The dynamics of food, alcohol and cigarette consumption in Russia during transition

Thomas Herzfeld
Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO), Halle, Germany
Wageningen University, Wageningen, The Netherlands

Sonya Huffman (corresponding author)
368D Heady Hall
Iowa State University, Ames, IA 50011, USA
skostova@iastate.edu

Marian Rizov
Middlesex University Business School, London, UK

The dynamics of food, alcohol and cigarette consumption in Russia during transition

Abstract:
This paper presents evidence on the impact of individual as well as regional characteristics on the dynamics of fat, protein, alcohol and cigarette consumption, and on the diversity of the diet in Russia between 1994 and 2005. All those aspects of nutritional behavior are important inputs to the production of health. A dynamic panel data model is used to estimate demand functions for fat, protein, alcohol, cigarette and diversity of the diet. The results suggest the existence of strong habits in drinking and smoking, and the absence of habits in fat and protein consumption. We also found evidence of habit formation for food diversity. Comparing nutritional behavior of younger and older consumers we find significant differences for demand for fat and cigarettes. Older consumers seem to be more persistent in their drinking and smoking behavior. Similarly, men show higher habit persistence for alcohol and cigarettes consumption. The results also suggest that among individual determinants, especially education, income and employment have statistically significant impacts on consumption behavior. Regarding the macroeconomic variables, economic growth is negatively related to protein consumption, while regional unemployment rate is negatively affecting demand for protein and food diversity. Finally, Russian consumers react to price changes of alcohol, cigarettes, fat and protein as suggested by theory. Consumer demand for food diversity responds negatively to price changes of alcohol and cigarettes but positively to price of fat.

Keywords: food consumption, diet diversity, smoking, alcohol, health, economic transition, Russia

The dynamics of food, alcohol and cigarette consumption in Russia during transition:

Introduction

Political, economic and social reforms in Russia since the collapse of the socialist economy in 1991 have brought significant changes to citizens' lives. The economic downturn signified the real GDP falling to 55% of its 1989 level by 1998, the lowest point over the last two decades, and a subsequent recovery to 88% by 2005 (World Bank, 2007). High inflation, which was still over 300% in 1994, emerging open unemployment, sharp declines in production, and quite common wage arrears eroded the income generating basis for many households. As a result, social indicators point to a fall in living standards, deterioration in health conditions and increased mortality. Psychological stress, unhealthy lifestyles which include heavy alcohol (vodka) and cigarette consumption, high-fat diet, and a lack of recreational exercise have been identified as the main and often intertwined determinants of poor health in Russia ((Zohoori et al., 1998). Several studies describe how Russian households had responded to the economic changes during the transition from planned to a market economy (Mroz and Popkin, 1995; Dore et al., 2003; Skoufias 2003; Stillman and Thomas, 2008; Staudigel, 2011).[1] However, the impact of macroeconomic developments on consumption behavior has been analyzed to a lesser degree so far. To what extent economic turmoil affects consumer behavior remains an important empirical question.

To gain a better understanding of the relationship between macroeconomic factors and healthy lifestyle behaviors, we focus directly on the potential causes of poor health. This paper investigates how the changes in socio-demographic and economic indicators affect consumption behaviors such as diet, drinking and smoking. Unhealthy lifestyles include behaviors that are found to increase the probability of getting a disease and having negative influences on health. During the transition, there are shifts in consumption behavior as a

[1] Jahns et al. (2012) focus on analysis of energy and fat consumption as well as physical activity of Russian children.

response to fluctuations in income, prices and employment status. However, there might also be strong habits in consumption behavior that would mitigate the effects of economic turmoil in Russia. Therefore, we examine the impact of predetermined consumption habits in the context of economic fluctuations in Russia.

More specifically, we estimate demand functions for macronutrients, cigarettes, and alcohol, as well as for the diversity of diet. Data from the Russian Longitudinal Monitoring Survey (RLMS) rounds 5 to 14, covering the period between 1994 and 2005, form the underlying database.[2] Our analysis aims to quantify the impact of micro- as well as macroeconomic determinants on nutritional behavior. Whereas previous studies analyze the link between socio-economic conditions and health outcomes such as life expectancy, or between healthy lifestyles and behaviors and health outcomes, this paper goes further into investigating the relationship between individual and regional characteristics and consumption behaviors, directly affecting health outcomes. The primary contribution of the paper is the examination of the relative impacts of individual, household, and regionally disaggregated (macroeconomic) determinants on food, alcohol and cigarette consumption during economic transition. Furthermore, we test to see if older and younger generations, and men and women respond differently to the same determinants of consumption behavior.

The paper continues as follows. First, we review of the literature on nutritional behavior and its changes during times of economic turmoil. We then develop our testable hypotheses, based on this review, various theories of consumption and previous empirical results. Third, the data and econometric methodology are described, followed by a presentation and discussion of the estimation results. Finally, conclusions are offered.

[2] The RLMS was not conducted in 1997 and 1999.

Economic turmoil and nutritional behavior

The transition period has been characterized by sharp decline in output and exploding inflation. Figures 1 and 2 display the changes in the main macroeconomic indicators, real annual GDP and inflation in Russia from 1994 to 2005, which is the period analyzed in this paper. Figure 1 shows the J-curve pattern of initial steep decline in output and slow recovery afterwards. The freeing of prices of government control led to an explosion in inflation at the beginning of the transition to a free market economy. Russia's economy is highly dependent on exports, particularly crude oil and natural gas. The Ruble devaluation and the Russian financial crisis in 1998 led to a further decline of economic output. Prices, especially of imported products, increased sharply, which pushed many households into poverty and increased the economic inequality in Russia (Lokshin and Popkin, 1999). The increase in oil prices in the world market greatly facilitated the economic recovery of Russia by 2000.

[Figures 1 and 2 around here]

Turning to food prices, Figures 3 and 4 show the development of the prices of fat, protein, alcohol and cigarettes, relative to the aggregate food price at the community level in Russia between 1994 and 2005 based on the authors' calculations.[3] Beside the mean, the figures present the 25^{th} and 75^{th} percentiles to give an indication of the variability across communities. Out of the four items, alcohol shows the highest increase in relative price. The price of alcohol reached a peak in 1998 and declined over the following years. The effect was determined by the Ruble devaluation and the significant rise of alcohol taxes during the mid-1990s.[4] The relative price of cigarettes remained rather stable during this period and shows the lowest variation across communities. Interestingly, the relative prices of protein and fat

[3] For a more detailed description of the calculation of relative prices, see the section entitled "Data and econometric specification".

[4] Taxes for spirits increased significantly in December 1993, and later doubled in 1997 (Boudreaux, 1994; Specter, 1997).

are most strongly correlated. While they increased up to 1996, the prices remained rather stable after 2000. Obviously, the two macronutrients share a large group of food items (e.g., milk and dairy products, different types of meat, etc). Thus, the development of derived prices will usually be highly correlated. However, the distribution of protein prices is narrower compared to fat prices.

[Figures 3 and 4 around here]

There is ample evidence in the literature that individuals who use or consume large amounts of alcohol, cigarettes, and a diet rich in fat will have health repercussions. This highlights the importance of lifestyle choice for an individual's health status (see among others McGinnis and Foege, 1993; Chou et al., (2004); Mokdad et al.,(2004); Lakdawalla et al., 2005; Lakdawalla and Philipson, 2009; Rashad et al., (2006); Khaw et al.,2008;Huffman et al., 2010). However, all of the studies listed focus on developed economies and stable economic conditions.

Analyses specifically focusing on periods of economic turmoil fail to establish a consistent relation between macroeconomic developments and consumer behavior. Using South Korean data over the late 1990s, Khang et al. (2005) report a surprising decline in mortality during recessions. Similar results are reported by Tapia Granados and Diez Roux (2009) for the Great Depression in the United States. Analyzing the severe economic crises in Mexico over the 1980s and 1990s, Cutler et al. (2002) identify a link between the availability of public health services and female labor force participation, and mortality among children and the elderly.

There is a growing literature on health outcomes and nutrition in Central and Eastern Europe and the former Soviet Union; Stillman (2006) presents an excellent review. Similar to findings for other countries and regions, heavy alcohol consumption and smoking, a high-fat

diet, and lack of leisure-time exercise are the most significant causes of heart disease and premature mortality in Russia (Cockerham, 2000). However, the direct impact of macroeconomic developments on consumption behavior is less analyzed so far.

Young women, children and the elderly are often thought to be the most vulnerable to poor economic conditions. Although nutrition responds to growing income (Stillman and Thomas, 2008) find no evidence that the nutritional well-being of men and women differ as households are subject to transitory resource fluctuations. Most of the Russian households have coped with economic hardships by adopting appropriate strategies to lower the cost of energy intake. Low income Russian families maintained existing eating patterns and dietary stability during the economic crisis by purchasing cheaper foods and increasing home production ((Mroz and Popkin, 1995). Thus, Russian households could partially protect their consumption from income changes (Skoufias, 2003; Mu, 2006). However, Mu (2006) finds that the effectiveness of protection varies with the level of human capital and household income. Analyzing the food consumption patterns of children in Russia, Dore et al. (2003) find that low income children consume less meat and poultry, but the energy intake was steady; while the high income children consume more eggs and dairy products, and their energy intake increased between 1994 and 2000.

Focusing on specific consumption items with unhealthy effects, Zohoori et al. (2001; 2006) show that among women and teenagers, smoking and drinking has increased. But the prevalence of smoking among men declined from 2002 to 60.6% in 2005. The prevalence of drinking among adult males has fluctuated between 67% and 70% over the period 1998-2005. Brainerd and Cutler (2005) show that during the 1990s, increased alcohol consumption and psychological stress were significant causes of increased mortality rates. Ogloblin and Brock (2003) investigate the risk factors and economics of the decision to smoke. Huffman and Rizov (2007, 2010) study the factors contributing to rising obesity, and find a strong positive effect of diet and a strong negative effect of smoking on weight and BMI. Staudigel (2011)

investigates the impact of food prices on overweight and obesity; his results do not show that food prices are an important determinant of weight.

Interestingly, the large majority of empirical studies that have analyzed determinants of nutrition, food choice, smoking, and obesity, control for regional variations only by including very broadly defined regional dummy variables. Obviously, there are regional differences in prices and in consumption behavior and it is reasonable to assume that regional consumption patterns develop differently. For instance, Simpura and Levin (1997) point to regional differences in alcohol consumption within the Russian Federation and attribute them to cultural and ethnic factors. Therefore, in the next section we develop a conceptual framework to guide the empirical analysis of the effects of several micro and regional (macro) factors on individual (and household) nutritional behavior.

Determinants of individual nutritional behavior

In the standard microeconomic theory, an individual's *i* demand q_i is a function of income *y*, a vector of good's own price and cross-prices **p**, and preferences θ:

(1) $q_i = q(y, \mathbf{p}; \theta, \mathbf{z})$,

where q_i represents demand for macronutrients (fat and protein), demand for cigarettes and alcohol, or demand for food diversity that is a measure of diet quality. We extend the framework by a set of regional characteristics **z,** which is assumed to influence an individual's demand either directly or indirectly. Demand is directly affected by the availability of food items or region specific prices and incomes. We assume macroeconomic conditions which shape consumer prospects for the future to affect consumer behavior indirectly. More specifically, a worsening economic situation and somber expectations of future economic development might cause consumers to change to a different consumption path, thus, lowering her or his preferences for future health status.

Income and Prices

Arnade and Gopinath (2006) develop a theoretically consistent demand function for fat as an outcome of dynamic utility maximization. As expected, demand for fat increases with income. Similarly, demand for protein and alcohol is expected to increase with income. Although, demand is expected to be negatively related to its own price, consumers are not able to reduce demand for nutrients to an absolute minimum. Rather, consumers will substitute between, for example, fat rich and less fatty food items following a price increase. Therefore, it is unclear *a priori* what is the net effect of prices on demand for nutrients. Consumers situated in different communities or regions might well be affected by spatially non-uniform changes in food prices. Therefore, separate community-level price indices of fat, protein, alcohol, and cigarettes are included in the econometric models. Furthermore, the theory suggests a relatively less elastic demand for alcohol and cigarettes, reflecting addictive behavior.[5]

Preferences

Preferences include a wide variety of drivers of individual consumption behavior and are not directly observable. Past consumption behavior and personal characteristics usually serve as measurable approximations of preferences. The cumulative effect of past consumption represents a "stock" of habit that might influence current consumption in two different ways (Taylor and Houthakker, 2010). (1) Consumers might maintain their consumption behavior from one year to the other, which is called habit persistence. The formation of habits would be linked to a positive coefficient of a previous period's consumption in the econometric model. Previous high consumption of alcohol and cigarettes is expected to result in an even higher demand for these items, reflecting the addiction aspect.[6] (2) Conversely, consumers might realize the negative effects of previous unhealthy consumption, and change their behavior.

