The Rise of Obesity in Transition Economies: Theory and Evidence from the Russian Longitudinal Monitoring Survey[1]

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Abstract
This study integrates theoretical and empirical models to facilitate understanding of human obesity and the factors contributing to rising obesity in Russia during the transition from a planned to a market economy. Recent individual level data from the Russian Longitudinal Monitoring Survey for 1994 and 2004 show that diet/caloric intake, smoking, gender and education are important determinants of obesity in Russia. Empirical results strongly support our model for production of BMI and demand for inputs in the BMI production function. The analysis provides information on the link between dietary patterns and other factors of obesity in Russia which is important for formulation, implementation and monitoring of effective policies designed to improve overall nutritional wellbeing and reduce obesity and mortality of the Russian population. Interventions, which enhance education toward healthy lifestyles and healthy diet, could play a vital role in preventing obesity in Russia.

Introduction

Since the early 1990's series of reforms have been implemented in transition economies. Economic reforms aiming at increase in efficiency comprised price liberalization, privatization and enterprise restructuring. However, the reforms also brought dramatic changes in all areas of the population's life. Important side effects were increase in unemployment and poverty, additional stress and uncertainty, rising crime, and fall in living standards, for certain groups of the population. As a result, the population in transition economies experienced dramatic changes in lifestyle and a significant decline in life expectancy.

The adverse effects of transition were most severe in the Former Soviet Union. Several studies examine the reasons for the mortality crisis in Russia and other former Soviet republics (Brainerd and Cutler, 2005; Cockerham, 2000; Shkolnikov et al., 2004). Breinerd and Cutler show that during the 1990s greater alcohol consumption was an important determinant of higher mortality rates in Russia. The increased stress from the transition to a market economy had dramatically affected the lifestyle and the diet of the population as well. Furthermore, the authors find that across households rising human obesity has important health consequences and is a significant predictor of mortality, however, the magnitude of the effect is small. Stillman (2006) reviews the literature examining health outcomes in Eastern Europe and the Former Soviet Union during the transition period and also points out to the link between obesity and health outcomes. Huffman and Rizov (2007) discuss the determinants of obesity in Russia, while Ogloblin and Brock (2003) investigate the risk factors and the economics of the decision to smoke in Russia and find that obesity is negatively associated with smoking.

Obesity has reached epidemic proportions globally, with more than 1 billion adults overweight, and at least 300 million of them clinically obese (WHO, 2006). Obesity has become a major contributor to the global burden of chronic diseases and disability. The health consequences range from increased risk of premature death to serious chronic conditions that reduce the overall quality of life. The emerging and transition economies, including Russia, had the highest number of diabetics – a condition closely associated with obesity - in 1995 (WHO, 2006). Therefore, a greater understanding of the rise in obesity and its causes in transition economies could lead to important policy recommendations for reducing the problem and improving the health of the population.

The risk of obesity is strongly influenced by diet and lifestyle which have been changing dramatically as a result of economic and nutritional transitions. However, very few studies have examined the causes of obesity in transition economies in contrast to the large literature on high-income countries such as the USA (Chou et al., 2004; Huffman et al., 2006; Komlos and Baur, 2004; Lakdawalla et al., 2005; Lakdawalla and Philipson, 2002; Rashad, 2006; Rashad et al., 2006). Mendez and Popkin (2004) find that the population of low-income countries has also become susceptible to obesity in the process of economic development. An interesting study by Liefert (2004) examines food security in Russia and points that a serious health problem is overweight and obesity "which have increased during transition and currently affect over half of the adult population." Zohoori et al. (1998) find that the prevalence of obesity, as well as the alcohol consumption, has risen significantly in Russia during 1992-1996.

The goal of this paper is to develop theoretical and empirical models to examine human obesity and its determinants in Russia, the largest transition economy. The analysis contributes to better understanding of how rationale economic agents respond to external factors that are expected to influence food consumption and weight. Russia is also one of the transition economies facing the most severe obesity and general health problems. Obesity has increased during transition, rising from 20.3 percent of the population in 1994 to 28.0 percent in 2004—a 38-percent increase, based on our weighted[1] sample. Individual and household level data from the Russian Longitudinal Monitoring Survey (RLMS) for 1994 and 2004 is employed to study the factors contributing to rising obesity in the framework of the productive household models and to empirically test our hypotheses. The models are estimated for the pooled sample and for subsamples by gender and residence. The analysis is stratified by urban/rural residence because the rural households often undertake extensive home production which has a large impact on food availability and presumably nutritional outcomes. Empirical results strongly support our models for production of BMI and demand for inputs in the BMI production function. The rest of the paper is organized as follows.

First, a conceptual framework is developed, based on health productive household models. Next, the data and econometric techniques are described, followed by a discussion of the estimation results. Finally, conclusions and policy recommendations are offered.

Theoretical model

The productive household models of health developed by Rosenzweig and Schultz (1982) and Grossman (2000), and the agricultural household models developed by Huffman (1991) provide a useful framework for analyzing overweight and obesity. An important proposition in the framework is that the health status of each household member is determined by the degree of overweight and obesity of that member. The individual has a utility function

$$U = U(D, C, BMI, L; O) . \quad (1)$$

Utility is determined by consumption of food (diet), D; consumption of other goods (excluding food) and services (other than health inputs), C; body mass index, BMI, and leisure, L. Furthermore, utility is affected by a vector O of fixed (observable) characteristics, such as education, age, gender, place of residence, etc.

The individual has a BMI production function

$$BMI = B(D, L, O, \mu) , \quad (2)$$

where μ is the unobservable individual characteristics that affect the individual's health; such characteristics may include genetic factors. Food consumption/diet affects utility directly and indirectly through BMI production, providing energy, protein, vitamins and minerals.

We assume that the individual has a budget constraint

$$P_D D + P_C C = W(T - L) + N , \quad (3)$$

where P_D and P_C denote the prices of food (D), and other goods and services (C), respectively. Further, W is the wage rate per unit of time, T is the fixed time endowment (T-L=work), and N is the nonlabor income.

For an interior solution of the model, substitute equation (2) into (1) and use the budget constraint (3). Then, the individual chooses D, L and C by maximizing his/her utility subject to the budget constraint. The utility maximization problem can be written as

$$L = U[D, C, B(D, L; O, \mu), L; O] + \lambda(WT + N - P_D D - P_C C - WL), \quad (4)$$

where λ is the Lagrange multiplier representing the marginal utility of individual's full income. The first order conditions for an optimal solution are:

$$U_B B_D + U_D = \lambda P_D, \quad (5)$$

$$U_B B_L + U_L = \lambda W, \quad (6)$$

$$U_C = \lambda P_C, \quad (7)$$

$$WT + N = P_D D + P_C C + WL, \quad (8)$$

where $U_B = \partial U / \partial B$, $B_D = \partial B / \partial D$, $U_D = \partial U / \partial D$, $B_L = \partial B / \partial L$, $U_L = \partial U / \partial L$ and $U_C = \partial U / \partial C$. For an interior solution, equations (5)-(8) yield the individual's optimal demand functions for D, L and C:

$$\Phi^* = f_\Phi(P_D, P_C, W, N, O, \mu), \qquad \Phi = D, L, C. \quad (9)$$

Therefore, the demand for inputs into the BMI production function depends on the prices of the purchased inputs (P_D, P_C), the wage rate (W), non-labor income (N), fixed factors (O) and unobserved factors (μ), which are assumed to have zero expected mean. After substituting the optimal demand functions D^* and L^* from equation (9) into the BMI production function (2), we obtain the individual's BMI supply function:[2]

$$\mathrm{BMI}^* = S_B(P_D, P_C, W, N, O, \mu)\,. \tag{10}$$

The individual's BMI production function (equation 2) is a technology relationship, while the BMI supply function (equation 10) is the behavior relationship based on the optimal individual's decisions.

Data and econometric specification

Data from the Russian Longitudinal Monitoring Survey (RLMS) for 1994 and 2004 is employed to investigate the factors contributing to the rising obesity in Russia. The RLMS is a nationally representative household survey that annually samples the population of dwelling units.[3] The RLMS is designed to monitor the effects of Russian reforms on the health and welfare of the Russian individuals and households and is coordinated by the Carolina Population Center at the University of North Carolina (http://www.cpc.unc.edu/projects/rlms). The survey is based on multi-stage probability samples of the Russian population. The collected data include a wide range of information concerning household characteristics such as demographic composition, income, and expenditures. Data on individuals includes employment, anthropometric measures, health status, nutrition, alcohol consumption, and medical problems. We use round 5 (1994) and round 13 (2004) of the RLMS. Table 1 presents the definitions, means and standard deviations for all variables used in the econometric analysis for the weighted data. The variables are based on the estimated sample of 6,424 individuals (age 18 and over) and 3,710 households that remain after observations with missing values are deleted.[4] The male and female samples consist of 2,532 and 3,892 individuals respectively, while 3,910 individuals reside in urban areas and 2,514 reside in rural areas.

Based on the theoretical model, we add empirical content by providing empirical definitions of the variables and imposing a specific algebraic form of equations (2) and (11). We focus our efforts on two dependent variables: individual's weight and body-mass-index (BMI). A standard measure of obesity is based on the BMI—individual weight in kilograms divided by height in meters squared (kg/m^2). According to the WHO, an individual with a BMI over 25 kg/m^2 is defined as overweight, and with a BMI of over 30 kg/m^2 as obese. However, the BMI may overestimate body fat in athletes who have a muscular build, and may underestimate body fat in older people who have lost muscle mass (NIDDKD, 1996). Hence, we choose both an individual's weight and BMI as measure of obesity. The BMI index is constructed for each respondent from data collected by trained personnel on weight and height. The average individual weight was 71.9kg in 1994 and it increased to 74.4kg in 2004, while the average BMI was 26.2 in 1994 and increased to 27.4 in 2004.

