left-hand figure below shows that being unemployed significantly increases the risk of lacking economic access to a healthy diet compared to people in-work. Secondly, the right-hand figure shows that families with children, and especially single parents, have a higher risk at income-related food insecurity compared to households without children. In further analysis we have found that within the group of families with children, it are particularly larger families with 3 children or more that are vulnerable. Other subgroup comparisons, not shown in the figure below, indicate that tenants generally experience more financial constraints compared to home owners and that young people (below the age of 18) generally have a higher risk compared to older people.

Figure 7. Percentage of people living in HH with a net disposable income (after housing costs) below the cost of a healthy diet, differentiated by employment status and household type, densely and intermediately populated areas.



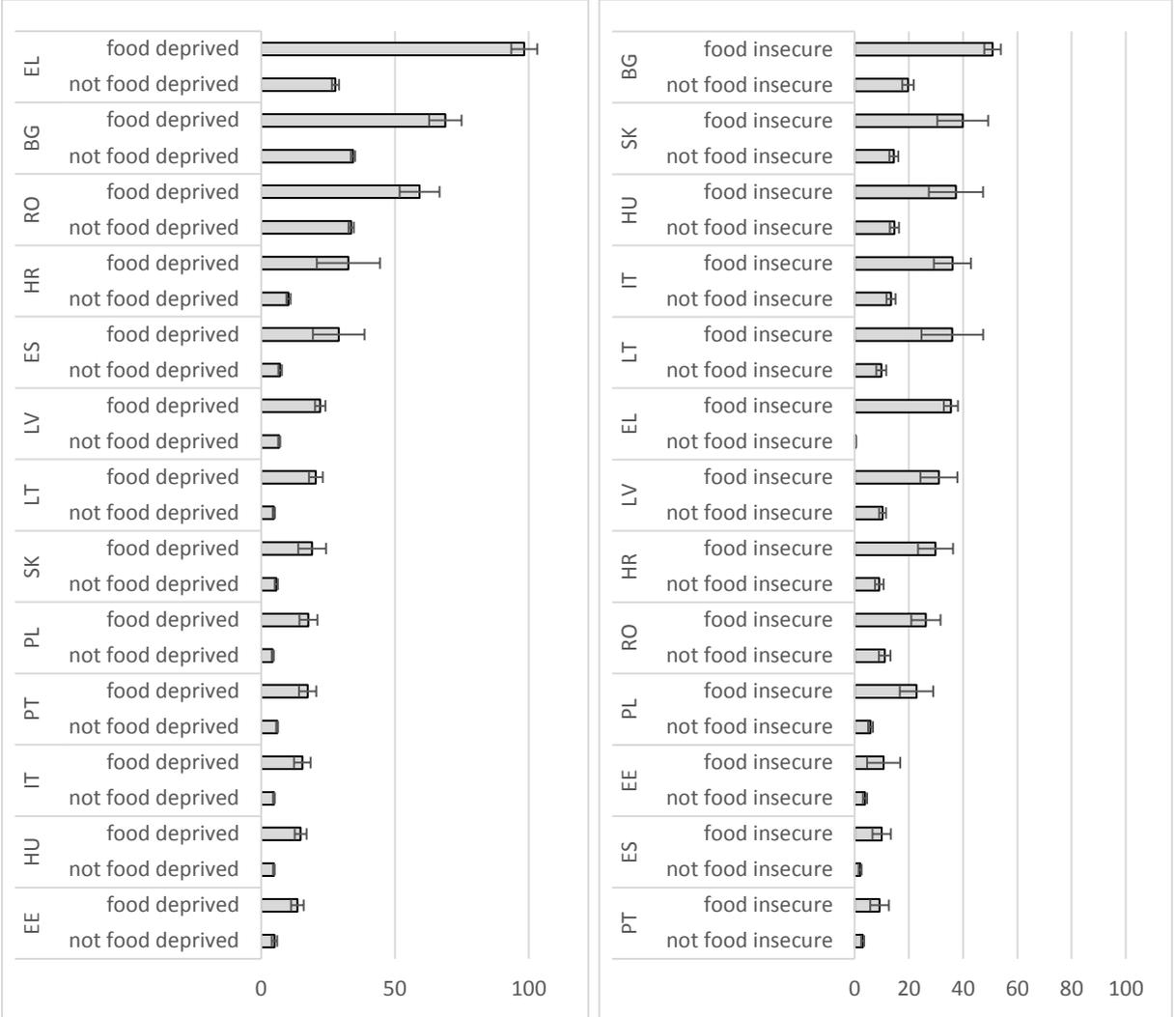
Note: Employment status is based on the self-defined current economic status (pl031), where ‘in-work’ means full or part-time employee of self-employed. Only including countries with at least 5% of the population in urban areas living in a HH with a net income (after housing) below the cost of a healthy diet. 95% confidence intervals taking into account sample design.