[5] Baltagi and Geishecker (2006) test the theory of rational addiction using panel data, and find some evidence of addictive behavior for alcohol consumption of Russian males.

[6] An excellent discussion of the theoretical models and empirical tests of addiction for risky health behaviors in developed countries is presented in Cawley and Ruhm (2011). Empirical tests of habits have been conducted for different goods such as tobacco, alcohol, food. Most of the studies use the empirical model developed by Chaloupka (1991). The main test is whether past consumption raises current consumption. We also limit our specification to the lagged consumption.

Such behavior will result in a negative coefficient of the previous period's consumption in the econometric model.

Furthermore, preferences are indirectly measured by individual characteristics such as age, gender, and education. Among these personal characteristics, age is expected to have a non-linear impact on consumption reflecting the life-cycle, generally increasing up to age about 60, and declining subsequently as identified in several empirical studies (e.g., Miquel and Laisney (2001). However, older consumers might adjust more slowly because they have less time to benefit from moving to a new equilibrium in lifestyle. The latter aspect might describe the consumption behavior across cohorts. That is, determinants of consumption behavior may differ between younger and older cohorts. In the econometric analysis, we test whether older consumers behave as the median consumer or follow a different consumption pattern.

An individual's employment status is clearly correlated with her or his budget constraint. In the case of lost employment, we expect the consumer to reduce, for example, demand for food diversity. Whether she or he will reduce aggregated demand for fat and protein depends on the substitutability of fat and protein containing food items. In contrast, demand for alcohol and cigarettes might even increase in response to stress and economic hardship.

Adjusting own consumption behavior to new products and new economic conditions is hypothesized to be easier for individuals who possess higher levels of formal education (Huffman, 1977); Schultz, 1975). Similarly, better educated consumers are expected to have a higher awareness of what comprises a healthy lifestyle, thus a more diverse diet without excessive fat and protein content.

Finally, (Sedik and Wiesmann, 2003) using data from Russia, show that larger households without access to garden plots suffer a higher level of food insecurity. Both household size and access to a garden plot are thus important factors in determining consumption behavior under uncertain economic conditions. However, the magnitude of their effects on consumption remains an empirical question.

Regional characteristics

Regional characteristics might affect individual consumption in two different ways. Prices, which are usually spatially correlated; and the development of income and availability of food items affect directly a consumer's choice set. Russian regions face a variety of production and marketing conditions and are differentially affected by business cycle developments. Huge distances as well as institutional conditions are shown to limit market integration, i.e. slow adjustment of prices across space, over the 1990s (Berkowitz and De Jong, 1999). A region's structure of the economy and its economic prospects, such as high unemployment rates, restructuring of large employers, or a boom of specific sectors might affect consumption behavior indirectly.[7] Somber expectations might lower consumer interest in future health status. Thus, the impact of facing somber economic conditions and employment perspectives might result in a lower interest in long-term health and less attention to healthy nutrition in the present. More specifically, deteriorating macroeconomic conditions such as declining Gross Regional Product (GRP) per capita and rising regional unemployment are expected to stimulate higher alcohol and cigarette consumption (Ruhm, 1995); (Brainerd and Cutler, 2005). However, an individual's employment prospects and regional unemployment are not independent of each other. Prospects for finding new employment will be much more somber in regions with a high unemployment rate, compared to prosperous regions. Thus, a consumer losing employment in a region with a higher unemployment rate might feel more stressed than a similar consumer in an economically prosperous region. Consequently, changes in demand are expected to be aggravated.

[7] The Russian economy during Soviet times was characterized by large industrial complexes and almost no small and medium sized enterprises. Furthermore, growth of newly founded private enterprises shows a strong regional heterogeneity (Berkowitz and DeJong, 2003).

Data and econometric methodology

Data, specification and variables

Our empirical analysis is based on data from the Russian Longitudinal Monitoring Survey (RLMS) and the Russian Statistical Yearbook (RSY). More specifically, we use rounds 5 to 14 spanning the period, 1994-2005. This offers the possibility to analyze long-term changes in consumption and persistence in consumption patterns against the background of significant changes in consumer socio-economic environment. The RLMS is coordinated by the Carolina Population Center at the University of North Carolina, in collaboration with the Russian Academy of Sciences and the Higher School of Economics (http://www.cpc.unc.edu/projects/rlms-hse). The RLMS is a nationally representative household survey that annually samples the population of dwelling units. The survey does not follow individuals or households that moved out of the primary sampling unit. Any new members or new households living at the sample dwelling are included. Assuming new entrants are exchangeable with those who exit; the sample will remain representative of the underlying population. Since 1996 (round 7), the RLMS started to follow households that had moved to new addresses whenever it was possible. Due to high attrition, the sample of Moscow and St. Petersburg has been renewed in 2001 (round 10), and the observations from Moscow and St. Petersburg have been excluded from the representative cross sectional sample, but continue to report. They still can be used for longitudinal analysis. We will discuss how we correct for sample attrition below.

Data collected contain a wide range of information concerning household characteristics such as demographic composition, income and expenditures, and individual characteristics such as employment, anthropometric measures, health status, nutrition, alcohol consumption and medical problems. Data on consumption are based on recall over the last 30 days or/and household diaries. Measures of individual food intake used for computation of protein and fat consumption are based on 24 hour recall. Maximum and minimum prices for about 90 food

products at 160 sites are recorded at the community level. Our sample consists of 2194 individuals aged 18 and above in 1155 households, that can be identified as repeated observations. The RSY provides data on the regional economic variables of the 31 regions (*oblasts* and *krays*) covered in our analysis.[8]

The relationship between an individual's (or household's) *i* consumption (q_i) and individual and household characteristics and regional economic indicators discussed theoretically in the previous section is analyzed empirically by using the following dynamic econometric model:

(2) $q_{it} = \alpha q_{i,t-1} + \beta X'_{it} + \gamma M'_{kt} + \delta Z_{ikt} + \sum_{t=1}^{9} \lambda_t D_t + u_{it}$.

The dependent variables (q) are defined as follows:

1) Diet is measured by three variables:

- share of daily calories from fat (in percent),[9]
- share of daily calories from protein (in percent),
- food diversity, measured by a Berry index: $BI = 1 - \sum s_j^2$,

where s_j is the share of expenditures on food group *j* in household's total consumption expenditure (Thiele and Weiss, 2003).[10] Higher values indicate a more diverse diet. Nutritionists believe that a more varied diet is one core element of healthy nutrition behavior (Drewnowski et al., 1996).

2) Alcohol consumption is measured by a continuous variable: pure alcohol (ethanol) consumption per day in grams, derived from self-reported consumption during the last 30 days. It is used in logarithmic form in the estimation.

[8]The RLMS covers 32 regions. However, due to exhibiting outlier behavior, for example, unemployment rates far higher than the sample average, and its closeness to war-torn Chechenia, the Kabardino-Balkarija region has been excluded.

[9] We refer from now on to the share of daily calories from fat and protein as a share of fat and protein in diet, respectively.

[10] Other studies just count the number of food items. The Berry index represents additionally information on the concentration among items. Food diversity could also be measured using an Entropy index, which assigns higher weights for items with small shares. The results with the Entropy index are very similar to the results reported and are available upon request.

3) Smoking is defined in terms of number of cigarettes smoked per day in a logarithmic form.

All dependent variables except food diversity are measured at the individual level. The food diversity index is calculated at the household level because our data contains expenditure information only for the household.

We have included the one period lagged value of the dependent variable (q_{it-1}) to test for the habit formation hypothesis, versus the accumulation hypothesis (Deaton and Muellbauer, 1980); (Arnade and Gopinath, 2006). Whereas a positive sign of the lagged consumption coefficient suggests an increasing effect of lagged consumption on current consumption, which we interpret as habit formation; a negatively signed coefficient points to a decreasing effect of past consumption due to the accumulation effect.

The matrix of explanatory variables X_i includes micro- or socioeconomic variables such as household size and household income (both in logarithmic form); and individual characteristics, such as education, age, age squared, gender, marital and employment status, and area of residence (rural or urban). The variable "garden" measures the access to land for food production and controls for the degrees of freedom to adjust consumption behavior over the transition period (as well as the degree of self-sufficiency).

The matrix M_k represents the economic indicators of region k including GRP per capita (in logarithmic form), GRP growth rate, shares of manufacturing, agriculture and services in the regional value added, and unemployment rate. Additionally, the relative prices for fat, protein, alcohol and cigarettes measured at the primary sampling unit (PSU) level are included in the respective specifications. Following Ogloblin and Brock (2003), the prices for alcohol, cigarettes, fat and proteins are calculated as weighted geometric averages using both the high and low prices. In the case of missing information on prices, the prices were imputed from the

average for the PSU.[11] All four relative prices are explanatory variables of a household's diet diversity.

In order to capture the interrelationship between the individual employment situation and regional labor market prospects, we introduce an interaction term *Z*, multiplying the employment status with the regional unemployment rate. Round-dummy variables (*D*) control for consumption shocks and other economic fluctuations through time, including the economic crisis in 1997/98. Finally, u_{it} is the error term composed of a true random disturbance term and an individual-specific time-invariant effect.

Assuming a constant relationship between consumption behavior and explanatory variables across all generations (age cohorts) is a very strong assumption. Therefore, we test whether the older generation reacts differently over the phase of economic transition compared to the younger generation. We classify as 'old generation' individuals who fully formed their consumption patterns during central planning, under the socialist system. The definition implies that individuals in their mid-40s and older fall in this category. Thus, we separate the full sample into two subsamples. The first subsample (the young cohort) includes individuals aged 50 and younger in 1994; the initial year in the data and the second subsample (the old cohort) includes individuals older than 50 in 1994. We first estimate the model using the full sample and including a dummy variable "oldcohort" equal to 1 if the individual is from the old cohort. Basically, this specification assumes the same behavioral trajectories for both cohorts shifted by a constant. Next, we estimate the model for each subsample separately. Results from the subsamples inform us about different shapes of the demand functions across generations. In addition, motivated by results by Baltagi and Geishecker (2006), we also split

[11]The prices are calculated relative to an aggregate price over the prices for all different types of foods for which expenditure information is available. The weights for alcohol price are the same as the weights to calculate pure alcohol content (Schultz, 2008): 0.05 beer; 0.10 wine; 0.20 fortified wine; 0.40 vodka; 0.40 cognac. The prices of fat and protein are based on weights from the USDA National Nutrition Database. The price of fat is based on the following weights: 0.80 butter; 0.78 mayonnaise; 0.70 margarine; 0.20 boiled sausage; 0.28 semi-smoked sausage; 0.28 wieners; 0.65 nuts; 0.30 chocolate candies; and 0.30 chocolate. The price of protein is based on the following weights: 0.36 hard cheese; 0.36 eggs; 0.17 beef; 0.15 pork; 0.28 chicken; 0.20 fresh fish; 0.63 salted fish; 0.20 stewed pork, canned; and 0.27 canned fish in oil.

the sample by gender and estimate separate models of demand for alcohol and cigarettes for men and women.

Tables 1a and b present the definitions, means and standard deviations for all variables used in the econometric analysis. Figures 5 through 9 show the evolution of the five dependent variables through time for the total sample and for the subsamples by age (generation) cohort. Consumption of fat, alcohol and cigarettes as well as diversity of diets reaches the lowest levels in the years of the economic crisis of 1997/98 (round 8). The early 2000s see an increasing consumption across all five dependent variables. Especially, the sharp increase of alcohol and cigarettes consumption is highly undesirable from a health perspective. When we consider the age cohort subsamples we can observe heterogeneity in behavior. The changes over the period of analysis are particularly unfavorable in the young cohort where the increases in fat, alcohol and cigarette consumption is the highest, while the increase in the food diversity is the smallest. Surprisingly, it seems that during the height of the crisis (1998, round 8), older consumers managed to increase food diversity.

