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Opinion

Changing Agricultural Systems and Food Diets to Prevent and Mitigate Global Health Shocks

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Abstract: No one would dispute that agricultural systems and food diets are not sustainable from an environmental and health point of view, and that increasing their sustainability must be a major objective of farm and food policies. Simultaneously, climatic, environmental, and health shocks are likely to increase in the coming years. This note defends the idea of an additional double benefit of public policies, aiming at favoring environmentally friendly food systems and healthy diets through two channels: by reducing the risks of developing shocks and by limiting their negative impacts on populations when they occur. As a result, public policies should address, simultaneously and consistently, supply and demand issues. This is illustrated in the case of the European Union. Supply measures should favor the agro-ecological transition of agricultural systems through a more rigorous application of the polluter pays principle, implying notably the taxation of the main determinants of agricultural greenhouse gas emissions (cattle heads and nitrogen fertilizers) and biodiversity loss (mineral fertilizers, synthetic pesticides, and antibiotic treatments). This would send the right signals to farmers and would legitimize an extended use of the provider gets principle, allowing the remuneration of positive externalities. Demand measures should favor the adoption of healthier and environmentally friendly food diets by changing consumer behaviors through dietary recommendations, information campaigns, nutritional labeling, and fiscal instruments.

Keywords: COVID-19; health shock; biodiversity; climate change; nutrition; food systems; European Union; common agricultural policy; green deal

1. Introduction

Several holistic and interdisciplinary approaches have been proposed to promote the underlying assumption of humans and animals sharing the same environmental and health challenges. The One Health concept puts forward the fact that human health and animal health are interdependent and bound to the health of ecosystems [1]. It aims at improving health and well-being through the prevention of risks that originate at the interface between humans, animals, and their environments. The EcoHealth concept involves the health of humans, animals, and ecosystems, including biodiversity. It relies on the assumption that health and well-being cannot be sustained in a resource-depleted, polluted, and socially unstable planet [2]. The Planetary Health concept focuses on mitigating and responding to threats to human health, equity, and well-being through judicious attention to the

human and the natural systems that define the safe environmental limits, within which humanity can flourish [3].

Beyond their differences [4], the common feature of the three concepts is to put forward the need to develop holistic approaches aiming at understanding risks for ecosystem, animal (domestic and wildlife), and human health as a whole [5]. The COVID-19 crisis illustrates the relevance of this approach. Indeed, interactions between these three components have had impacts on the diffusion of the pathogen and its spillover to humans [6,7], leading to serious health, social, and economic consequences worldwide.

Similar crises are likely to multiply in the coming years as the degradation of ecosystem health, coupled with the globalization of economies and climate change, increases the risks of epidemics and their evolution into pandemics [8]. Avoiding such crises is, thus, a crucial issue that raises questions for tracking, detection, control, and intervention systems. It is just as important to understand the mechanisms of emergence and diffusion of diseases, and to identify and implement solutions aiming at preventing the transmission of pathogens, mitigating health consequences, and minimizing the economic and social impacts of epidemics or measures adopted to address them.

In that perspective, there is an urgent need to adopt integrated visions of health and environmental dimensions, and to better link the corresponding public policies, generally considered and implemented separately. In particular, it is required to rethink, in a consistent way, agricultural and food policies, as they are clearly at the interface of environment and health.

Renewed farm and food policies that would reduce negative climatic and environmental impacts of food systems and promote environmentally friendly and healthy diets would be beneficial by themselves, that is, from a climatic, environmental, and health point of view. They could induce two additional benefits depicted in Figure 1. By improving the environmental health of ecosystems, notably regarding biodiversity, they could reduce the risk of epidemics and global health shocks (left side in Figure 1). By favoring the adoption of healthier food consumption patterns and diets, they could reduce the prevalence of chronic diseases, improve population health, and ultimately, make people more resilient to global health shocks (right side in Figure 1).

