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The Effect of Economic Crises on Nutritional Status: Evidence From Russia

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Abstract - The Effect of Economic Crises on Nutritional Status: Evidence from Russia

This paper uses data from the Russian Longitudinal Monitoring Survey (RLMS) to examine the relationship between six dimensions of nutritional status and household resources paying special attention to the distinction between longer-run resources and short-run fluctuations in resources. Between 1996 and 1998, Russia experienced a dramatic decline in economic activity which was followed by an equally dramatic rise between 1998 and 2000. We exploit this fact in combination with the panel nature of RLMS to measure the effect of changes in household resources on nutritional status. Nutritional status appears to be very resilient to variation in household resources. Gross energy intake, adult body mass index (BMI), and child stature all change very little as expenditure deviates from its long-run average. In contrast, we find a positive, significant and substantively large effect of longer-run resources on energy intake, two indicators of diet quality, adult body mass index (BMI), and child stature. It appears that individuals and households are able to weather large economic crises at least in terms of maintaining body mass and energy intake.

Keywords: nutrition, caloric intake, BMI, consumption smoothing, economic shocks, Russia, economic crises

JEL-Code: D12, I12, O12, P36

1) Introduction

Increased globalization of the last few decades has resulted in many less developed countries becoming more integrated into world markets. This integration has brought with it elevated risk of exposure to economic fluctuations and, in some cases, dramatic economic crises. The economies of the former Soviet Bloc have been especially volatile since the transition to market-based economies which began in the early 1990's. Nowhere has this been more true than in Russia where, in the last half of 1998, real GDP collapsed by around 30% and was then followed by rapid growth that brought income back to its pre-crisis level.

This paper examines the impact of this collapse and subsequent revival of the Russian economy on the well-being of the population as indicated by their nutritional status. Our first goal is to measure the impact of large fluctuations in household income on physical well-being and, thereby, assess the degree to which increased income volatility associated with globalization is likely to affect the health of the population. Second, we address an important issue in the literature regarding the extent to which households in low income settings are able to smooth out fluctuations in income and thus provide evidence on whether markets in Russia might be treated as if they are complete. In addition, our results provide new evidence on the relationship between income and nutrient intakes which has been a controversial issue for many years. We highlight the importance of distinguishing the effect of long-run growth in income from the effect of fluctuations in income.

Using extremely rich longitudinal household survey data from the Russian Longitudinal Monitoring Survey (RLMS), we examine gross energy intake in conjunction with two indicators of diet quality. Since energy output likely varies with income, we also examine energy intake net of output as indicated by changes in the weight of adults as well as changes in the weight and stature of children. We find that long-run growth in income is associated with increased energy intake, greater intake of protein and fats, greater weight among adults and faster growth among children. The 1998 crisis brought about a dramatic decline in household expenditure which bounced back by 2000. While spending on food tracked overall spending very closely, gross and net energy intakes were essentially unaffected. This is true for richer and poorer households as well as for all demographic sub-groups. Since spending on food changed while nutrient intake did not, diet composition must have changed in response to transitory income variation. We show that individuals switched to cheaper and less tasty calories in lean times. Individuals and households are apparently able to weather large changes in income in terms of maintaining body mass and energy intake. This indicates that, at least in terms of one important dimension of well-being, nutritional status, the greater economic uncertainty that might accompany globalization is unlikely to have long lasting effects.

2) Background

2.1 Permanent Income Hypothesis

There is a long and distinguished literature on the extent to which the behavior of individuals and households is adequately described by the permanent income (or life cycle) hypothesis (Hubbard, Skinner, and Zeldes 1995; Deaton 1992; Townsend 1994; Dercon and Krishnan, 2003). A key assumption underlying these models is the existence of mechanisms for economic agents to transfer resources from one period to another. A related literature in development has emphasized the role of markets in decision-making and has tested implications of the complete markets hypothesis (Pitt and Rosenzweig 1986; Benjamin 1992). Many of these tests assess whether anticipatable changes in the environment a household faces affects behavioral choices. For example, Benjamin points out that household composition should have no effect on total demand for labor for a family farm if there are complete markets. In his study of rural Java, he fails to reject this hypothesis and concludes that markets work well in the local economy.

It is possible, however, that in equilibrium, mechanisms exist that mask the absence of markets but when there are shocks those mechanisms fail to respond as quickly as a market would. This suggests that an alternative, and arguably more demanding, test of the complete markets hypothesis should focus on transitory changes in the environment. This is in the spirit of Paxson (1992) who examines the impact of income shocks on savings decisions in rural Thailand. For other examples, see also Cochrane (1991), Deaton (1992), and Gersovitz (1983).

This paper provides new evidence on the impact of income shocks on the well-being of individuals. We move beyond consumption and savings decisions and focus, instead, on nutrient intakes and nutrition outcomes (Ligon and Shechter, 2003). This is because the welfare implications of income volatility on physical health are more directly interpretable than, say, variation in spending on clothing or other semi-durable goods in the face of income volatility. To wit, even with complete markets, it is likely to be optimal to delay spending on semi-durables when incomes are low if there is little impact of that delay on the consumption value of services from those goods (Browning and Crossley, 2002; Frankenberg, Smith and Thomas, 2003).

Important work by Dustmann and Windmeijer (2000) compares investment in exercise and self-assessed satisfaction with one's own health to changes in wages in a life-cycle model. They distinguish permanent from transitory variation in wages and find time spent on healthy behaviors is crowded out when wages are temporarily high. Similar evidence is found by Ruhm (2000, 2003) when examining the relationship between health and the business cycle. In this paper, we focus on variation in nutrition intakes and outcomes, which unlike exercise or visiting the doctor, are likely to be primarily influenced by income effects rather than time effects since extra time is rarely needed to prepare and consume more nutritious meals.

2.2 Nutritional Status and Economic Development

Malnutrition is a serious problem throughout much of the developing world. Poor nutrition during the fetal period and in early life is a leading cause of death among infants and children and has been shown to have longer-term consequences on economic growth and productivity (see, for example, Fogel 1994). During the 1970s, it was widely believed that food availability was the key constraint that limited improving nutritional status. Noting that world food production exceeded needs, it was argued that purchasing power was the binding constraint and that as economic growth proceeded malnutrition would decline. Influential studies by Behrman and Deolalikar (1987) and others challenged this wisdom and pointed out that households invest not only in energy but also other dimensions of diet such as quality and taste. Indeed, the nutrition literature has highlighted the importance of a balanced diet which is rich in an array of macro and micro-nutrients.

This paper provides new evidence on the relationship between income and nutrition.[1] In addition to examining energy intake and diet quality – as suggested by Behrman and Deolalikar – we examine net energy intake and take into account variation in needs across individuals. Moreover, we highlight the differential effect of longer-run income from income fluctuations.

2.3 Russian Context

Households in transition economies face high levels of economic uncertainty. The market infrastructure and economic institutions in these countries are mostly underdeveloped and Russia's economy, in particular, is highly dependent on commodity exports that are prone to considerable price volatility. Figure 1 displays quarterly changes in Russia's seasonally adjusted real GDP (bars), inflation rate (solid line), and the percentage deviation from the

[1] See Bliss and Stern (1978) and Strauss and Thomas (1995) for discussions of the effect of nutrition on

average real dollar spot price of European Brent crude oil (dashed line) from the fourth quarter of 1993 to the fourth quarter of 2001.[2] During the 1990s, the Russian economy saw little growth but tremendous volatility. In the last half of 1998, GDP collapsed by 30%, an amount that is similar to the decline of the US economy during the first year of the Great Depression. By 2000, the Russian economy had bounced back to its pre-crisis level.

Exploiting variation in the world price of oil to identify exogenous changes in income, Stillman (2001) concludes that there is an almost one-to-one correspondence between exogenous shocks to income and non-durable expenditure innovations indicating very little smoothing of expenditure in response to transitory income shocks. A contribution of this paper is our examination of the extent to which households smooth nutritional status in the face of these large, transitory income innovations.

Few studies have examined nutritional status in Russia during the transition period. Using official Goskomstat for 1991 and 1992, Cornia (1994) concludes there is only a small correlation between household resources (measured by income or expenditure) and caloric intake. Zohoori, Gleiter, and Popkin (2001), Popkin, Zohoori, and Baturin (1996), Vella (1997) and Dore, Adair and Popkin (2003) use RLMS data to examine caloric intake and other measures of nutrition. These studies report little variation in aggregate levels of nutrition intake and nutritional status over time. None of these studies has attempted to link changes in nutrition to longer run and shorter run variation in income at the micro level.

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income.

[2] Quarterly data on nominal GDP are obtained from IMF International Financial Statistics Online (imf.largo. apdi.net). Daily data on the spot price of crude oil are obtained from the Energy Information Administration at the U.S. Department of Energy (www.eia.doe.gov/oil_gas/petroleum/info_glance/crudeoil.html). Each series is deflated using monthly CPI data available from Goskomstat (The Russian Federation Statistical Agency - www.gks.ru/eng/) and the US Bureau of Labor Statistics (http://www.bls.gov/cpihome.htm), and is averaged over the appropriate time period. Russia's real GDP is seasonally adjusted by regressing the series on quarterly indicator variables.

3) Theoretical Model

Assume that household members co-ordinate to maximize the present discounted value of household welfare. In each period, utility depends on the consumption of goods, x_{ht}, by the household, *h*, in time *t*; where x_{ht} includes commodities, leisure and the nutrient intake, n_{it}, of each individual, *i*. Utility also depends on the health (or, more generally, human capital) of each household member, θ_{it} (Grossman, 1972). The nutritional status, as indicated by anthropometry, h_{it}, of each household member is a subset of the vector, θ. Preferences depend on observed characteristics, Z_{it}, such as the age and education of each household member, as well as unobserved characteristics, ε_{it}, such as tastes:

$$u_{ht} = u(x_{ht}, \theta_{it}; Z_{it}, \varepsilon_{it})$$

In addition, assume that preferences are intertemporally separable so that a household maximizes the discounted sum of time-specific utility:

$$\max \int_{t}^{T} e^{-\rho t} u_{ht}(.) dt$$

subject to the budget constraint

$$p_t x_{ht} = \sum_{i} w_{it}(T_i - \ell_{it}) + y_{it} + A_{ht} - r_t A_{h(t-1)}$$

where *p* are prices of goods, *w* are wages, *T* is total time endowment, ℓ is leisure, *y* is non-labor income, *A* are assets and *r* is the interest rate. Household decisions are also constrained by the technology underlying the production of health, θ_{it} (Dustman and Windmeijer, 2000).