Tables 2a-2e present the descriptive characteristics of the Russian population by categories of normal weight, overweight and obese based on the definitions discussed above for the whole sample, and by gender and residence for each round (1994 and 2004) and all rounds together. The overweight and obese are on average older (50 and 54 years respectively) as compared to individuals with normal weight (43 years), shorter (165 cm and 162 cm as compared to 167 cm), with less education, smoke significantly less, drink alcohol less than the individuals with normal weight. The average total expenditure for the overweight group is higher (9972 rubles/month) while for the obese group is lower (9238 rubles/month) than the normal-weight individual's expenditure average (9686 rubles/month). Controlling for three levels of education the overweight and obese males are more likely to have higher education compared to individuals with normal weight (15% and 18% as compared to 12%). While the opposite is true for the overweight and obese females that are less likely to have higher education than normal-weight females (17% and 11% as compared to 22%). Overweight men are more likely to be employed (68%) compared to the obese (60%) and normal weight men (64%) but obese men are less likely to have a job compared to the normal-weight men. The obese males are earning less than the overweight and normal weight males, but their wage is much higher than the female's wage. Females are earning less than males. Ninety percent of the obese males are married while only 74 percent of the normal weight male are married; 71 percent of the obese females are married compared to 63 percent of the normal weight females. Normal weight females and males are more likely to have kids. Overweight men eat more fat while overweight females eat less fat. Furthermore, overweight and obese men live in households with slightly higher real expenditure than the normal-weight men. They are slightly less likely to drink alcohol than the normal-weight men (69 % versus 72%) and they are significantly less likely to smoke (52% of overweight, 39% of obese as compared to 72% of normal-weight individuals). Similar characteristics for the females, the urban and rural population point that the overweight and obese females and individuals residing in urban or rural areas, smoke and drink less, and are less likely to work.

Our (weighted) data reveal that the share of the population that is overweight and obese has increased in Russia between 1994 and 2004. Overweight people accounted for 34.25 percent of the total in 1994 and for 36.07 percent in 2004. In 1994 the overweight rate of males was higher than that of females—35.81 percent versus 33.16 percent. The increase in obesity was much more dramatic during the transition period, from 20.28 percent in 1994 to 28.00 percent in 2004. In 1994, the obesity rate was much higher for females, at 27.82 percent, compared to only 9.49 percent for males. Based on our data, women are more likely to be obese in Russia, which is a trend similar to western countries. For women, the overweight rate increased slightly from 33.16 to 34.59 percent, for men from 35.81 to 38.07 percent, for urban residents from 34.83 to 35.40 percent, and for rural residents from 34.21 to 36.75 percent. However, the increases in obesity rates were more significant in magnitude, from 27.82 to 36.62 percent for women, from 9.49 to 16.34 percent for men, from 19.59 to 28.75 percent for urban residents, and from 22.75 to 27.13 percent for rural residents. The increase in obesity was much higher for the males and for urban residents during the ten-year period. The overweight and obesity rates have increased for both genders and urban/rural residents over 1994 to 2004. Therefore, it is important to identify and understand the factors that could have contributed to this dramatic increase in obesity in Russia during the economic transition.

Following our theoretical model, we first establish the technical relationship between BMI (and weight, in an alternative specification) and its determinants, including diet as measured by caloric intake and composition, and control for selected economic and socio-demographic factors. The individual's BMI production function (2) or the technical relationship is specified as

$$\begin{aligned} \ln BMI_i = \gamma_1 + \gamma_2 \ln Calories_i + \gamma_3 Fat_i + \gamma_4 \Pr otein_i + \gamma_5 Smo\ker_i + \gamma_6 Male_i \\ + \gamma_7 Education_i + \gamma_8 Work_i + \gamma_{90} Age_i + \gamma_{10} (Age_i)^2 + \gamma_{11} Year + \varepsilon_{i1} \end{aligned}, \quad (11)$$

where subscript *i* refers to an individual.[5] Calories is the total individual calories consumed per day; Fat is the share of fat intake in the total calorie intake; Protein is the share of protein in the total calorie intake; Smoker is a dummy variable equal to one if the individual smokes and zero otherwise; Male is a dummy variable equal to one if the individual is male and zero otherwise (i.e. female); Education is a set of dummy variables for three levels of education (basic, high, and higher); Work is the labor force participation (employment) indicator equal to one if the individual works and zero otherwise; and Year is a dummy variable equal to one if the year is 2004 and 0 for year 1994. γ_1- γ_{11} are parameters of the individual's BMI production function to be estimated. The year dummy variable controls for changes over time related to public health and the organization of the health care system as transition progresses. The random disturbance term ε represents the impact of all other factors and has a zero mean.

Larger caloric intake, other things equal, is expected to lead to weight gain and eventually to obesity (γ_2>0). Likewise, an increase in fat in the diet, beyond a certain threshold, is expected to accelerate obesity (γ_3>0), and increase in protein - possibly to accelerate obesity (γ_4><0). Smokers consume fewer calories than non-smokers. Specifically, cigarette smoking is associated with lower weight because smoking tends to increase metabolism and suppress appetite, thus having a negative effect on BMI weight (γ_5<0). For other variables the *a priori* hypotheses are more complex and outcomes less clear; therefore, we do not state prior expectations about the signs of coefficients for these variables.

Next, we estimate demand equations (eq. 9) for calories, meat and fish, fruits and vegetables, and dairy products. The empirical specification for these demand equations is

$$\begin{aligned}\ln Q_I^{i/h} &= \alpha_1 + \alpha_2 \ln \mathrm{Expend}_{i/h} + \alpha_3 \ln(\mathrm{Expend}_{i/h})^2 + \alpha_4 \mathrm{Age}_i + \alpha_5 (\mathrm{Age}_i)^2 + \alpha_6 \mathrm{Education}_i \\ &+ \alpha_7 \mathrm{Male}_i + \alpha_8 \mathrm{Smoker}_i + \alpha_9 \ln \mathrm{Height}_i + \alpha_{10} \ln \mathrm{Eqnum}_h + \alpha_{11} \mathrm{Year} + \sum_{r=12}^{18} \alpha_r \mathrm{Region}_r + \varepsilon_{i2},\end{aligned} \quad (12)$$

where $Q_I^{i/h}$ is the individual's (i) demand for (I=) a) calories, or the household's (h) demand for (I=) b) meat and fish, c) fruits and vegetables, and d) dairy products. *Expend* is the total household expenditures, which is used as a proxy for income. *Height* is the individual's height measured in cm. The variable adult equivalent number (*Eqnum*) of household members is excluded from the individual's demand for calories equation 12a. Regional dummy variables are used to capture the differences in real prices.[6] In equations 12 (b, c, and d) height, gender, age, education, and smoking habits are proxied by the characteristics of the household head who is assumed to be the main decision maker in the household. Equation 12a is estimated by ordinary least squares (OLS), while for equations 12 (b, c, and d) we use the interval regression estimator in STATA to deal with the censoring of dependent variables.

The probability of an individual consuming alcohol (A_i) is estimated as a function of exogenous demographic and socio-economic variables (O), including Height, Calories, Smoker, Male, Education, Expenditure, Expenditure^2, Age, Age^2, Year and Region, using a probit model:

$$A_i^* = \delta_i' O_i + \varepsilon_{i3} \text{ where } A_i = 1 \text{ if } A_i^* > 0 \text{ and 0 otherwise.} \qquad (13)$$

Alcohol consumption can affect obesity through caloric intake in our analysis, as well as it may increase mortality caused by accidents, cardiovascular disease, etc.

The individual's BMI supply function (10) is specified as

$$\begin{aligned} \ln BMI_i = {} & \beta_1 + \beta_2 Smoker_i + \beta_3 Male_i + \beta_4 Education_i + \beta_5 \ln Wage_i \\ & + \beta_6 Age_i + \beta_7 (Age_i)^2 + \beta_8 Year + \sum_{r=9}^{15} \beta_r Region_r + \varepsilon_{i4} \end{aligned}, \qquad (14)$$

where *Wage* is the real individual hourly wage, which is the implicit cost of time, and *Region* is a dummy variable for each of the eight regions of the country that represent, largely, the regional differences in real food prices. The predicted wage is used as the opportunity wage for each individual. Because observed wages are also endogenous to the choice to work, we control for this self-selection bias by constructing the variable for the ln*Wage* using a Heckman sample selection model. We use the Heckman sample selection model to construct the predicted individual wage as a function of individual characteristics used in previous regressions plus non-labor income, marital status, number of children as well as the set of regional dummies and year.[7] Regional fixed effects will control for relative prices of food and other omitted variables that differ by region. Studies on transition economies by Gardner and Brooks (1994) and Huffman and Johnson (2004) have found geographical price differences. Wage (earned income) is expected to have a positive effect on the supply of good health. We expect individual BMI (or weight) to increase with age, at least up to middle age, but eventually the digestive system starts to lose its efficiency and capacity and the effects of finite life set in. Therefore, we expect $\beta_6>0$ and $\beta_7<0$.

The econometric specifications in equation (11) and (14) are estimated by OLS, both for the whole sample, by gender (male/female) and residence (urban/rural) subsamples. We also test for homogeneity of the BMI production and supply functions across genders (male/female) and across residence (urban/rural) and expect to reject homogeneity.

Estimation results

We estimate the BMI production function, individual demand functions for calories and alcohol, and the household demand functions for other food types, and then the BMI supply function as specified in equations (11), (12), (13) and (14). The individual's BMI production function (equation 11), demand function for calories (equation 12a) and BMI supply function (equation 14) are fitted by OLS.[8] The household's demand functions for meat and fish (equation 12b), fruits and vegetables (equation 12c) and dairy products (equation 12d) are estimated by interval regression to account for censoring of the dependent variable. The parameters of the alcohol consumption equation (13) are estimated using the probit estimator. The equations are fitted on a balanced panel for individuals and households from 1994 and

2004. We report the robust standard errors that have been corrected for individual clustering.[9]

Table 3 presents the OLS estimates of the BMI production function where the dependent variable is the natural log of weigth. It is fitted on pooled data and separately by gender and residence. We test for equality across gender and across residence and reject the homogeneity.[10] We find strong econometric evidence for the BMI production function for both females and males, and in urban and rural subsamples. Weight increases with an individual's height. Age has a positive and significant effect on weight, but the age effect is diminishing at higher ages. Total calories consumed positively and significantly affect male's weight and rural resident's weight, while the protein intake leads to an increase in the weight of both men and women, but only of urban resident's weight. A ten percent increase in caloric intake increases individual's weight by 0.6 percent for males and by 0.4 percent for rural residents. An increase in food fat content, holding protein content and calorie consumption constant, increases the weight for both females and males, and urban and rural residents. Increasing protein content, holding fat content and calories consumed constant, increases an individual's weight by gender and only the urban residents' weight, as well. Smoking decreases significantly the male's weight by 7.6 percent and the female's weight by 2.7 percent. Having a higher level of education has a strong and significant negative effect on woman's weight—a decrease of 3.8 percent compared to the basic education category, and on urban resident's weight—a decrease of 2.5 percent, but there is no significant effect of male's or rural resident's education on their weight. An individual being employed has a statistically significant positive effect on male's (a 1.7 percent increase) and urban resident's (a 1.6 percent increase) weight. However, there is no a significant effect for women. Being employed could possibly increase the opportunity costs of off-the-job physical exercise needed to maintain lower (optimal) weight. The estimated coefficients for the year dummy are statistically significant and positive for all subsamples, indicating that people are heavier in 2004 than 1994. During the transition, individual weights have increased by 1.2 percent, other things equal. This finding suggests that the standard mechanism driven by technological change is also at work, as it is observed for other countries.