[Tables 1a and b around here]

[Figures 5-9 around here]

Econometric issues

We estimate our models specified in Equation (2) by a general method of moments estimator (system GMM). Arellano and Bond (1991) propose a GMM estimator that treats the model as a system of equations, one for each time period. The equations differ only in their instrument condition sets, where the predetermined and endogenous variables in first differences are instrumented with suitable lags of their own levels. Strictly exogenous regressors, as well as any other instruments, can enter the instrument matrix in first differences, with one column per instrument. However, the Arellano-Bond GMM estimator is biased in the presence of unit

roots, and suffers from the weak instrument problem as the coefficient of the lagged dependent variable gets close to one. Arellano and Bover (1995) proposed to add the original equations in levels to the system. As a result additional moment conditions are brought to increase efficiency. In these equations, predetermined and endogenous variables in levels are instrumented with their own first differences. Blundell and Bond (1998) formally developed the "system" GMM, which uses the level information and allows the variables in levels to be instrumented with suitable lags of their own first differences. Here we use the "system" GMM estimator, following Blundell and Bond (1998), to estimate our empirical model of micro and macro impacts on consumption behavior. We use the `xtabond2` (with two-step option) command in STATA to apply the system GMM estimator. In our estimations, we treat the lagged dependent variables as endogenous and education, employment status, marital status, income, household size and access to land plot as predetermined; we consider these variables as affected by individual choices that might be correlated with consumption preferences. Age, gender, prices, regional economic characteristics and time dummies are used as exogenous instruments. Modifying the assumptions about the variables in terms of endogenous or predetermined does not significantly change the results reported.

Due to the sample design, our panel data is vulnerable to panel attrition bias, when the reasons for moving out of the sample are correlated with the dependent variables of interest. To correct for panel attrition, a probability of survival has been estimated using a Probit model, and included in the estimation of the changes in diet, smoking and alcohol consumption. We follow closely the approach by (Mu, 2006), who uses the inverse probability weighting (IPW) method applied to the same RLMS data. The method has the advantage that we don't need to identify exogenous variables affecting attrition, but not consumption behavior. In a nutshell, the predicted probabilities ($\hat{\pi}_{it}$) from an attrition Probit model at the first stage are used to calculate the joint probabilities that individuals (households) stay in the survey for each year ($\hat{p}_{it}$). Each individual (household) is assigned a

weight equal to the reciprocal of the joint probability ($w_{it}=1/\hat{p}_{it}$). IPW corrects for sample attrition by weighting heavier households who are likely to leave the sample, and leads to consistent estimates.[12]

Given that only a subsample of individuals report positive quantities (nonzero purchases) of alcohol and cigarette there could be a selection bias affecting estimates of these models. Kyriazidou (2001, pp.545-546, p.552) shows in a static GMM framework under pairwise exchangeability of the error vector (implying stationary of the errors) time-differencing of the equation with censored dependent variable eliminates not only the individual effect but also the effect of sample selection, thus generating a consistent estimator. In a dynamic setting, identification of the estimators can also be achieved for a subsample where individuals are observed for at least three periods. The key assumption is that all conditional moments of the main equation error term are constant, due to the assumed stationarity of the error vector and are therefore eliminated by time-differencing.[13] In our estimated subsample, all individuals who drink or smoke exhibit their drinking or smoking pattern for three or more periods. Therefore, as a robustness check, we estimate the two equations with GMM, which is a first difference estimator on subsamples of individuals who report positive consumption for three or more rounds.

We estimate the alcohol and cigarette consumption equations with kernel-weighted GMM following Kyriazidou (2001). Our exclusion restriction between the explanatory variables of the main (demand) equation and the selection equation is based on information, if individuals drank and smoked at a young age and for a long period of time (Huffman and Rizov (2010) discuss this RLMS variables). To implement this estimator, we estimate in a first step a conditional Logit (fixed effects) model (see Chamberlain, 1980). The first step estimates

[12] The formal proof of consistency of estimates is given by Wooldridge (2002). The results of the first step (IPW) estimation are available from the authors on request. Estimates without corrections for sample selection/attrition do not qualitatively affect the results reported.

[13] The idea suggested in Honoré (1992) is that although the censoring ruins the symmetry of the distribution of the dependent variables, some of the implications of symmetry are not affected by the censoring. An important implication of the conditional pairwise exchangeability assumption is that pairwise differences of the error terms from two different periods are symmetrically distributed around zero, conditional on exogenous regressors.

(predictions) are then used to calculate weights for the pairs of observations in the GMM difference estimator. To construct the weights we use a normal density function for the kernel. For bandwidth selection in the kernel weights we follow the procedure in Kyriazidou (1997). Finally, we perform the kernel-weighted GMM on the subsamples of smokers and drinkers only.[14]

Results and discussion

Tables 2-6 present the results from the econometric analysis. The model (Equation 2) is estimated for the full weighted and unweighted sample, and separately by age (generation) cohort.[15] In addition, the demand for alcohol and cigarettes is estimated separately by gender too. The null hypothesis that all of the estimated coefficients of the explanatory variables in any specification are jointly zero is rejected in all cases. Results of the test for second-order autocorrelation AR(2) and the Hansen tests of over-identifying restrictions support the validity of the estimates. The hypothesis of joint equality of coefficients across subsamples can be rejected for demand for fat, food diversity and cigarettes (see results in Table A1 in the Appendix).

Next, we discuss the estimated coefficients, starting with demand for fat (Table 2) and protein (Table 3), followed by the demand for food diversity (Table 4), alcohol (Table 5), and cigarettes (Table 6).

Demand for fat and protein

[Tables 2 and 3 around here]

[14] Results of an alternative sample selection procedure are quite similar and are available from the authors upon request.

[15] Results of the unweighted sample are relatively similar to the weighted results reported, and are available from the authors on request.

Past consumption behavior affects negatively current demand for fat but does not affect current demand for protein based on coefficients of the lagged levels of fat and protein. In the case of fat, the result is consistent with (Arnade and Gopinath, 2006), who show theoretically that demand is decreasing in total cumulative fat intake due to consumers' awareness of adverse health effects fat consumption. Looking at subsamples, only the lagged coefficient of fat demand for the younger cohort is negative and large.[16] This result points to different behavior of the younger generation compared to the older one. Younger people with a previously high consumption of fat tend to reduce their demand. Russian young people could be aware of the negative consequences of too much fat on health.

Our second main concern is a possible difference in the consumption behavior of younger and older consumers. The results suggest on average a higher fat consumption and a higher protein consumption of individuals from the old cohort. This difference can be related to a different demand of older consumers with higher education, they consume more protein, and still having work, again consuming more fat. One possibility might be a different composition of the diet. Unfortunately, the data do not allow tracing back the sources of fat and protein. Clearly, men demand significantly more protein than women but no statistically significant difference is detected for fat. Turning to household characteristics, increasing household income is predicted to increase demand for both, fat and protein. As fat, salt and sugar are known to affect taste positively, the result suggests that the taste effect dominates the health effect. The access to a land plot ("garden") has varying effects for individuals in the young cohort compared to individuals in the old cohort. Individuals, equally younger and older, with access to a garden consume more fat than their generational counterparts without a garden. We cannot rule out that this variable reflects some unmeasured income.[17]

[16] We use Wald tests to verify statistically the differences in the coefficients from the age cohort subsamples. The differences that we point to throughout the results section are significant at the 5% level or smaller.
[17] We thank one anonymous reviewer for pointing this out.

Turning to the macroeconomic characteristics, the estimated coefficients of relative prices are negative and statistically significant, implying that the demand for fat and protein is responsive to the respective relative prices. Consumers in high income regions consume more protein, although the demand declines in fast growing regions. Individuals living in regions with higher agricultural share in the value added are predicted to consume more fat and protein, possibly because they have access to food items containing more livestock products. Consumers in regions with higher share of services (mostly office workers) demand less protein and the demand is statistically stronger and larger in magnitude for the young cohort.

Turning to the question how unemployment affects consumption behavior, the estimated coefficients support a direct link between regional unemployment and protein consumption.[18] Individuals living in areas with high unemployment rates consume less protein. A possible explanation could be that the unemployed people need less energy relative to those who are working. However, for fat demand the gross effect of unemployment, combining individual employment status, regional unemployment rate and the interaction effect between the two variables, differs between young and old consumers. Figure 10 displays the predicted consumption of an employed individual compared to an unemployed consumer facing the same regional unemployment rate. Whereas older consumers having employment in a region with an average unemployment rate demand more fat then unemployed older consumers, the difference is almost vanishing for consumers in the young cohort. Looking at the interaction effect only, we can conclude that younger consumers still having work will demand less fat if the labor market conditions worsen at regional level. However, we cannot rule out that this correlation is caused by a higher risk of dismissal for consumers which are used to have a more unhealthy diet. Finally, individuals living in rural areas consume less fat than their urban counterparts, suggesting a different composition of diets.

[18] We cannot exclude that the result is driven by errors in the measurement of individual determinants. However, in such a case measurement errors must systematically vary across regions. Multilevel mixed-effects longitudinal models provide an opportunity to test for errors at individual and regional level (Rabe-Hesketh and Skrondal, 2006). Unfortunately, those models do not allow for a consistent modeling of the dynamic relationship.

[Figure 10 around here]

Demand for food diversity

[Table 4 around here]

Previous consumption positively affects current demand for food diversity, pointing to habit formation. There is no difference between old and young cohorts. Among the household characteristics, income is predicted to have a statistically significant impact on food diversity, showing positive income elasticity of food diversity for the total sample and for both age cohorts. The result suggests that more expensive food items will enter the food basket when relaxing the budget constraint. The new food items do not seem to substitute traditional food items completely. Behavior of young and old consumers differs with respect to employment status, household size and access to garden. Households in the young cohort with a household head having work consume a less diverse diet. This finding points to possibly higher opportunity cost of time for employed (younger) individuals in providing diversity in the diet. However, increasing household size is correlated with higher food diversity for households in the young cohort. Households in the old cohort that have access to a garden plot are predicted to have higher diversity of their diet.

Regarding regional characteristics, the relative prices of alcohol and cigarettes have a statistically significant and negative effect on food diversity. This result points to an indirect negative effect of drinking and smoking via a less diverse diet. Households in higher income regions show a more diverse diet. Again, the result might reflect a broader food supply in higher income regions. Households living in primarily agricultural areas are predicted to consume less diverse diets, possibly due to a less diverse supply of food items. Residents of these areas rely mostly on local food, which may not be as diverse compared to people living

in urbanized and manufacturing dominated regions with lots of different food products. Similarly, households in rural areas are predicted to consume less diverse diets. The last result underlines the explanation of poorer supply compared to urban centers.

Clearly, the employment situation affects household's demand for food diversity. It is noteworthy that we observe a direct effect of the regional unemployment rate. For both age cohorts, households in regions with a high unemployment rate consume a less diverse diet. Combining direct and indirect effects of employment still leads to the same conclusion as shown in Figure 10. Younger consumers, although still in employment, are more affected by employment prospects in their region and reduce their food diversity. However, only for the old cohort, when the household head is employed and the household resides in a region with high unemployment, the household's diet is more diverse, compared to households with unemployed household heads.

Changes in alcohol consumption and smoking behavior

[Table 5 and 6 about here]

The results presented in Tables 5 and 6 for alcohol and cigarette consumption,[19] respectively, clearly confirm habit elements in demand for alcohol and cigarettes. Estimated coefficients of lagged consumption are positive and statistically significant. Because alcohol and cigarette consumption measures are in logs, the estimated coefficients can be directly interpreted as elasticities. A one percent increase in the past value of alcohol consumption is predicted to increase current alcohol consumption by 0.6%. For cigarette consumption, a 1 percent increase in the previous year's consumption leads to an increase by 0.7%. When the models is

[19] We report here the results from the restricted samples of drinkers and smokers only using the kernel-weighted GMM estimator. Overall, the estimated coefficients are consistent with the full samples estimates using the system GMM estimator. The results from the full samples are available from the authors on request.

estimated separately by age and gender, older consumers and men are predicted to show a higher persistence of consumption behavior.

Again, turning to the individual characteristics points to a different demand across age and gender subsamples. On average, older people drink and smoke less. However, this result masks significant differences across gender. Whereas older female consumers drink and smoke significantly less than their younger counterparts, older men are predicted to drink more and smoke less than young men. We relate this result to still persisting traditions of a lower acceptance of alcohol and cigarettes consumption with respect to women. Better educated individuals show a more healthy behavior with respect to alcohol and cigarettes. The conclusion holds equally for individuals with college as well as university education. Again the effect, especially of high school education, is stronger for women. These results might be an indication of an increasing awareness of the negative health effects of excess drinking and smoking. Therefore, education may be an important instrument for improving lifestyles in Russia. Finding a job may improve lead to healthier lifestyles. This is especially true for cigarettes consumption of women. Based on our results, employed women consume 57% less cigarettes compared to the unemployed.