Under these assumptions, households do not face liquidity constraints and thus seek to maintain constant marginal utility of income over time. The household can be treated as if it maximizes lifetime utility subject to lifetime resources in which case the reduced form demand for goods and services will depend on all prices and household permanent income. In this study, we focus on the derived demand for nutrients of each household member, n_{it}, and anthropometric outcomes, h_{it}, which depend on the same factors, controlling for household observed characteristics, *Z*, and unobserved characteristics, υ_{it} which encompass tastes, health endowments, including nutrient intake needs, and unobserved factors that affect the production of health:

$$\begin{matrix} n_{it} \\ h_{it} \end{matrix} = f(p_s, \int e^{-\rho\tau}(y_{h\tau} + A_{h0})d\tau; Z_{is}, \upsilon_{it}) \qquad \text{s=1....T}$$

If liquidity constraints are binding in any period, household resource allocations will also depend on the level of resources in each time period

$$\begin{matrix} n_{it} \\ h_{it} \end{matrix} = f(p_s, \int e^{-\rho\tau}(y_{h\tau} + A_{h0})d\tau, y_{ht}; Z_{is}, \upsilon_{it}) \qquad [1]$$

Estimates of derived demands for nutrients and anthropometric outcomes based on [1] are reported below. Empirical implementation of this model requires a measure of household permanent income.

Exploiting the richness of RLMS, we explore two alternative approaches. First, according to the theory, in the absence of liquidity constraints, permanent income can be treated as a fixed effect in a panel data model. In that case, we replace all permanent individual and household characteristics with an individual-specific fixed effect, μ_i, and re-interpret the model in terms of deviations from the longer-run average of each dependent and independent variable. In the model, variation in household resources, y_{ht}, can be interpreted as measuring the effect of shocks to transitory income. In models with a fixed effect, it is not possible to estimate the impact of long-run household resources on outcomes. We address this by creating a proxy for permanent income by drawing on all waves of RLMS and calculating average per capita expenditure for each household over the decade covered by this study. A comparison of the estimates of transitory income (and other covariates) provides one assessment of how well this measure proxies permanent income.

4) Data

RLMS is an on-going longitudinal household survey of Russia designed and implemented by Barry Popkin and his colleagues at the Carolina Population Center, University of North Carolina, in collaboration with colleagues at the Russian Academy of Sciences and the Russian Institute of Nutrition. Since data from the first and second phases of the project are not comparable, all empirical analyses in this paper uses data from phase II of the survey, which spans the period 1994 through 2000.[3]

The sampling frame for RLMS is a set of dwellings which are intended to be representative of the Russian population in the early 1990s. For cost reasons, the survey does not attempt to follow individuals or households who move from the sample dwelling. Instead, any new household member or new household living at the sample dwelling is included in the sample in each wave.[4] The sample will remain representative of the underlying population assuming new entrants are exchangeable with movers.[5]

The survey is extremely rich and contains an array of information on economic, social, demographic and health characteristics of respondents, their households and the communities in which they live. This paper exploits the fact that data are collected at the individual, household, and site level.[6] Specifically, we focus on indicators of nutrient intake and

[3] Surveys were conduced in 1994, 1995, 1996, 1998, and 2000 (waves 5 through 9, respectively). A full project description is available at www.cpc.unc.edu/rlms which provides sampling procedures, survey instruments and field protocols. Surveys in phase II are conducted in the late Fall of each year: November and December, 1994; October and November, 1995; October and November, 1996; November and December, 1998; October and November, 2000.

[4] A household includes all individuals in a sample dwelling who have common income and expenditures and unmarried children younger than age 18 who are not living in the sample dwelling because they study in a different population center. We consider a household to be same across years if the either the self-defined head of household or their spouse remains in the dwelling in the following year. Most of the analysis in this paper is done at the individual level and thus how we define households longitudinally is fairly unimportant for interpreting our results.

[5] See Thomas, Frankenberg, and Smith (2001) for a discussion of the likely implications of this assumption.

[6] All individuals in each household are surveyed with the exception of some elderly and very young members.

nutritional status, measured at the individual level; we examine the relationship between those indicators and measures of resources available at the household level; and we carefully control for the characteristics of the environment in which respondents are living, including local food prices.

The survey has collected information on nearly 18,000 respondents. About a quarter of Russians live in rural areas and because information on production of food for own consumption by farmers is limited, those household are excluded from the analyses below. Since our model requires multiple observations on each respondent, around 5,000 respondents who have been interviewed only once are also excluded. Our analytical sample includes approximately 9,500 respondents (and over 35,000 person-year observations).[7]

4.1 Household Resources and Expenditure Patterns

Household resources, as measured by real monthly household per capita non-durable expenditure (PCE), are reported for each year of the survey in the first panel of table 1. We interpret PCE as indicative of longer-run resource availability within the household.[8] On average, PCE remained fairly constant during the first three years of the survey. Between 1996 and 1998, it declined by 18%. This is a huge decline and is the household-level manifestation of the 1998 crisis. In the two following years, the economy grew rapidly and average PCE increased by 33% to slightly above its pre-crisis level. It is this large fluctuation in household resources that provide the variation underlying our strategy to

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Extensive data is collected for each of the 159 survey sites. Information is provided to assign the 159 sites to 38 raion (county) level primary sampling units (PSUs), referred to in this paper as communities, and to 12 regions.

[7] 94 observations are missing valid data on caloric, fat, and protein intake, 332 on BMI, 612 on weight for height, and 142 on height for age. 25% of the respondents were interviewed in two waves, 18% in three waves, 18% in four waves, and 40% were interviewed in all five waves of phase II.

[8] PCE is the sum of expenditure on food, clothing, fuel, services, rent, and utilities at the household level; these questions are typically asked of the senior woman in the household who, in theory, knows the most about the family's income and expenditure. All nominal values are deflated using a chain-weighted community-level Tornqvist price index (1998 Moscow City is the base community-year) which is calculated using the household expenditure and community price data available in RLMS. As discussed in Deaton and Muellbauer (1980), at a second-order approximation this is the true index for any arbitrary cost function.

disentangle the effects of permanent differences in resources from transitory changes. Real per capita food expenditure is presented in the second row of the table. It declined by 19% between 1996 and 1998 and then increased by 25% between 1998 and 2000.

Expenditure and quantity data are available at the household level and price data at the community level for 56 different foods.[9] The remainder of table 1 presents averages of real per capita expenditure, quantity consumed, as well as, unit values for the four major food groups (starches, meats, dairy, and fruits and vegetables) along with average real per capita expenditure, quantity consumed, and community prices for the two most important items within each group.[10] Expenditure declined between 1996 and 1998 for every food group and item in the table and then increased between 1998 and 2000 for all foods except beef and veal. For many foods, predominately meats and dairy, there is evidence of a secular decline in expenditure that pre-dates the crisis.

Changes in quantities of food consumed do not track changes in expenditures. In particular, the unit value of starches and dairy decreased sharply in 1998 while quantities remained steady; as a result expenditures declined by 20-30%. In fact, quantities of starches and dairy are essentially unchanged across the entire sample period. In contrast, fruit and vegetable consumption appears to have adjusted entirely in terms of quantities. Putting aside 1994 (when prices were very high), prices have remained constant during the study period,

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[9] The quantity data include the consumption of various foods produced at home which is asked of households for the year prior the interview. The available price data does not allow this quantity information to be satisfactorily converted into expenditure values. The community price data is collected by locals recruited at each survey site who report on store prices for all 56 foods and market prices for a few commonly purchased foods (milk, beef, poultry, eggs, potatoes, onions). As household level data is collected on expenditures and quantities purchased for these foods, unit values can also be created. Unit values incorporate differences in the quality of the food while the individuals who collect the community price data are supposed to report on food of a standard quality. Further problems arise when calculating average unit values because many households choose not to purchase certain foods.

[10] Starches include white and brown bread, pasta, rice, kasha, and other grains. Meats include beef, pork, lamb, poultry, fish, sausage, processed meats, and animal organs. Dairy includes fresh, canned, and sour milk, butter, cheese, curd, and sour cream. Fruits and vegetables include potatoes, cabbage, sauerkraut, onions, beets, tomatoes, melons, cucumbers, canned vegetables, squash, other vegetables, fresh, canned, and dried fruit, nuts,

quantities consumed almost halved between 1996 and 1998 (and so did expenditures) and then both almost doubled by 2000. In the case of meat, however, the picture is more nuanced: expenditures declined throughout the 1990s with a large decline in 1998; in 2000, expenditures rose but remained below their level in the mid-1990s. Unit prices were fairly constant during the early 1990s, fell slightly between 1996 and 1998 and then rose substantially between 1998 and 2000. The decline in unit prices between 1996 and 1998 is most marked for pork, sausage and processed meats suggesting there may have been a switch to cheaper and lower quality products, possibly reflecting a behavioral response to the crisis.

This evidence on changes in food quantities and expenditures indicates that studies that focus exclusively on expenditures may miss an important response to variation in income which is revealed only in quantities and prices of foods purchased. In the context of a model of welfare smoothing in the face of large fluctuations in income, it makes sense for households to substitute away from more expensive nutrients towards cheaper sources of nutrition. We turn, therefore, to an examination of nutrient intakes which provides an alternative method for aggregating food intakes that not only has a long history in the nutrition sciences but is also directly related to welfare (Anand and Sen 2000).

4.2 Nutrient Intakes and Anthropometry

Measurement of nutrient intakes in household surveys is difficult. RLMS is arguably unique among general purpose socio-economic surveys in the amount of effort placed on good measurement of intake information from each respondent. Respondents are asked to provide a 24 hour recall of their food intake using prompt cards to identify the type of food and size of portion consumed. Those quantities are translated into nutrient intakes using food composition tables developed for the Russian diet (Zohoori, Gleiter, and Popkin 2001;

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berries, and jams.

Popkin, Zohoori, and Baturin 1996).