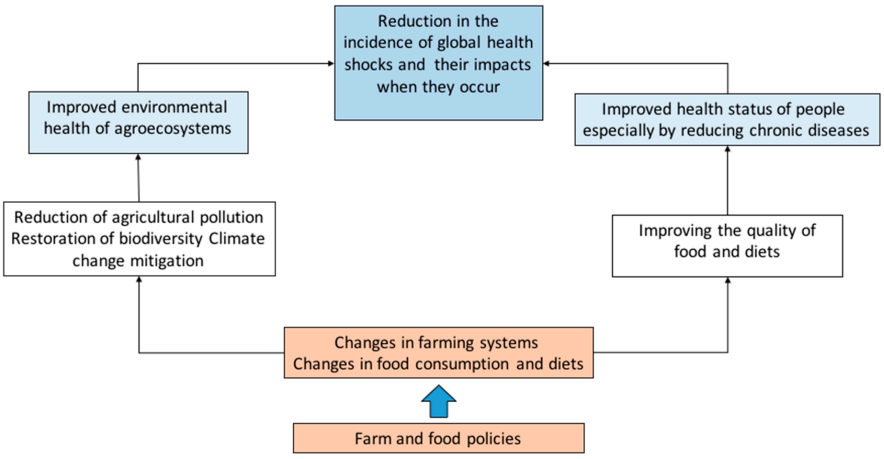

Figure 1. An integrated framework linking farm and food policies and global health shocks.

The goal of this paper is to propose a consistent set of policy tools for agricultural systems and food diets aiming at reducing the risk and the impacts of epidemics and global health shocks, using the COVID-19 pandemic in the EU as a case study. In Section 2, we first recall the links between agricultural practices, ecosystem health, and the risks of zoonotic diseases; we then focus on policy measures that should be implemented for promoting the agro-ecologic transition of farming practices and systems. In Section 3, we show why an improved health status of populations decreases the health impacts of epidemics; we then describe a set of measures aiming at changing food patterns and diets.

Overall, we argue that measures targeting supply and demand have to be defined simultaneously and consistently in order to increase their efficiency for both environmental and public health considerations. In the context of the EU, supply measure changes should mainly concern the Common Agricultural Policy (CAP), once again under review since June 2018. Regarding demand measures, nutritional policies, today set by each Member State (MS), should be reinforced and coordinated at the EU level. The Green Deal initiative launched by the new European Commission (EC) presidency in December 2019 is an opportunity to seize in that perspective [9].

2. Reducing the Likelihood of Global Health Shocks by Changing Farming Systems

The frequency of zoonoses has sharply increased over the past 25 years [10]. Among all the explanatory factors, the decline in biodiversity as a result of human activity is frequently highlighted. The loss of natural habitats pushes wild animals to seek feed resources closer to humans, increasing the risks of pathogen transmission to domestic animals and humans. Over the last century, tropical forests, in which around two-thirds of living organisms find habitat and feed, have been halved. Changes in land use and farming practices would explain more than 40% of new zoonotic diseases that are not restricted to tropical or subtropical regions [11].

Although scientists stress the complexity of climate change impacts on epidemics, climate change is likely to increase the risks of proliferation and propagation of infectious diseases that are highly dependent on temperature and humidity levels [12]. One can fear an extension towards Europe of pathogens from other latitudes.

2.1. Negative Impacts of Farming Systems

In the EU, as in other regions of the planet, changes in agricultural practices and systems since the end of World War II have been a major source of biodiversity loss and greenhouse gas emissions (GHGE). The simplification and specialization of agricultural systems, induced by plant and cattle breeding, irrigation, mechanization, and the massive use of chemical inputs (mineral fertilizers, synthetic pesticides, veterinary medicaments) and promoted by public policies, have provided a way of increasing production levels but at the cost of degraded quality of soil, water, and air, and biodiversity loss in agricultural ecosystems and natural surroundings [13–15]. These adverse effects have been worsened by an increasing homogenization of agricultural landscapes, with reduced habitats favorable to fauna and flora (hedges, wetlands...).

Many figures can be featured to illustrate the climatic and environmental degradation of agro-ecosystems in the EU. A large part of the decline in European birds has been attributed to decreases in the number of farmland birds (−20% in one generation) induced by agricultural intensification [16]. Biodiversity loss has also reflected in the decline of all flying insects, including in protected areas which have experienced a loss of more than 75 percent over slightly more than a quarter century [17]. The IUCN European Red List of Bees [18] reveals that over 9% of European bee species are facing extinction. Equally worrying are the negative impacts on the air, water, and soil compartments. Agricultural GHGE—around 10% of total EU emissions—have declined during several years, but are, again, on a slightly increasing trend over the most recent years: +4% between 2013 and 2017 [19,20]. In 2019, only 40% of surface water achieved good chemical status (good or more). Pressures exerted by irrigation on water resources are very significant in the south of the EU and, depending on the year, in a much larger number of MS in summer [21]. Soil erosion affects about 13% of EU arable land, more importantly in southern MS [21]. In addition, European feed and food systems have negative climatic and environmental impacts outside the continent, being notably responsible for part of global deforestation through imports of meat, soya, and maize for animal feed, palm oil, cocoa... [22].