Table 4 presents the OLS estimates of the BMI production function where the dependent variable is the natural log of BMI. It is fitted to data pooled over men and women, and separately by gender and by residence. The results from the BMI equation look similar to those from the weight equation. Age follows a nonlinear relationship with both weight and BMI. BMI and obesity appear to rise with age and then peak at 61 for females and 60 for males, thereafter lowering again for those in their 60's and 70's. We tested for equality across male and female subsamples and across rural and urban subsamples, and rejected the hypothesis at the 1 percent level for both gender and residence. A male's age, total calories and the fat and protein content of his food consumption have statistically significant and positive effects on his BMI. A female's and urban resident's BMI increases with their dietary fat and protein consumption, while rural resident's BMI increases with fat and calories consumption. Having higher education decreases women's and urban residents' BMI. While being employed increases only the male's BMI, being a smoker significantly decreases his BMI. However, the BMI for both genders and residence locations is higher in 2004 than in 1994.

Diet (food consumption) is an important determinant of an individual being overweight or obese. In Russia, the traditional diet is high in sugar and livestock products (meat and dairy) that contain fat, protein and cholesterol, but is low in consumption of healthier foods, such as vegetables and fruits, and has extremely low intake of citrus fruit (Ginter 1995). This is probably due to the difficulty of growing fruits and vegetables in the Russian climate, as well as to the state authorities' food recommendations during the Soviet era that heavily favored meat and dairy products. The original Recommended Daily Intake in the Soviet Union specified that high protein intakes were necessary for maintaining good health. But high animal protein diets are likely to be high in saturated fat also.

How did consumption of meat and fish, fruits and vegetables, dairy, and alcohol change during the transition? Tables 2a-2e present the changes in consumption of fruits and vegetables, meat and fish, and dairy products from 1994 to 2004 by population categories. Consumption of food products is measured by the household real (with reference to June 1992) monthly expenditures. There is a trend of declining consumption of food products for all groups, with the most dramatic decline in consumption of meat and fish, and fruits and vegetables. The decline was much higher for the urban residents compared to the rural residents. For the pooled sample the consumption of fruits and vegetables declined the most for the overweight people (49 percent), followed by decline for the normal-weight people (45 percent) and for the obese (33 percent). The consumption of meat and fish declined the most for the normal-weight people, by 50 percent, followed by decline for the overweight people, 43 percent and for the obese, 36 percent. The dairy products consumption declined by 37 percent for normal-weight people and by 32 percent for the overweight and obese groups. The average Russian adult's calories consumption is about 1870 calories per day. Protein intake contributes around 13 percent of total calories, with a very small increase during the transition period. Caloric intake from fat declined from 34 percent for adult men and women, to 32 percent only for the normal-weight and overweight groups, possibly due to an overall improvement in nutritional status, while for the obese people it stayed the same at 33 percent. It is notable that the average calorie intake by obese is slightly lower than the calorie intake by other categories. It is to suggest the composition of the diet as well as factors representing variation in lifestyle play more important role than simple calorie counts.

Tables 2a-2e show also the changes in consumption of alcohol and cigarette smoking in Russia during the period 1994-2004. The general pattern during the transition period is that the number of people who consume alcohol has decreased, while there was a slight increase in the number of people who smoke. The increase in the share of people with normal weight who smoke is higher than those residing in rural areas (24 versus 13 percent) and is the highest increase among all individuals. The decrease in the share of individuals consuming alcohol is the highest for rural residents, ranging from 38 percent for overweight individuals, 27 percent for obese individuals, to 19 percent for normal weight individuals, while the decline of the share of individuals consuming alcohol is 11 percent for obese and overweight people and 12 percent for normal-weight urban residents.

Next, we estimated the individual demand for a) calories by OLS, the household demands for b) meat and fish, c) fruits and vegetables, and d) dairy products (equation 12) by interval regressions,[11] and the individual demand for alcohol (equation 13) using a probit model. First, we fitted the demand equation for individual's total calories for the pooled sample over urban and rural residents and separately by residence. An increase in age and expenditures significantly increases the demand for calories but the effect of expenditure is diminishing at higher expenditure levels, given the negative coefficient on the squared term of expenditure. The expenditure elasticity estimated at the sample mean is 0.015 for the pooled sample, and

0.010 for the urban and 0.04 for the rural samples. Therefore, the estimated expenditure effects are quite small. Being a male increases the demand for calories by about 10 percent. The demand for calories is increased by 6.2 percent for a male residing in urban areas, while the demand is increased by 14.3 percent for a male living in rural area. The higher demand for calories for rural resident is consistent since the likely more physical work for rural residents requires more energy. During the transition, the demand for (consumption of) calories has increased by 2.7 percent and by 1.6 percent and 4.6 percent for urban and rural residents, respectively. Being a smoker decreases the demand for calories by 3.2 percent. This effect is statistically significant only for the rural sample and the calorie demand is decreased by 5.7 percent. The results of the estimation of the demand for calories equation show significant regional effects, as well. Compared to the base Moscow-St. Petersburg metropolitan regions, the consumption of calories in all less urbanized regions is higher by between 10.5 and 23.6 percent. In the urban sample the base is Moscow-St. Petersburg metropolitan regions, while this region is dropped from the rural sample estimation because it does not include rural population. The base region for the rural sample estimation is the North and Northwest region. The calorie demand is significantly higher in North Caucuses, Ural and West Siberia regions compared to the base North and Northwest region.

The household demand equations for meat and fish, fruits and vegetables, and dairy products were fitted to the household data. The results are presented in Tables 5a, b and c. The adult equivalent number of household members is included to control for the size of the household, and the individual characteristics of the household head are used. The height, year dummy variable, household expenditure and the head’s education are among the important factors that significantly increase the household’s demand for meat and fish, fruits and vegetables, and dairy products. The quantity demanded of these products is 82 to 106 percent higher in 2004 than in 1994, or about 10 percent higher per year. The demands for fruits and vegetables, meat and fish, and dairy products are also convex in age of the household head—the quantity demanded declines until middle age and increases later. However, the effects are statistically significant only for the fruits and vegetables and dairy demand equations. The positive coefficient on expenditure and the negative coefficient on expenditure squared indicate that the demands for calories, meat and fish, fruits and vegetables, and dairy products are concave with respect to expenditure. The expenditure elasticities computed at the mean values of expenditures are positive and higher than unity—1.99 for fruits and vegetables, 1.70 for meat and fish and 1.28 for dairy products, indicating that as real income fell there was a major reduction in the consumption of these products. For the urban residents the expenditure elasticity for dairy products is less than unity (0.93), indicating a necessity good, while the other elasticieties are 1.67 for fruits and veggies, and 1.43 for meat and fish. The estimated elasticities are relatively high compared to those found in developed countries but comparable to those found in other transition economies (Hossain and Jensen, 2000). The regional differences in demands are interesting as the pattern of demand for all types of food is just the opposite of the pattern of demand for calories. In all regions, demands are lower compared to the base Moscow-St. Petersburg regions. The results suggest that dietary patterns differ substantially between metropolitan areas and rural provinces in Russia.

Table 6 presents the marginal effects of the individual's probability of consuming alcohol for the pooled sample and by urban/rural residence. The marginal effects are evaluated at the sample means. Being a male, a smoker, and having a higher education, all increase the probability of consuming alcohol by 20.6, 12.5 and 11.3 percent, respectively, for the whole sample. The magnitude of the effects of male, smoker and higher education are larger for the rural sample, being 27.0, 12.2, and 12.4 percent versus 19.3, 10.4 and 7.6 percent for the urban sample. The marginal effect of age evaluated at the sample mean is negative. The marginal effect of expenditure at the mean is positive and statistically significant for the pooled and rural sample, but small in magnitude. The probability of alcohol consumption is significantly higher in Ural (by 11.9 percent) region and significantly lower (by 9.9 percent) in the North Caucuses region compared to the Moscow-St. Petersburg regions. Urban residents from the North and Northwest, Central and Ural regions have higher probability of alcohol consumption compared to the base Moscow-St. Petersburg regions, while for the rural sample the probability of consuming alcohol is lower in the North Caucuses rural areas and higher in the Ural region compared to the North and Northwest region. The probability of consuming alcohol is lower in 2004 compared to 1994, by 5.3 percent for the whole sample and by 12.3 percent for the rural residents' sample, while the effect for the urban sample was not statistically different from zero, at conventional levels.

The results from the OLS estimation of the BMI supply function using lnWeight as the dependent variable for the pooled sample, and by gender and residence are presented in Table 7. The estimated coefficient for the predicted wage is positive suggesting that the more sedentary nature of higher wage jobs as well as higher opportunity cost of off-the-job exercising increases the individual weights. The estimated coefficient is statistically significant at the 5 percent level for the pooled and rural samples. Urban residents' weights were higher in 2004 than 1994, by 2.3 percent, and rural residents' weights were 2.8 percent higher. Only the weight of individuals living in the Central, North Caucasus, Siberia and

East Siberia regions are statistically significantly higher relative to the weight of individuals residing in the base Moscow-St. Petersburg regions.