Furthermore, men drink and smoke cigarettes significantly more than women across both cohorts. In line with previous research (e.g., (Zohoori et al., 1998), men display a higher consumption of alcohol. The estimated coefficients point to a 275% difference for the young cohort and 401% difference for the old cohort between men and women. However, married women consume less alcohol and cigarettes compared to the single women. The demand for alcohol is responsive to income. Regarding the total sample, consumption of alcohol increases with household income. For consumers in the old cohort, income elasticities for both, alcohol and cigarettes, are larger in magnitude and statistically significant. Old cohort individuals with access to a garden drink and smoke less than their counterparts of the same age. Similarly, women that have gardens consume fewer cigarettes. Having a garden could

indicate an individual's preference for healthier lifestyle or a strategy for working off frustration caused by the transition and sedentary life in general. However, access to garden might be an indicator of unmeasured income too.

Regarding the macroeconomic determinants, alcohol and cigarette demands are sensitive to relative price of the respective good. However, the estimated coefficients suggest a low price elasticity of demand. This result is consistent with the findings of a low price elasticity of demand for cigarettes in Russia and China by Lance et al. (2004). Baltagi and Geishecker (2006) report a very broad range of price elasticities for alcohol, which does not allow for a precise comparison with our results. Furthermore, consumers from the young cohort and women living in higher income regions and areas with high GRP growth smoke more cigarettes. Interestingly, rural consumers are predicted to consume less alcohol. The access to and availability of alcohol might be higher in urban areas. In addition, the advertisement of foreign alcohol and cigarettes in big cities might contribute to this effect. However, we should also be aware of the phenomenon of home produced alcohol in Russia which is more common in rural areas where it is also associated with more under-reporting of alcohol consumption. Finally, consumers in regions with a relatively higher importance of the agricultural sector are predicted to consume less alcohol and cigarettes. The result holds across all subsamples.

Looking at the relationship between regional unemployment and demand for alcohol and cigarettes, we find a direct effect only for alcohol consumption for consumers in the old cohort. It suggests higher alcohol consumption among older people who live in regions with high unemployment rates. Again, this could be related to the stress and frustration of not having a job. But the coefficient of regional unemployment and its interaction with individual work status is only statistically significant for cigarette consumption and negative. This indicates a positive effect of regional unemployment on health behavior only for those who still have a job (Figure 10). It implies that it is not the direct economic situation that affects health behavior, but rather the fear and psychic stress of possibly losing one's job. However,

most coefficients, i.e. interaction effects in the alcohol equations and regional unemployment in the cigarettes equations, are affected by a low degree of precision.

Conclusions

Excessive consumption of alcohol, cigarettes and fat as well as a poor diet are expected to influence directly or indirectly consumer's health. This paper analyzes empirically the demand for alcohol and cigarettes, as well as diet characteristics of Russian adults. Our sample covers the period 1994 – 2005, which is dominated by the economic and political transition in Russia. Therefore, in our analysis we control, beside individual and household characteristics, for the macroeconomic environment of an individual's consumption behavior and the impact of previous consumption. The results from the dynamic panel data models clearly underline the impact of regional macroeconomic characteristics on consumption behavior. Lagged consumption levels affect significantly demand for fat, food diversity, alcohol, and cigarettes. Whereas consumers with a high diet rich in fat are predicted to reduce fat consumption, for food diversity, alcohol and cigarettes the results indicate habit persistence. Furthermore, our analysis points to various differences in consumption behavior of old and young generations of consumers, as well as women and men.

Looking at differences across gender, our results indicate that Russian men consume significantly more protein, alcohol and cigarettes than women. Therefore, measures to increase the awareness for healthier nutrition should focus on men as the most vulnerable group. Income elasticity of fat consumption is almost two and a halve times larger than the income elasticity of protein consumption. We argue that consumers cover their demand for fat mainly from meat, milk, and other dairy products, and all these products have higher income elasticity in Russia. Similarly, improving household's income will lead to a more diverse diet. But at the same time, our results indicate that demand for alcohol and cigarettes increases with household income. Consumer education should try to break this link between a

household's economic status and consumption of unhealthy items like alcohol and cigarettes. Here we see the potential for future research linking the demand for macronutrients with specific food items consumed. Similarly, future research is required to explore the relationship between consumption behavior and budget constraint at the individual and household level.

Regarding the macroeconomic variables, prices for nutrients, alcohol and cigarettes matter. Almost all estimated coefficients of relative prices are statistically significant. Besides prices, other macroeconomic variables are important too. Consumers in regions with higher unemployment rate have a less diverse diet. In the case of alcohol and cigarette consumption, the results indicate a positive effect of regional unemployment on health behavior, only for those individuals who still have work. Therefore, improving the economic situation in Russia and decreasing unemployment will have a positive effect on individuals who are currently unemployed. Comparing the impact of individual and macroeconomic characteristics we should keep in mind that strong habits in smoking and drinking mitigate the effects of the economic fluctuation on these consumption behaviors. Thus, awareness of this effect is relevant for the design of food policy instruments that should bring down unwanted nutritional behavior.

References:

Arellano, M., Bond, S., 1991. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. Review of Economic Studies 58, 277-197.

Arellano, M., Bover, O., 1995. Another look at instrumental variables estimation of error-component models. Journal of Econometrics 68: 29–51.

Arnade, C., Gopinath, M., 2006. The Dynamics of Individuals' Fat Consumption. American Journal of Agricultural Economics 88, 836-850.

Baltagi, B.H., Geishecker, I., 2006. Rational Alcohol Addiction: Evidence from the Russian Longitudinal Monitoring Survey. Health Economics 15, 893-914.

Berkowitz, D., DeJong, D.N., 1999. Russia's Internal Border. Regional Science and Urban Economics 29, 633-649.

Blundell R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics 87, 115-143.

Boudreaux, R., 1994. Spirits Dip in Russia as Vodka Distillery Shuts Down for 2 Weeks. Los Angeles Times, February 8, 1994. http://articles.latimes.com/1994-02-08/news/mn-20498_1_russian-vodka [accessed May 24, 2012].

Brainerd, E., Cutler, D.M., 2005. Autopsy on an Empire: Understanding Mortality in Russia and the Former Soviet Union. Journal of Economic Perspectives 19, 107-130.

Cawley, J., Ruhm, C.J., 2011. The Economics of Risky Health Behaviors, in: Pauly, M.V., McGuire, T.G., Barros, P.P. (Eds.), Handbook of Health Economics. Elsevier, Amsterdam, pp. 95-199.

Chaloupka, F., 1991. Rational Addictive Behavior and Cigarette Smoking. Journal of Political Economy 99, 722-742.

Chamberlain, G., 1980. Analysis with qualitative data. Review of Economic Studies 47, 225-238.

Chou, S.-Y., Grossman, M., Saffer, H., 2004. An Economic Analysis of Adult Obesity: Results from the Behavioral Risk Factor Surveillance System. Journal of Health Economics 23, 565-587.

Cockerham, W.C., 2000. Health Lifestyles in Russia. Social Science and Medicine 51, 1313-1324.

Cutler, D. M., Knaul, F., Lozano, R., Mendez, O., Zurita, B., 2002. Financial Crisis, Health Outcomes and Ageing: Mexico in the 1980s and 1990s. Journal of Public Economics, 84(2), 279-303.

Deaton, A., Muellbauer, J., 1980. Economics and Consumer Behavior. Cambridge University Press, Cambridge.

Dore, A.R., Adair, L.S., Popkin, B.M., 2003. Low Income Russian Families Adopt Effective Behavioral Strategies to Maintain Dietary Stability in Times of Economic Crisis. Journal of Nutrition 133, 3469-3475.

Drewnowski, A., Henderson, S.A., Shore, A.B., Fishler, C., Preziosi, P., Hercberg, S., 1996. Diet Quality and Dietary Diversity in France: Implications for the French Paradox. Journal of the American Dietetic Association 96, 663-669.

Honoré, B., 1992. Trimmed LAD and least squares estimation of truncated and censored regression models with fixed effects, Econometrica 60, 533-565.

Huffman, W., 1977. Allocative Efficiency: The Role of Human Capital. Quarterly Journal of Economics 91, 59-79.

Huffman W. E., Huffman, S. K., Tegene, A., Rickertsen, K., 2010. The Economics of Obesity-Related Mortality among High Income Countries. Forum for Health Economics and Policy 13(1), p. 2 (article).

Huffman, S. K., Rizov, M., 2007. Determinants of Obesity in Transition Economies: The Case of Russia. Economics and Human Biology 5(3), 379-391.

Huffman, S. K., Rizov, M., 2010. The Rise of Obesity in Transition Economies: Theory and Evidence from the Russia. Journal of Development Studies 46(3), 1-22.

Jahn L., Adair L., Mroz T., Popkin, B., 2012. The Declining Prevelance of Overweight among Russian Children: Income, Diet, and Physical Activity Behavior Changes. Economics and Human Biology 10, 139-146.

Khang, Y.-H., Lynch, J.W., Kaplan, G.A., 2005. Impact of Economic Crisis on Cause-specific Mortality in South Korea. International Journal of Epidemiology 34, 1291-1301.

Khaw, K. T., Wareham, N., Bingham, S., Welch, A., Luben, R., Day, N., 2008. Combined Impact of Health Behaviors and Mortality in Men and Women: The EPIC-Norfolk Prospective Population Study. PLoS Med 5, 39-46.

Kyriazidou, E., 1997. Estimation of a panel data sample selection model. Econometrica 65, 1335-1364.

Kyriazidou, E., 2001. Estimation of dynamic panel data sample selection models. Review of Economic Studies 68, 543-572.

Lakdawalla, D., Philipson, T., 2009. The growth of obesity and technological change. Economics & Human Biology 7(3), 283-293

Lakdawalla, D., Philipson, T., Bhattacharya, J., 2005. Welfare-enhancing technological change and the growth of obesity. American Economic Review 95(2), 253-257.

Lance, P.M., Akin, J.S., Dow, W.H., Loh, C.-P., 2004. Is Cigarette Smoking in Poorer Nations Highly Sensitive to Price? Evidence from Russia and China. Journal of Health Economics 23, 173-189.

Lokshin, M., Popkin, B.M., 1999. The Emerging Underclass in the Russian Federation: Income Dynamics, 1992-1996. Economic Development and Cultural Change 47, 803-829.

McGinnis, J., Foege, W. H., 1993. Actual Causes of Death in the United States. Journal of the American Medical Association 270, 2207–2212.

Miquel, R., Laisney, F., 2001. Consumption and Nutrition: Age-intake Profiles for Czechoslovakia 1989-92. Economics of Transition 9, 115-151.

Mokdad, A.H., Marks, J.S., Stroup, D.F., Gerberding, J.L., 2004. Actual Causes of Death in the United States, 2000. Journal of the American Medical Association 291, 1238-1245.

Mroz, T.A., Popkin, B.M., 1995. Poverty and the Economic Transition in the Russian Federation. Economic Development and Cultural Change 44, 1-31.

Mu, R., 2006. Income Shocks, Consumption, Wealth, and Human Capital: Evidence from Russia. Economic Development and Cultural Change 54, 857-892.

Ogloblin, C.G., Brock, G., 2003. Smoking in Russia. The 'Marlboro Man' Rides but Without 'Virginia Slims' for Now. Comparative Economic Studies 45, 87-103.

Rabe-Hesketh, S., Skrondal, A., 2006. Multilevel Modelling of Complex Survey Data. Journal of the Royal Statistical Society, Series A 169, 805-827.

Rashad, I., Grossman, M., Chou, S.-Y., 2006. The Super Size of America: An Economic Estimation of Body Mass Index and Obesity in Adults. Eastern Economic Journal 32, 133-148.

Russia Longitudinal Monitoring Survey, RLMS-HSE: conducted by HSE and ZAO "Demoscope" together with Carolina Population Center, University of North Carolina at Chapel Hill and the Institute of Sociology RAS (RLMS-HSE sites: http://www.cpc.unc.edu/projects/rlms-hse, http://www.hse.ru/org/hse/rlms).

Schultz, T.P., 2008. Health Disabilities and Labor Productivity in Russia in 2004, in: Mete, C. (Ed.), Economic Implications of Chronic Illness and Disability in Eastern Europe and the Former Soviet Union. World Bank, Washington DC, pp. 85-118.

Schultz, T. W., 1975. The Value of the Ability to Deal with Disequilibria. Journal of Economic Literature 13(3), 827-846.

Sedik, D., Wiesmann, D., 2003. Globalization and Food and Nutrition Security in the Russian Federation, Ukraine and Belarus, in: Agriculture and Economic Development Analysis Division (Ed.), ESA Working Paper No. 03-04. FAO, Rome, p. 14.

