A soft pillow for hard times:

Effects of economic insecurity on body weight in transitional Russia

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Abstract

Recent literature has identified increasing economic insecurity as a possible explanation for globally increasing obesity rates. This study investigates the causal effect of economic insecurity on weight outcomes in transitional Russia. Using data from the Russia Longitudinal Monitoring Survey from 1994 to 2005 I construct several cumulative measures of economic insecurity and estimate their impact on Body Mass Index and waist circumference. I apply instrumental-variables methods to control for reverse causality and unobserved heterogeneity. Results show a mixed picture with both positive and negative effects of insecurity on weight and waist circumference, depending on the economic insecurity measure. Additional regressions on subjective statements of anxiety highlight the importance of examining the pathway from objective insecurity over subjective anxiety and behavior to final health and weight outcomes in more detail.

Keywords: Insecurity, obesity, Russia, instrumental variables, RLMS.

JEL codes: D01, C26, I14

1. Introduction

Recent literature put forward the hypothesis that economic insecurity may be an important determinant of modern obesity patterns. The underlying mechanism supposed to be at work is stress-induced overeating, a relic from hunter-gatherer times when fattening was an optimal response against food shortages (Smith 2009). Although there is no immediate risk of starvation in modern societies, these psychological and endocrinologic processes are still very sensitive to external signals of stress and lead humans to prefer energy-dense foods high in fat or sugar (see e.g. Dallman et al. 2005). Indeed, the economic insecurity hypothesis has the potential to explain two key features of obesity. The first is the commonly observed negative social gradient of obesity in affluent countries. People of lower socio-economic status may be exposed to greater stress from income insecurity but also from feelings of inequality and subordination and gain more body weight in turn. A second feature is the onset of the dramatic rise in obesity prevalence in the early 1980s. Offer et al. (2010) and Wisman and Capehart (2010) draw a link to political shifts towards market liberalization in the U.S., the U.K. and other English-speaking countries. They argue that less secure jobs and incomes, stressful workplaces, rising income inequality, growing status-seeking or reductions in social security systems made life more stressful and triggered soaring obesity rates (Wisman and Capehart 2010).

There are only a few pioneering studies so far that provide very mixed empirical evidence on causal effects of economic insecurity on obesity and other health outcomes (Smith et al. 2009, Keese and Schmitz 2010, Averett and Smith 2014, Rohde et al. 2014b). These studies differ regarding variables used as a proxy for economic insecurity but they are quite similar with respect to their methodological approach. Each of them focuses on the immediate impact that insecurity exerts on health outcomes, leaving the hypothesized effect on subjective anxiety and resulting behavior in a black box. Shedding light on this black box would definitely strengthen the case for a causal effect of insecurity and would also provide more concrete implications for policy intervention. Another point is the exclusive focus on Western affluent societies. Evidence is also needed for less wealthy countries, where obesity is on the rise, too, and which suffer from equal or even higher levels of economic stress.

This study aims to address these points using data from the Russia Longitudinal Monitoring Survey (RLMS). This household panel survey gathers data on the economic situation of Russian households, their personal accounts of an individual's future prospects, their food consumption and nutrient intake, as well as several anthropometric measures and health issues. It thus represents a

unique source for many of the data needed to trace the pathway from objective insecurity over subjective anxiety to behavior and final health outcomes.

I construct several aggregate indicators of economic insecurity experienced by individuals from 1994 to 2005 and test whether variation in cumulative insecurity can explain changes in Body Mass Index and waist circumference in 2005. Moreover, I test whether objective insecurity measures also affect subjective measures of anxiety, a necessary condition for the hypothesized pathways. I employ instrumental-variable techniques to prevent bias from reverse causality and unobserved heterogeneity.

I proceed as follows. In Section 2, I give some brief information about the economic turmoil and health situation in Russia. Section 3 provides an assessment of existing empirical studies on economic insecurity and obesity and their strategies to identify causal effects. The empirical analysis follows in Section 4, where I present the dataset, the economic insecurity measures the estimation strategy, and regression results. In Section 5, I discuss the results and give a conclusion.