The median adult male consumes 2,411 calories in an average day and the median adult female consumes 1,690 calories. As is commonly observed in 24 hour recall data, there is a good deal of heterogeneity in energy intakes (standard deviation is around 975 for males and 675 for females). In part, this reflects the fact that intakes vary substantially from day to day for an individual; in part, the variation is likely to be inflated by measurement error. We can obtain some indication of the extent to which day to day variation is important by exploiting the longitudinal dimension of the survey and averaging intakes for individuals over the survey period: the standard deviation is reduced by around 22%. Another experiment is built into the survey design: wave 7 recorded a 48 hour recall whereas all other waves obtained a 24 hour recall. The standard deviation of calorie intake in round 7 is 14% smaller than the standard deviation in all other rounds. We conclude that a substantial part of the variability in calorie intakes is due to random measurement error associated with variation in energy intake on a day to day basis; this should not lead to bias in our estimated effects of the link between nutrition and household resources but will reduce our estimates of precision.

In order to assess how the distribution of calorie intakes changed during the 1990s, figure 2 presents kernel density estimates of the distribution of daily caloric intake of individuals stratified by age and gender. Children (age < 18) are in the left panel, prime-age adults (age 18 through 59) in the middle and the elderly (age > 59) are in the right panel; females are in the upper part of the figure and males are in the lower part. Since expenditure levels were approximately the same from 1994 to 1996, we report the distribution of average intake prior to the crisis. The pre-crisis distribution is represented with a solid line, the distribution in 1998 with short dashes and the distribution in 2000 with long dashes. The evidence is both unambiguous and striking: the entire distribution of calorie intake remained stable during the late 1990s for all demographic groups (the small increase in intakes for children reflects aging of the longitudinal sample and the fact that intakes increase with age among children).

Energy intake is not the sole motivation for consuming food. The intake of many macro- and micro-nutrients are important components of the diet and studies have shown that even the poorest households purchase a wide array of food characteristics (Behrman and Deolalikar, 1987). Two indicators of diet quality are examined in this study: the percentage of calories from protein and the percentage of calories from fats. Both tend to increase as intake of animal foods rise with about one-eighth of energy intake being from protein and one-third from fats. Protein and fat are both important for maintaining muscle mass and general nutritional well-being, although excessive amounts of either can be detrimental to overall health status. Fatty foods are also typically of higher quality and better taste than less fatty alternatives (again, this is mainly true at lower levels of fat content).

Figure 3 presents kernel density estimates of the distribution of two dimensions of diet quality – the percentage of calories from protein (in the left panel) and the percentage from fat (in the center panel) – as well as body mass index (BMI), a physical indicator of nutritional status (in the right panel). These estimates are stratified by gender (women are in the upper row and men in the lower row) with all age groups combined in each graph. Graphs which continue to stratify by age group show qualitatively similar patterns for each groups leading us to this specification.

Relative to pre-crisis levels, the proportion of calories from protein declined slightly in 1998, when income collapsed, and remained at that level in 2000 when the economy bounced back. As the density estimates indicate, the decline is concentrated at lower levels of protein shares for both men and women. The proportion of calories from fat declined substantially in 1998 and while it rose in 2000, the increase was relatively small and so the fraction of calories from fat remained considerably lower than pre-crisis levels. Again, the shifts in the distributions are concentrated at lower levels of fat shares. For example, between 1996 and

1998, the share of calories from fat declined by 10% at the bottom quartile of the distribution and then rose by only 5% at that point between 1998 and 2000. At the top quartile, the decline and rise was 2% and 1%, respectively. Whereas energy intake remained unchanged during the crisis, there is clear evidence that diet quality – particularly fat intake – fell when incomes collapsed and did not fully recover when incomes bounced back.

There are two reasons for examining physical indicators of nutritional status. First, it is possible that recall diet information understates change in nutrient intake and diet quality. This would arise, for example, if respondents are inclined to report 'usual' consumption. Physical indicators of nutrition measured by a trained anthropometrist in the household are not subject to respondent-specific reporting error. Second, anthropometric measures are of direct interest themselves as they have been shown to be indicative of health status and correlated with economic prosperity. BMI, weight (in kilograms) divided by height (in meters) squared, is a commonly used indicator of nutritional status for adults which reflects energy intakes net of energy output. Very low (<18.5) and very high BMI (>28) have been shown to be associated with elevated risk of morbidity and mortality (Waaler 1984).

Very few Russian adults have low BMI. However, around forty percent of adult men and fifty percent of adult women are considered overweight (BMI>25) and around ten percent of adult men and over twenty percent of adult women are obese (BMI>30).[11] The right panel of figure 3 demonstrates that, like calorie intake, the distribution of BMI is remarkably stable across the study period. Adult weight appears to have stood up very well to the collapse in household resources. This is an important result and suggests that even in the face of very substantial income fluctuations, individuals and families seek to maintain their investment in their bodies.

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[11] The vertical lines in figure 3 mark the level of BMI associated with being underweight, overweight, and

Results for children are essentially identical (and thus not shown). Calorie intakes are unchanged, the fraction of calories from protein falls slightly and the fraction of calories from fat falls in 1998 and does not fully recover by 2000. It is standard practice to examine two indicators of child anthropometry. Height for age is a measure of longer-run nutritional status and is, according to the nutrition literature, largely determined by age 3 or 4 (except for instances of extreme famine). During these early ages -- and during the fetal period -- the longer-term well-being of a child is particularly vulnerable to nutritional stresses and so it is children of these ages that we would expect to be most affected by the collapse of household resources in 1998. Weight for height, on the other hand, is a shorter-run indicator and is likely to respond to changes in net energy intake. Paralleling our results for BMI, neither the distribution of height for age (of young children) nor the distribution of weight for height changed during the study period.[12]

This descriptive evidence suggests that while household expenditure responded strongly to both the collapse of the Russian economy in 1998 and to the heady growth in 1999 and 2000, there was very little change in energy intake or net energy output although fat and to a less extent protein intake did decline as incomes fell. Similar results have been reported in Zohoori, Gleiter, and Popkin (2001) and Dore et. al. (2003). Before turning to our regression analyses linking household income to nutrient intakes, we present non-parametric evidence on the shape of these Engel curves.

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obese.

[12] Following the nutrition literature, weight for height and height for age are examined only for children under 9 years. To aid interpretation, they have been standardized for age and gender as z-scores using the NCHS standards which are based on anthropometric measures of a population of well-nourished Caucasian children in the United States. A z-score of 0 indicates the sample child is the same weight (given height) and height (given age), as a child of the same age and gender in the United States in the early 1960s. A z-score of –2 indicates a severe state of malnutrition referred to as wasting if found for weight for height and stunting if found for height for age.

4.3 Nutritional Status and Household Resources

Figure 4 presents results from non-parametric regressions (locally weighted smoothed scatterplots) of each indicator of nutritional status and log PCE.[13] The vertical bars indicate the bottom quartile, median and top quartile of PCE. The relationship between (log) calorie intake and (log) PCE for male and female adults is presented in the upper left panel. For males, calorie intakes rise with PCE; this is also true for females until intakes reach 1,600 calories per day when they remain constant as PCE rises. In contrast, as shown in the upper center (for calories from protein) and upper right (for calories from fat) panels, as PCE rises, diet quality rises with PCE throughout the distribution for both males and females. Moreover, controlling PCE, females tend to consume lower quality diets than males. Thus, apart from higher income females, the evidence suggests that as income rises, Russians consume more calories and they switch to higher quality calories.

The relationship between BMI and PCE is displayed in the lower left panel. If there is no association between energy output and household resources, the relationship between BMI and resources should mimic that of energy intake. BMI rises with PCE at all levels of household resources and the relationship is close to (log-)linear. Since energy intake for women is essentially constant among higher PCE individuals, the evidence suggests that energy output for women is a declining function of PCE which likely reflects the shift from manual and physically demanding work to sedentary work as wages increase.

There are, however, reasons to suppose that measurement error in reported food intakes and PCE may be correlated (for a discussion see Bouis and Haddad 1992; Strauss and Thomas 1995). It is hard to measure food that is wasted in intake recalls and higher income households tend to waste more food than lower income households. In combination, this

[13] A bandwidth of .20 is used in each regression (.40 for weight for height and height for age z-scores) and semi-parametric age effects (i.e. dummy variables for each age) are partialed out of the model. Calorie intake and

imparts a positive bias in the relationship between calorie intakes and resources. This might explain the difference in the relationship between calorie intakes and PCE for males relative to females if males waste more food. These sorts of leakages will have no effect on the relationship with diet quality if wastage is unrelated to quality of the calories. The empirical strategy described below will address this concern in an attempt to purge estimated income effects of bias due to measurement error.

The relationship between child weight-for-height and PCE is displayed in the lower center panel and the relationship between child height-for-age and PCE is in the lower right panel. Both indicators of child nutritional status are only weakly positively associated with household resources, with the exception being that there appears to be no relationship between household resources and weight for height for boys.

These aggregate results may mask considerable individual and household specific heterogeneity and so we turn next to a formal model of the relationship between household resources and nutritional status and to regression analyses that attempt to uncover the responses of nutritional indicators to long-run and short-run changes in resource availability at the household level.

5) Regression Results

5.1 Empirical Model

Re-writing model (1) above in linear form:

$$N_{it} = \mu_i + \beta PCE_{ht} + \delta X_{it} + \gamma Z_{ht} + \lambda p_{ct} + \alpha_t + \alpha_r + \xi_{it} \qquad (2)$$

where i indexes individuals; h, households; c, communities; r, regions; t, time; N_{it} encompasses nutrient intake, n, and anthropometric outcome, h. Household permanent income is captured by the fixed effect, μ_i which, in some specifications, will be proxied by

BMI are specified in logs.

the average of household resources over the study period. Household expenditure is generally thought to be a better indicator of resource availability than income and so we will use the average of the logarithm of *PCE*, as our proxy for permanent resources. Conditional on permanent income, PCE_{ht}, the logarithm of contemporaneous *PCE*, is interpreted as transitory income. Z_{it} is a vector of individual characteristics (including age entered semi-parametrically using dummy variables, education, marital status, and work status) and household characteristics (household size and household composition, including the number of children, prime age adults and older adults).[14] This specification permits a flexible adjustment of household resources for variation in the "costs" of each demographic group. p_{ct} is a vector of community prices for twenty commonly purchased foods.[15] The α terms capture year and region effects to capture unobserved variation in prices in a flexible way. Unobserved heterogeneity is captured by ξ. Standard errors are calculated using the infinitesimal jackknife estimate of variance (also known as the robust Huber/White estimate), allowing for arbitrary correlation in an individual's error term across years and within households. Summary statistics of the dependent variables and covariates are in appendix table 1.