Table 8 presents the OLS estimates of the individual's BMI supply function where the dependent variable is lnBMI. The results are very similar to the results of the specification where the dependent variable is lnWeight. We fitted the models separately for the 1994 and 2004 subsamples and also for each year by gender.[12] The effects of the factors affecting obesity are similar, with the only difference being the impact of wages (income), which is larger in magnitude and more significant in 2004. This is an important result pointing to the fact that economic forces have begun to play an increasingly important role in individual choices with the unfolding transition to a market economy.

Conclusions

This paper develops both theoretical and empirical models to facilitate understanding of the increased human obesity, measured as weight and BMI, and the factors contributing to it in Russia during the transition from a planned to a market economy. During ten years of transition there was a significant rise in obesity in Russia - a 38 percent increase by 2004. Empirical results strongly support our models for BMI production and demand for inputs in the BMI production function. Diet/caloric intake, smoking, gender and education are important determinants of obesity in Russia. The study finds a strong positive effect of caloric intake and a strong negative effect of smoking on weight and BMI - findings similar to those in developed market economies (Chou et al., 2004; Rashad, 2006; and Rashad et al., 2006).

We employ a balanced panel from the RLMS for 1994 and 2004 for both households and individuals in order to evaluate the changes in overweight and obesity during the transition and the effects of various factors. The individual BMI production and supply functions are the main focus of this analysis. Demographic and anthropometric characteristics such as height, gender, and age positively and significantly influence the degree of overweight and obesity in Russia, while age has a nonlinear effect, and better educated individuals are less overweight and obese. Economic and dietary factors such as caloric intake and composition of fat and protein also affect positively and significantly the individual's weight, and therefore contribute to obesity, but smoking deters overweight. These findings are similar to findings for developed economies, including the US (Chou et al., 2004; Lakdawalla and Philipson, 2002). Being employed increases individual's weight only for males and urban residents, also. Higher income, measured as expenditure in our study, is associated with increase in calorie demand, suggesting that calories are normal good and a major contributing factor to obesity with rising incomes, a trend currently observed in developed countries. For example, in 1970s the obesity rate of the population in the United States was heavily concentrated in low income households, but over the past three decades obesity has spread throughout the middle and high income population groups as well (Maheshwari et al., 2005).

Unbalanced diet and unfavorable health behavior such as large increases in alcohol and tobacco consumption amongst certain groups of the population are important determinants of health. Since diet is an essential factor affecting obesity, we fitted demand equations for several food groups, including meat and fish, fruits and vegetables and dairy products. Among the factors significantly and positively affecting consumption are household income/expenditure, and the education and age of the household head. Although the total calories consumed did not change over the ten-year period, obesity has increased. Change in the composition of the diet such as shifting away form healthy food as fruits and vegetables toward fatty and sugary products, or unhealthy lifestyle such as alcohol consumption, as well as the change in lifestyle with the technological progress, are among the possible explanations.

Understanding obesity in Russia is important in order to define what strategies are most likely to be effective in preventing and reducing obesity. This study indicates that higher education, other things equal, has a significant and negative effect on obesity, and contributes to the production and supply of good health. Education not only provides economic returns such as increasing earnings and employment, but also improves health and well being. Therefore, interventions which enhance education could play a vital role in preventing obesity in Russia. People should be educated about healthy lifestyles and healthy diet.

Notes

1. We use the sample weights provided with the data to correct for sample design and sampling procedure.
2. This is analogous to the derivation of the supply function for farm output in an agricultural household model (see Huffman, 1991).
3. This is not a true panel survey where sample households and individuals are followed and interviewed in each round. However, after 1999 the original design was modified and some households and individuals who moved were surveyed at their new locations. Most importantly, the analyses of the RLMS data for attrition, carried out by the Institute for Social Research at the University of Michigan, show that the exits can be characterized as random and that the sample distributions remain unchanged (Heeringa, 1997).
4. In the sample 19 percent of the observations had missing values of BMI, 7 percent had missing values of total calories, and 4 percent had missing values of income.
5. In the alternative estimation, where the dependent variable is Weight, lnHeight is included as an explanatory variable. We include the individual's mature height in this equation as a summary indicator of an individual's genetic potential and early investments in good health.
6. Although the RLMS collects detailed community level price data for 58 items each year, we do not have access to these data and cannot include the prices in our analysis.
7. The results from the estimation of the Heckman selection model to predict the individual wage are available from the authors upon request.

8. We use OLS estimates to exploit the between and within dimensions of the data even though not efficiently. To improve the efficiency of the estimates we use cluster option which produces cluster-robust covariance matrix. Such estimator allows for general forms of heteroskedasticity as well as autocorrelation within a given individual, and has been recently argued to be preferred or at least as good as random effects approach but without the need to make restrictive assumptions about correlations of the error terms (Verbeek and Vella 2005).
9. Results from estimation of unbalanced panel are similar to the reported results for the balanced panel and are available from the authors.
10. We applied Wald tests for coefficient differences between the male and female, and urban and rural subsamples. The results are available from the authors upon request.
11. Due to data limitations, we estimated demands for meat and fish, fruits and vegetables, and dairy at the household rather than the individual level.
12. The results are available from the authors upon request.

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Table 1
Variable names, definitions, means and standard deviations (weighted data)

Symbol	Mean (SD)	Definition
lnWeight	4.272(0.003)	Individual weight (kg) in logarithm
lnHeight	5.106(0.001)	Individual height (cm) in logarithm
lnBMI	3.270(0.002)	Individual weight divided by height (m) squared (kg/m2) in logarithm
lnCalories	7.493(0.004)	Total calories consumed per day in logarithm*
Fat	32.994(0.138)	Percent of daily calories from fat
Protein	12.885 (0.048)	Percent of daily calories from protein
lnMeat&fish	5.307(0.051)	Real total household expenditure per month on meat and fish (rubles) in logarithm
lnFruits&veggies	3.574(0.052)	Real total household expenditure per month on vegetables and fruit (rubles) in logarithm
lnDairy	4.097(0.046)	Real total household expenditure per month on dairy products (rubles) in logarithm
Alcohol	0.547 (0.007)	Dummy variable equal to 1 if the individual consumes alcohol and 0 otherwise**
Smoker	0.289(0.006)	Dummy variable equal to 1 if the individual smokes currently and 0 otherwise
Male	0.417(0.007)	Dummy variable equal to 1 if the individual is a male and 0 otherwise
Education1	0.378(0.006)	Dummy variable equal to 1 if the individual has education level below grade 8 and 0 otherwise
Education2	0.465(0.007)	Dummy variable equal to 1 if the individual has completed high school and 0 otherwise
Education3	0.157(0.005)	Dummy variable equal to 1 if the individual has completed higher education and 0 otherwise
Age	48.00(0.208)	Age in years
Age2	2550.34(20.72)	Square of age
Work	0.569(0.007)	Dummy variable equal to 1 if the individual is employed and 0 otherwise
lnExpend	8.718(0.887)	Monthly total household expenditures (rubles) in logarithm
lnExpend_sq	76.798(15.297)	Square of monthly total household expenditures in logarithm
lnWage	3.048(0.908)	Hourly wage (rubles) in logarithm ***
lnPred_wage	2.851(0.465)	Predicted value of hourly wage (rubles) in logarithm
lnNL_income	8.021(1.903)	Monthly non-labor individual income (rubles) in logarithm
Married	0.722(0.448)	Dummy variable equal to 1 if the individual is married and 0 otherwise
Kids6	0.248(0.559)	Number of children age 6 and less
Kids18	0.534(0.812)	Number of children age between 7 and 18

*Since the data for year 1994 was not available, we calculated it by extrapolation using information from five years over the 2000-2004 period.
**Individuals are asked direct questions in the health module about alcohol consumption.
***Number of observations is 2777.

Table 1 Continued

Symbol	Mean (SD)	Definition
lnEqnum	1.014(0.006)	Adult equivalent number of household members in logarithm
Moscow-St Peterburg	0.017(0.002)	Dummy variable equal to 1 if the individual resides in Moscow-St. Petersburg region and 0 otherwise
North&Northwest	0.059(0.003)	Dummy variable equal to 1 if the individual resides in North and Northwest region and 0 otherwise
Central	0.214(0.005)	Dummy variable equal to 1 if the individual resides in Central region and 0 otherwise
Volga region	0.225(0.006)	Dummy variable equal to 1 if the individual resides in Volga region and 0 otherwise
North Caucasus	0.156(0.005)	Dummy variable equal to 1 if the individual resides in North Caucasus region and 0 otherwise
Ural region	0.161(0.005)	Dummy variable equal to 1 if the individual resides in Ural region and 0 otherwise
West Siberia	0.085(0.004)	Dummy variable equal to 1 if the individual resides in West Siberia region and 0 otherwise
East Siberia	0.082(0.004)	Dummy variable equal to 1 if the individual resides in East Siberia region and 0 otherwise
Year	0.432(0.007)	Dummy variable equal to 1 if year is 2004 and 0 if the year is 1994

Note: Number of observations is 6424 individuals and 3, 710 households

Table 2a Characteristics of obese and overweight and their consumption, polled sample (weighted data)