2. Economic insecurity and health in Russia

The breakdown of the Soviet Union and the subsequent transformation from communism to a market economy were accompanied by huge levels of economic insecurity for the Russian population. Psychosocial stress, uncertainty and behavioral responses to them have been claimed as main drivers of the Russian mortality crisis (Shkolnikov et al. 1998; Brainerd and Cutler 2005). Male life expectancy dropped from 64.2 years in 1989 to 57.2 years in 1994, and, after a short period of recovery, fell again after the financial crisis in 1998 to 58.5 years in 2002 (Brainerd and Cutler 2005). Female life expectancy is higher but shows substantial drops nevertheless.

A few figures suffice to illustrate the economic misery in Russia during transition. The development of Russian households' real per-capita expenditures in Figure 1 serves as a blueprint. Expenditures decreased from 1994 on, reached a low point during the Rouble crisis in 1998 and recovered in subsequent years until 2005. Table 1 depicts the development of other key variables such as self-reported unemployment rates, wage delays, household debt status and average debt value, unpaid housing bills which emulate this general pattern over time. Although the proportion of people affected by these calamities decreased over the early 2000s, the figures are still high in 2005. Quite surprising is the proportion of Russians with medical insurance. While less than 50 % had medical insurance in 1994, up to 95 % got medical insurance until 2005

Table 2 shows impressively, how these bare figures translate into personal insecurity and feelings of stress. Most Russians reveal substantial concerns and pessimism when asked about their families' situation in the near future, employment, and life satisfaction in general. The negative responses outbalance the positive ones for almost all indicators with females giving substantially more negative responses than men. Nevertheless, a glimmer of hope may be found in people's responses to the question whether they think that their families will live better or worse in the next 12 months. Here, only around 13 % expected their situation to be much or somewhat worse in 2005.

Figure 2 illustrates the scope of the obesity problem in Russia. Obesity is a predominantly female issue in Russia with almost one third of all women being obese and nearly the same proportion being overweight. In contrast, only around 10 % of all males are obese but 30-35 % are overweight. Over time, the figures indicate an increase in obesity from 1994 to 2005 by 12 % (3.2 percentage points) for women and 37 % (3.6 percentage points) for men.

Although descriptive statistics strongly hint at stress from economic insecurity triggering unhealthful behavior like smoking, frequent binge drinking, unbalanced diets, and violence (Shkolnikov et al. 1998), there are only few studies that attempted to investigate *causal effects of economic insecurity* on health status and behavior in Russia.

Cockerham et al. (2006) found a generally higher level of psychosocial distress among women than men in Russia, Kazakhstan, Belarus and Ukraine and different effects of distress on health lifestyles such as smoking, drinking and unbalanced diet across gender. Richter (2006) examines effects of wage arrears on health status and nutrition for the elderly in Russia. Wage arrears were very common in the mid-1990s and often led to massive shortages in household incomes. Herzfeld et al. (2014) investigate how macroeconomic conditions such as regional growth or unemployment rates affected health behavior during transition. They found a strong role of regional unemployment rates causing higher cigarette demand, less diverse diets, and lower demand for proteins.

Stillman and Thomas (2008), Skoufias (2003), and Notten and de Crombrugghe (2011) focused on nutrition and health behavior during the financial crisis in 1998. Their basic finding is that Russian households were surprisingly resilient in terms of their weight status despite massive income drops. The authors stress however, that these effects are valid for transitory changes in household resources and the question remains how an individual's health and nutritional status change when he or she is exposed to different degrees of volatility in economic resources and chronic stress over a longer period.