Shkolnikov, V., Andreev, E., Leon, D., McKee, M., Mesle, F., Vallin, J., 2004. Mortality Reversal in Russia: the Story so Far. Hygiea Internationalis 4(1), 29–80.

Simpura, J., Levin, B. M., 1997. Demystifying Russian Drinking: Comparative Studies from the 1990s. Helsinki: National and Development Center for Welfare and Health.

Skoufias, E., 2003. Consumption Smoothing in Russia: Evidence from the RLMS. Economics of Transition 11(1), 67-91.

Specter, M., 1997. Yeltsin Goes After a Russian Religion: Vodka. The New York Times, January 21, 1997, http://www.nytimes.com/1997/01/21/world/yeltsin-goes-after-a-russian-religion-vodka.html?pagewanted=all&src=pm [accessed May 24, 2012].

Staudigel, M., 2011. How (much) do Food Prices Contribute to obesity in Russia? Economics and Human Biology 9(2), 133-147.

Stillman, S., 2006. Health and Nutrition in Eastern Europe and the Former Soviet Union During the Decade of Transition: A Review of the Literature. Economics and Human Biology 4, 104-146.

Stillman, S., Thomas, D., 2008. Nutritional Status During an Economic Crisis: Evidence from Russia. Economic Journal 118, 1385-1417.

Tapia Granados, J., Diez Roux, A.V., 2009. Life and Death During the Great Depression. Proceedings of National Academy of Sciences of the United States of America - PNAS 106, 17290-17295.

Taylor, L.D., Houthakker, H.S., 2010. Consumer Demand in the United States: Prices, Income, and Consumption Behavior. Springer, New York.

Thiele, S., Weiss, C.R., 2003. Consumer Demand for Food Diversity: Evidence for Germany. Food Policy 28, 99-115.

Wooldridge, J. M., 2002. Inverse Weighted M-Estimation for Sample Selection, Attrition and Stratification. Portuguese Economic Journal 1, 117-39.

World Bank. World Development Indicators, 2007. CD-Rom, Washington DC: World Bank.

Zohoori, N., Gleiter, K., Popkin, B.M., 2001. Monitoring Health Conditions in the Russian Federation: The Russia Longitudinal Monitoring Survey 1992-2000, Report submitted to the U.S. Agency for International Development. Caroline Population Center, University of North Carolina, Chapel Hill, NC.

Zohoori, N., Mroz, T.A., Popkin, B.M., Glinskaya, E., Lokshin, M., Dominic, M., Kozyreva, P., Kosolapov, M., Swafford, M., 1998. Monitoring the Economic Transition in the Russian Federation and its Implications for the Demographic Crisis: The Russian Longitudinal Monitoring Survey. World Development 26, 1977-1993.

Zohoori, N., Terry, J., Popkin, B.M., 2006. Monitoring Health Conditions in the Russian Federation: The Russian Longitudinal Monitoring Survey 1992-2005, in: Carolina Population Center (Ed.), Report submitted to the US Agency for International Development. University of North Carolina, Chapel Hill, NC.

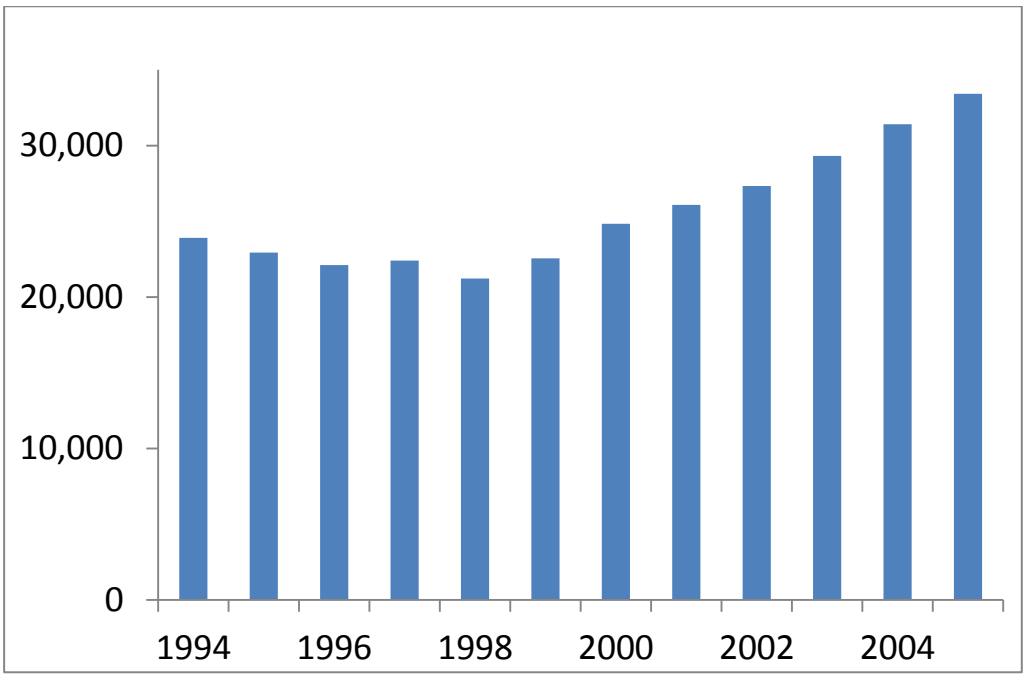

Figure 1: Real GDP, Russia 1994-2005 (in bln Rubles)
Source: IMF World Economic Outlook database

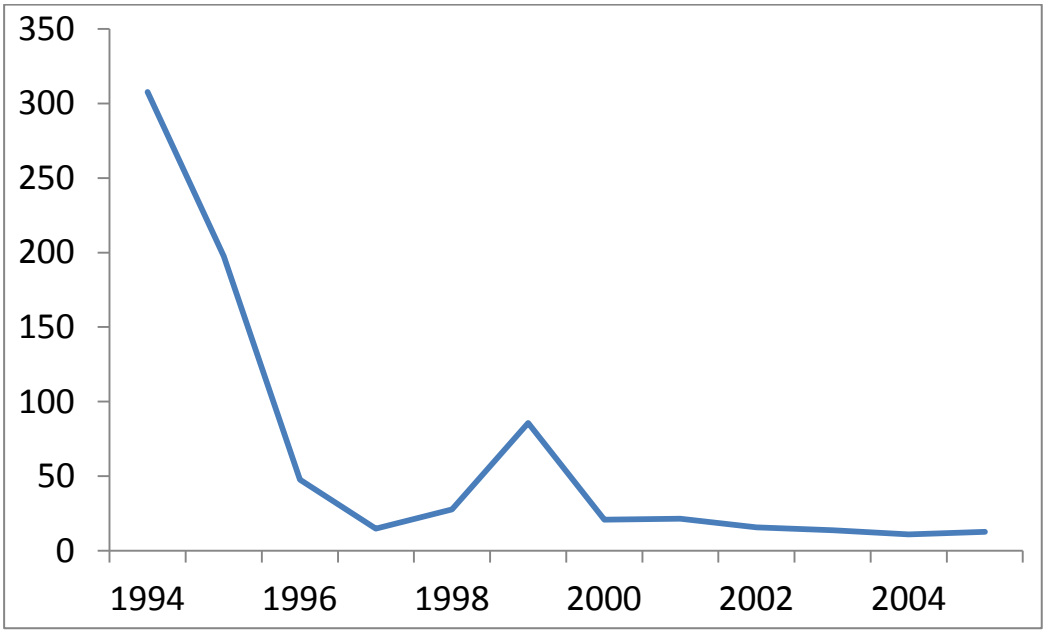

Figure 2: Rate of Inflation, Russia 1994-2005 (in percent).
Source: IMF World Economic Outlook database

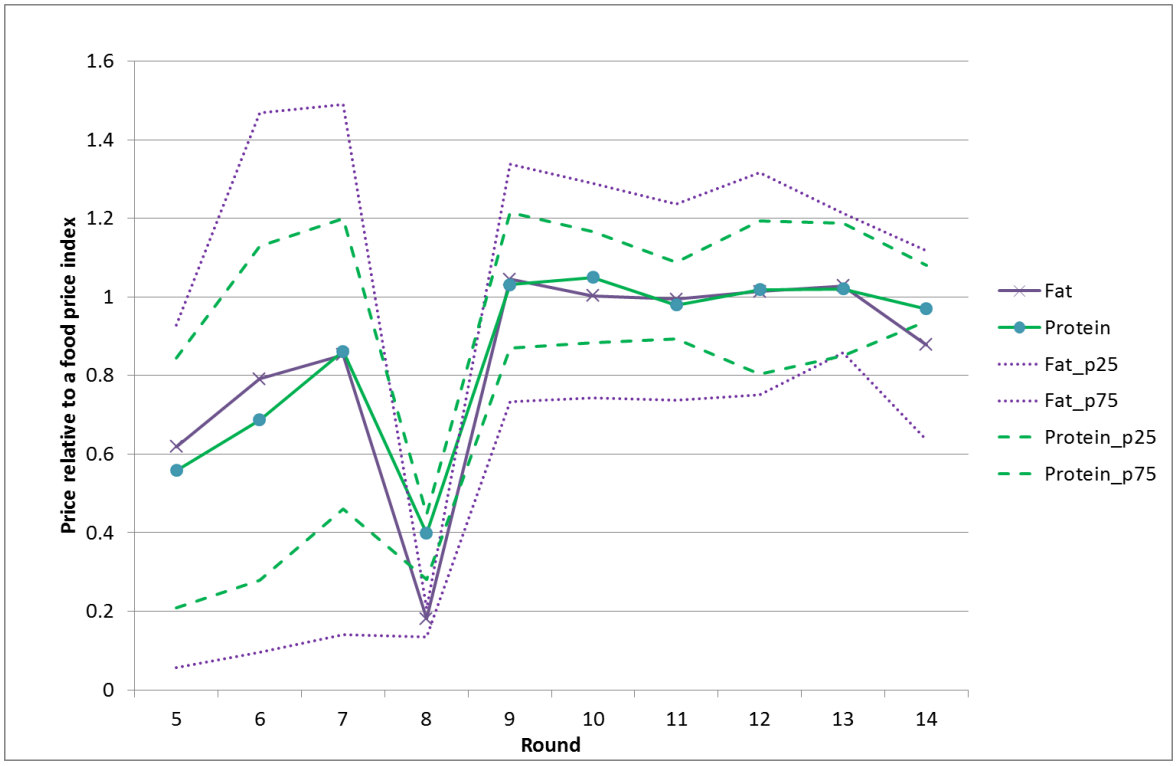

Figure 3: Developments of relative prices for fat and protein
Note: Round indicates survey waves of the RLMS. Round 5 corresponds to the year 1994 and round 14 is 2005.
Source: Authors' calculations from the RLMS

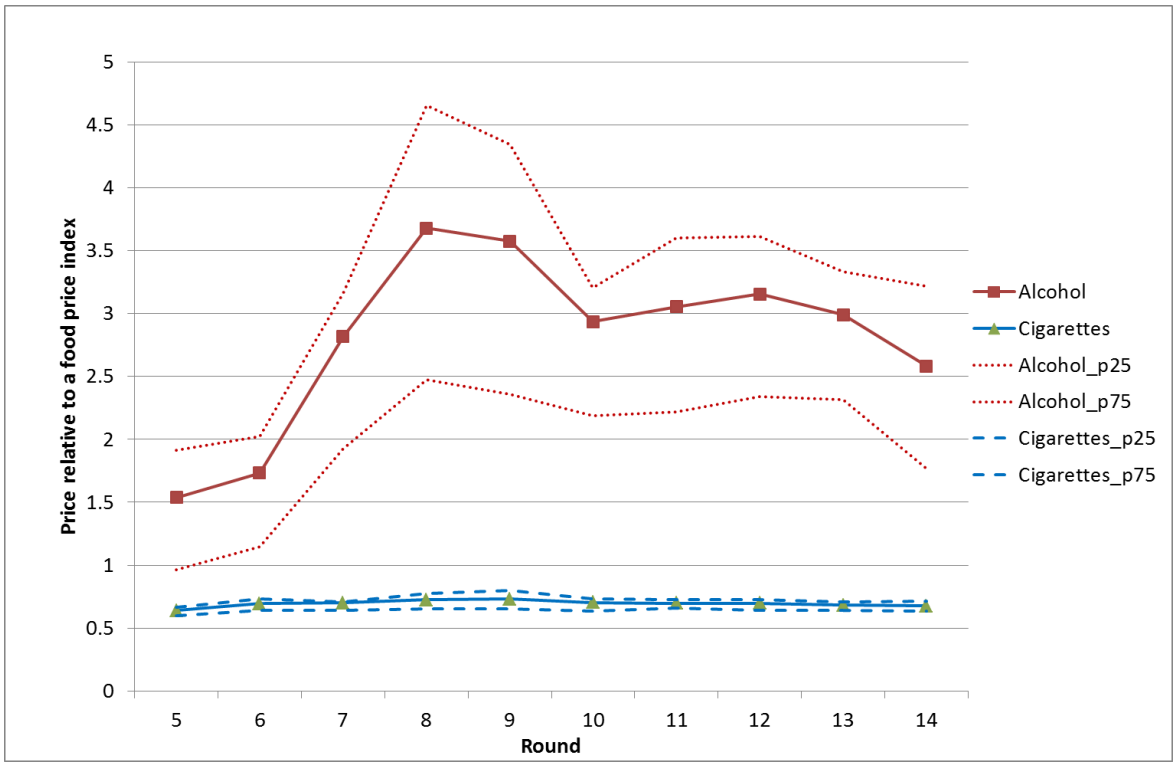

Figure 4: Development of relative prices for alcohol and cigarettes
Note: Round indicates survey waves of the RLMS. Round 5 corresponds to the year 1994 and round 14 is 2005.
Source: Authors' calculations from the RLMS