5.2 Household Resources and Nutritional Status

Table 2 reports the effect of log PCE on each alternative measure of nutritional and anthropometric status for all demographic groups pooled together. The results from three

[14] Our educational controls include indicator variables for currently enrolled in primary or secondary school, currently enrolled in vocational school or university, completed general secondary education (equivalent to US high school), has a technical school diploma (high end vocational training such as nursing), has a university diploma, and has a professional course diploma (such as bookkeeping).

[15] The twenty foods are bread (white and brown), staple vegetables (potatoes, cabbage, sauerkraut, onions, and beets), other starches (pasta, rice, kasha, and other grains), flour, sugar, cooking fat (butter and lard), cooking oil (vegetable and margarine), pork products (pork, sausage, and processed meat), beef, poultry, fish (fresh and canned), eggs, milk (fresh, canned, and sour), milk products (cheese, sour cream, and curd), other vegetables (tomatoes, melons, cucumbers, canned vegetables, squash, and others), fruit (fresh, canned, and dried fruit, nuts, berries, and jams), snack foods (candy, cakes, honey, and ice cream), coffee and tea, tobacco products, and vodka and hard liquor.

model specifications are presented. The first, which is specification commonly estimated in the nutrition literature, relates log PCE to the nutrition outcome and serves as a baseline for comparison purposes. In the second specification, we attempt to separate the effect of shorter run household resources from longer-run resources using average log(PCE) as our measure of the latter and the deviation of current log(PCE) from the average as our indicator of shorter-run resources. The third specification includes an individual-specific time-invariant fixed effect to capture longer-run resource availability so that current log(PCE) can be interpreted as capturing fluctuations around the permanent level of resource availability. The fixed effect also absorbs all time-invariant characteristics of the individual including those dimensions of body size and basal metabolic rate, exercise expenditures, propensity to waste food or mis-report intakes, tastes for work and exercise that do not vary during the study period. These estimates will be purged of bias due to correlated measurement error in PCE and intakes as long as that correlation does not change over time for an individual. Estimates of income effects are reported for (log) calorie intake per day, the percentage of calories from protein, the percentage of calories from fat, (log) BMI of adults, weight for height and height for age of children.[16]

The results in the first specification imply that a 10% increase in PCE is associated with a small (albeit precisely estimated) increase of 1% in total calorie intake, a 5% increase in the share of calories from protein, an over 20% increase in the share from fat, and a small increase in BMI (0.2%), child weight-for-height (0.01 standard deviations), and height-for-

[16] Replacing the individual fixed effect with a household fixed effect has no effect on the results suggesting that they are not driven by intra-household variation in the effects of resources on nutrition. While the collapse and revival of the Russian economy was dramatic and no part of the country was unaffected, the timing and magnitude of this shock may vary across communities. To allow for this possibility, models that allow the community effects to vary in arbitrary ways have been estimated by including community and year effect interactions. These models account for any time-varying community-level changes that affect both household resources and nutrition, such as changes in the local infrastructure or prices. The results are identical to those reported in the tables. Results from all of these checks are available from the authors.

age (0.01 sds).[17] All of these increases are significant (weight-for-height at the 10% level). As discussed above, these estimates combine the response to both long-run and short-run changes in household resources. A substantial literature has focused on estimating the expenditure elasticity of calorie demand. Strauss and Thomas (1995) review a selection of these papers. Our estimated elasticity of 0.09 is around the median for estimates based on nutrient intake data in the literature (estimates based on calorie availability tend to be higher and arguably are upward biased).

Turning to the second specification in panel A, the estimated elasticities with respect to longer run resources are substantially larger than shorter-run elasticities for all indicators other than child weight-for-height. The differences are all significant and indicate that the baseline estimates in the first row are a combination of two different effects. Specifically, the longer run elasticity of the demand for calories is about one-third higher than the estimate that does not attempt to distinguish permanent from transitory effects. Similarly, the long-run elasticities for calories from protein and fat, for BMI, and for height for age, are 35-90% higher when we distinguish permanent from transitory effects; permanent resources are found to have no effect on child weight for height. The view that over the long-run, resources do not affect energy intake is resoundingly rejected by these data. Not only is there clear evidence that economic growth will lead to elevated energy intakes, but increases in permanent resources are also associated with increases in the proportion of calories from both protein and fat, child stature, and adult body mass.

The effect of longer-run resources on fat intake is very large and dominates the effect on protein. This suggests that economic growth is not only likely to result in increased energy intake but, also, in shifts towards diets that are higher in fat; a phenomenon that has been

[17] No additional insights are gained by examining the probability that each anthropometric outcome is above or

documented many developed countries. The fact that economic growth is associated with improvements in height has been well established in the historical and development literatures (see, for example, Fogel 1994), so it is not surprising that we find similar evidence for Russia. The finding that adult weight also rises with economic growth is consistent with our estimate for the positive effect of long-run resources on energy intake as long as energy output does not increase faster. Indeed, the evidence suggests that, in aggregate, energy output declines with economic growth as people move away from physically demanding labor to more sedentary work. This, in combination with the large longer run elasticity of demand for fat raises legitimate concerns regarding the longer-run health of populations as economic growth proceeds (Lakdwalla and Philipson, 2003).

Transitory changes in PCE are found to be positively and significantly associated with calorie intake, fat intake, protein intake, adult BMI, and child weight for height. The estimated short-run effect for calorie intake is about half the magnitude of the long-run elasticity. While fluctuations in resources at the household level translate into substantial shifts in food expenditures, the response of calorie intakes is muted. Similar results are found for protein and fat intake with the estimates of the transitory effects about 30-40% of the permanent ones. Turning to our anthropometric measures, fluctuations in PCE are found to affect child weight for height, have a limited impact on BMI and no effect on child stature.

The fixed effect estimates presented in Panel B provide measures of the effects of transitory income on diet with a less parametric assumption for the measurement of longer-run resources. The transitory income elasticities are very similar to those reported in the previous model which suggests that average PCE is, in fact, a good measure of longer-run

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below a threshold (underweight, overweight, and obese for adults, and wasted and stunted for children). Those results are, therefore, not reported.

resources in this application.[18] Since our focus hereinafter will be on the effect of income fluctuations on behavior, attention is restricted to the model with individual fixed effects

Specific demographic groups such as young women and the elderly are often thought to be particular vulnerable to worsening economic conditions. Unlike studies which examine household expenditure, because our outcomes variables are measured at the individual level, we are able to directly test for this type of vulnerability and for discrimination in intrahousehold resource allocation.

Table 3 presents individual fixed effects estimates allowing all of the estimated coefficients to differ by age-group and gender. While there is a tendency for elasticities to be largest for prime age adults, this is not always the case and the differences across demographic groups are both small and never significant. We conclude, therefore, that there is no evidence that the nutritional health of men and women, the older and younger differ as households are subjected to transitory income fluctuations.[19]

5.2 Extensions

One possible explanation for our results is that nutrients are associated with greater productivity and thus we are picking up a reverse causality effect where changes in nutritional status lead to changes in household resources. While this is an unlikely explanation for children and older adults, one way to assess its importance in this context is to stratify the analyses on work status of the individual. While work status is itself a choice, any time-invariant tastes for work will be captured by the individual fixed effect.

[18] This is important for two reasons. First, fluctuations in resources from the long-run average confound transitory changes in resources and measurement error. Second, we have assumed liquidity constraints are not binding. If there is a correlation between our measure of transitory income and nutrient intake, the estimated elasticities will be biased. An alternative strategy is to identify the transitory component of income innovations with an instrument that is uncorrelated with individual or household choices but correlated with income fluctuations. We explored using oil prices in combination with levels of local oil production as instruments. However, they did a poor job of predicting income fluctuations (partial R^2 <0.02) indicating the estimates will be biased because of weak instruments (Staiger and Stock, 1997).

Nonetheless, the estimates will be biased if characteristics that are not observed and correlated with decisions to enter or exit the labor force are also correlated with unobserved tastes for energy and diet quality.

Table 4a presents individual fixed effects estimates of the effect of changes in PCE on the four measures of nutritional status, where the coefficient on PCE is allowed to vary depending on an individual's work status in the survey year. The sample is restricted to adults. We also report the coefficient on the indicator variable for whether an individual switches between working and not working in a particular year. For each measure of nutritional status, transitory changes in PCE are significantly related to changes in outcomes for both non-workers and workers. In fact, the coefficients for the two groups are both qualitatively similar and not significantly different. If these results are driven by selectivity of those who enter and exit the labor force, then that selection would have to exactly offset the effect of transitory income on all dimensions of nutrition examined. That seems very unlikely.

It is possible that households with lower levels of permanent resources are more likely to be liquidity constrained either because they have less accumulated wealth upon which they can draw or less access to credit markets. To assess whether the effects of income fluctuations differentially affects lower resources households, table 4b presents individual fixed effects estimates of the effect of changes in PCE on nutritional status, where the coefficient on PCE is allowed to vary depending on whether a household's permanent resources are above or below median for the entire sample.

While none of the differences is statistically significant, the effect of transitory changes in PCE on nutrition tends to be greater for individuals in households with lower permanent

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[19] Similarly, the effects of long run resources on nutrition indicators do not differ by age and gender.

PCE. This is particularly true for the share of calories from protein and child weight for height where the elasticities are 65% greater in magnitude for low permanent PCE households. Appendix table 2 presents estimates of this model which are allowed to vary by demographic group. Those results indicate that the difference in elasticities for child weight for height is driven by heterogeneity in the effect of fluctuations in household resources on girls from low permanent PCE households compared to those from high permanent PCE households. Young girls from poor households appear to be more vulnerable to resource shocks than others even though their caloric intake does not change by much. This may occur because the physical strenuousness of their work load at home increases during bad times.

It may also be the case that households are affected differently by positive and negative transitory shocks. Panel 2 of table 4b presents individual fixed effects estimates of the effect of changes in PCE on nutritional status, where the coefficient on PCE is allowed to vary depending on whether the change is negative or positive. For all measures of nutrition besides protein intake, negative and positive resource shocks have qualitatively and statistically the same effect on outcomes. Protein intake is actually more responsive to positive shocks to resources than to negative ones. One possible explanation is that positive resource shocks allow households to increase their protein intake by purchasing higher quality cuts of meat that are not available in smaller portions or by taking advantage of quantity discounts.

5.3 Household Resources and Expenditure Patterns

The descriptive evidence in table 1 suggests that for many foods, especially starches and dairy, the average quantity purchased by households remained stable during the economic crisis even in the face of a large decline in average food expenditure. Households could have purchased the same quantity of food with lower levels of expenditure either by shifting their expenditure towards foods whose relative price decreased during the crises or by purchasing lower quality foods. Examining the relationship between changes in household resources and the composition and quality of foods purchased can help us gain a better understanding of how households adjusted to the economic crisis.