Source: EU-SILC 2016, ver1, own calculations.

Finally, it is interesting to see that income-related food insecurity is not fully captured by the commonly used indicator of food deprivation. Figure 8 shows, at the left hand side, the percentage of income-related food insecurity, measured as having an after-housing-cost income below the cost of a healthy diet, in the group of people identified as food deprived compared with the group who is not. Clearly, food deprivation (as stating that you cannot afford meat, fish or vegetarian alternative every second day) is correlated with income-related food insecurity. However, in several countries the deprivation indicator fails to capture a significant share of the population with an income (after housing costs) below the level of a healthy diet. This is especially the case of Romania, Bulgaria and Greece. This underlines the added-value of our approach.

In the right hand side of the figure, we depict the level of food deprivation among those that we identify as income-related food insecure or not. It shows that, having an income below the cost of a healthy diet is associated with a high incidence of food deprivation as commonly measured, relative to having an income above that threshold. Second, clearly, our indicator of income-related food insecurity also misses part of the population who feel financial constraints for assessing important food items, confirming that we estimated a lower bound on the number of people without sufficient resources to access a healthy diet.

Figure 8. Percentage food insecurity by food deprivation vs. percentage food deprivation by food insecurity, densely and intermediately populated areas.



Note: ‘food deprived’ = persons who cannot afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day, ‘food insecure’ = persons living in HH with a net disposable income (after housing costs) below the cost of a healthy diet in urban areas.

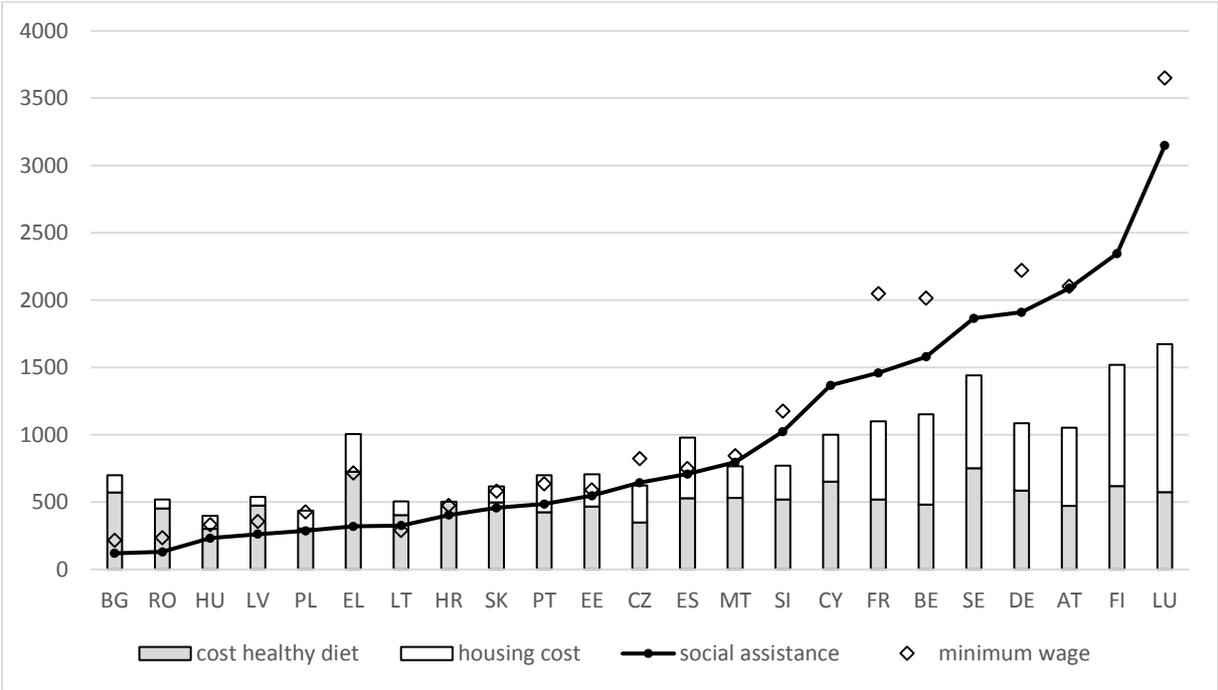
Only including countries with at least 5% of the population in urban areas living in a HH with a net income (after housing) below the cost of a healthy diet. 95% confidence intervals taking into account sample design.