Variables	Round 1994			Round 2004			All rounds		
	normal	overweight	Obese	normal	overweight	Obese	normal	overweight	obese
Age	38(0.38)	46(0.41)	50(0.48)	51(0.52)	56(0.48)	57(0.50)	43(0.33)	50(0.33)	54(0.36)
Height	168(0.24)	166(0.28)	162(0.31)	167(0.31)	165(0.31)	162(0.33)	167(0.19)	165(0.21)	162(0.23)
Male	0.49(0.01)	0.43(0.02)	0.19(0.02)	0.54(0.02)	0.45(0.02)	0.25(0.02)	0.51(0.01)	0.44(0.01)	0.22(0.01)
Education1	0.34(0.01)	0.37(0.01)	0.45(0.02)	0.37(0.02)	0.39(0.02)	0.40(0.02)	0.35(0.01)	0.38(0.01)	0.42(0.01)
Education2	0.49(0.01)	0.47(0.02)	0.44(0.02)	0.47(0.02)	0.44(0.02)	0.46(0.02)	0.48(0.01)	0.46(0.01)	0.45(0.01)
Education3	0.17(0.01)	0.16(0.01)	0.12(0.01)	0.16(0.01)	0.17(0.01)	0.14(0.01)	0.17(0.01)	0.16(0.01)	0.13(0.01)
Married	0.68(0.01)	0.76(0.01)	0.74(0.02)	0.69(0.02)	0.77(0.01)	0.76(0.02)	0.68(0.01)	0.77(0.01)	0.75(0.01)
Kids6	0.43(0.02)	0.35(0.02)	0.26(0.02)	0.13(0.01)	0.14(0.01)	0.11(0.01)	0.32(0.01)	0.26(0.01)	0.18(0.01)
Kids18	0.60(0.02)	0.63(0.03)	0.53(0.03)	0.53(0.03)	0.44(0.03)	0.38(0.03)	0.57(0.02)	0.54(0.02)	0.45(0.02)
Predicted wage	23.72(0.25)	22.49(0.29)	19.31(0.29)	16.36(0.22)	15.29(0.22)	13.90(0.24)	20.96(0.19)	19.29(0.20)	16.54(0.20)
Work	0.65(0.01)	0.66(0.01)	0.58(0.02)	0.51(0.02)	0.48(0.02)	0.43(0.02)	0.59(0.01)	0.58(0.01)	0.50(0.01)
Expenditure	10734(269.71)	11498(428.95)	10650(345.57)	7940(295.27)	8065(237.10)	7891(267.12)	9686(202.95)	9972(263.18)	9238(220.09)
Nonlabor_income	5894(161.96)	5986(208.52)	5627(200.48)	6393(223.05)	6438(217.02)	6889(319.94)	6081(131.37)	6187(150.83)	6273(191.51)
Smoker	0.39(0.01)	0.25(0.01)	0.11(0.01)	0.46(0.02)	0.25(0.01)	0.13(0.01)	0.42(0.01)	0.25(0.01)	0.12(0.01)
Drinker	0.64(0.01)	0.59(0.01)	0.51(0.02)	0.54(0.02)	0.46(0.02)	0.43(0.02)	0.60(0.01)	0.53(0.01)	0.47(0.01)
Calories	1879(13.90)	1883(16.27)	1822(22.22)	1860(18.26)	1902(18.29)	1843(19.09)	1872(11.07)	1892(12.15)	1833(14.59)
Fat	34(0.29)	34(0.31)	33(0.45)	32(0.34)	32(0.31)	33(0.35)	33(0.05)	33(0.22)	33(0.28)
Protein	13(0.09)	13(0.10)	13(0.14)	13(0.12)	13(0.12)	13(0.14)	13(0.07)	13(0.08)	13(0.10)
Fruits&veggies	488(22.64)	514(26.02)	443(37.99)	269(20.76)	260(13.29)	298(26.32)	406(16.30)	401(15.85)	369(22.99)
Meat&fish	1507(77.60)	1632(69.10)	1448(87.20)	757(32.77)	929(35.59)	929(43.67)	1226(50.56)	1320(42.18)	1182(48.49)
Dairy	383(13.99)	391(15.27)	383(20.11)	243(10.46)	266(9.71)	261(10.59)	331(9.68)	336(9.59)	320(11.31)
Percentage	45.47	34.25	20.28	35.93	36.07	28.00	41.36	35.03	23.61
Number of observations	1432	1111	669	1155	1154	903	2587	2265	1572

Table 2b Characteristics of obese and overweight and their consumption, males only (weighted data)

Variables	Round 1994			Round 2004			All rounds		
	normal	overweight	obese	normal	overweight	Obese	normal	overweight	obese
Age	38(0.51)	43(0.58)	48(1.04)	50(0.04)	54(0.70)	55(0.98)	43(0.44)	48(0.49)	52(0.74)
Height	173(0.27)	173(0.33)	171(0.68)	172(0.34)	172(0.36)	172(0.63)	173(0.21)	172(0.24)	172(0.46)
Education1	0.36(0.02)	0.35(0.02)	0.39(0.04)	0.39(0.02)	0.39(0.03)	0.35(0.04)	0.37(0.01)	0.37(0.02)	0.37(0.03)
Education2	0.51(0.02)	0.48(0.02)	0.49(0.05)	0.50(0.02)	0.46(0.03)	0.43(0.04)	0.50(0.02)	0.48(0.02)	0.45(0.03)
Education3	0.13(0.01)	0.16(0.02)	0.13(0.03)	0.11(0.02)	0.14(0.02)	0.22(0.03)	0.12(0.01)	0.15(0.01)	0.18(0.02)
Married	0.73(0.02)	0.86(0.02)	0.91(0.03)	0.75(0.02)	0.88(0.02)	0.90(0.02)	0.74(0.01)	0.87(0.01)	0.90(0.02)
Kids6	0.41(0.03)	0.40(0.03)	0.27(0.06)	0.12(0.02)	0.16(0.02)	0.12(0.03)	0.30(0.02)	0.29(0.02)	0.18(0.03)
Kids18	0.65(0.03)	0.67(0.04)	0.63(0.09)	0.52(0.04)	0.47(0.04)	0.42(0.06)	0.60(0.03)	0.58(0.03)	0.51(0.05)
Predicted wage	26.85(0.37)	26.36(0.44)	24.25(0.80)	18.57(0.30)	18.28(0.34)	18.80(0.60)	23.57(0.28)	22.68(0.32)	21.12(0.51)
Work	0.73(0.02)	0.79(0.02)	0.76(0.04)	0.52(0.02)	0.55(0.03)	0.48(0.04)	0.64(0.01)	0.68(0.02)	0.60(0.03)
Expenditure	11376(420.18)	12472(826.26)	11758(820.96)	8488(448.95)	8550(348.59)	9160(579.89)	10234(312.53)	10688(482.06)	10265(487.67)
Nonlabor_income	5687(219.50)	5677(296.20)	5309(432.79)	6761(336.31)	6846(349.04)	7824(977.86)	6112(188.31)	6208(227.34)	6755(596.18)
Smoker	0.70(0.02)	0.52(0.02)	0.44(0.05)	0.75(0.02)	0.51(0.03)	0.36(0.04)	0.72(0.01)	0.52(0.02)	0.39(0.03)
Drinker	0.76(0.02)	0.77(0.02)	0.78(0.04)	0.65(0.02)	0.59(0.03)	0.63(0.04)	0.71(0.01)	0.69(0.02)	0.69(0.03)
Calories	1941(21.29)	2030(27.30)	2078(56.75)	1951(26.86)	1989(27.55)	2040(44.49)	1945(16.68)	2011(19.47)	2056(35.19)
Fat	35(0.44)	35(0.49)	36(1.02)	32(0.47)	32(0.49)	35(0.74)	33(0.33)	34(0.35)	35(0.61)
Protein	13(0.14)	13(0.17)	13(0.31)	13(0.17)	14(0.19)	13(0.27)	13(0.11)	13(0.12)	13(0.20)
Fruits&veggies	487(32.45)	565(43.75)	453(110.3)	275(25.89)	269(19.87)	410(91.32)	403(22.33)	430(25.98)	428(70.39)
Meat&fish	1563(117.4)	1677(105.2)	1729(267.97)	780(41.76)	1003(55.54)	1140(115.55)	1254(73.70)	1370(63.63)	1390(132.78)
Dairy	379(20.36)	426(26.71)	348(44.49)	237(14.64)	281(16.38)	303(25.10)	323(13.75)	360(16.50)	322(23.80)
Percentage	54.70	35.81	9.49	45.59	38.07	16.34	50.70	36.80	12.50
Number of observations	680	460	126	578	478	210	1,258	938	336

Table 2c. Characteristics of obese and overweight and their consumption, females only (weighted data)

Variables	Round 1994			Round 2004			All rounds		
	normal	overweight	obese	normal	overweight	Obese	normal	overweight	obese
Age	38(0.56)	48(0.56)	50(0.54)	52(0.84)	58(0.64)	58(0.57)	43(0.50)	52(0.44)	54(0.41)
Height	162(0.24)	160(0.26)	160(0.27)	160(0.36)	159(0.29)	159(0.26)	161(0.20)	160(0.19)	159(0.35)
Education1	0.32(0.02)	0.38(0.02)	0.46(0.02)	0.34(0.02)	0.39(0.02)	0.42(0.02)	0.33(0.01)	0.39(0.01)	0.44(0.01)
Education2	0.47(0.02)	0.45(0.02)	0.42(0.02)	0.43(0.02)	0.42(0.02)	0.47(0.02)	0.46(0.01)	0.44(0.01)	0.45(0.01)
Education3	0.21(0.01)	0.16(0.01)	0.12(0.01)	0.22(0.02)	0.19(0.02)	0.11(0.01)	0.22(0.01)	0.17(0.01)	0.11(0.01)
Married	0.63(0.02)	0.68(0.02)	0.70(0.02)	0.62(0.02)	0.68(0.02)	0.72(0.02)	0.63(0.01)	0.68(0.01)	0.71(0.01)
Kids6	0.45(0.02)	0.32(0.03)	0.25(0.03)	0.14(0.02)	0.12(0.02)	0.11(0.01)	0.34(0.02)	0.23(0.02)	0.18(0.02)
Kids18	0.55(0.03)	0.59(0.03)	0.51(0.04)	0.53(0.04)	0.42(0.03)	0.37(0.03)	0.54(0.02)	0.52(0.02)	0.44(0.02)
Predicted wage	20.66(0.29)	19.58(0.32)	18.14(0.28)	13.76(0.29)	12.86(0.24)	12.29(0.21)	18.22(0.23)	16.65(0.23)	15.25(0.20)
Work	0.57(0.02)	0.56(0.02)	0.54(0.02)	0.50(0.02)	0.42(0.02)	0.41(0.02)	0.54(0.01)	0.50(0.01)	0.48(0.02)
Expenditure	10104(335.45)	10762(419.11)	10386(379.91)	7299(364.53)	7670(322.17)	7472(296.85)	9112(254.94)	9413(278.20)	8946(245.70)
Nonlabor_income	6096(237.66)	6220(289.39)	5703(225.64)	5962(280.09)	6107(271.64)	6581(275.99)	6049(182.90)	6171(201.61)	6137(178.19)
Smoker	0.09(0.01)	0.05(0.01)	0.03(0.01)	0.13(0.02)	0.04(0.01)	0.06(0.01)	0.10(0.01)	0.04(0.01)	0.04(0.01)
Drinker	0.53(0.02)	0.46(0.02)	0.45(0.02)	0.41(0.02)	0.35(0.02)	0.36(0.02)	0.48(0.01)	0.41(0.01)	0.41(0.01)
Calories	1819(17.63)	1772(18.48)	1762(23.09)	1754(23.06)	1832(24.01)	1778(19.91)	1796(14.04)	1798(14.80)	1770(15.27)
Fat	33(0.39)	33(0.38)	32(0.49)	32(0.48)	32(0.40)	32(0.40)	33(0.31)	34(0.28)	32(0.32)
Protein	12(0.13)	13(0.13)	13(0.15)	13(0.18)	13(0.17)	13(0.16)	12(0.10)	13(0.10)	13(0.11)
Fruits&veggies	490(31.61)	475(31.46)	440(39.01)	262(33.34)	252(17.89)	262(17.50)	409(23.80)	378(19.62)	352(21.70)
Meat&fish	1452(101.86)	1599(91.65)	1381(86.85)	730(51.66)	868(45.89)	859(43.34)	1196(68.99)	1280(56.33)	1123(49.43)
Dairy	388(19.24)	365(17.59)	391(22.52)	251(14.89)	254(11.48)	247(11.33)	339(13.63)	317(11.21)	320(12.86)
Percentage	39.02	33.16	27.82	28.79	34.59	36.62	34.66	33.77	31.57
Number of observations	752	651	543	577	676	693	1,329	1,327	1,236