Table 5 presents individual fixed effects estimates of the effect of changes in PCE on total per capita food expenditure, and on per capita expenditures, quantities, and unit values for the four major food groups (starches, meats, dairy, and fruits and vegetables). In the first panel, the results are reported for the main model with all demographic groups pooled together. In the second, all of the estimated coefficients are allowed to differ by age-group and gender. These regressions continue to control for all of the covariates in equation (2) including local food prices. Thus, the expenditure regressions examine the relationship between household resources and the composition of food expenditure; the quantity regressions estimate expenditure elasticities for the four food groups; and the unit value regressions examine the relationship between household resources and the quality of foods purchased.[20]

Total expenditures on food and, in particular, expenditures on meats and fruits and vegetables, are strongly related to overall household resources, while expenditures on starches are weakly related. These findings are echoed when we examine expenditure elasticities with the elasticity of starches estimated to be 0.3; meats, 1.0; dairy, 0.7; and fruits and vegetables, 0.9. For Russian households, meats are almost a luxury item. The effect of changes in household resources on the average unit value of foods purchased is fairly small for starches and dairy, where a 10% increase in household resources leads to almost a 1% increase in the average quality of foods purchased. A small negative relationship is found

[20] Changes in the average unit value of foods purchased by a household controlling for average local prices

between household resources and the unit value of meats. This likely reflects quantity discounts that are available when household resources change. Unfortunately, since we do not have data on the size of these discounts it is not possible to ascertain if the quality of meats purchased has changed as well. Quality effects are twice as large for fruits and vegetables as for dairy and starches.

Overall, it appears that changes in household resources have fairly large effects on the aggregate quantity of meats, dairy, and fruit and vegetables purchased and that the quality of foods purchased only adjusts a small amount. This suggests that households during the crisis shifted expenditure both towards foods with declining relative prices and to those that provided more calories per quantity purchased.

6) Conclusions

Russia experienced a major crisis in 1998 when real GDP declined by more than 25% in the last half of the year. At that time, expenditure patterns changed dramatically with households reducing food expenditure by 25% and cutting per capita expenditure by around 20% between 1996 and 1998. By 2000, expenditures had returned to their pre-crisis level. This paper examines the effect of this dramatic change in income on the nutritional well-being of the Russian population. We evaluate six indicators of nutrition – gross energy intake, two dimensions of diet quality, adult BMI, child weight for height, and child stature. All are, arguably, important dimensions of health, and they are intimately connected to food consumption, as well as, energy output.

We have demonstrated that distinguishing between responses in nutrition to long-run differences in economic prosperity and to fluctuations in resources is key. Long-run economic growth is clearly associated with greater energy intake, increased adult weight,

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should mainly reflect changes in the quality of those foods. Changing unit values may also pick quantity child height, and higher fractions of calories from protein and fat. Fluctuations in resources, in contrast, appear to have no discernible impact on either gross or net energy intake (i.e. BMI), or child height. However, as individuals switch to cheaper diets, protein (quality of calories) and fat content (taste) appear to be sacrificed, as both of these dietary dimensions are responsive to income fluctuations. The fact that energy intake is maintained even as household resources collapse indicates that the cost of a diet which is sufficiently rich in energy is well below the amount spent, per capita, by Russian households.

The evidence suggests that individuals and households are very resilient -- even in the face of major economic upheavals -- and that they optimize over many dimensions. Studies of household responses to income fluctuations which focus exclusively on changes in total expenditure are likely to miss part of this very rich picture. Moreover, to the extent that globalization results in elevated longer run household resources but greater volatility of those resources, the evidence indicates that at least in terms of nutritional status, households will exploit the benefits and mitigate the costs that come with globalization.

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discounts available to households with increased resources.

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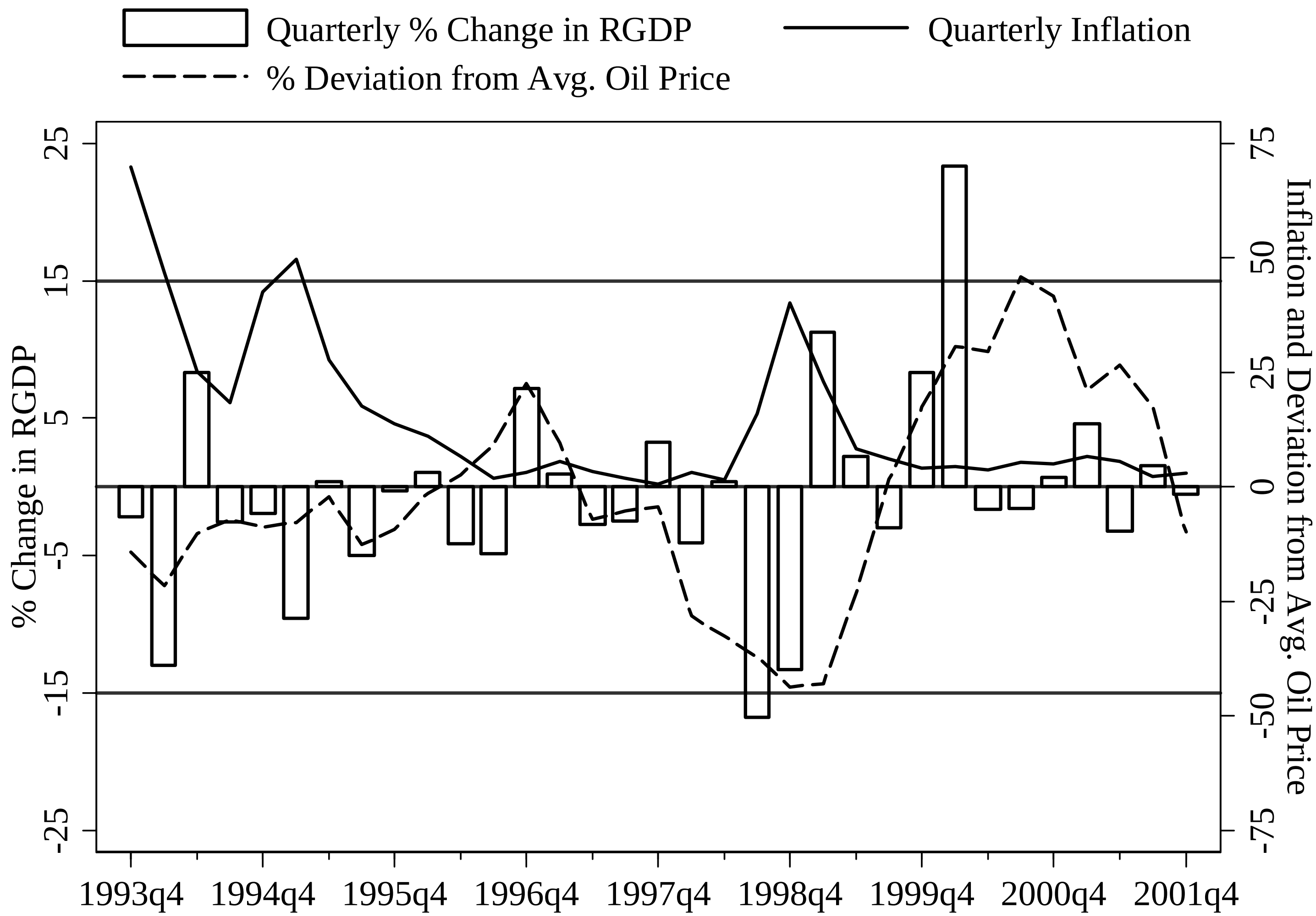

