Community infrastructure and price dynamics on adult health in China

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In a rapidly changing country like China, overweight trends have also occurred quickly together with changes in its economic, social and physical environment. Chinese adults specifically, are the driving force behind the recent growth in the Chinese economy because they contribute the most to the country's productivity as well as determine the majority of consumption patterns. At the same time, they have had the largest changes in BMI and overweight prevalence and annualized incidence (Popkin, Conde et al., 2006). This is certainly troubling, especially given that already, it is estimated that the cost of overweight and related diseases will be almost 9% of China's gross national product (GNP) by 2025 (Popkin, Kim et al., 2006; Raymond et al., 2006).

One of the main theories considered in trying to understand the economics of obesity (Lakdawalla & Philipson, 2006; Rashad & Grossman, 2004) is the neo-classical model. This model assumes that individuals are rational and forward-looking, making utility-maximizing choices about their consumption and physical activity levels within a set of time, budget and biological constraints (Cawley, 2004; Lakdawalla et al., 2005; Lakdawalla & Philipson, 2002; Sturm, 2004). Studies on emerging economies focus on economic drivers due to the importance of economics in all aspects of the development of these countries (Guo et al., 2000; Guo et al., 1999), and are based on neo-classical model because of its strength in argument and relative ease in estimating empirically. Hence, it would be sensible to use the neo-classical conceptualization of the economics of obesity in the case of China for understanding individual choices regarding their diets, activity levels and the resultant weight changes.

With economic development comes new job opportunities towards more service oriented and less labor intensive jobs (Proper et al., 2007); falling activity levels at work, even within same job due to mechanization, use of computers and various work technology (Bell et al., 2001; Popkin, 2006); better wages; access to a larger variety of goods; more roads and greater motorized transportation and nearer markets (Bell et al., 2002; Popkin et al., 1995; Tudor-Locke et al., 2007; Tudor-Locke et al., 2003); improved neighborhood facilities; and increased ownership of durable goods. In addition, societal expectations and norms also change towards increased female labor force participation, and changes in division of labor among household members. These can all affect the amount and degree of physical activity individuals perform, as well as their choices in dietary intake, which will together impact changes in BMI. In addition, these are not simply compositional changes, they are structural. For example, it is not just the percentage of the population that is working in the service economy that is important, it is also the type of knowledge or skills people are getting from their jobs that matters.

For a country as large and diverse as China, one would expect variations in the infrastructural development communities undergo. A number of studies have looked at a

broader concept of urbanization and its impact on nutritional change using an index constructed from ten dimensions (Mendez et al., 2003). While the use of an urbanization index can help reflect multidimensional changes in factors that characterize urban living, it does not allow one to identify which of the factors are the main drivers. Using separate measures that are more focused on infrastructure development such as access to markets, transportation and communication networks, job opportunities, and educational, health and sanitation facilities can provide greater insight into how important each of these are. In addition, the budget constraint is central in the neo-classical model. Therefore, it is important to include real prices in any model that seeks to explain the determinants of changing diets and activity levels. Not surprisingly, past studies have found that falling prices and increased food supply (quantity and variety) decreases energy cost (Du et al., 2004).

This research uses comprehensive longitudinal data from the China Health and Nutrition Survey (CHNS) to address the above aims. The five waves (1991, 1993, 1997, 2000, and 2004) of the CHNS were conducted in nine diverse provinces of China, and contains detailed individual-level information on income, diet, health and demography for all members of sampled households as well as detailed data on community-level prices, and public services and facilities. Table 1 shows the descriptive statistics of the analytic sample. [Note: The final paper will utilize six waves and include CHNS 2006.]

I used a time-series random effects model for individuals over time with clustering at the community level to correct for heteroskedasticity, with separate models for men and women. I started with a model which includes only time, in order to see how variation in physical activity and dietary intake is allocated between and within individuals across communities. Evidence of between-person and between-community variation will justify addressing individual and community level predictors. Next, cross-level interactions will be tested to evaluate whether the effects of community level characteristics on physical activity levels and dietary intake differed over time. These interaction terms were included in the final models only if they improved the model fit significantly.

Preliminary findings indicate that market accessiblity are negatively related to activity levels and higher fuel prices is positively related to activity levels. Meanwhile, individual living in communities with higher education institutions have better health facilities , and have higher prices have lower caloric intake. Also, improved market accessibility, economic opportunities and lower prices are positively related to BMI. It is important to note, however, that the time variable continues to be significant in all the models. This indicates that there are additional time varying factors that have not been accounted for.