Table 2d. Characteristics of obese and overweight and their consumption, urban only (weighted data)

Variables	Round 1994			Round 2004			All rounds		
	normal	overweight	obese	normal	overweight	Obese	normal	overweight	obese
Age	37(0.46)	46(0.53)	51(0.64)	50(0.69)	56(0.63)	58(0.65)	42(0.42)	51(0.43)	55(0.47)
Male	0.48(0.02)	0.40(0.02)	0.18(0.02)	0.53(0.02)	0.44(0.02)	0.22(0.02)	0.50(0.01)	0.42(0.01)	0.20(0.01)
Height	168(0.30)	166(0.35)	162(0.41)	167(0.41)	165(0.42)	162(0.43)	168(0.24)	166(0.27)	162(0.30)
Education1	0.29(0.02)	0.34(0.02)	0.40(0.02)	0.35(0.02)	0.35(0.02)	0.35(0.02)	0.31(0.01)	0.34(0.01)	0.37(0.02)
Education2	0.49(0.02)	0.45(0.02)	0.44(0.03)	0.43(0.02)	0.44(0.02)	0.47(0.02)	0.47(0.01)	0.45(0.01)	0.46(0.02)
Education3	0.21(0.01)	0.21(0.02)	0.16(0.02)	0.22(0.02)	0.21(0.02)	0.18(0.02)	0.22(0.01)	0.21(0.01)	0.17(0.01)
Married	0.67(0.02)	0.74(0.02)	0.71(0.02)	0.68(0.02)	0.76(0.02)	0.73(0.02)	0.67(0.26)	0.75(0.01)	0.72(0.02)
Kids6	0.37(0.02)	0.27(0.02)	0.16(0.02)	0.10(0.01)	0.11(0.01)	0.09(0.01)	0.27(0.01)	0.20(0.01)	0.12(0.01)
Kids18	0.57(0.03)	0.59(0.03)	0.45(0.04)	0.51(0.02)	0.42(0.03)	0.35(0.03)	0.28(0.03)	0.48(0.02)	0.36(0.02)
Predicted wage	25.59(0.34)	24.07(0.39)	20.52(0.43)	17.52(0.31)	16.14(0.31)	14.48(0.35)	22.64(0.26)	20.60(0.28)	17.33(0.29)
Work	0.67(0.02)	0.67(0.02)	0.61(0.02)	0.56(0.02)	0.54(0.02)	0.44(0.02)	0.63(0.01)	0.61(0.01)	0.52(0.02)
Expenditure	11020(358.96)	11627(655.11)	10403(455.42)	8457(411.36)	8652(344.71)	8189(383.54)	10090(274.99)	10326(400.40)	9233(297.65)
Nonlabor_income	5442(207.48)	5068(224.82)	4872(233.10)	5807(240.81)	5978(222.85)	6691(460.01)	5575(158.50)	5466(160.24)	5833(268.76)
Smoker	0.38(0.02)	0.24(0.02)	0.11(0.02)	0.47(0.02)	0.24(0.02)	0.13(0.02)	0.41(0.01)	0.24(0.01)	0.12(0.01)
Drinker	0.68(0.02)	0.62(0.02)	0.53(0.03)	0.60(0.02)	0.55(0.02)	0.47(0.02)	0.65(0.01)	0.59(0.01)	0.50(0.02)
Calories	1829(15.59)	1792(16.60)	1748(22.27)	1810(21.28)	1830(20.57)	1776(20.60)	1822(12.58)	1809(12.98)	1763(15.13)
Fat	34(0.37)	34(0.38)	33(0.57)	32(0.46)	33(0.41)	33(0.45)	34(0.29)	34(0.28)	33(0.36)
Protein	12(0.12)	13(0.14)	13(0.19)	13(0.16)	13(0.16)	13(0.19)	13(0.09)	13(0.10)	13(0.14)
Fruits&veggies	611(31.96)	603(30.74)	541(58.75)	271(17.31)	297(16.41)	335(22.49)	488(21.79)	469(19.24)	432(30.35)
Meat&fish	1955(111.37)	2089(88.95)	2060(141.59)	891(37.01)	1071(42.36)	1079(52.81)	1569(73.56)	1644(55.32)	1542(74.44)
Dairy	485(18.54)	503(20.00)	493(26.91)	325(15.05)	363(13.61)	334(14.65)	427(13.18)	442(12.88)	409(15.11)
Percentage	46.93	34.31	18.76	35.89	35.85	28.26	42.22	34.97	22.81
Number of observations	891	681	383	701	692	562	1,592	1,373	945

Table 2e. Characteristics of obese and overweight and their consumption, rural only (weighted data)

Variables	Round 1994			Round 2004			All rounds		
	normal	overweight	obese	normal	overweight	Obese	normal	overweight	obese
Age	39(0.65)	45(0.65)	49(0.75)	51(0.81)	56(0.73)	56(0.76)	44(0.54)	50(0.52)	53(0.55)
Male	0.52(0.02)	0.47(0.02)	0.20(0.02)	0.55(0.03)	0.46(0.03)	0.28(0.03)	0.53(0.02)	0.46(0.02)	0.24(0.02)
Height	167(0.38)	165(0.45)	162(0.46)	166(0.49)	164(0.46)	162(0.51)	167(0.30)	165(0.32)	162(0.34)
Education1	0.41(0.02)	0.42(0.02)	0.40(0.03)	0.45(0.03)	0.47(0.03)	0.42(0.02)	0.40(0.02)	0.43(0.02)	0.49(0.02)
Education2	0.49(0.02)	0.49(0.02)	0.43(0.03)	0.52(0.03)	0.44(0.03)	0.44(0.03)	0.50(0.02)	0.47(0.02)	0.44(0.02)
Education3	0.10(0.01)	0.09(0.01)	0.07(0.02)	0.09(0.01)	0.11(0.02)	0.08(0.02)	0.09(0.01)	0.10(0.01)	0.08(0.01)
Married	0.70(0.02)	0.79(0.02)	0.76(0.03)	0.70(0.02)	0.79(0.02)	0.81(0.02)	0.70(0.02)	0.79(0.01)	0.79(0.02)
Kids6	0.52(0.03)	0.47(0.04)	0.37(0.04)	0.16(0.02)	0.19(0.03)	0.14(0.02)	0.38(0.02)	0.34(0.03)	0.26(0.03)
Kids18	0.65(0.04)	0.68(0.04)	0.62(0.06)	0.67(0.05)	0.57(0.05)	0.52(0.05)	0.66(0.03)	0.63(0.03)	0.57(0.04)
Predicted wage	20.85(0.32)	20.21(0.39)	17.86(0.35)	14.77(0.30)	14.14(0.31)	13.09(0.32)	18.46(0.25)	17.45(0.27)	15.52(0.26)
Work	0.61(0.02)	0.66(0.02)	0.55(0.03)	0.44(0.03)	0.39(0.02)	0.41(0.03)	0.55(0.02)	0.54(0.02)	0.48(0.02)
Expenditure	10287(398.62)	11310(449.64)	10948(528.59)	7233(411.95)	7272(300.50)	7473(348.31)	9085(294.83)	9475(289.01)	9243(326.41)
Nonlabor_income	6600(256.32)	7318(385.36)	6538(334.35)	7195(409.23)	7062(409.71)	7167(417.70)	6834(223.99)	7202(280.75)	6846(266.72)
Smoker	0.40(0.02)	0.26(0.02)	0.11(0.02)	0.45(0.03)	0.26(0.02)	0.13(0.02)	0.42(0.02)	0.26(0.02)	0.12(0.01)
Drinker	0.57(0.02)	0.55(0.02)	0.49(0.03)	0.46(0.03)	0.34(0.02)	0.36(0.03)	0.53(0.02)	0.45(0.02)	0.43(0.02)
Calories	1952(24.95)	2010(30.79)	1910(40.35)	1947(32.24)	2011(32.09)	1931(34.59)	1950(19.74)	2010(22.24)	1920(26.66)
Fat	33(0.48)	34(0.50)	33(0.70)	31(0.50)	31(0.48)	31(0.57)	32(0.35)	32(0.35)	32(0.45)
Protein	13(0.16)	13(0.16)	13(0.20)	13(0.19)	13(0.19)	13(0.19)	13(0.12)	13(0.13)	13(0.14)
Fruits&veggies	297(27.50)	385(44.82)	324(43.77)	265(43.09)	210(21.78)	247(54.67)	285(23.79)	305(26.54)	286(34.90)
Meat&fish	808(88.20)	970(101.62)	710(66.29)	573(57.49)	737(59.51)	717(72.66)	716(58.17)	864(61.81)	713(49.09)
Dairy	224(19.21)	229(21.22)	249(28.33)	132(11.45)	135(10.02)	158(12.75)	188(12.57)	186(12.53)	204(15.84)
Percentage	43.37	34.17	22.46	35.99	36.37	27.64	40.13	35.13	24.74
Number of observations	541	430	286	454	462	341	995	892	627