Figure 1: The Russian Economy

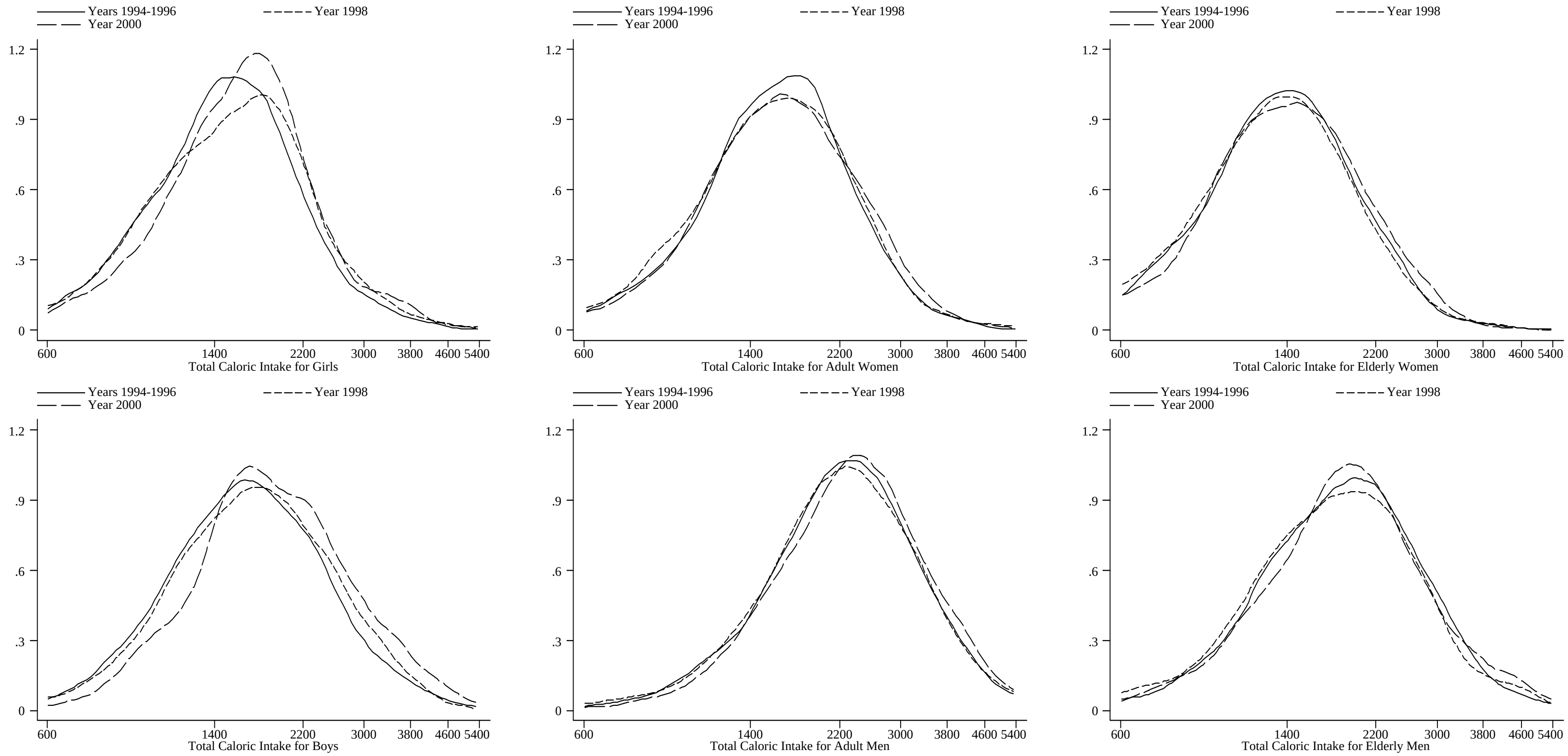

Figure 2: Total Caloric Intake by Gender, Age Group, and Year

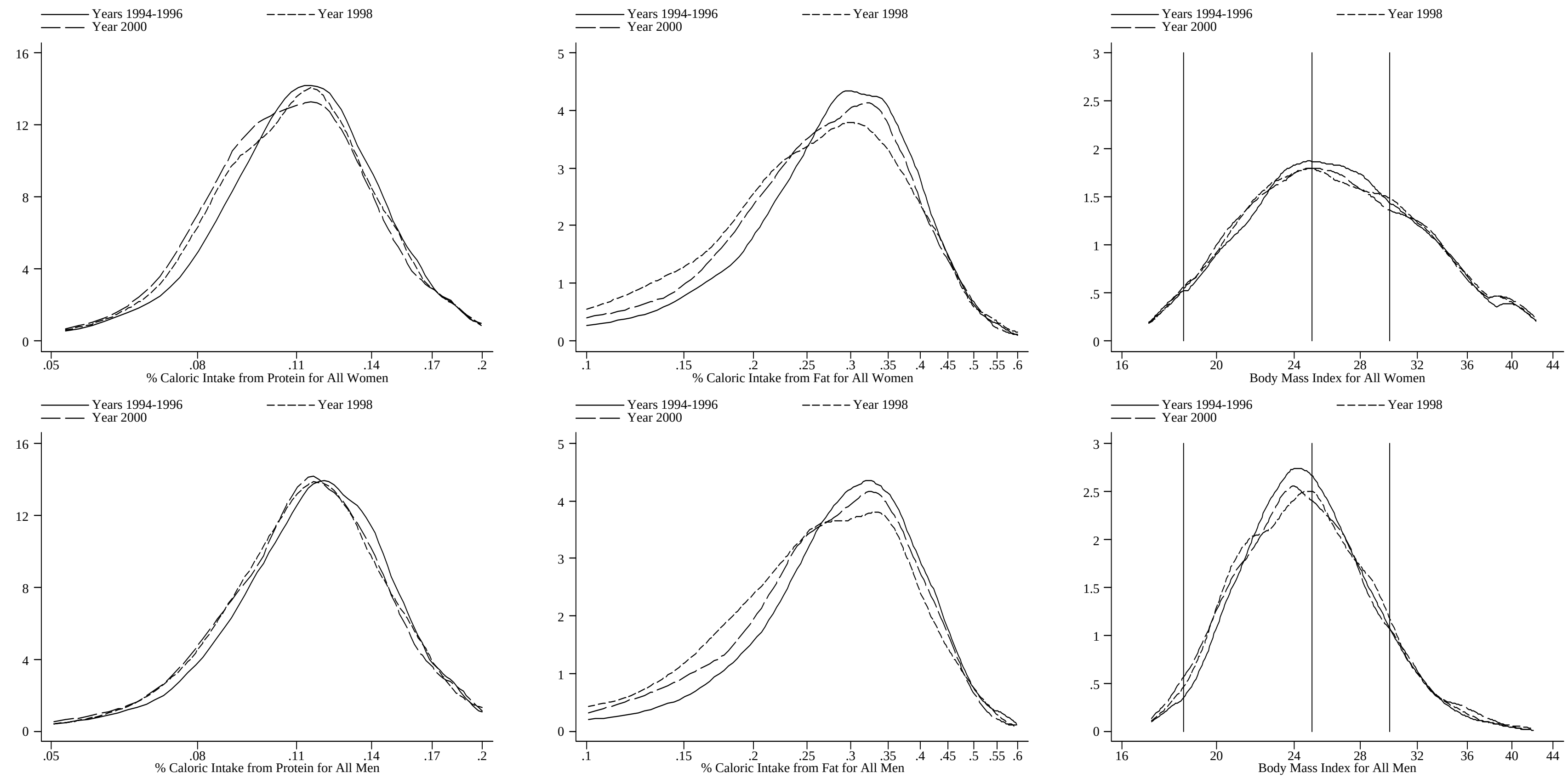

Figure 3: % Caloric Intake from Protein and Fat and Body Mass Index by Gender and Year

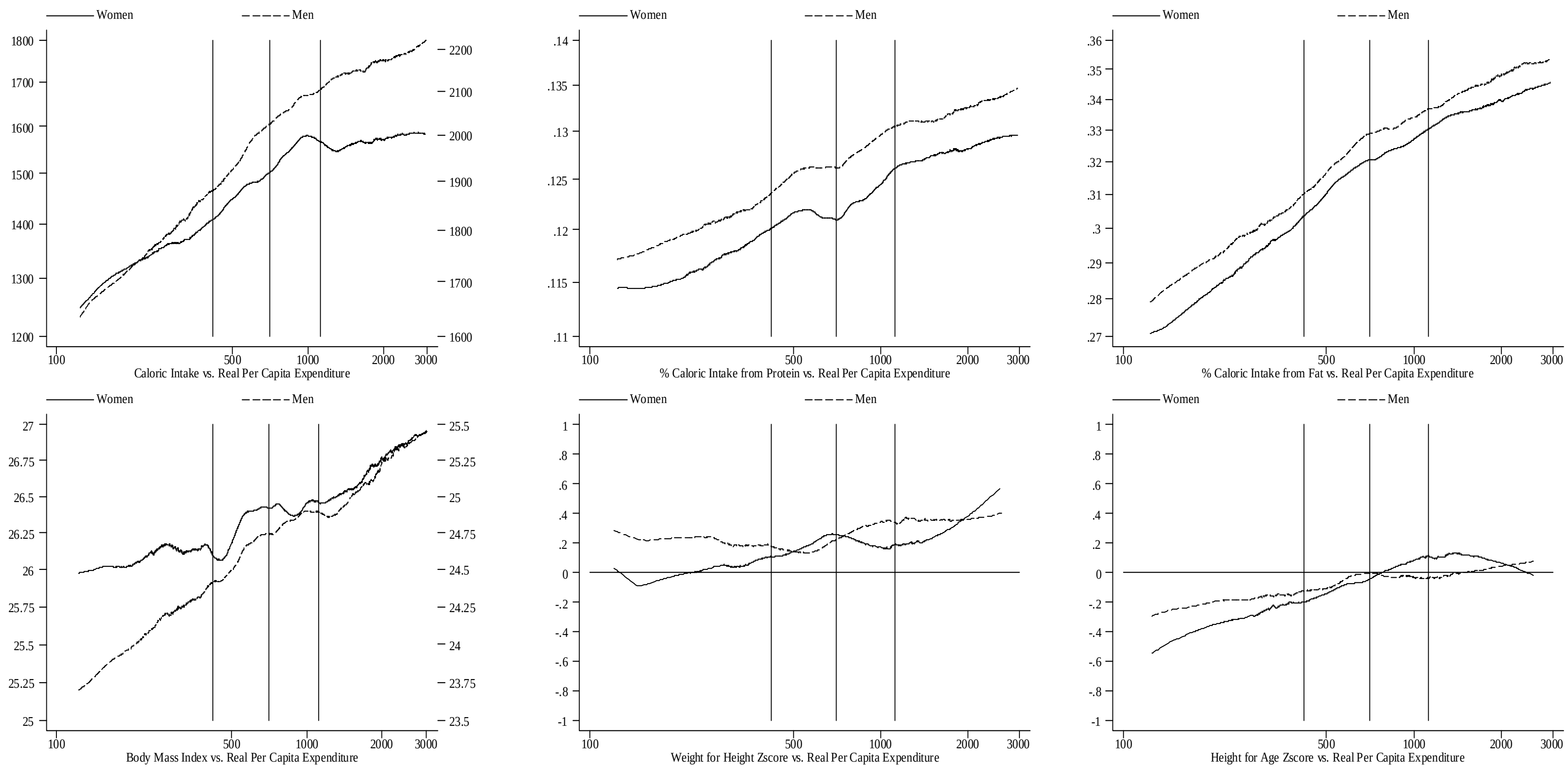

Figure 4: Non-Parametric Graphs of Nutritional Status versus Real Per Capita Expenditure