Source: EU-SILC 2016, ver1, own calculations.

## 5 The lack of adequate minimum income protection

Do welfare states guarantee adequate income protection for accessing a healthy diet? To answer this question, we compare the minimum cost of a healthy diet to the level of minimum income protection in the different EU Member States. Figure 9 shows the monthly net income from social assistance or one full-time minimum wage of a couple with two children (the partner is assumed to be inactive). The net incomes are simulated taking into account all relevant benefits and taxes (Marchal et al., 2018). The vertical lower part of the bars represent the cost of a healthy diet, while the upper part of the bars illustrates the median housing cost for private tenants (HHoT-MIPI database, based on actual rent in EU-SILC). Obviously, the latter does not represent the same quality of housing across countries and the representativeness varies largely depending on the number of private tenants in each country. Nevertheless, the figure demonstrates clearly the inadequacy of minimum income protection schemes in quite a few European countries. In most Eastern and Southern member states (except CZ, SI, MT & CY), social assistance recipients have insufficient resources to access a healthy diet and rent a dwelling. Moreover, even in some wealthier member states such as France, Belgium and Sweden, the social assistance income after housing costs, is lower than twice the cost of a healthy diet (cf. indicator 3). Hence, minimum incomes will in many cases not allow to access all other essential goods and services that are needed for adequate social participation, such as health care, clothing, education, social and cultural activities and transportation. Also for couples with two children with one partner working on a minimum wage, we see that there are many Eastern European countries, as well as Greece and Spain, where the net income is not (or barely) sufficient to pay for housing and food. In sum, families on minimum income protection, including those with one partner at work, bear a high risk of having no access to a healthy diet.

Figure 9. The net income for a couple with two children (10,14y) with social assistance benefits or a full-time minimum wage, compared to their minimum cost of a healthy diet and the cost of rented housing, EUR/month



Note: Prices and incomes year 2015. Results refer to the capital city of each country. No minimum income data available for IT, no statutory minimum wage in CY, FI, SE.

Source: Food baskets from EU pilot project on Reference budgets (Goedemé et al., 2015; Carrillo-Álvarez et al., 2018); Simulated net minimum incomes and median housing costs for private tenants from the MIPI-HHoT database (Euromod). The median housing costs for private tenants are based on actual rent in EU-SILC. For Bulgaria, Lithuania and Romania median housing costs for the whole population were used due to few observations (Marchal et al. 2018).

## 6 Discussion and conclusion

In European welfare states, many people face financial constraints to access essential goods and services, including access to a healthy diet. Nevertheless, food insecurity is insufficiently recognised as a structural phenomenon, embedded in the broader picture of poverty and inequality. Common policy responses include providing information to facilitate more healthy food choices, financial incentives through health-related food taxes, as well as direct food assistance. In contrast, with this article we try to show that food insecurity is to an important extent an issue of inadequate income.

The paper relies on cross-nationally comparable food baskets that represent a healthy diet in accordance with national food-based dietary guidelines for 24 European capital cities. We estimate three indicators of income-related food insecurity: (1) having a disposable income after housing costs that is less than twice the cost of a healthy diet, taking account of the cost of other essential expenses; (2) having a disposable income after housing costs that is less than the cost of a healthy diet; (3) having a disposable income (without deducting housing costs) below the cost of a healthy diet. By making use of representative household surveys

(EU-SILC), we estimate the percentage of people confronted with income-related food insecurity in densely and intermediately populated areas. This rather conservative estimation indicates that financial constraints for accessing a healthy diet are not distributed equally across the Europe. Especially in the poorer countries, and in particular in Bulgaria and Romania, inadequate incomes seem to be an important reason for high levels of food insecurity. In a wider group of countries, people at the bottom of the income distribution are confronted with severe budget constraints for obtaining a healthy diet. Unemployed persons, single parents, families with three children or more, young people, and tenants seem to experience generally a higher risk of having no economic access to a healthy diet. In the majority of EU member states, minimum income protection is highly inadequate and fails to secure access to a healthy diet and other essential needs. Further, our study also shows that food insecurity cannot be separated from the affordability of other essential goods and services, in particular adequate housing.