Table 3
OLS Estimates of the BMI production function (dependent variable lnWeight)

Variable	Pooled Sample	Females	Males	Urban	Rural
lnHeight	1.855(0.071)***	1.729(0.096)***	2.007(0.101)***	1.867(0.094)***	1.874(0.109)***
Male	-0.034(0.008)***			-0.041(0.011)***	-0.034(0.013)**
Age	0.016(0.001)***	0.022(0.001)***	0.009(0.001)***	0.017(0.001)***	0.015(0.001)***
Age2	-0.0001(0)***	-0.0002(0)***	-0.0001(0)***	-0.0001(0)***	-0.0001(0)***
Education2	0.010(0.006)*	0.013(0.008)	0.007(0.008)	0.012(0.008)	0.003(0.010)
Education3	-0.023(0.008)***	-0.038(0.011)***	0.007(0.011)	-0.025(0.010)**	-0.014(0.014)
Work	0.014(0.005)**	0.009(0.007)	0.017(0.008)**	0.016(0.007)**	0.011(0.008)
lnCalories	0.024(0.01)**	0.008(0.013)	0.056(0.014)***	0.005(0.013)	0.038(0.015)**
Fat	0.0008(0.0002)***	0.001(0.0003)**	0.001(0.0003)***	0.0009(0.0003)***	0.0007(0.0004)**
Protein	0.003(0.001)***	0.002(0.001)**	0.003(0.001)***	0.004(0.001)***	0.0007(0.001)
Smoker	-0.063(0.007)***	-0.027(0.014)*	-0.076(0.008)***	-0.056(0.009)***	-0.071(0.011)***
Year	0.010(0.003)***	0.012(0.004)***	0.012(0.004)***	0.010(0.004)**	0.009(0.005)*
Constant	-5.855(0.365)***	-5.244(0.494)***	-6.747(0.527)***	-5.825(0.482)***	-5.981(0.557)***
R-squared	0.25	0.22	0.30	0.25	0.255
Number of observations	6,424	3,892	2,532	3,910	2,514

Note: * Statistically significant at the 10 percent level or less;
** Statistically significant at the 5 percent level or less;
***Statistically significant at the 1 percent level or less.
Robust standard errors are in parentheses.

Table 4
OLS Estimates of the BMI production function (dependent variable lnBMI)

Variable	Pooled Sample	Females	Males	Urban	Rural
Male	-0.047(0.008)***			-0.051(0.008)***	-0.043(0.010)***
Age	0.016(0.001)***	0.022(0.001)***	0.009(0.001)***	0.017(0.001)***	0.015(0.001)***
Age2	-0.0001(0.00)***	-0.0001(0)***	-0.0001(0)***	-0.0001(0)***	-0.0001(0)***
Education2	0.010(0.006)	0.011(0.008)	0.007(0.008)	0.012(0.008)	0.003(0.010)
Education3	-0.024(0.008)***	-0.042(0.011)***	0.007(0.011)	-0.028(0.010)***	-0.015(0.014)
Work	0.014(0.005)**	0.009(0.007)	0.017(0.008)**	0.016(0.007)**	0.011(0.008)
lnCalories	0.024(0.01)**	0.008(0.013)	0.056(0.014)***	0.005(0.013)	0.037(0.015)**
Fat	0.001(0.0002)***	0.001(0.0003)**	0.001(0.0003)***	0.0008(0.0003)***	0.0007(0.0004)**
Protein	0.003(0.001)***	0.002(0.001)**	0.003(0.001)***	0.004(0.001)***	0.0006(0.001)
Smoker	-0.063(0.007)***	-0.027(0.014)*	-0.076(0.008)***	-0.056(0.009)***	-0.071(0.011)***
Year	0.010(0.003)***	0.011(0.004)**	0.012(0.004)***	0.010(0.004)**	0.008(0.005)*
Constant	2.616(0.076)***	2.591(0.102)***	2.500(0.110)***	2.709(0.104)***	2.590(0.113)***
R-squared	0.18	0.18	0.14	0.21	0.155
Number of observations	6,424	3,892	2,532	3,910	2,514

Note: * Statistically significant at the 10 percent level or less;
** Statistically significant at the 5 percent level or less;
*** Statistically significant at the 1 percent level or less.
Robust standard errors are in parentheses.

Table 5a
OLS Coefficients for caloric demand and interval regression coefficients for fruits and vegetables, meat and fish and dairy products (Pooled sample)

Variable	lnCalories	lnFruits&veggies	lnMeat&fish	lnDairy
lnEqnum		-1.035(0.184)***	-0.834(0.143)***	-0.576(0.143)***
lnHeight	0.041(0.116)	2.171(1.533)	3.750(1.442)**	4.353(1.529)***
Male	0.101(0.014)***	-0.462(0.227)**	-0.381(0.167)***	-0.687(0.186)***
Age	0.002(0.002)	-0.130(0.026)***	-0.018(0.021)	-0.101(0.021)***
Age2	-0.0001(0.000)**	0.001(0.0002)***	0.0003(0.0002)	0.001(0.0002)***
Education2	-0.001(0.01)	0.549(0.168)***	0.328(0.128)**	0.359(0.140)***
Education3	0.010(0.013)	1.097(0.206)***	0.638(0.150)***	1.213(0.153)***
Smoker	-0.032(0.012)**	-0.168(0.198)	0.005(0.144)	-0.014(0.162)
lnExpend	0.139(0.053)**	8.300(1.085)***	7.349(0.865)***	4.356(0.828)***
lnExpend_sq	-0.007(0.003)**	-0.357(0.061)***	-0.320(0.049)***	-0.174(0.047)***
Year	0.027(0.005)***	0.966(0.144)***	1.055(0.107)***	0.824(0.104)***
North&Northwest	0.105(0.036)***	-0.833(0.314)**	-0.520(0.222)**	-1.023(0.281)***
Central	0.115(0.030)***	-1.651(0.251)***	-0.394(0.183)***	-0.653(0.202)***
Volga region	0.135(0.030)***	-2.841(0.267)***	-0.854(0.188)***	-1.397(0.218)***
North Caucases	0.236(0.031)***	-2.290(0.306)***	-1.399(0.226)***	-1.708(0.244)***
Ural region	0.154(0.030)***	-1.525(0.266)***	-0.645(0.199)***	-0.757(0.214)***
West Siberia	0.173(0.033)***	-3.067(0.345)***	-2.361(0.278)***	-1.775(0.283)***
East Siberia	0.193(0.033)***	-2.162(0.325)***	-2.204(0.274)***	-1.735(0.279)***
Constant	6.401(0.641)***	-47.905(10.68)***	-52.396(8.359)***	-39.844(6.947)***
R-squared/Log Pseudolikelihood	0.09	-7660.76	-8382.49	-8026.40
Number of observations	6,424	3,710	3,710	3,710

Note: * Statistically significant at the 10 percent level or less;
** Statistically significant at the 5 percent level or less;
*** Statistically significant at the 1 percent level or less.
Robust standard errors are in parentheses.

Table 5b
OLS Coefficients for caloric demand and interval regression coefficients for fruits and vegetables, meat and fish and dairy products (Urban sample)

Variable	lnCalories	lnFruits&veggies	lnMeat&fish	lnDairy
lnEqnum		0.605(0.177)***	-0.232(0.123)*	0.177(0.115)
lnHeight	-0.009(0.143)	0.181(1.899)	2.179(1.179)*	1.416(1.168)
Male	0.062(0.017)***	-0.256(0.223)	-0.143(0.133)	-0.119(0.139)
Age	-0.001(0.002)	-0.060(0.025)**	0.031(0.019)*	-0.033(0.018)*
Age2	-0.0000(0.000)	0.001(0.0002)**	-0.0002(0.0002)	0.0004(0.0002)**
Education2	-0.008(0.012)	0.189(0.170)	-0.097(0.107)	-0.100(0.114)
Education3	0.016(0.015)	0.608(0.197)***	-0.086(0.123)	0.252(0.117)**
Smoker	-0.014(0.014)	-0.239(0.194)	-0.180(0.119)	-0.375(0.130)***
lnExpend	0.063(0.064)	8.747(1.098)***	7.913(0.783)***	4.367(0.681)***
lnExpend_sq	-0.003(0.004)	-0.399(0.061)***	-0.366(0.044)***	-0.194(0.038)***
Year	0.016(0.005)***	0.527(0.145)***	0.109(0.091)	0.369(0.092)***
North&Northwest	0.125(0.036)***	-0.617(0.303)**	-0.445(0.211)**	-0.493(0.245)**
Central	0.126(0.030)***	-1.282(0.232)***	-0.063(0.153)	-0.295(0.168)*
Volga region	0.131(0.030)***	-1.512(0.239)***	-0.236(0.162)	-0.358(0.179)**
North Caucases	0.165(0.034)***	-0.414(0.262)	-0.104(0.186)	-0.644(0.220)***
Ural region	0.141(0.030)***	-1.188(0.244)***	-0.352(0.170)**	-0.361(0.176)**
West Siberia	0.115(0.034)***	-1.846(0.353)***	-0.975(0.261)***	-0.430(0.220)**
East Siberia	0.209(0.035)***	-1.267(0.325)***	-0.799(0.240)***	-0.428(0.229)*
Constant	7.067(0.799)***	-39.818(10.52)***	-46.505(7.089)***	-24.862(6.688)***
R-squared/Log Pseudolikelihood	0.05	-5001.53	-4799.64	-4718.74
Number of observations	3,910	2,306	2,306	2,306

Note: * Statistically significant at the 10 percent level or less;
** Statistically significant at the 5 percent level or less;
*** Statistically significant at the 1 percent level or less.
Robust standard errors are in parentheses.