Table 1: Expenditure, Quantity, and Price of Foods from 1994-2000

	1994	1995	1996	1998	2000
Household Resources					
Real Expenditure Per Capita	964	968	949	778	1037
Real Food Expenditure Per Capita	711	684	632	513	638
Starches					
Real Expenditure Per Capita	60	78	81	56	69
Quantity Per Capita	10.3	10.3	9.9	9.6	10.1
Real Unit Value	5.9	7.8	8.4	5.8	7.0
White and Brown Bread					
Real Expenditure Per Capita	41	57	60	36	47
Quantity Per Capita (kg)	8.3	8.5	8.0	7.8	7.7
Real Price Per Unit (kg)	5.6	6.8	7.8	4.8	6.4
Pastas, Grains, Rice, and Kasha					
Real Expenditure Per Capita	19	21	22	20	22
Quantity Per Capita (kg)	2.0	1.9	1.9	1.9	2.5
Real Price Per Unit (kg)	13.1	13.9	15.4	15.0	11.6
Meats					
Real Expenditure Per Capita	214	190	175	135	164
Quantity Per Capita	7.6	6.3	5.8	4.9	4.9
Real Unit Value	30.8	31.5	30.9	29.1	34.2
Pork, Sausage, and Processed Meat					
Real Expenditure Per Capita	89	81	75	59	77
Quantity Per Capita (kg)	2.4	2.0	2.0	1.8	1.9
Real Price Per Unit (kg)	49.9	50.4	49.1	45.0	52.4
Beef and Veal					
Real Expenditure Per Capita	53	46	42	35	32
Quantity Per Capita (kg)	2.3	1.6	1.4	1.3	0.9
Real Price Per Unit (kg)	41.8	40.9	39.4	38.9	50.2
Dairy					
Real Expenditure Per Capita	85	79	76	63	69
Quantity Per Capita	6.9	6.4	6.4	6.3	6.4
Real Unit Value	17.6	17.8	16.7	14.1	14.2
Fresh, Canned, and Sour Milk					
Real Expenditure Per Capita	27	27	30	27	29
Quantity Per Capita (liters)	5.2	5.0	5.0	5.3	5.2
Real Price Per Unit (liters)	9.7	8.6	7.9	7.1	7.5
Sour Cream, Curd, Cream Cheese, and Cheese					
Real Expenditure Per Capita	24	26	26	19	24
Quantity Per Capita (kg)	0.97	0.82	0.88	0.69	0.82
Real Price Per Unit (kg)	31.1	37.1	35.6	31.7	35.3
Fruits and Vegetables					
Real Expenditure Per Capita	80	93	78	44	88
Quantity Per Capita	11.6	23.4	20.4	11.3	25.7
Real Unit Value	7.5	4.5	4.4	4.8	4.4
Potatoes, Cabbage, Sauerkraut, Onions, and Beets					
Real Expenditure Per Capita	25	51	41	21	50
Quantity Per Capita (kg)	7.1	17.2	15.0	8.2	18.8
Real Price Per Unit (kg)	6.6	4.4	4.1	5.0	3.5
Fresh, Canned, and Dried Fruit					
Real Expenditure Per Capita	48	29	26	20	24
Quantity Per Capita (kg)	3.5	2.8	2.8	1.8	2.5
Real Price Per Unit (kg)	19.8	15.3	16.3	25.0	21.3
# Observations	6886	7353	7232	7226	6601

Note: All values are in real 1998 Moscow City rubles (1 USD ≅ 17 real rubles) and are for the month prior to the survey.

Table 2: Relationship between Nutritional Status and Real Per Capita Expenditure

Dependent Variable	Log Total Daily Calories	% Daily Calories from Protein	% Daily Calories from Fat	Log Body Mass Index (Age > 17)	Weight for Height Z-score (Age < 11)	Height for Age Z-score (Age < 11)
			A) Pooled Ordinary Least Squares Regressions			
Log Per Capita Expenditure	0.093*	0.498*	2.137*	0.015*	0.064+	0.126*
	(0.005)	(0.035)	(0.099)	(0.002)	(0.038)	(0.033)
R-Squared	0.25	0.05	0.12	0.21	0.06	0.07
Permanent Log PCE	0.120*	0.721*	2.944*	0.025*	0.006	0.238*
	(0.007)	(0.049)	(0.138)	(0.004)	(0.056)	(0.052)
Transitory Log PCE	0.061*	0.231*	1.174*	0.004*	0.138*	-0.021
	(0.005)	(0.046)	(0.127)	(0.001)	(0.042)	(0.035)
R-Squared	0.25	0.06	0.12	0.21	0.06	0.08
			B) Pooled Individual Fixed Effects Regressions			
Log Per Capita Expenditure	0.064*	0.221*	1.236*	0.004*	0.109*	-0.017
(Transitory Log PCE)	(0.006)	(0.054)	(0.148)	(0.001)	(0.052)	(0.040)
Within R-Squared	0.08	0.01	0.03	0.03	0.06	0.03
Observations	35194	35194	35194	26071	3794	4273
Individuals	9468	9468	9468	7096	1252	1395

Note: Coefficients followed by a star are significantly different from zero at the 5 percent level, those by a plus sign at the 10 percent level. Permanent Log PCE is calculated as average Log Per Capita Expenditure for the household in which the individual resides in each year the individual is in the sample. Transitory Log PCE is the deviation from Permanent Log PCE in each sample year. All standard errors are robust Huber/White type, allowing for arbitrary correlation in an individual's error term across years and within households. All regressions also control for the individual's age (semi-parametrically with an indicator variable for each year of age), education, marital and work status, the number of other children, adults, and elderly in the household, the community level prices of 20 commonly purchased goods and year fixed effects. The OLS specifications also include region fixed effects.

Table 3: Changes in Transitory Per Capita Expenditure and Nutritional Status by Demographic Group

Dependent Variable	Log Total Daily Calories	% Daily Calories from Protein	% Daily Calories from Fat	Log Body Mass Index (Age > 17)	Weight for Height Z-score (Age < 11)	Height for Age Z-score (Age < 11)
Coefficient on Log Per Capita Expenditure controlling for Individual Fixed Effects						
Girls	0.040*	0.132	0.992*	NA	0.109	-0.011
	(0.015)	(0.118)	(0.339)		(0.077)	(0.054)
Boys	0.073*	0.266*	0.685⁺	NA	0.104	-0.020
	(0.015)	(0.118)	(0.359)		(0.065)	(0.056)
Adult Women	0.060*	0.338*	1.418*	0.005*	NA	NA
	(0.010)	(0.086)	(0.216)	(0.001)		
Adult Men	0.068*	0.271*	1.458*	0.003⁺	NA	NA
	(0.009)	(0.089)	(0.245)	(0.002)		
Elderly Women	0.072*	0.001	1.002*	0.003	NA	NA
	(0.012)	(0.102)	(0.276)	(0.002)		
Elderly Men	0.060	0.163	1.038*	0.001	NA	NA
	(0.018)	(0.152)	(0.415)	(0.003)		
Within R-Squared	0.09	0.02	0.04	0.04	0.08	0.05
F-Test Pooling Men/Women	1.17	0.75	0.170	0.64	0.004	0.012
	[0.32]	[0.52]	[0.92]	[0.53]	[0.95]	[0.91]
F-Test Pooling All Groups	0.84	1.65	1.220	0.74	NA	NA
	[0.52]	[0.14]	[0.29]	[0.53]		
Observations	35194	35194	35194	26071	3794	4273
Individuals	9468	9468	9468	7096	1252	1395

Note: All models include individual fixed effects (as in Panel B of the previous table). Coefficient on Log (Per Capita Expenditure) is interpreted as effect of transitory changes in household resources. Coefficients followed by a star are significantly different from zero at the 5 percent level, those by a plus sign at the 10 percent level. All standard errors are robust Huber/White type, allowing for arbitrary correlation in an individual's error term across years and within households. All regressions also control for the individual's age (semi-parametrically), education, marital and work status, the number of other children, adults, and elderly in the household, the community level prices of 20 commonly purchased goods, and include year fixed effects.

Table 4a: The Effect of Changes in Real Per Capita Expenditure on Nutritional Status by Work Status of Adults

Dependent Variable	Log Total Daily Calories		% Daily Calories from Protein		% Daily Calories from Fat		Log Body Mass Index	
Work Status	Not Working	Working	Not Working	Working	Not Working	Working	Not Working	Working
	Pooled Individual Fixed Effects Regression							
Log Per Capita Expenditure	0.068*	0.067*	0.312*	0.310*	1.676*	1.405*	0.005*	0.004*
	(0.014)	(0.008)	(0.118)	(0.074)	(0.276)	(0.209)	(0.002)	(0.001)
Change to Working	0.057		0.215		2.614		0.004	
	(0.087)		(0.725)		(1.911)		(0.013)	
F-Test Pooling Work Status	0.02		0.00		0.87		0.20	
	[0.90]		[0.99]		[0.35]		[0.65]	
Observations	19924		19924		19924		19764	
Individuals	5649		5649		5649		5607	

Table 4b: The Effect of Changes in Real Per Capita Expenditure on Nutritional Status by Household Income

Dependent Var.	Log Daily Calories		% Calories - Protein		% Calories - Fat		Log Body Mass Index		Weight for Height		Height for Age	
Income	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
	1) Stratified by Household Permanent Income											
Log PCE	0.071*	0.053*	0.268*	0.163^{+}	1.366*	1.019*	0.004*	0.004*	0.124*	0.075	-0.008	-0.031
	(0.008)	(0.009)	(0.063)	(0.088)	(0.189)	(0.215)	(0.001)	(0.002)	(0.059)	(0.093)	(0.048)	(0.070)
F-Test Pool High + Low Perm Inc	2.26		1.02		1.63		0.08		0.21		0.08	
	[0.13]		[0.31]		[0.20]		[0.78]		[0.65]		[0.78]	
	2) Stratified by Household Transitory Income											
Log PCE	0.070*	0.069*	0.106	0.129^{+}	1.172*	1.182*	0.002	0.003^{+}	0.052	0.063	0.082	0.063
	(0.010)	(0.009)	(0.085)	(0.076)	(0.234)	(0.209)	(0.002)	(0.001)	(0.084)	(0.074)	(0.067)	(0.058)
F-Test Pool High + Low Trans Inc	0.80		3.43		0.09		1.53		0.64		2.72	
	[0.16]		[0.10]		[0.79]		[0.06]		[0.83]		[0.27]	
Observations	35194		35194		35194		26071		3794		4273	
Individuals	9468		9468		9468		7096		1252		1395	

Note: Coefficients followed by a star are significantly different from zero at the 5 percent level, those by a plus sign at the 10 percent level. All standard errors are robust Huber/White type, allowing for arbitrary correlation in an individual's error term across years and within households. All regressions also control for the individual's age (semi-parametrically), education, and marital status, the number of other children, adults, and elderly in the household, the community level prices of 20 commonly purchased goods, and include year fixed effects.