3. Empirical analyses of economic insecurity, behavior and health

The issue of economic insecurity has gained considerable momentum in literature the last few years, not least because of the effects of the economic crisis and media coverage of widening income gaps. One branch of existing work is devoted to measuring and comparing economic insecurity for whole populations and over time (see Osberg 2015 for a comprehensive review). Recent approaches comprise 1) the Economic Security Index (ESI) developed by Hacker et al. (2014) based on considerable year-to-year drops in disposable household income, 2) present wealth as a buffer stock combined with past wealth streams proxying experiences (Bossert and D'Ambrosio 2013; D'Ambrosio and Rohde 2014), 3) downward instability of income (Rohde et al. 2014a) as well as 4) a "named risks approach" (e.g. Osberg and Sharpe 2014) considering individual hazards such as insecurity from unemployment, illness, or single-parent family status (Osberg 2015). These approaches are still "work in progress" (Osberg 2015) each of them having advantages and disadvantages.

A second stream of literature investigates how economic insecurity affects individual behavior and health outcomes. These studies vary substantially in terms of examined health outcomes, measures of economic insecurity, and statistical approaches. The empirical evidence on insecurity effects is mixed.

Averett and Smith (2014) investigate how body weight and obesity respond to financial hardship such as credit card debt or trouble paying bills for e.g. telephone, gas, and electricity. Lyons and Yilmazer (2005) attempt to disentangle the bidirectional causality between health status and financial strain. Subjective health status of the household head serves as indicator for health while financial strain is measured by delinquency on any loan payment, the ratio of total assets to total debts, and the ratio of liquid assets to income. Smith et al. (2009) investigate effects of economic insecurity on weight gain over a twelve-year period using four different constructs for insecurity: 1) an individual's Bayesian posterior probability of unemployment, 2) the number of (50 % or greater) drops in real annual household income experienced from 1988 to 2000, 3) the rate of change and the volatility of reported annual income received from slope and goodness of fit of linear regressions of family income on a time trend, separate for each household, and 4) the probability that income in the year 2000 will fall below the poverty threshold. Additionally, Smith et al. investigate receipt of inheritance payments and health insurance status that may act as safety nets potentially mitigating the effects of financial difficulties. The analysis of Barnes and Smith (2009) seeks to identify effects of economic insecurity on smoking using insecurity measures similar to those of Smith et al. (2009).

Keese and Schmitz (2010) examine effects of debts on health satisfaction, mental health, and obesity. Debt status is indicated by 1) consumer debts and 2) housing loan repayments, both as the ratio to household income, and 3) a binary variable that indicates overindebtedness. Rohde et al. (2014b) analyse effects of a "conceptually diverse set of insecurity measures" on the SF-36 mental health index. The authors construct eight economic insecurity variables that rest on three types of measures: subjective indicators (e.g. job insecurity, financial dissatisfaction, ability to raise emergency funds), income streams (substantial drops, level-and-change index), risk of specific hazards (probability of unemployment or substantial income drop).

Offer et al. (2010) follow a different, more macro-oriented approach and investigate the hypothesis that market liberal societies shape a more stressful environment. They analyze variation in countries obesity rates by means of cross-sectional regressions where independent variables are a dummy variable for market-liberal economies and several measures for economic inequality and economic insecurity. For the latter two, Offer et al. use data from Osberg's Index of Economic Well-being (IEWB).

From an econometric perspective, almost all authors discuss reverse causality and unobserved heterogeneity as potential source of biased coefficients. The first problem may arise when weight or health status *do not only depend on* economic insecurity and behavioral reactions to stress like overeating and less physical exercise but also *cause* economic insecurity, e.g. through lower productivity or labour market discrimination of obese people. The second concern applies to situations where third factors like motivation, laziness, or genetics influence both weight and economic insecurity at the same time and are not adequately controlled for. The studies approach these issues with a range of different techniques such as Propensity Score Matching (PSM), fixed-effects (FE) models, instrumental variables (IV), lagged variables, or regressions on subsamples. Hence, there are substantial efforts to identify causal effects of insecurity on health and weight outcomes.