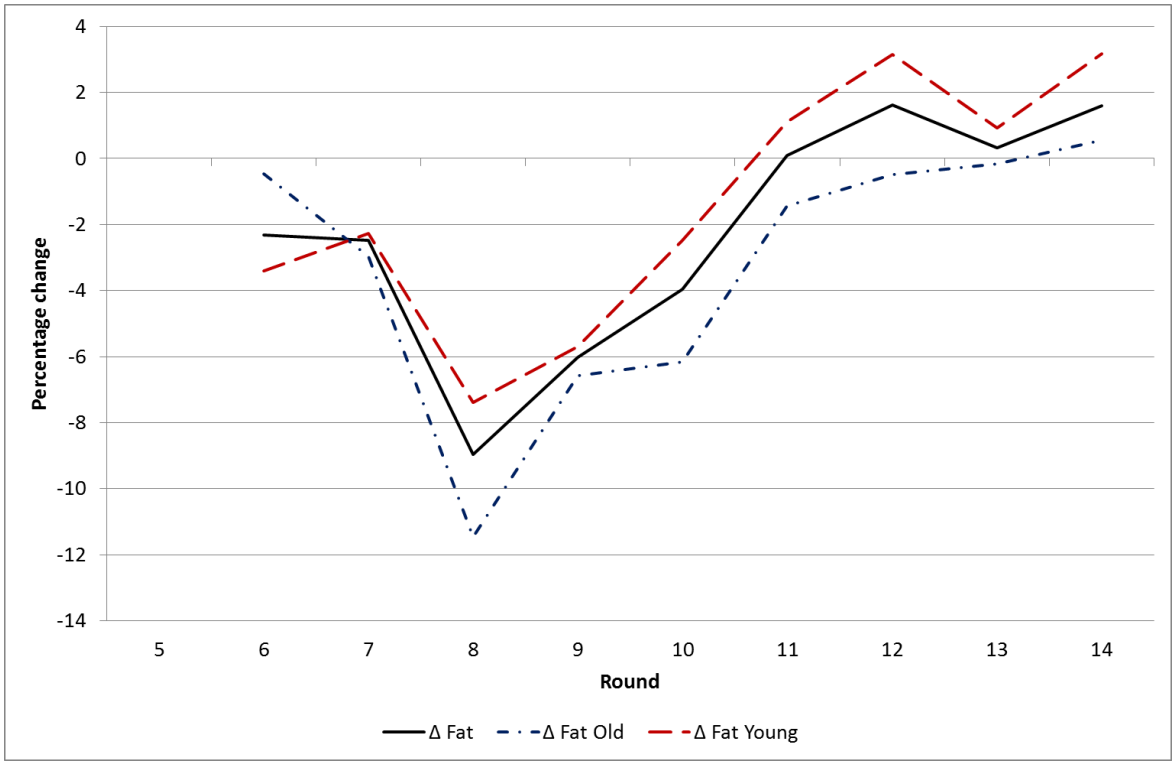

Figure 5: Changes in fat 1994-2005 (percentage change)
Note: Round indicates survey waves of the RLMS. Round 5 corresponds to the year 1994 and round 14 is 2005.

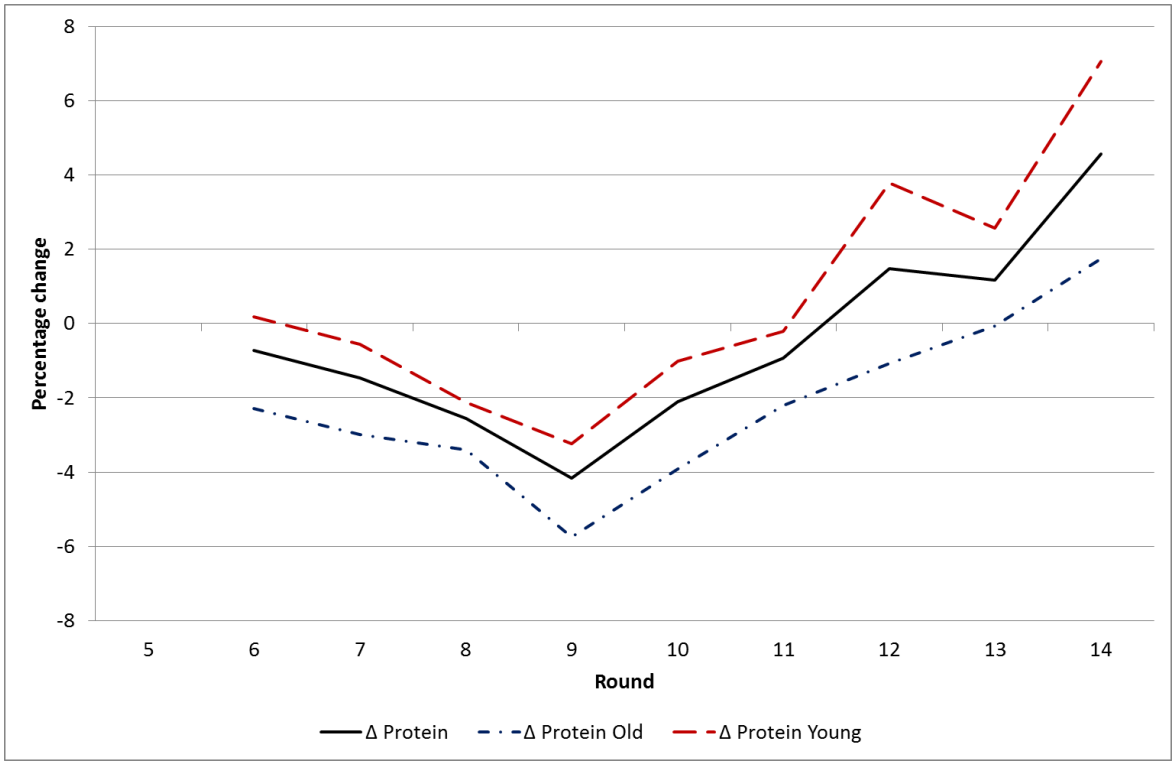

Figure 6: Changes in protein 1994-2005 (percentage change)
Note: Round indicates survey waves of the RLMS. Round 5 corresponds to the year 1994 and round 14 is 2005.

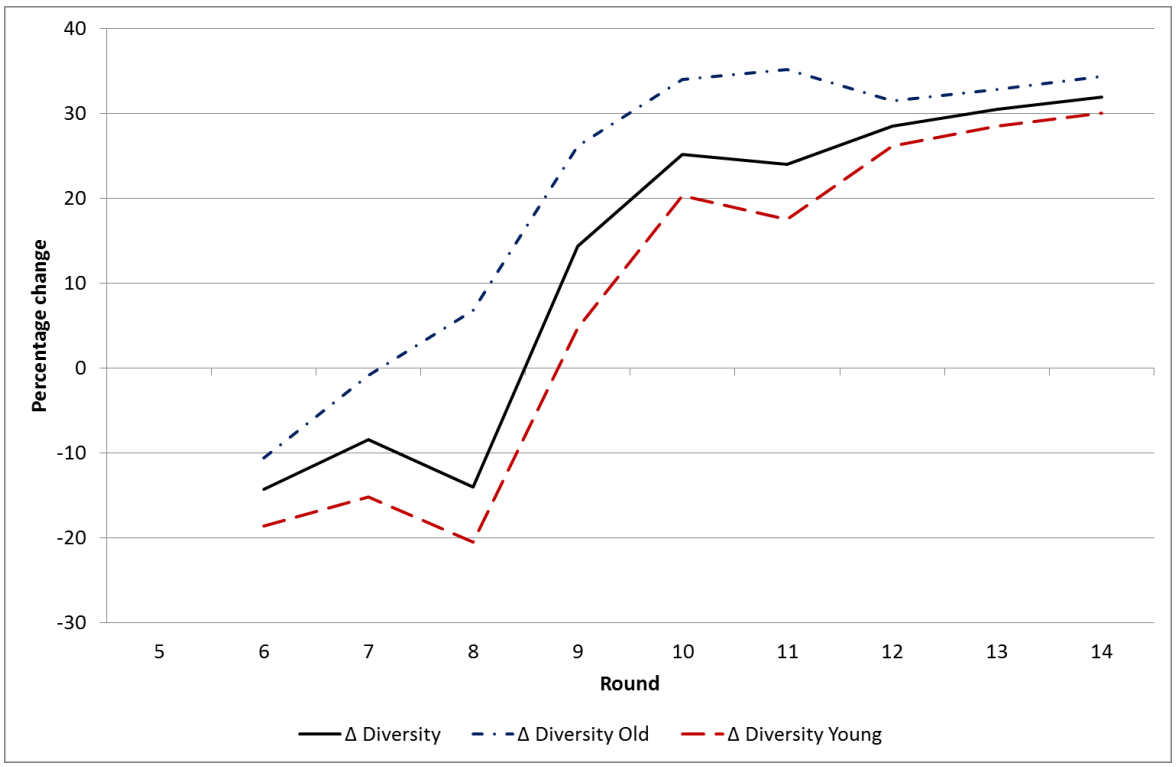

Figure 7: Changes in food diversity 1994-2005 (percentage change)

Note: Round indicates survey waves of the RLMS. Round 5 corresponds to the year 1994 and round 14 is 2005.

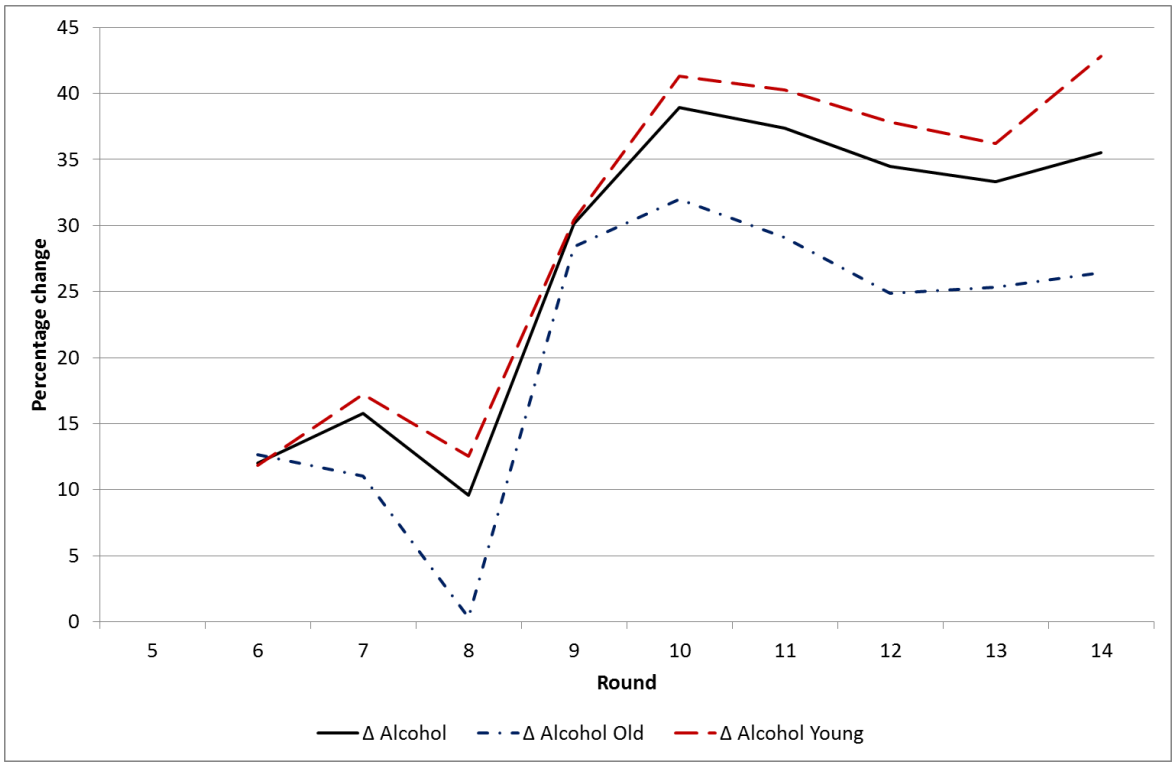

Figure 8: Changes in alcohol 1994-2005 (percentage change)

Note: Round indicates survey waves of the RLMS. Round 5 corresponds to the year 1994 and round 14 is 2005.