Table 5: The Effect of Changes in Real Per Capita Expenditure on Expenditure, Quantity, and Unit Value of Different Types of Foods

Dependent Variable (All Per Capita)	Log Food Expenditure	All Starches			All Meats			All Dairy			All Fruits and Vegetables		
		Ln(EX)	Ln(QT)	Ln(VL)	Ln(EX)	Ln(QT)	Ln(VL)	Ln(EX)	Ln(QT)	Ln(VL)	Ln(EX)	Ln(QT)	Ln(VL)
A) Pooled Individual Fixed Effects Regression													
Log Per Capita Expenditure	0.948*	0.299*	0.237*	0.062*	0.952*	0.993*	-0.045*	0.658*	0.583*	0.076*	0.936*	0.789*	0.147*
	(0.010)	(0.014)	(0.013)	(0.007)	(0.019)	(0.022)	(0.009)	(0.019)	(0.023)	(0.016)	(0.027)	(0.029)	(0.019)
B) Individual Fixed Effects Regression: Independent Variable is Log Per Capita Expenditure													
Girls	0.929*	0.272*	0.199*	0.074*	0.995*	1.053*	-0.055*	0.606*	0.536*	0.072*	0.863*	0.703*	0.161*
	(0.019)	(0.028)	(0.025)	(0.015)	(0.034)	(0.039)	(0.016)	(0.036)	(0.045)	(0.031)	(0.047)	(0.048)	(0.034)
Boys	0.899*	0.295*	0.220*	0.077*	0.895*	0.924*	-0.032+	0.642*	0.604*	0.040	0.922*	0.751*	0.169*
	(0.020)	(0.028)	(0.027)	(0.013)	(0.037)	(0.041)	(0.017)	(0.037)	(0.044)	(0.031)	(0.048)	(0.051)	(0.036)
Adult Women	0.912*	0.308*	0.247*	0.063*	0.939*	0.966*	-0.025*	0.656*	0.600*	0.058*	0.877*	0.706*	0.172*
	(0.014)	(0.021)	(0.019)	(0.010)	(0.024)	(0.028)	(0.011)	(0.027)	(0.032)	(0.021)	(0.036)	(0.036)	(0.025)
Adult Men	0.917*	0.293*	0.226*	0.066*	0.944*	0.972*	-0.030+	0.628*	0.561*	0.070*	0.848*	0.675*	0.177*
	(0.014)	(0.018)	(0.017)	(0.010)	(0.028)	(0.031)	(0.016)	(0.027)	(0.034)	(0.028)	(0.041)	(0.042)	(0.029)
Elderly Women	1.010*	0.305*	0.253*	0.050*	0.969*	1.043*	-0.073*	0.689*	0.566*	0.125*	1.038*	0.979*	0.061*
	(0.022)	(0.025)	(0.024)	(0.013)	(0.042)	(0.048)	(0.019)	(0.039)	(0.047)	(0.029)	(0.055)	(0.062)	(0.035)
Elderly Men	1.027*	0.301*	0.249*	0.059*	0.994*	1.035*	-0.078*	0.689*	0.624*	0.049	1.089*	0.894*	0.177*
	(0.026)	(0.037)	(0.032)	(0.017)	(0.051)	(0.068)	(0.020)	(0.049)	(0.062)	(0.042)	(0.077)	(0.074)	(0.052)
F-Test Pooling Men/Women	0.60	0.31	0.48	0.12	1.74	2.08	0.55	0.54	1.13	1.31	0.59	0.70	1.50
	[0.62]	[0.82]	[0.70]	[0.95]	[0.16]	[0.10]	[0.65]	[0.66]	[0.33]	[0.27]	[0.62]	[0.55]	[0.21]
F-Test Pooling All Groups	5.88	0.33	0.91	0.55	1.22	1.83	2.12	0.83	0.72	1.26	2.62	4.28	1.87
	[0.00]	[0.90]	[0.48]	[0.74]	[0.30]	[0.10]	[0.06]	[0.53]	[0.61]	[0.28]	[0.02]	[0.00]	[0.10]
Observations	35297	35235	35297	35235	35256	35291	35256	35247	35291	35247	35258	35297	35258
Individuals	9478	9459	9478	9459	9464	9475	9464	9461	9475	9461	9465	9478	9465

Note: Coefficients followed by a star are significantly different from zero at the 5 percent level, those by a plus sign at the 10 percent level. All standard errors are robust Huber/White type, allowing for arbitrary correlation in an individual's error term across years and within households. All regressions are weighted by the inverse of the number of household members in a particular year, also control for the individual's age (semi-parametrically), education, marital and work status, the number of other children, adults, and elderly in the household, the community level prices of 20 commonly purchased goods, and include year fixed effects.

Appendix Table 1: Summary Statistics

Mean (Standard Deviation)	Round 5	All Rounds
Male	45%	44%
Age	35.9	36.7
	(21.6)	(21.5)
Total Daily Calories	1836	1867
	(882)	(853)
Percentage of Caloric Intake From Protein	0.125	0.124
	(0.036)	(0.034)
Percentage of Caloric Intake From Fat	0.334	0.319
	(0.104)	(0.098)
Body Mass Index (age > 17)	26.2	26.1
	(4.8)	(5.0)
Weight for Height Z-Score (age < 11)	0.222	0.217
	(1.484)	(1.361)
Height for Age Z-Score (age < 11)	-0.138	-0.080
	(1.436)	(1.328)
Real Per Capita Non-Durable Expenditure	964	937
	(876)	(915)
Real Per Capita Food Expenditure	711	635
	(615)	(561)
Currently Attends Primary or Secondary School	16%	16%
Currently Attends Technical School or University	3%	3%
Completed General Secondary Education	42%	45%
Technical School Diploma	20%	23%
Institute / University Diploma	15%	15%
Professional Course Diploma	18%	21%
Currently Married	50%	51%
Currently Working	46%	45%
Number of Other Children in the Household	1.00	0.86
	(1.02)	(0.93)
Number of Other Adults in the Household	1.69	1.56
	(1.14)	(1.10)
Number of Other Elderly in the Household	0.29	0.29
	(0.53)	(0.54)
Year is 1994	100%	20%
Year is 1995	0%	21%
Year is 1996	0%	20%
Year is 1998	0%	20%
Year is 2000	0%	19%
Region is Moscow City	8%	7%
Region is Northwest (includes St. Petersburg)	4%	4%
Region is North	6%	6%
Region is Central	15%	15%
Region is Central Black-Earth	6%	6%
Region is Volga-Vaytski	6%	6%
Region is Volga	13%	13%
Region is North Caucasia	9%	9%
Region is Ural	16%	16%
Region is West Siberia	10%	10%
Region is East Siberia	5%	5%
Region is Far East	3%	3%
# Observations	6886	35299

Note: All values are in real 1998 Moscow City rubles (1 USD ≅ 17 real rubles) and are for the month prior to the survey.

Appendix Table 2: Effect of Permanent and Transitory Income by Demographic Group

Dependent Var.	Log Daily Calories		% Calories - Protein		% Calories - Fat		Log Body Mass Index		Weight for Height		Height for Age	
Income	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1. Stratified by Household Permanent Income												
Girls	0.040*	0.033^{+}	0.169	0.033	0.917*	0.848*	NA	NA	0.155^{+}	0.017	-0.003	-0.028
	(0.017)	(0.018)	(0.127)	(0.151)	(0.390)	(0.385)			(0.084)	(0.141)	(0.061)	(0.098)
Boys	0.086*	0.056*	0.320*	0.206	1.157*	0.284	NA	NA	0.107	0.099	-0.018	-0.022
	(0.016)	(0.018)	(0.136)	(0.144)	(0.406)	(0.421)			(0.078)	(0.111)	(0.069)	(0.089)
Adult Women	0.070*	0.052*	0.425*	0.246*	1.688*	1.248*	0.006*	0.005*	NA	NA	NA	NA
	(0.011)	(0.014)	(0.096)	(0.120)	(0.268)	(0.278)	(0.002)	(0.002)				
Adult Men	0.080*	0.054*	0.311*	0.222^{+}	1.651*	1.195*	0.003	0.003	NA	NA	NA	NA
	(0.012)	(0.012)	(0.101)	(0.125)	(0.297)	(0.320)	(0.002)	(0.002)				
Elderly Women	0.073*	0.064*	0.054	-0.118	1.016*	0.799*	0.003	0.002	NA	NA	NA	NA
	(0.014)	(0.015)	(0.114)	(0.138)	(0.313)	(0.349)	(0.002)	(0.003)				
Elderly Men	0.059*	0.046*	0.163	0.116	0.828^{+}	0.836^{+}	-0.001	0.002	NA	NA	NA	NA
	(0.020)	(0.020)	(0.170)	(0.177)	(0.474)	(0.463)	(0.004)	(0.004)				
F-Test Pooling PI	1.28		0.43		2.15		0.65		0.39		0.03	
	[0.26]		[0.86]		[0.05]		[0.63]		[0.68]		[0.97]	
Observations	35194		35194		35194		26071		3794		4273	
Individuals	9468		9468		9468		7096		1252		1395	
2. Stratified by Household Transitory Income												
Girls	0.033	0.035	0.027	0.048	0.887^{+}	0.908^{+}	NA	NA	0.076	0.082	0.104	0.082
	(0.024)	(0.021)	(0.184)	(0.164)	(0.531)	(0.471)			(0.123)	(0.108)	(0.087)	(0.075)
Boys	0.115*	0.107*	0.277	0.271^{+}	0.192	0.287	NA	NA	0.056	0.066	0.052	0.038
	(0.022)	(0.020)	(0.175)	(0.157)	(0.550)	(0.493)			(0.110)	(0.097)	(0.090)	(0.079)
Adult Women	0.054*	0.055*	0.244^{+}	0.263*	1.397*	1.402*	0.004^{+}	0.005*	NA	NA	NA	NA
	(0.016)	(0.014)	(0.139)	(0.124)	(0.352)	(0.314)	(0.002)	(0.002)				
Adult Men	0.080*	0.078*	-0.009	0.046	1.281*	1.316*	-0.002	-0.001	NA	NA	NA	NA
	(0.015)	(0.013)	(0.133)	(0.119)	(0.376)	(0.336)	(0.003)	(0.002)				
Elderly Women	0.064*	0.066*	0.066	0.049	1.293*	1.224*	0.005	0.004	NA	NA	NA	NA
	(0.018)	(0.016)	(0.158)	(0.138)	(0.427)	(0.373)	(0.003)	(0.003)				
Elderly Men	0.086*	0.080*	-0.001	0.032	1.450*	1.350*	0.004	0.003	NA	NA	NA	NA
	(0.027)	(0.024)	(0.226)	(0.200)	(0.629)	(0.550)	(0.005)	(0.004)				
F-Test Pooling TI	1.55		1.78		0.53		2.31		0.19		1.30	
	[0.16]		[0.10]		[0.79]		[0.06]		[0.83]		[0.27]	

Note: Coefficients followed by a star are significantly different from zero at the 5 percent level, those by a plus sign at the 10 percent level. All standard errors are robust Huber/White type, allowing for arbitrary correlation in an individual's error term across years and within households. All regressions also control for the individual's age (semi-parametrically), education, and marital status, the number of other children, adults, and elderly in the household, the community level prices of 20 commonly purchased goods, and include year fixed effects.