Agronomic, zootechnical, biological, and technical solutions to reduce the negative impacts of European agriculture on biodiversity and climate do exist. These solutions are today well documented. They involve significant reductions in the use of fossil energy, water and chemical inputs, greater diversity of cropping systems, new associations between plant and livestock productions, and the

reintroduction of natural and semi-natural elements in agricultural landscapes; in other words, they require an agro-ecological transition [23]. These solutions remain too little implemented for a large part because command and control policy instruments are not sufficiently constraining and incentive measures are too modest [24,25].

2.2. Climate and Environment in the CAP

Climatic and environmental issues of agriculture in the EU are essentially addressed at the European level within the CAP. The current policy includes command and control measures through cross-compliance and greening in the so-called first pillar of the CAP totally funded by the EU budget. Cross-compliance makes farm income support direct aids (about 40 billion euros per year) conditional on the respect of minimal sanitary and environmental requirements, as well as a range of obligations corresponding to Good Agricultural and Environmental Conditions (GAEC). Greening makes 30% of direct aids conditional in respect of three additional requirements aiming at diversifying cropping systems, maintaining permanent grassland at the regional or national level, and dedicating 5% of arable land to areas beneficial for biodiversity (trees, hedges, wetlands . . .). Requirements are too weak to generate significant climatic and environmental benefits [14,15,26,27].

Subsidies are granted through Agro-Environmental and Climatic Measures (AECM) that take the form of voluntary multiannual contracts with compensation for additional costs or income forgone linked to the adoption of more environmentally friendly farming practices or systems. As a tool of the second pillar of the CAP, AECM are co-funded by national and regional public authorities. Their environmental efficiency is greater but limited by several drawbacks [28]. With a modest budget of less than five billion euros per year, they are optional for farmers so that they cover only 25% of European agricultural area; public and private transaction costs are high; targets are numerous but potentially conflicting; windfall effects are frequent; etc. In addition, the CAP supports organic farming and grants additional aids to farms located in Areas under Natural Constraints (ANC), mainly for economic reasons but with positive environmental benefits as these areas contribute to maintain open landscapes and the associated biodiversity.

A reform of the CAP is again on the agenda. The June 2018 EC proposals for the future CAP include three main changes [29]. (These proposals were expected to come into force on January 1, 2020. This will not be the case, implying a transitional period at least two years.) A new delivery model for the CAP is proposed, relying on increased subsidiarity left to MS in order to better adapt measures and expenditure to national and regional priorities. Greening requirements are integrated into cross-compliance, renamed conditionality. A new climatic and environmental tool, the so-called eco-scheme, targets climatic and environmental objectives that go beyond conditionality and complement AECM. Like the latter, the eco-scheme would be voluntary for farmers to enter into and compulsory for MS but without any minimum spending requirement. Unlike AECM, eco-scheme annual payments would be totally funded by the EU budget as a tool of the first pillar, and possibly not limited to the compensation of additional costs, which opens the door to payments for environmental services.

These proposals offer opportunities to enhance climatic, environmental, and health benefits of the CAP on the condition of making conditionality constraints more binding, and AECM and eco-scheme incentives really ambitious and more robust. In that perspective, recent agricultural and environmental economic research provides helpful guidelines and insights for designing and implementing required changes in CAP measures.

2.3. Towards More Ambitious and More Efficient Climatic and Environmental Measures

In accordance with lessons of environmental federalism [30], the eco-scheme totally funded by the EU should primarily target global public goods, that is, climate mitigation and biodiversity preservation, while co-financed AECM should prioritize local public goods such as soil preservation, water quality or open landscapes. The new delivery model of the CAP would offer large room for

maneuver to MS for eco-scheme design and implementation. The underlying assumption is that leaving more freedom to MS would increase the efficiency of measures which would be better adapted to local needs. This is relevant for local public goods with greater support of local populations. This is much less relevant for global public goods, with a real risk of not sufficiently including them in national eco-schemes. A simple way to address this problem would be to set constraining quantitative targets for agricultural GHGE reduction and biodiversity restoration for each MS in accordance with EU objectives, and to leave each MS free to choose the most efficient instruments to be used to meet the targets. This is the intention of the Green Deal, notably of the EU Biodiversity Strategy for 2030 [31] and the Farm to Fork Strategy [32]. This intention needs to be reflected in the CAP budget and instruments.