However, even the most sophisticated method does not provide any information about the exact transmission of economic insecurity on body weight and health. More insights on how periods of personal economic downturns or expectations thereof affect individual levels of stress and anxiety and how these, in turn, influence harmful behavior like unbalanced diets with high levels of fat and sugar, drinking and smoking, and physical inactivity would yield more robust empirical evidence on the causal effect. Such an analysis would also give some hints whether, where, and what kind of policy intervention is necessary.

The following analysis makes a first step in that direction by looking not only on how insecurity measures affect weight outcomes but also on their impact on subjective statements on future expectations. A significant effect of objective insecurity measures on anxiety levels is a necessary condition that must be fulfilled in order for insecurity effects on health to be meaningful.

4. Econometric analysis of economic insecurity and body weights in Russia

4.1. Database and sample

The Russia Longitudinal Monitoring Survey (RLMS) is a nationally representative survey that collects comprehensive information about the situation of Russian households and individuals from 1994 until today. The issues that are covered range from income, expenditures and other finances, over labour, education and social issues to health status, food consumption, and living environment. Conceptually, the RLMS is an annually repeated cross-section on the basis of dwelling units but also includes a large longitudinal component of continually interviewed households. The key variables that I use in this study are firstly the anthropometric indicators of personal weight, height, and waist circumference. These were collected by trained personnel from 1994 until 2005. Therefore, I restrict my analysis to this time period since self-reported height and weight as collected afterwards are most probably contaminated by measurement errors. Second, I use income and expenditure data reported by each household for the month prior to the interview and deflated by the monthly consumer price index provided by Goskomstat and available from the statistics database of the OECD (2014).

Since I want to measure the effect of insecurity accumulated over time or chronic stress, respectively, I need to include those households/individuals that provide information on income and work situation for each year. Hence, I restrict the sample further to those respondents that were interviewed in every round from 1994-2005 in order to compute our insecurity measures described in Section 4.2. This yields 1,855 observations per year.

4.2. Measures of economic insecurity

This study uses seven different measures of economic insecurity (*EI*) that are described below. These measures were chosen based on recent literature and the restrictions given by RLMS data. The first indicator measures the frequency of severe income drops experienced by an individual. Similar to Smith et al. (2009), Rohde et al. (2014a), and Hacker et al. (2014), an indicator variable L is created for each period t that assumes the value of one when household income y dropped more

than 25 % compared to the previous period *t-1* and when income in *t* is smaller than average income over time:

$$L_{it} = 1 \quad \text{if} \quad (y_{it} < 0.75 \cdot y_{it-1}) \cap (y_{it} < \bar{y}_i)$$

$$L_{it} = 0 \quad \text{otherwise.}$$

Summation over time provides then a measure of an individual's vulnerability to such shocks:

EI-Measure 1: $\textbf{\# Income drops} = \sum_{t=1994}^{2005} L_{it}$

A second measure is based on income change and volatility over time and has been used by Smith et al. (2009) as well as Barnes and Smith (2009). These authors regressed income on a time trend for each individual ($y_{it} = \alpha_i + \beta_i \cdot t + \varepsilon_{it}$) and used the goodness of fit and the time coefficient to construct

EI-Measure 2: $\textbf{Volatility} = 1 - R_i^2$;

EI-Measure 3: $\textbf{Income change} = \beta_i$.

One criticism of ***Volatility*** may be that it mirrors just "uncertainty" about future income but not "insecurity" because it disregards downside risk (Osberg 2015). Barnes and Smith (2009) as well as (Smith et al. 2009) suggest to use an individual's probability to fall below the poverty line that may combine both aspects. Their procedure is to run individual income-trend regressions similar to those described above and compute predicted values ($\hat{y}_{2005}$) for the last year of observation. Using the root mean squared error of the trend regression and the regional poverty line[1] (r_{pov}), one can obtain the t-statistic (t_{pov}):

$$t_{pov} = \frac{\hat{y}_{2005} - r_{pov}}{RMSE}$$

Using the 'ttail'-command in Stata returns the probability of $P(T > t_{pov})$. Then the probability of falling below the poverty line is given by:

EI-Measure 4: $\textbf{Prob. poverty} = 1 - P(T > t_{pov})$

[1] Regional, need-based poverty thresholds are computed by the RLMS for each year. See Mroz and Popkin (2012) and Popkin et al. (2012).

