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# Curbing global meat consumption: Emerging evidence of a second nutrition transition

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## ABSTRACT

Meat consumption patterns worldwide have dramatically changed over the past 50 years, putting pressure on the environment and leading – especially in industrialised and emerging countries – to unbalanced diets. Given demographic projections and foresight reports, the question is raised whether there are limits to the meat consumption. Based on data from 120 countries, this article analyses the evolution of meat consumption in general and the relationship between meat consumption and income in particular. The study shows evidence for an inverted U-shaped relationship between meat consumption and income, meaning that – at a certain level of income – average meat consumption will stagnate or even decline. The results can help policy makers to develop incentives for both environmental and health policies and offers stakeholders opportunities for further research and innovation.

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## 1. Introduction

Over the past 50 years, food consumption patterns in general and meat consumption in particular has changed dramatically. Human diet and nutritional status have undergone a sequence of major shifts, referred to as the nutrition transition. Focusing on the recent history, the EU has experienced an important shift after World War II. As more food per capita became available, consumers increased their energy intake, mainly through an increased consumption of vegetable-based foodstuffs. This is called the expansion stage of the nutrition transition. Another phase is referred to as the substitution stage in which carbohydrate-rich staples such as cereals, roots and tubers are replaced by vegetable oils, animal products and sugar. The substitution stage is the current nutritional phase in most industrialised and emerging countries (like Brazil, Russia, India, China and South Africa).

Also in Asia, a nutrition transition is taking place. More in particular, the Asian diet is shifting away from relatively monotonous diets based on the indigenous staple grain or root, local legumes, vegetables and fruits, and limited food of animal origin. Instead, an industrialised and usually more varied diet is adopted which includes more pre-processed food, more food of animal origin, more added sugar and fat, and often more alcohol (Popkin, 2006; Tey et al., 2010).

Increased meat consumption per capita and global population growth has resulted in an overall increase of global meat production and consumption. This tendency puts serious pressure on the environment as livestock production, especially intensive livestock production, is one of the major causes of greenhouse gas emissions (Garnett, 2009). Meat and meat products account for 4–12% of the impact on global warming of all consumer products (Tukker et al., 2006). Moreover, world population is expected to increase up to 9 billion people in 2050. In addition, the share of meat

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consumption in emerging countries and developing countries is growing rapidly because of increasing economic growth (Delgado, 2003). According to FAO projections, meat consumption in these countries may increase from an average annual per capita consumption of 10 kg in the 1960s to 26 kg in 2000, reaching 37 kg around the year 2030. This forecast suggests that in a few decades, developing countries' consumption of meat will move towards that of developed countries where meat consumption remains stagnant at a high level.

From a nutritional point of view, meat is undeniably a high quality source of proteins. Average requirements for healthy adults are currently estimated at 0.66 g/kg body mass per day (EFSA). However, few data are available on the mean protein intake on a body mass weight basis. EU statistics report daily protein consumption between 0.8 and 1.25 g/kg body weight for adults. Main contributors to dietary protein intake are meat and meat products, grains and grain-based products, and milk and dairy products. The relation between health and meat strongly depends on the type of meat considered (Wang and Beydoun, 2009). Basically, there are major nutritional benefits to consuming some red white meat but almost no reason – aside from tastes – to consume mostly processed meats (Popkin, 2009). Overconsumption of meat might result in a too high intake of saturated fatty acids, which is one of the main reasons for high incidence of coronary heart diseases. Further, improperly processed meat and the use of chemicals in agriculture and animal production increases the risks of food poisoning.

Given the already very high meat consumption rates in industrialised countries, the question raises whether there are limits to the increase in meat consumption. In this context, there are promising signals. On the demand side, consumer awareness on health, animal welfare and global environmental changes might reverse the tendency of increasing meat consumption. A study among French households showed a positive relation between education level of the household head and reduced meat consumption (Allais et al., 2010). Initiatives like the emergence of vegetarian organisations and the introduction of meatless days (such as Meatless Monday in the USA) illustrate increased citizens' environmental and health concerns related to meat consumption. In addition, evidence-based guidelines on a sustainable and healthy diet have been developed. Stehfest et al. (2009) calculated that a healthy diet worldwide would reduce the required area of arable land globally by 10%, and the area of grassland by 40%, compared to the FAO projections.

An example of a healthy diet is the Willett diet (Willett, 2005), which includes 10 g beef, 10 g pork, 47 g chicken and eggs, and 23 g fish, per person, per day on average. The associated reduction in costs for mitigation of carbon dioxide emissions could be as large as 50% in 2050, compared to the reference case. An increased number of governments have integrated environmental issues into national dietary guidelines. Against the lobby of food industry, some governments have integrated sustainability into their national dietary recommendations. In Finland, experiments have even been set up to analyse the short and long run effects of a Mandatory Vegetarian Day in Helsinki schools (Lombardini and Lankoski, 2013).

Will meat consumption continue to raise, or is there a limit? Will health concerns or global drivers of change

motivate consumers to decrease meat consumption? Is a second nutrition transition in which meat is substituted back to plant based foodstuffs emerging? This paper addresses the evolution of meat consumption and analyses the relationship between meat consumption and income. The key hypothesis is that meat consumption stagnates or even decreases once a GDP threshold is reached. Little empirical evidence is reported on the probability of an inverted U shaped relationship between income and meat consumption. This relationship is similar to the Environmental Kuznets Curve (EKC) hypothesis. The EKC represents graphically the hypothesis that as an economy develops environmental pollution (e.g. SO<sub>2</sub> concentration) first increases, and then decreases after a certain average income is attained (Grossman and Krueger, 1991, 1993). One explanation for the shape of the EKC relates to the income elasticity of environmental quality demand. When income increases people care more about the environment they live in. Once a certain level of income is reached, their willingness to pay for improved environmental quality increases by a greater proportion than income (Pezzey, 1989; Selden and Song, 1994; Baldwin, 1995). The level of income beyond which pollution starts to decline while income further increases, is called the turning point. While there is a sound theoretical background for the EKC, the empirical evidence provides some controversy (Stern, 2005; Dinda, 2004). Research on the EKC includes, among others, the relationship between income and CO<sub>2</sub> emission, sulfur emission and deforestation (Rothman, 1998; Saboori et al., 2012; Culas, 2012; Leitão, 2010). Empirical studies confirmed an inverted U-shape relation with income for local pollutants with a short term impact, but not for global pollutants with an indirect and long-term impact such as carbon dioxide. Particularly for local pollutants that directly affect health, the U-shape relation is confirmed. Empirical findings also suggest that the U-shaped relationship between income and pollution is country specific because different national regulations result in large differences in country level per capita emissions (Dinda, 2004; Stern et al., 1996). When it comes to meat consumption, the hypothesis for an inverted U-shaped relationship between income and meat consumption can be motivated because meat consumption does not only contribute to global pollutants but also has a direct impact on consumers' health. However, the relation might be country specific due to for example cultural and religious differences which affect meat consumption and result in a large difference in national levels of per capita meat consumption.

Using panel data for 120 countries in the period 1970–2007, this paper empirically analyses the link between meat consumption and income, while controlling for fixed effects and geographical area, culture and trade. The results of the research indicates the need for more interdisciplinary research and arguments for improved cooperation between environmental and health policy in industrialised and emerging countries as well as in developing countries.

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## 2. Determinants of meat consumption

Food choice is determined by a complex set of socioeconomic and demographic characteristics (Frank, 2007). This also holds

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