A first-rank policy would require a more rigorous application of the Polluter Pays Principle (PPP). This could be done through the taxation of the main determinants of agricultural GHGE (nitrogen fertilizers and cattle heads) and biodiversity loss (mineral fertilizers, synthetic pesticides, veterinary products). This would send the right price signals to farmers. Since climate and biodiversity are global public goods, taxes should be designed and implemented at the EU level, notably to avoid unfair competition among MS. However, taxation policies are the sovereign prerogatives of MS. It is very likely that it will be very difficult to obtain a political agreement on such a taxation scheme at the EU level. Fortunately, the same climatic and environmental outcome could be achieved by considerably reinforcing conditionality requirements, removing national dispositions that tend to make them very poorly efficient, and making penalties for non-compliance really dissuasive. Furthermore, a stricter application of the PPP would enhance the legitimacy and acceptability of a more ambitious implementation of its counterpart, the Provider Gets Principle (PGP) which underlines both the eco-scheme and AECM.

In order to cover the whole European agricultural area, eco-scheme measures should aim at favoring permanent grassland without ploughing, an ambitious diversity of annual crops accompanied by an obligation to cover soils during at least 330 days, and the dedication of at least 10% of total agricultural land to areas beneficial for biodiversity. Minimal requirements in these three domains would be set by conditionality and farmers would be remunerated for additional efforts. Payments would no longer be limited to the compensation of additional costs or profits foregone. In a shift from an obligation of means (practices) to an obligation of results (impacts), payments would be proportionate to climatic and environmental benefits. As a result, they would increase with the age and the species' richness of permanent grassland, with the number of crops in cropping systems and the length of soil cover, and with the percentage of land devoted to areas beneficial for biodiversity; this because climatic and environmental benefits increase with these properties (See [33,34] for permanent grassland; [15] for crop diversity and [35] for land cover; and [36] for ecological focus areas.) In addition, this shift towards an obligation of results would make it possible to implement payments for climatic and environmental services funded not only by taxpayers but also, partially or totally, by intermediate and final users. It would also open the door for an increased application of green finance in agriculture [37].

It is very difficult to provide a robust quantitative assessment of the previous proposals because of the many uncertainties and numerous gaps in the data and models available for analyzing the consequences of policy changes on all sustainability dimensions. From different assessments of scenarios that, however, do not match strictly with our proposals, a clear trade-off emerges between environmental and economic targets, at least in the short term, without taking into account effects on productivity gains that are highly uncertain. By contrast, the negative link between productivity in agriculture and pollution levels has been recognized and described [38]. Stricter conditionality requirements would enhance the climatic and environmental performance of the CAP and European agriculture, but at an economic cost for farmers and food processors, notably in the arable crop sector, with a significant decline in area and income, and a deterioration of the EU trade balance [39].

In the same way, taxes on mineral fertilizers or synthetic pesticides should be set at very high levels to generate significant environmental and climatic benefits [40]. In addition, the positive effects of reduced GHGE and improved biodiversity in the EU can be partly offset by emissions and biodiversity

leakages to other parts of the world, if production decreases in the EU are replaced by less virtuous imports. This has two practical consequences.

Firstly, our proposals would very likely undermine the revenue of many farms whose income is heavily dependent on CAP support, notably decoupled and coupled direct aids that would be considerably reduced to finance both the eco-scheme and AECM for about 50% of CAP expenditure. As a consequence, implementation can only be gradual, the important point being to set the duration of the transition period with intermediate success indicators. Risk-taking would be encouraged through the granting of a risk premium to any farmer firmly committed to the agro-ecological transition, along the lines of a premium paid to farmers in conversion towards organic farming. If our proposals were implemented through taxes, the product of the latter should be maintained in the agricultural sector, for example, through a bonus–malus scheme encouraging "virtuous" farmers and penalizing the "less virtuous". Finally, the alignment of EU trade agreements with the same climatic and environmental requirements would complete the system in order to ensure no unfair competition from third countries. Ultimately, microeconomic and macroeconomic impacts of our proposals should be assessed through modelling exercises. Such analysis would take into account policy measures aiming at changing food diets that are discussed in the following section.