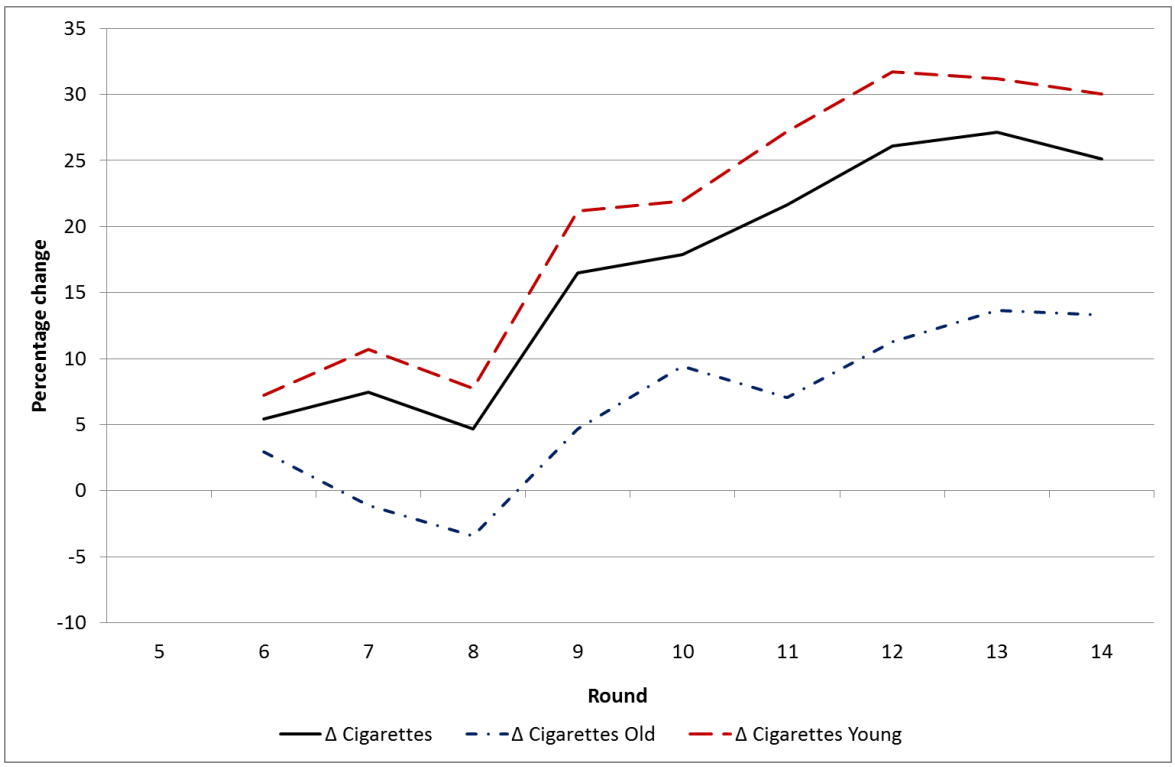

Figure 9: Changes in cigarettes 1994-2005 (percentage change)
Note: Round indicates survey waves of the RLMS. Round 5 corresponds to the year 1994 and round 14 is 2005.

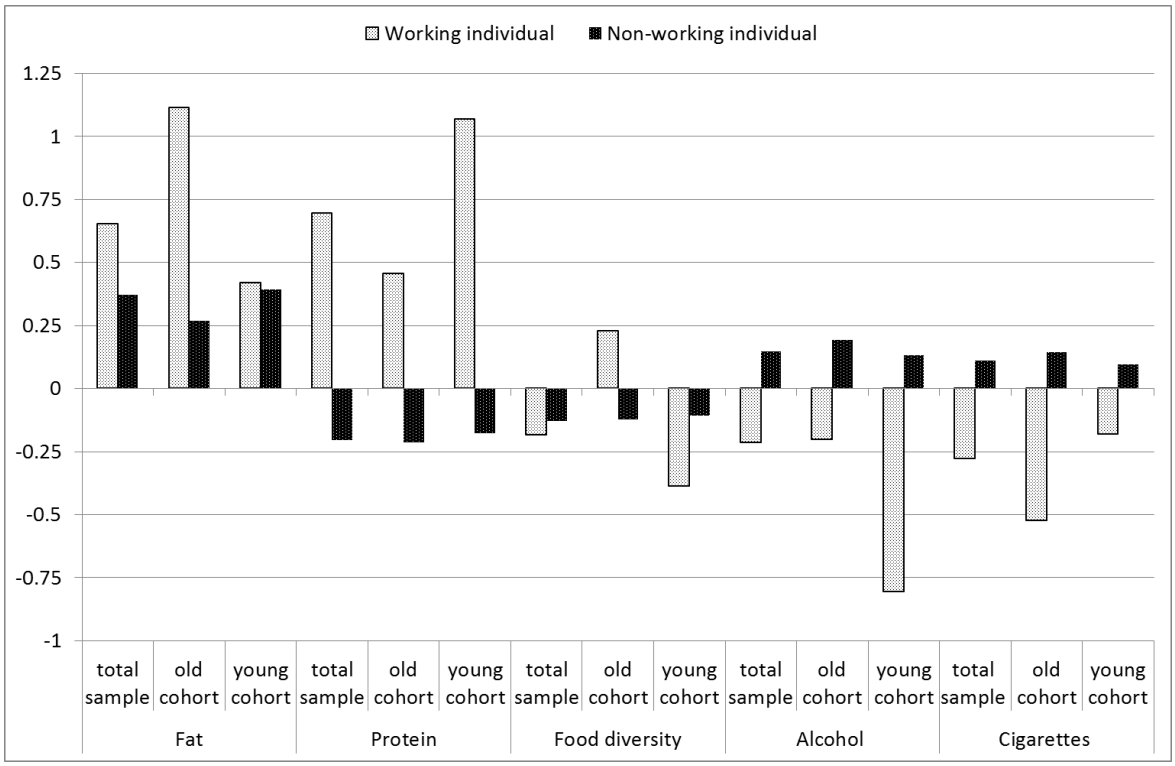

Figure 10: Predicted demand of working and non-working consumer
Note: Predicted demand compared at mean level of regional unemployment.

Table 1a: Summary statistics for full sample and by age cohorts

Variable (definition)	Unit	Full sample		Old cohort		Young cohort	
Dependent variables		Mean	SD	Mean	SD	Mean	SD
Fat (% of daily calories)t	[%]	31.45	9.66	29.86	9.46	32.33	9.65
Protein (% of daily calories)	[%]	12.71	3.46	12.65	3.46	12.75	3.46
Food diversity (TBI=ln[BI/(1-BI)])[1]		0.83	1.38	0.83	1.38	0.83	1.38
Lcigarettes (# of per day, ln(Cc+1))		2.67	0.57	2.67	0.58	2.67	0.57
Lalchohol (grams per day, ln(C_A+1))		2.14	1.26	1.92	1.29	2.22	1.24
Explanatory variables							
Individual and household characteristics							
Age	[years]	50.20	14.49	66.19	7.16	41.34	8.82
Primary school (has primary education)	[0/1]	0.39	0.49	0.64	0.48	0.24	0.43
High school (has high school education)	[0/1]	0.46	0.50	0.24	0.43	0.59	0.49
University (has university education)	[0/1]	0.15	0.36	0.12	0.33	0.17	0.38
Work (is employed)	[0/1]	0.54	0.50	0.27	0.37	0.74	0.44
Old cohort (age is >50 in 1994)	[0/1]	0.36	0.48				
Gender (male)	[0/1]	0.36	0.48	0.30	0.46	0.39	0.49
Married (married)	[0/1]	0.72	0.45	0.59	0.49	0.79	0.40
HH size (# members)	[ln]	0.83	0.41	0.69	0.45	0.90	0.37
HH income	[ln]	8.31	0.86	8.01	0.87	8.48	0.82
Garden (has household plot)	[0/1]	0.34	0.48	0.35	0.48	0.34	0.47
Regional characteristics							
Alcohol price (relative)	[ln]	0.96	0.50	0.98	0.50	0.95	0.50
Cigarettes price (relative)	[ln]	-0.36	0.12	-0.36	0.12	-0.36	0.12
Fat price (relative)	[ln]	-0.53	0.70	-0.54	0.66	-0.53	0.72
Protein price (relative)	[ln]	-0.28	0.64	-0.28	0.66	-0.28	0.63
GRP per capita (real GRP)	[ln]	10.40	0.37	10.38	0.37	10.40	0.37
GRP growth (cumulative)		0.27	0.31	0.27	0.29	0.27	0.33
Agriculture (Share in regional value added)		0.23	0.12	0.23	0.12	0.23	0.12
Services (Share in regional value added)		0.11	0.05	0.11	0.05	0.11	0.05
Manufacturing (Share in regional value added)		0.66	0.14	0.66	0.13	0.66	0.14
Unemployment (regional, in percentage points)		0.10	0.04	0.10	0.04	0.10	0.04
Rural (lives in rural area)	[0/1]	0.44	0.50	0.44	0.50	0.44	0.50

Notes: [1] TBI = Transformed Berry index

Number of individuals in the sample is 2193 and the number of households is 1155. The average of (log of) cigarettes smoked is reported for 671 individuals that smoke at least in one of the years. The average of (log of) alcohol consumption is reported for 1749 individuals that drink at least in one of the years. The average of the Berry index is reported for 1155 households.

Table 2b: Summary statistics by gender

Variable (definition)	Unit	Full sample		Men		Women	
Dependent variables		Mean	SD	Mean	SD	Mean	SD
Fat (% of daily calories)t	[%]	31.45	9.66	32.16	9.79	31.05	9.56
Protein (% of daily calories)	[%]	12.71	3.46	13.07	3.41	12.51	3.48
Food diversity (TBI=ln[BI/(1-BI)])[1]		0.83	1.38	0.83	1.38	0.83	1.37
Lcigarettes (# of per day, ln(Cc+1))		2.67	0.57	2.75	0.52	2.21	0.63
Lalchohol (grams per day, ln(C_A+1))		2.14	1.26	2.82	1.21	1.59	0.95
Explanatory variables							
Individual and household characteristics							
Age	[years]	50.20	14.49	48.22	13.49	51.32	14.91
Primary school (has primary education)	[0/1]	0.39	0.49	0.40	0.49	0.38	0.48
High school (has high school education)	[0/1]	0.46	0.50	0.47	0.50	0.46	0.50
University (has university education)	[0/1]	0.15	0.36	0.13	0.34	0.16	0.37
Work (is employed)	[0/1]	0.54	0.50	0.60	0.49	0.50	0.50

Old cohort (age is >50 in 1994)	[0/1]	0.36	0.48	0.30	0.46	0.39	0.49
Gender (male)	[0/1]	0.36	0.48				
Married (married)	[0/1]	0.72	0.45	0.89	0.32	0.63	0.48
HH size (# members)	[ln]	0.83	0.41	0.92	0.34	0.77	0.44
HH income	[ln]	8.31	0.86	8.44	0.83	8.24	0.88
Garden (has household plot)	[0/1]	0.34	0.48	0.38	0.48	0.33	0.47
Regional characteristics							
Alcohol price (relative)	[ln]	0.96	0.50	0.97	0.51	0.96	0.49
Cigarettes price (relative)	[ln]	-0.36	0.12	-0.36	0.12	-0.36	0.12
Fat price (relative)	[ln]	-0.53	0.70	-0.58	0.58	-0.51	0.68
Protein price (relative)	[ln]	-0.28	0.64	-0.30	0.66	-0.27	0.63
GRP per capita (real GRP)	[ln]	10.40	0.37	10.38	0.37	10.41	0.37
GRP growth (cumulative)		0.27	0.31	0.28	0.33	0.27	0.30
Agriculture (Share in regional value added)		0.23	0.12	0.24	0.12	0.23	0.12
Services (Share in regional value added)		0.11	0.05	0.11	0.05	0.11	0.05
Manufacturing (Share in regional value added)		0.66	0.14	0.65	0.14	0.66	0.14
Unemployment (regional, in percentage points)		0.10	0.04	0.10	0.04	0.10	0.04
Rural (lives in rural area)	[0/1]	0.44	0.50	0.48	0.50	0.42	0.49

Notes: [1] TBI = Transformed Berry index

Number of individuals in the sample is 2193 and the number of households is 1155. The average of (log of) cigarettes smoked is reported for 671 individuals that smoke at least in one of the years. The average of (log of) alcohol consumption is reported for 1749 individuals that drink at least in one of the years. The average of the Berry index is reported for 1155 households.