Another limitation of the current analysis is that measures of physical activity used here are limited to only occupational and domestic activities and does not account for travel and leisure activities because the CHNS only asked about travel and leisure activities beginning in 1997. It is possible that there are trade-off made between the different sources of activity, hence it may not be clear what the relationships between the community variables and activities may be like without having more complete information regarding activity levels from various sources. A similar problem is

associated with diet since prices impact specific food groups and not necessarily aggregate caloric intake. Additional work will need to be done to improve on these models.

In addition, factors such as technology ownership of energy-saving devices such as washing machines, microwaves, vacuum cleaners, and while ownership of leisure devices such as color televisions, video players and computers can impact both activity levels and diet. However, ownership of these items can be endogenous with activity and diet since it is not clear if for example, people who own washing machines do so because they want to lower their activity levels, or they have lower activity levels because they own a washing machine. It is also possible that there are other factors such as income which can affect both the ability to own a certain househodl technology as well as affect activity level or diet. Hence, future empirical work on household level ownership of these items that controls for endogeneity will be useful in understanding the role of technology ownership on changes in activity levels and diet.

Table 1: Descriptive statistics from CHNS (1991- 2004)

Variables	**1991**	**1993**	**1997**	**2000**	**2004**
Dependent Variables					
Energy expended beyond BMR in occupational and domestic activity (per week)	1565.74 (3047.21)	1497.79 (2905)	1444.56 (2964.15)	1374.51 (2598.66)	1359.07 (2631.41)
Total Caloric Intake (kilocalories/day)	2613.65 (836.61)	2519.38 (930.15)	2299.63 (760.97)	2306.42 (979.23)	2251.83 (820.66)
Body Mass Index (kg/m^2)	21.06 (3.21)	21.29 (3.25)	21.93 (3.00)	22.39 (3.28)	23.65 (5.01)
Community Infrastructure					
Market accessibility #	4.39 (3.02)	4.17 (3.14)	4.87 (3.69)	5.57 (3.49)	4.50 (3.65)
Communication Infrastructure #	6.53 (3.41)	6.85 (2.43)	7.04 (2.47)	7.05 (2.12)	6.41 (2.08)
Transportation infrastructure #	4.90 (3.04)	5.15 (2.66)	5.01 (2.52)	5.44 (2.62)	5.74 (2.52)
Highest educational institution #	5.97 (2.91)	6.48 (2.77)	6.74 (2.46)	8.04 (2.12)	8.07 (2.19)
Health facilities #	6.71 (2.29)	6.37 (2.25)	6.37 (2.39)	6.47 (2.19)	5.86 (2.46)
Economic development #	3.42 (1.07)	3.51 (1.01)	4.61 (2.05)	5.03 (2.41)	5.71 (2.29)
Community Prices					
Price Index %	108.93 (7.75)	120.02 (10.97)	228.22 (17.63)	225.71 (16.58)	229.63 (15.08)
Real Price of Coal (yuan/kg) ‡	0.25 (0.26)	0.25 (0.22)	0.25 (0.23)	0.34 (0.35)	0.37 (0.32)
Real Price of Kerosene (yuan/liter) ‡	1.12 (0.44)	1.96 (0.63)	1.34 (0.42)	1.43 (0.39)	1.53 (0.17)
Real Price of Rice (yuan/kg) ‡	0.99	1.05	0.84	0.71	1.18

Variables	1991	1993	1997	2000	2004
	(0.27)	(0.25)	(0.25)	(0.12)	(0.86)
Real Price of Flour (yuan/kg) ‡	1.06 (0.20)	1.11 (0.34)	1.06 (0.30)	0.80 (0.23)	1.25 (0.12)
Real Price of Pork (yuan/kg) ‡	5.19 (0.71)	5.97 (1.23)	6.03 (1.02)	4.35 (0.84)	6.39 (1.27)
Real Price of Vegetables (yuan/kg) ‡	0.47 (0.37)	0.54 (0.34)	0.63 (0.68)	0.47 (0.42)	0.73 (0.82)
Real Price of Eggs (yuan/dozen) ‡	4.72 (1.03)	5.12 (1.59)	3.03 (0.86)	2.33 (0.72)	2.98 (1.12)
Real Price of Cooking oil (yuan/liter) ‡	3.78 (0.52)	4.29 (0.72)	3.19 (0.62)	2.23 (0.49)	3.06 (0.83)
Individual Characteristics					
Age (in years)	33.42 (15.63)	34.61 (15.89)	35.42 (16.25)	37.80 (17.03)	41.44 (17.49)
Males (%)	47.78	47.66	50.72	49.97	51.66
Drink (%)	34.76	33.39	34.93	36.16	35.47
Smoke (%)	31.05	30.09	30.52	30.16	30.68
N	6745	5589	4206	3792	3071

[#] 0-10 scale with 10 indicating better infrastructure; [%] urban Liaoning was the base =100; ‡ denotes deflated using price index; figures in parentheses denote standard deviations

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