The second consequence is indeed that action on the demand side is required simultaneously. As pointed out by Poore and Nemecek [41], changes in agricultural practices are unlikely to be sufficient to reach ambitious climatic and environmental targets. Changes in food consumption and diets are required. Dietary recommendations for consumers are now provided in many countries, mainly to address public health issues related to overweight and obesity and the prevention of several chronic diseases (type 2 diabetes, cardiovascular diseases, some cancers . . .). Sustainable issues are also being taken more fully into account in designing dietary recommendations.

3. Reducing the Impacts of Global Health Shocks by Changing Diets and Food Consumption Practices

The COVID-19 crisis reveals the extent to which a good health status of people is a factor of resilience in the face of pandemics. Indeed, the primary victims of the COVID-19 are the most fragile people, first of all, the elderly but also people with co-morbidities, in particular related to overweight and obesity, diabetes, and hypertension, partly due to unhealthy eating behaviors and more frequent in the most disadvantaged populations [42,43]. Zabetakis et al. [44] described how nutritional status, diets, and lifestyle affect patient outcomes and may play a role in COVID-19 infection. They showed, in particular, the importance of nutrition as a mitigation strategy to support immune function, identifying food groups and key nutrients of importance that may affect the outcomes of respiratory infection. The underlying mechanism relates to systematic inflammation that might favor the development of Non-Communicable Diseases (NCD) as well as exacerbate COVID-19 infection (on the role of inflammation as a cause of chronic diseases, see [45]).

This relationship between nutrition and such infectious diseases shows that acting on the food system and notably, on the quality of diets is a lever for improving the health status of populations for a double dividend, preventing chronic diseases and reducing health impacts of crises of infectious origin when they occur. The adoption of healthier diets is, then, an important challenge for the EU.

3.1. Public Policy Instruments for Healthier Food Diets

Many European countries have implemented nutritional policies to reduce health risks associated with high calorie and unbalanced diets. These policies did not yet permit the curbing of the epidemic of overweight and obesity. Prospects are pessimistic if more effective interventions are not implemented (Table 1). There is, thus, place for action at the EU level to make health and nutritional policies more effective and coherent, and doing so to increase the resilience of populations to global health shocks.

Table 1. Observed and future trends in obesity in different European countries.

Country	Prevalence of Obesity in 2014 [1] (%)	Prevalence of Obesity by 2025 [2] (%)
Estonia	19.7	34
Finland	17.8	20
France	14.7	24
Germany	16.4	19
Greece	16.0	40
Ireland	18.2	43
Italy	10.5	13
Lithuania	16.6	24
Netherland	12.9	14
Sweden	13.4	17

[1] Observed prevalence (Source: Eurostat data [46]).[2] Forecasting future trends in obesity (Source: [47]).

Several policy tools can be used to improve the nutritional quality of diets. Until now, most nutritional policies have sought to better inform consumers on health benefits of more balanced diets in the form of dietary recommendations, information campaigns, and/or nutritional labeling.

Dietary recommendations and food-based dietary guidelines have been published in many countries [48] and are provided to consumers by national food safety and public health agencies. On this basis, information campaigns are periodically launched and disseminated through various media channels. The most well-known example is the "five-a-day" recommendation aiming at encouraging the consumption of fruits and vegetables. Ex-post evaluations of these information campaigns tend to show that they have positive but small impacts on fruit and vegetable consumption [49].

Dietary recommendations can be included in school programs, as establishing healthy dietary practices at an early age may be crucial. Indeed, knowledge transferred at school can be an important link in shaping the attitudes and eating habits of young people and future adults. Reviews of interventions at school show that multicomponent approaches that are adapted to age and of adequate duration, that engage parents, and that ensure fidelity and proper alignment between the stated objectives, the intervention, and the desired outcomes, are likely to succeed [50]. In particular, school meals provide valuable opportunities for nutrition education.