Table 3: Estimates of fat demand in Russia, 1994-2005

	Full sample	Old cohort	Young cohort
Individual characteristics			
Share of fat in t-1	-0.29**	-0.15	-0.38**
Age	0.35	0.17	0.52
Age_squared x 10^2	-0.41	-0.07	-0.63
High_Education	0.69	0.88	0.20
University	-1.16	-1.08	-1.48
Work	0.41	0.64**	0.31
OldCohort	1.23**		
Gender	0.37	0.27	0.44
Married	0.83	1.22	0.70
HHsize	0.49	1.35*	-0.87
HHincome	0.92**	1.02*	0.82***
Garden	1.27*	1.94*	0.71**
Regional characteristics			
Relative price of fat	-0.27***	-0.70**	-0.18**
GRP per capita	0.65	1.05	0.46
GRP growth	-0.75*	1.36	-1.69**
Agriculture	1.71**	1.95*	1.64**
Services	0.22	1.92*	0.03
Unemployment	3.81	2.75	4.03
Work*Unemployment	-1.31*	2.16*	-2.94**
Rural	-1.86***	-1.40	-2.04***
N/Individuals	13883/2194	5544/742	8339/1452
AR(1) test	-18.90***	-17.56***	-17.78***
AR(2) test	1.46	0.69	0.82
Hansen test	0.20 (120)	0.15 (119)	0.19 (119)

Difference (Hansen) test	0.90 (29)	0.55 (28)	0.89 (28)

Notes: Samples used are weighted for attrition. *, **, *** denote statistical significance at the 10, 5 and 1 percent level, respectively. Year dummies and controls for federal regions included but not reported to save space. Default categories for dummy sets are: primary education, unemployed, female, unmarried, without access to garden plot, urban. For AR(.) tests z-statistics is reported; reference category for regional sector composition is manufacturing. For Hansen test and Difference (Hansen) test reported is Prob > Chi2; next in parenthesis the number of moment conditions is reported.

Table 4: Estimates of protein demand in Russia, 1994 – 2005

	Full sample	Old cohort	Young cohort
Individual characteristics			
Share of protein in t-1	0.23	0.24	0.22
Age	0.14	0.23	0.13
Age_squared x 10^2	-0.15	-0.13	-0.15
High_Education	0.28	0.75*	0.09
University	1.98**	2.08**	1.51**
Work	0.73*	0.53	1.06**
OldCohort	0.82**		
Gender	0.47*	0.93**	0.36**
Married	0.67	0.95	0.80
HHsize	-0.37	-0.72	-0.26
HHincome	0.43***	0.40***	0.46***
Garden	0.15	0.75*	-0.57*
Regional characteristics			
Relative price of protein	-0.15***	-0.16**	-0.15**
GRP per capita	0.53**	0.91***	0.39*
GRP growth	-0.58**	-0.83**	-0.51*
Agriculture	2.00***	2.40**	1.69**
Services	-2.84***	-1.82*	-3.51***
Unemployment	-2.11***	-2.21***	-1.84*
Work*Unemployment	1.74	1.48	1.96
Rural	0.27	0.37	0.20
N/Individuals	13883/2194	5544/742	8339/1452
AR(1) test	-15.67***	-14.26***	-16.99***
AR(2) test	1.10	-0.29	1.17
Hansen test	0.16 (120)	0.15 (119)	0.13 (119)
Difference (Hansen) test	0.42 (29)	0.72 (28)	0.24 (28)

Notes: Samples used are weighted for attrition. *, **, *** denote statistical significance at the 10, 5 and 1 percent level, respectively. Year dummies and controls for federal regions included but not reported to save space. Default categories for dummy sets are: primary education, unemployed, female, unmarried, without access to garden plot, urban. For AR(.) tests z-statistics is reported; reference category for regional sector composition is manufacturing. For Hansen test and Difference (Hansen) test reported is Prob > Chi2; next in parenthesis the number of moment conditions is reported.

Table 5: Estimates of demand for food diversity in Russia, 1994-2005

	Full sample	Old cohort	Young cohort
Household characteristics			
Diet diversity in t-1	0.21***	0.23***	0.20***
Age	0.07	0.26*	-0.18*
Age_squared x 10^2	-0.07	-0.23**	0.23*
High_Education	0.05	0.07	0.05
University	0.14	0.23	0.09
Work	-0.14	0.24	-0.32**
OldCohort	0.25**		
Gender	-0.09	-0.20*	-0.03
Married	0.23	0.33	0.21
HHsize	0.16*	0.10	0.25**
HHincome	0.11***	0.09**	0.15***
Garden	0.16*	0.27**	0.09
Regional characteristics			
Relative price of fat	0.04**	0.05*	0.04**
Relative price of protein	-0.02	-0.03	-0.01
Relative price of alcohol	-0.07**	-0.07*	-0.08***
Relative price of cigarettes	-0.49***	-0.36**	-0.51***
GRP per capita	0.17**	0.19*	0.16**
GRP growth	0.04	0.06	0.03
Agriculture	-1.14***	-1.26***	-1.09***
Services	0.53**	0.73**	0.09
Unemployment	-1.33**	-1.27**	-1.12***
Work*Unemployment	0.82*	1.14*	0.46
Rural	-0.41***	-0.43***	-0.37***
N/Households	8171/1155	3262/445	4909/710
AR(1) test	-5.83***	-3.74***	-4.62***
AR(2) test	1.44	1.17	0.44
Hansen test	0.14 (120)	0.68 (117)	0.25 (117)
Difference (Hansen) test	0.96 (29)	1.00 (28)	0.80 (28)

Notes: Samples used are weighted for attrition. *, **, *** denote statistical significance at the 10, 5 and 1 percent level, respectively. Year dummies and controls for federal regions included but not reported to save space. Default categories for dummy sets are: primary education, unemployed, female, unmarried, no access to garden plot, urban; reference category for regional sector composition is manufacturing. For AR(.) tests z-statistics is reported. For Hansen test and Difference (Hansen) test reported is Prob > Chi2; next in parenthesis the number of moment conditions is reported.

Table 5: Estimates of alcohol demand in Russia, 1994 - 2005

	Full sample	Old cohort	Young cohort	Men	Women
Individual characteristics					
Consumption in t-1	0.64***	0.69***	0.59***	0.80***	0.38***
Age	-0.09	0.13	-0.21**	0.11	-0.17**
Age_squared x 10^2	0.08	-0.13	0.19**	-0.07	0.15
High_Education	-0.25**	-0.33*	-0.29**	-0.13	-0.37**
University	-1.27***	-1.09***	-1.39***	-1.20**	-1.37**
Work	-0.21	-0.23	-0.19	-0.10	-0.41*
OldCohort	-0.33**			0.29**	-0.82**
Gender	1.16***	1.39***	1.01***		
Married	-0.67*	-0.62	-0.72*	-0.50*	-0.81***
HHsize	-0.22*	-0.16	-0.76***	-0.80**	-0.06
HHincome	0.16***	0.29***	0.08*	0.18***	0.14***
Garden	-0.15	-0.54***	-0.04	-0.18	-0.13
Regional characteristics					
Relative price of alcohol	-0.10***	-0.12**	-0.10***	-0.18***	-0.07**
GRP per capita	-0.15	-0.27	-0.07	-0.21	-0.12
GRP growth	-0.18*	-0.20*	-0.08	-0.28*	-0.07
Agriculture	-1.36***	-1.57**	-1.24***	-1.10**	-1.57***
Services	1.56**	1.79***	1.45**	1.88*	1.18***
Unemployment	1.51	1.97**	1.36	1.92	1.22*
Work*unemployment	-1.59	-1.67	-1.26	-1.80	-1.42
Rural	-0.27*	0.14	-0.32**	-0.23	-0.29*
N/Individuals	7196/1749	2061/508	5135/1241	4261/999	2935/750
AR(1) test	-16.42***	-7.26***	-11.70***	-12.49***	-13.86***
AR(2) test	1.49	1.01	1.41	1.32	0.81
Hansen test	0.66(125)	0.28 (123)	0.38 (123)	0.29 (123)	0.43 (123)
Difference (Hansen) test	0.47 (29)	0.98 (28)	0.74 (28)	0.55 (27)	0.30 (27)

Notes: Samples used are weighted for attrition. *, **, *** denote statistical significance at the 10, 5 and 1 percent level, respectively. Year dummies and controls for federal regions are included but not reported. Reference categories for dummy sets are: primary education, unemployed, female, unmarried, no access to garden plot, urban; reference category for regional sector composition is manufacturing. For AR(.) tests z-statistics is reported. For Hansen test and Difference (Hansen) test reported is Prob > Chi2; next in parenthesis the number of moment conditions is reported.

Table 6: Estimates of cigarettes demand in Russia, 1994 - 2005

	Full sample	Old cohort	Young cohort	Men	Women
Individual characteristics					
Consumption in t-1	0.67***	0.82***	0.42***	0.80***	0.45***
Age	0.03	0.08	0.03	0.03	0.05
Age_squared $x10^2$	-0.12	-0.07	-0.14	-0.04	-0.20
High_Education	-0.17**	-0.28**	-0.04	-0.09	-0.39**
University	-0.46***	-0.90***	-0.23***	-0.42**	-048**
Work	-0.24*	-0.43***	-0.17	-0.05	-0.56***
OldCohort	-0.31***			-0.13**	-0.78***
Gender	0.59**	0.36*	0.67**		
Married	-0.18*	-0.21	-0.15	-0.11	-0.34***
HHsize	-0.22*	-0.04	-0.43*	-0.15	-0.30**
HHincome	0.10*	0.16**	0.05	0.13*	0.09***
Garden	-0.13*	-0.22*	0.02	-0.17*	-0.07***
Regional characteristics					
Relative price of cigarettes	-0.16**	-0.22**	-0.13***	-0.12**	-0.17**
GRP per capita	0.16*	0.04	0.22**	0.04	0.31**
GRP growth	0.08	-0.07	0.17**	-0.05	0.23**
Agriculture	-0.55**	-0.19*	-0.62**	-0.40**	-0.75
Services	0.35	0.28	0.46	0.17	0.84
Unemployment	1.14	1.47	0.98	1.81**	0.78
Work*unemployment	-1.57**	-2.41**	-1.07*	-1.62	-1.43**
Rural	-0.09	-0.12	-0.04	-0.04	-0.23*
N/Individuals	3153/671	639/114	2514/557	2517/527	636/144
AR(1) test	-9.46***	-5.10***	-8.67***	-9.82***	-5.82***
AR(2) test	1.40	1.28	0.95	1.11	1.30
Hansen test	0.26 (125)	0.99 (123)	0.19 (123)	0.19(123)	0.72(123)
Difference (Hansen) test	0.70 (29)	0.73 (28)	0.66 (28)	0.48 (27)	0.98 (27)

Notes: Samples used are weighted for attrition. *, **, *** denote statistical significance at the 10, 5 and 1 percent level, respectively. Year dummies and controls for federal regions are included but not reported. Reference categories for dummy sets are: primary education, unemployed, female, unmarried, no access to garden plot, urban; reference category for regional sector composition is manufacturing. For AR(.) tests z-statistics is reported. For Hansen test and Difference (Hansen) test reported is Prob > Chi2; next in parenthesis the number of moment conditions is reported.

Appendix

Table A6: Summary of Wald tests of joint equality

Dependent variable	Fat	Protein	Food diversity	Alcohol		Cigarettes	
Reference subsample	Young	Young	Young	Young	Female	Young	Female
Wald Statistic	33.54	24.66	32.54	28.28	25.53	32.52	30.65
d.f.	18	18	21	18	18	18	18
p-value	0.01.	0.12	0.05	0.06	0.11	0.03	0.03

Note: H_0: Estimated coefficients are jointly equal.