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# Economic development, urbanization, technological change and overweight: What do we learn from 244 Demographic and Health Surveys?

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## ABSTRACT

Obesity and overweight are spreading fast in developing countries, and have reached world record levels in some of them. Capturing the size, patterns and trends of the problem has, however, been severely hampered by the lack of comparable data in low and middle income countries. We seek to begin to fill this gap by testing several hypotheses on the determinants/correlates of overweight among women, related to the influence of economic and technological development. We undertake econometric analysis of nationally representative data on about 878,000 women aged 15–49 from 244 Demographic and Health Surveys (DHS) for 56 countries over the years 1991–2009. Our findings support most previously expressed hypotheses of what might explain obesity patterns in developing countries, but they also reject some prior notions and add considerable nuance to the emerging pattern.

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## 1. Introduction

Obesity has become a global phenomenon not solely confined to rich countries (James, 2008; Popkin, 2007), with the total number of overweight and obese people being estimated at about 1.5 billion in 2008 worldwide (Popkin et al., 2012). However, the accurate description of its size, trends and socioeconomic patterns has been compromised by the scarcity of globally comparable data. One recent study (Finucane et al., 2011) attempted to fill this void by estimating data on mean body mass index (BMI) among adults over the age of 20 living in 199

countries (analyzing 960 country years worth of data on 9.1 million participants). They found that between 1980 and 2008, mean BMI in all countries combined increased by 0.4 (0.5) kg/m<sup>2</sup> per decade for men (women). In order to study the trends and determinants of obesity and overweight specifically in the developing countries, a small set of recent studies (Martorell et al., 2000; Mendez et al., 2005; Mendez and Popkin, 2004; Monteiro et al., 2004; Subramanian et al., 2011) has used data from the Demographic and Health Surveys (DHS), a particularly rich source of information that had hitherto primarily been used for the analysis of fertility and “traditional” developing country disease challenges in the area of maternal and child health. In this article we exploit to an even greater extent the DHS dataset, using data on almost one million women aged 15–49 from 244 Demographic and Health Surveys (DHS) for 56 countries over the years 1991–2009. We use this data to examine a broader range of questions than the previous studies that predominantly focused on how overweight, obesity or BMI in women varied between socioeconomic groups within a cross

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section of developing countries. By combining the DHS data with appropriate socioeconomic indicators or determinants from other sources, we are in a position to test selected hypotheses that are either derived from theoretical predictions or, for the most part, have been proposed in the literature (or expressed in the public debate) without yet having been submitted to closer empirical scrutiny.

Taken together, our findings aim to produce a set of empirically confirmed stylized facts on patterns, trends and correlates of being above normal weight (defined as having the Body Mass Index (BMI) of 25, or greater), in the developing countries. As a number of potential explanations for increasing overweight prevalence have been suggested over the last years (e.g. see Popkin et al., 2012 for a recent overview), we grouped them into two main categories (necessarily omitting some well-known potential correlates related to early life events, e.g. famine (Popkin et al., 2012), as well as genetics-related explanations): (1) those that concern the relationship between proxies of economic development and individual overweight, and (2) those examining the association between proxies of urbanization and proxies of technological change on one hand and individual overweight status on the other hand. It is important to note that we apply a somewhat more general definition of “technological change” here than in the economic growth literature, where it is more narrowly understood as a change in total factor productivity. We broadly interpret technological change as the process of invention, innovation and diffusion of various technologies (e.g. labour saving and food production ones) that may facilitate changes in energy expenditure or consumption, and therefore may affect the likelihood of being overweight or obese. There is a significant public health and economic literature which considers the term “technological change” in this similar, broader sense (e.g. Finkelstein et al., 2005; Huffman and Rizov, 2007; Lakdawalla and Philipson, 2009; Philipson, 2001; Philipson and Posner, 2003a; Swinburn et al., 2011).

Given the data constraints, we focus the empirical tests of the hypotheses on women only. We examine a third group of hypotheses, linking overweight prevalence to globalization-related determinants in a companion paper (Goryakin and Suhrcke, 2013).

### 1.1. The role of economic development in overweight

**Hypothesis 1.1.** Overweight is a “disease of affluence”, but only up to a point: as countries grow out of extreme poverty, overweight among women will increase. However, as countries continue to grow richer, the increase should slow down at some level of per capita income.

Why should overweight be positively related to national income? The concept of the nutrition transition (Popkin, 2001; Popkin et al., 2012) emphasizes the role played by increased affordability of processed foods, as well as foods rich in calories high in fat and sugar (both due to rising incomes, and advances in food technologies) in developing countries, especially since the 1970s. Similarly, economic theory (Philipson and Posner, 2003b) predicts that technological change (which drives and accompanies

rising national income) entails lower costs of consuming calories and higher opportunity cost of expending them, which, taken together, increases weight. Within this theory, the nonlinearity can arise because greater income would also increase the demand for health (and thus a BMI closer to the medically ideal level), assuming that health is a normal good (Grossman, 1972). The theory predicts that the latter effect would at some point more than compensate the weight-enhancing effect resulting from the changes in calorie consumption and expenditure.

**Hypothesis 1.2.** An adverse economic shock (recession) will be associated with lower likelihood of being overweight among women.

How might body weight respond to a sudden fall in income? It is tempting to infer from the hypothesized concave and positive relationship between per capita gross domestic product (GDP) and overweight prevalence from Hypothesis 1.1 that a recession should be associated with a reduction in overweight in countries below a certain threshold of per capita GDP and either no change or even an increase in overweight in middle income countries. However, the concave relationship at one point in time across countries (which was the focus of Hypothesis 1.1) is more likely to describe a long-term association. Relationships between short-term *changes* in per capita GDP and *changes* in overweight may well differ from the long-term relationship in *levels*.

In a series of papers, Ruhm (2000, 2001, 2003, 2005, 2007) examined the impact of recession on health in a range of high income countries, finding evidence for improving (deteriorating) health in response to a recession (boom). Ruhm (2000) found that obesity declined in times of rising national unemployment rates in the US, likely due to (1) the opportunity cost of exercise falling as unemployment increases, (2) more time available for health enhancing activities, and (3) possibly due to less income being available for calorie consumption. In addition, a number of studies have shown that undernutrition prevalence increased rapidly during times of global economic crises in Cambodia, Bangladesh, Indonesia, Kenya and Mauritania (SCN, 2009). Similarly, Pongou et al. (2006) have found that child undernutrition increased considerably during times of economic crises and structural adjustment programmes in the 1990s in Cameroon. To the extent that undernutrition is the flipside of overweight, this should mean that overweight will decrease in low income countries experiencing a recession.

**Hypothesis 1.3.** In low income countries, women of higher socioeconomic status (SES) will be more likely to be overweight than those with lower SES, whereas in middle income countries, the burden of overweight will shift towards women of lower SES, resulting in an insignificant or mildly negative relationship between SES and the probability of being overweight.

The previous hypotheses predicted the association between national income and overweight prevalence in all population groups. By contrast, Hypothesis 1.3 considers within-country differences between women of

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