By providing information on food products to consumers, labeling policies aim also at influencing consumer behavior and food choices. However, informative labels that only mention the nutritional composition of food products have weak impacts [51,52]. This finding is related to difficulties for consumers in interpreting the information on labels, to limited time to process information in-store, and to complex trade-offs between price, taste, and health concerns. To strengthen the impact of product labeling, health agencies have suggested that labels should not only inform consumers about product quality, but also influence more strongly their choices by ranking products and providing explicit information about consequences for consumer health. Some countries have implemented such "prescriptive" labels to raise awareness of nutritional issues by using front-of-pack logos (e.g., traffic lights on food products in the United Kingdom (UK)). Such labels appear to be more effective if modifying consumers' food choices, as they exploit the salient effect of simple and colored logos to capture their attention [53]. Their adoption at the EU level is clearly an important challenge to address in the next years.

Besides information-based policies, public health agencies are now considering other policies to modify the market environment and facilitate healthier food choices, even for consumers who are not sensitive to health dimensions or for consumers not fully informed about the links between food consumption and health [54]. Decreasing the salt, sugar or fat content in foods are good examples of food composition changes being made to address health-related issues. Such product reformulation policies aiming at decreasing the food product content in "bad" nutrients have been implemented in some countries. For now, they are mainly based on voluntary commitments by firms [55]. The modest

impacts of such actions suggest that more coercive initiatives, based, for instance, on nutrition-related food standards and designed at the European level, would be required to reach more ambitious targets.

Another type of policy targeting changes in the market environment is related to food prices. Except for sugary drinks, so-called "fat taxes" designed to limit the consumption of "bad" products have not yet been used to a large extent in European countries. The health economic literature has dealt with such fiscal policies based on nutritional taxes, and analyzed their potential impacts on the consumption of soft drinks and sugar-sweetened beverages [56] or fat products [57]. Overall, these studies show that such tax policies affect consumers' purchases in the right direction by improving the nutritional quality of diets. On average, the effects can be positive, but they may be budgetary regressive for low-income people that buy proportionally more taxed products. This is no more the case when health benefits are included in the evaluation.

The prevalence of obesity and chronic diseases is negatively correlated with income. As a consequence, the health impact of the COVID-19 crisis has been much more important for disadvantaged social groups. An option to improve dietary choices among low-income households is to provide them vouchers that can only be spent on specific healthy foods, such as fruit and vegetables. Griffith et al. [58] showed that in the UK, such a policy has enabled increases in fruit and vegetable purchases and improvement in the quality of diets. To be efficient, the amount of the voucher should be sufficiently high, as both the theory and results from the UK study suggest that the impact of targeted vouchers is larger for "distorted" consumers (those for whom the voucher is larger than the initial expenditure in healthy foods) than for infra-marginal consumers (the others).

3.2. Public Policy Instruments for More Environmentally Friendly and Healthier Food Diets

Sustainable issues are also being taken more fully into account in designing dietary recommendations. Indeed, it is now well-established that western diets with high consumption of animal products generate larger GHGE, as well as nitrogen and phosphorous applications, and require more resources (land, water, energy) than plant-based diets [59]. It turns out that favoring diet changes by consumers is a crucial challenge to improve both the health status of populations (right side in Figure 1) and the environmental impact of food systems (left side in Figure 1).

In that perspective, a key issue is to determine which diet changes can simultaneously benefit public health and the environment, and which policy instruments may promote their adoption by consumers. The difficulty is that nutritionally adequate diets are not systematically environmentally friendly diets [60]. For example, some energy dense products, such as sugary products, have a low greenhouse gas content but are of poor nutritional quality. Nevertheless, it is possible to design diets that are both nutritionally adequate and low in GHGE [61]. In a general way, significant increases in the consumption of fruits, vegetables, whole grains, legumes, and nuts, and significant decreases in the consumption of red and processed meats would make diets more sustainable [62]. Many studies that simultaneously analyze the health and environmental impacts of diets consider only GHGE under the stake of environmental issues. Some studies consider, in addition, water and/or land use. In practice, land use and land use changes are considered as proxies for biodiversity loss or gain. There are also attempts to quantify various environmental impacts of food products based on life cycle analysis. Because much pollution is local and/or depends on local conditions, these studies face methodological difficulties [63].

Regarding policy tools, information campaigns promoting the consumption of fruits and vegetables may induce both nutritional and environmental benefits. For instance, it has been shown that in the UK, the increase in fruit and vegetable consumption has coincided with a drop in meat consumption, suggesting a decrease in GHGE of diets [64]. Irz et al. [65] concluded that even if nutritional recommendations have only a small positive impact on fruit and vegetable consumption, they should, nonetheless, be encouraged, as they are likely to be welfare improving with positive effects on both the environment and health.