Table 5c
OLS Coefficients for caloric demand and interval regression coefficients for fruits and vegetables, meat and fish and dairy products (Rural sample)

Variable	lnCalories	lnFruits&veggies	lnMeat&fish	lnDairy
lnEqnum		-1.240(0.419)***	-1.511(0.304)***	-1.598(0.328) ***
lnHeight	0.296(0.194)	0.450(4.326)	0.094(3.141)	1.691(3.825)
Male	0.143(0.024)***	0.015(0.528)	-0.157(0.390)	-1.191(0.479) **
Age	0.007(0.003)**	-0.232(0.060)***	-0.041(0.048)	-0.164(0.053) ***
Age2	-0.0001(0.000)***	0.002(0.0006)***	0.0004(0.0004)	0.002(0.001) ***
Education2	0.001(0.018)	0.796(0.374)**	0.712(0.286) **	0.878(0.348) **
Education3	0.002(0.029)	0.574(0.197)	1.148(0.440) **	2.423(0.484)***
Smoker	-0.057(0.021)**	-0.462(0.493)	0.174(0.362)	0.857(0.444)*
lnExpend	0.163(0.087)*	5.534(2.521)**	5.333(1.862)***	3.194(2.145)
lnExpend_sq	-0.007(0.005)	-0.170(0.143)	-0.179(0.108)*	-0.072(0.123)
Year	0.046(0.008)***	2.121(0.350)***	3.202(0.257) ***	2.170(0.270)***
Central	0.027(0.048)	-1.712(0.612)**	-1.230(0.445) ***	-0.115(0.628)
Volga region	0.064(0.044)	-4.774(0.641)***	-1.248(0.417) ***	-1.486(0.630)**
North Caucases	0.173(0.044)***	-2.944(0.651)***	-1.549(0.437) ***	-0.226(0.624)
Ural region	0.122(0.048)**	-2.027(0.696)***	-1.545(0.519)***	-1.321(0.703)*
West Siberia	0.160(0.047)***	-4.035(0.728)***	-3.704(0.539)***	-1.761(0.715)**
East Siberia	0.090(0.050)	-2.490(0.690)***	-3.737(0.522)***	-1.875(0.702)**
Constant	4.918(1.048)***	-28.884(24.086)	-27.166(17.679)	-25.065(21.649)
R-squared/Log	0.17			
Pseudolikelihood		-2377.20	-2951.82	-2563.10
Number of observations	2,514	1,404	1,404	1,404

Note: * Statistically significant at the 10 percent level or less;
** Statistically significant at the 5 percent level or less;
*** Statistically significant at the 1 percent level or less.
Robust standard errors are in parentheses.

[a]The dummy North&Northwest region is dropped in regressions for the rural sample because the base category Moscow Saint Petersburg does not have rural population and thus one other category must be dropped from the regression.

Table 6
Probit estimation of the demand for alcohol (probability of drinking)

Variable	Marginal effects					
	Pooled sample		Urban sample		Rural sample	
lnHeight	-0.238	(0.186)	-0.208	(0.244)	-0.552	(0.282)**
Male	0.206	(0.021)***	0.193	(0.026)***	0.270	(0.032)***
Age	-0.002	(0.0002)***	-0.001	(0.0003)***	-0.003	(0.0005)***
Age2						
Education2	0.012	(0.017)	0.016	(0.022)	0.050	(0.027)*
Education3	0.113	(0.021)***	0.076	(0.025)***	0.124	(0.039)***
Smoker	0.125	(0.019)***	0.104	(0.024)***	0.122	(0.032)***
lnExpend	0.027	(0.003)***	0.021	(0.014)	0.043	(0.011)***
lnExpend_sq						
Year	-0.053	(0.013)***	-0.008	(0.016)	-0.123	(0.021)***
North&Northwest	0.077	(0.047)	0.143	(0.045)***		
Central	0.063	(0.041)	0.072	(0.041)*	0.067	(0.059)
Volga region	0.034	(0.041)	0.053	(0.042)	0.041	(0.056)
North Caucases	-0.099	(0.043)**	0.061	(0.048)	-0.114	(0.054)**
Ural region	0.119	(0.040)***	0.117	(0.040)**	0.142	(0.061)**
West Siberia	0.003	(0.046)	0.030	(0.052)	0.014	(0.063)
East Siberia	0.057	(0.045)	0.089	(0.046)*	0.065	(0.064)
Pseudo R_squared	0.12		0.12		0.13	
Number of observations	6,424		3,910		2,514	

Note: * Statistically significant at the 10 percent level or less;
** Statistically significant at the 5 percent level or less;
*** Statistically significant at the 1 percent level or less.
Robust standard errors are in parentheses.

Table 7
OLS Estimates of the BMI supply function (dependent variable lnWeight)[a]

Variable	Pooled Sample	Females	Males	Urban	Rural
lnHeight	1.867(0.072)***	1.745(0.097)***	2.036(0.104)***	1.878(0.095)***	1.883(0.109)***
Male	-0.047(0.011)***			-0.051(0.014)***	-0.052(0.016)***
Age	0.015(0.001)***	0.022(0.002)***	0.010(0.001)***	0.016(0.001)***	0.013(0.002)***
Age2	-0.0001(0.000)***	-0.0002(0.00)***	-0.0001(0.00)***	-0.0001(0.00)***	-0.0001(0.00)***
Education2	0.008(0.007)	0.014(0.010)	0.001(0.009)	0.012(0.008)	-0.005(0.010)
Education3	-0.043(0.015)***	-0.036(0.029)	-0.023(0.025)	-0.042(0.019)**	-0.057(0.026)**
Smoker	-0.063(0.007)***	-0.026(0.015)*	-0.079(0.008)***	-0.056(0.009)***	-0.071(0.011)***
lnPred_wage	0.048(0.023)**	0.006(0.049)	0.058(0.039)	0.038(0.029)	0.087(0.039)**
Year	0.023(0.007)***	0.015(0.014)	0.022(0.009)**	0.023(0.008)**	0.028(0.011)**
North&Northwest	0.029(0.019)	0.032(0.029)	0.010(0.024)	0.030(0.021)	-
Central	0.044(0.021)**	0.032(0.040)	0.045(0.026)*	0.050(0.023)**	0.003(0.026)
Volga region	0.036(0.024)	0.010(0.046)	0.042(0.034)	0.027(0.028)	0.035(0.031)
North Caucases	0.068(0.026)**	0.029(0.049)	0.093(0.038)**	0.052(0.032)*	0.068(0.033)**
Ural region	0.028(0.020)	0.012(0.038)	0.026(0.025)	0.019(0.022)	0.029(0.025)
West Siberia	0.052(0.028)*	0.023(0.052)	0.042(0.027)	0.031(0.034)	0.068(0.037)*
East Siberia	0.049(0.021)**	0.042(0.034)	0.042(0.027)	0.040(0.023)*	0.038(0.025)
Constant	-5.839(0.367)***	-5.251(0.503)***	-6.635(0.551)***	-5.888(0.489)***	-5.967(0.559)***
R-squared	0.25	0.22	0.28	0.25	0.26
Number of observations	6,424	3,892	2,532	3,910	2,514

Note: * Statistically significant at the 10 percent level or less;
** Statistically significant at the 5 percent level or less;
*** Statistically significant at the 1 percent level or less.
Robust standard errors are in parentheses.

[a]The dummy North&Northwest region is dropped in regressions for the rural sample because the base category Moscow Saint Petersburg does not have rural population and thus one other category must be dropped from the regression.

Table 8
OLS Estimates of the BMI supply function (dependent variable lnBMI)[a]

Variable	Pooled Sample	Females	Males	Urban	Rural
Male	-0.056(0.010)***			-0.059(0.013)***	-0.059(0.015)***
Age	0.015(0.001)***	0.022(0.002)***	0.010(0.001)***	0.016(0.001)***	0.013(0.002)***
Age2	-0.0001(0.000)***	-0.0002(0.00)***	-0.0001(0.00)***	-0.0001(0.00)***	-0.0001(0.00)***
Education2	0.008(0.007)	0.014(0.009)	0.0007(0.010)	0.011(0.008)	-0.005(0.010)
Education3	-0.044(0.015)***	-0.036(0.029)	-0.023(0.025)	-0.043(0.019)**	-0.057(0.026)**
Smoker	-0.063(0.007)***	-0.027(0.014)*	-0.079(0.008)***	-0.056(0.009)***	-0.072(0.011)***
lnPred_wage	0.045(0.024)**	0.0004(0.049)	0.059(0.039)	0.035(0.029)	0.085(0.039)**
Year	0.022(0.006)***	0.012(0.014)	0.022(0.009)**	0.022(0.008)**	0.027(0.010)**
North and Northwest	0.031(0.019)*	0.036(0.029)	0.009(0.024)	0.033(0.021)	
Central	0.043(0.021)**	0.019(0.040)	0.044(0.026)*	0.049(0.023)**	0.002(0.026)
Volga region	0.035(0.024)	0.006(0.046)	0.042(0.034)	0.026(0.028)	0.034(0.030)
North Caucases	0.067(0.026)**	0.024(0.049)	0.093(0.038)**	0.050(0.032)	0.066(0.033)**
Ural region	0.028(0.020)	0.010(0.037)	0.025(0.025)	0.018(0.022)	0.029(0.025)
West Siberia	0.051(0.028)*	0.020(0.052)	0.054(0.041)	0.029(0.034)	0.066(0.037)*
East Siberia	0.050(0.021)**	0.043(0.034)	0.041(0.027)	0.041(0.023)	0.038(0.025)
Constant	2.700(0.075)***	2.674(0.143)***	2.764(0.151)***	2.706(0.094)***	2.656(0.118)***
R-squared	0.18	0.18	0.12	0.20	0.16
Number of observations	6,424	3,892	2,532	3,910	2,514

Note: * Statistically significant at the 10 percent level or less;
** Statistically significant at the 5 percent level or less;
*** Statistically significant at the 1 percent level or less.
Robust standard errors are in parentheses.

[a] The dummy North&Northwest region is dropped in regressions for the rural sample because the base category Moscow Saint Petersburg does not have rural population and thus one other category must be dropped from the regression.