There are several limitations to this study. First of all, the estimations of the cost of food are done for a limited number of household types, living in urban areas. Hence, the results cannot easily be generalised to the population as a whole. To allocate a more precise food budget to all households in the survey, the cost of a healthy diet should ideally be calculated for households with small children, students and elderly as well. Since the food baskets are priced in the capital cities, we do not take into account the large variation in food prices, purchasing patterns and (home) food production within countries. Because of potentially large differences between urban and rural areas in some countries, thinly populated areas are excluded from the analysis. Secondly, the study measures food insecurity at one point in time, while food prices and incomes might fluctuate frequently. For future research, a longitudinal study would be beneficial to understand changes in income-related food insecurity over time. Thirdly, national food-based dietary guidelines represent only one ‘official’ way of healthy eating, which should not be seen as prescriptive and often deviates from actual daily-life consumption patterns. Moreover, the quality of the guidelines differs across countries (Carrillo-Álvarez et al. 2019a; EFSA Panel 2010). Nevertheless, they offer a useful starting point and can be seen as an important policy tool for influencing providers and consumers. Fourthly, this paper only focuses on the cost of a healthy diet, while not taking into account the cost of kitchen equipment to conserve, prepare and consume the food. Furthermore, food is not only about being in a good health but it is also an important part of social and cultural life (e.g. Ginn et al. 2016; O’Connell et al. 2019). A more generous food insecurity measure could take that on board. Fifth, we take other essential needs into account in a rather crude way. While this results in a conservative estimation of food insecurity, with more data on the cost of essential goods and services across Europe it would be possible to considerably fine-tune this indicator to the local situation in each country.

Finally, although economic access to a healthy diet is crucial, it is not sufficient to avoid food insecurity (Barrett 2010; Burchi and De Muro 2016). Resources should be used properly, depending on the socio-cultural acceptability of the food, the individual capacities and the societal circumstances. As part of the project in which we estimated the minimum cost of a healthy diet (Goedemé et al. 2015a), we co-organised two to three focus group discussions (FGs) in each Member State. In these focus groups, citizens with varying socio-economic status reflected critically on the acceptability of the food baskets and the underlying assumptions. In order to construct a minimal budget that should enable people to eat healthily,

we made the assumption that (1) people have the capacity to cook daily healthy meals, and, (2) people are able to shop economically, meaning that they are well-informed about prices and that the cheapest retailers are accessible to them. Although the content of the food basket was generally accepted, focus groups in all countries argued that preparing healthy food and shopping economically is not always feasible due to constraints such as a lack of time and energy. This accounts especially for full-time working parents and single parent families. Several other studies have emphasized that, in particular for vulnerable groups, dietary guidelines are not always easy to interpret, there is a lack of comprehensive information and not everyone has sufficient skills, time and energy to prepare healthy meals (Welch et al. 2008; Roberto et al. 2015; Tiwari et al. 2017). The focus group participants argued that a good kitchen equipment (freezer, microwave,...) to work with left-overs, healthy lunches at school or work and supportive family members can increase the feasibility to cook on a regular basis. Similarly, studies have argued that the social environment, including parents, schools, the work environment and the media, can have a mediating effect on creating a context where healthy eating is stimulated and supported (Vereecken et al. 2005; Ball et al. 2005; Brambila-Macias et al. 2011). As written by other scholars (Doyal and Gough 1991; Sen 1981; Burchi and De Muro 2016), if the necessary individual and societal preconditions are not realized, additional policy efforts will be needed in order to ensure food security.

A potential danger of studying food insecurity is that it is perceived as being isolated from the problem of poverty and inequality, and their structural determinants. Obviously, a lack of access to nutritious food is only one dimension of the multi-faceted problem of poverty. With this paper, we hope to have shown that a more healthy population, and a healthy diet for all, can only be realised if food policies are embedded in economic and social policies that address the structural inadequacy of income and the cost of other essential goods and services (such as housing) that many households face. In other words, although providing better information on the health effects of food and financial incentives to help people make healthier choices are important, their impact will always be limited by the severe financial constraints that some people face. Also, the trend towards providing more food assistance through food banks (Greiss et al. 2019) is unlikely to address the scale of income-related food insecurity that we identified in this paper. While food banks may help to increase access to food for some households, it does not solve the underlying more structural cause of food insecurity which, for many households, is a lack of adequate income.

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## Appendix

Table 1. Exchange rates used to convert the food budgets expressed in their national currency to Euro

BG	1 EURO	1,96	BGN
CZ	1 EURO	27,1	CZK
DK	1 EURO	7,46	DKK
HR	1 EURO	7,65	HRK
HU	1 EURO	308	HUF
PL	1 EURO	4,13	PLN
RO	1 EURO	4,43	RON
SE	1 EURO	9,3	SEK