The economic literature has also addressed the question of diet changes through the assessment of environmental tax policies on GHGE and public health. Simulations for different MS suggest that GHGE associated to food consumption might decrease by 5 to 12% in response to taxes on food products based on their greenhouse gas content with a carbon price of 32 EUR/t [66]. The decrease in GHGE is due to a significant reduction in the consumption of meat products, particularly beef meat. It is also due to a global decrease in food consumption as all food products are taxed. Such a taxation scheme decreases significantly consumer welfare because it increases the prices of all food products. Its impact on public health is uncertain. Moreover, the reallocation of consumers' budgets between food and non-food items is not taken into account. As a result, the decrease in the consumption of animal products and, therefore, in GHGE of diets might be overestimated.

A few papers [67,68] simulated revenue-neutral schemes of taxation. Products with a high content in greenhouse gas are taxed, while products with a low greenhouse gas content are subsidized. Two main conclusions emerge. Firstly, the decrease in GHGE is small, in the range of 4.5 to 6% with a carbon price of 32 EUR/t. Secondly, health impacts are likely to be negative because such taxation schemes subsidize the consumption of energy dense products such as soft drinks and sugary products. In fact, as shown by Springmann et al. [59], in order to achieve convergence between health and environmental objectives in a revenue-neutral policy, one has to tax products with a high greenhouse gas content (ruminant meat in particular) and use the product of taxes to subsidize the consumption of healthy products, such as fruits and vegetables. In this case, it is more likely that consumers will choose diets that are both healthier and more climate friendly.

In summary, even if the impact of each tool used separately is likely to be only modest, a policy-mix combining information, mandatory labeling, and fiscal instruments, targeted on at-risk people and the whole population, might contribute in a consistent way to diet changes beneficial to both health and the environment. Because substitutions and complementarities among food products are complex, it is not certain that a policy targeting one dimension will generate positive effects on the other dimension. Notwithstanding, it is possible to design a policy that does improve the two dimensions simultaneously, if substitution and complementarity relationships between food items are adequately addressed.

4. Conclusions

The transition of food systems, made all the more necessary in a context of potential environmental and health crises, has to be supported by integrated public actions combining supply and demand measures targeted on environmental and health issues. The COVID-19 crisis illustrates this challenge. Changes in agricultural practices and systems and changes in food diets and consumption behaviors are needed to better prevent future crises and simultaneously mitigate their impacts in case of event.

The recent literature in health and environment economics shows potential co-benefits of well-designed policy measures. It is worth noting that in research papers concluding that health and climatic objectives may converge, the health effect in monetary terms is higher, sometimes much higher, han the environmental effect. This reflects that the consumers' willingness to pay is higher for health than for the environment. The huge economic consequences of the COVID-19 crisis confirm this statement.

In a recent article, Helm [69] argues that in the aftermaths of the COVID-19 crisis, policy-makers are likely to focus on consumption and health rather than on climatic and environmental issues. To overcome this pessimistic assessment, it is crucial to put forward the health benefits of well-designed environmental policies and, symmetrically, the environmental benefits of well-designed health policies. In that perspective, in a consistent way with the One Health approach, public policies would have to take into account the fact that the health dimension, through the prevention of infectious and chronic diseases, could be an important driver of required climatic and environmental changes.

This approach is at odds with the past action scheme. Until now, public policies have largely considered separately health and environmental issues. In the case of European food systems, environmental issues related to agricultural production fall within the competence of the EU, whereas

food and health policies are essentially in the hands of MS. In that perspective, the Green Deal initiative launched by the EC in December 2019 can be seen as a welcome breakdown, calling for better integration of environmental and health issues in what would be an evolution of the CAP towards a Common Agricultural and Food Policy.

Implementing such a policy is a great challenge. We made proposals to that end, but future researchs are expected to go further. In particular, increased cooperation between environmental and health economists as well as among agricultural production and food consumption economists is needed. For example, such a cooperation would be very useful for designing optimal taxes on gross GHGE and optimal subsidies on carbon sequestration practices in a consistent way, taking into account all sources of emissions and sinks as well as distributional consequences of measures.

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