Averett and Smith (2014) propose household reports of having trouble paying bills as a measure of financial hardship. I construct a similar measure based on two items within the RLMS that query whether households have unpaid bills and to what value these unpaid bills amount. I define U_{it} as an indicator for having trouble paying bills in a certain year if the household reports unpaid bills and if these bills amount to more than twice their monthly income. These yearly indicators are then summed up over time to get:

EI-Measure 5: ***# Unpaid bills*** *= the number of years with unpaid bills > 2x monthly income.*

Lyons and Yilmazer (2005) use delinquency on any time of loan payment by two months or more as an indicator of financial pressure. Based on the RLMS questions whether an individual has not got paid by his or her employer and for how long, I define:

EI-Measure 6: ***# No payment*** *= number of years an individual's employer owes more than two months' pay.*

Hacker et al. (2014) also use some subjective statements of individuals about their personal prospects. In that line, I construct

EI-Measure 7: ***Job concern =*** *Mean of an individual's subjective chance of losing his or her job over time.*

4.3. Econometric model

The objective of this analysis is to investigate how economic insecurity during transition in Russia affected body composition *W* measured in terms of Body Mass Index, waist circumference, and waist-to-hip ratio. Basically, I follow the estimation strategy proposed by Smith et al. (2009, p.6) with some small changes, depicted in Equation (1):

$$(1) \qquad \Delta W_{ij}^{94-95} = \alpha + EI_{ij} \cdot \beta + X_{ij}^{2005} \cdot \gamma + \sigma_{ij} \, .$$

Change of individual *i*'s BMI (waist circumference, waist-to-hip rato) from 1994 to 2005, ΔW_{ij}^{94-95}, is explained by one of the different measures of economic insecurity (*EI*) and a vector of individual and household control variables *X* as collected in 2005. Personal and socio-demographic covariates comprise household expenditure per capita, the respondent's height/height squared, age, gender, smoking status, relationship status, place of living, and highest level of education. σ_{ij} is an error term assumed to be clustered on the community level *j*.

The extended number of dependent variables examined compared to Smith et al. (2009) should provide a more comprehensive picture about effects of insecurity on body composition. Body Mass Index is simply a measure of weight corrected for height and, although widely used, has the disadvantage of providing information neither about the proportion of fat in total body mass nor about its distribution over the body. These shortcomings are alleviated by the use of waist circumference as well as waist-to-hip ratio which give insights on whether economic insecurity also affects distribution of body fat, i.e. whether stress leads to fat accumulation in the abdomen (Dallman et al. 2005).

Additionally to differences in BMI and waist circumference, I examine the impact of the same RHS variables as described in Equation (1) on two indicators of subjective anxiety regarding the near future. The first is an individual's concerns about whether the family is able to get the essential necessities in the next 12 months, the second one is whether the individual expects his or her family to live better or worse in 12 months. Both variables are scaled from 1 to 5, where 5 indicates the most optimistic response.

The reason to select a more or less cross-sectional specification in the presence of panel data arises from the uncertainty about the dynamics and time delays in the relationship between economic insecurity and body weight. Hence, a fixed-effects panel model based on annual observations of anthropometric measures and of income, job situation etc. only in the survey month would not be able to provide a robust measure of economic insecurity (which is forward-looking but based on past experiences (Osberg 2015) and may miss strong and persistent effects of economic insecurity. The purpose of this model is thus to measure whether individuals who experienced more economic insecurity over a long time period (i.e. who suffered from a higher level of chronic stress) gained more weight over this period.

This model departs from Smith et al. (2009)'s specification in that we use differences on the left-hand-side instead of levels and leave out initial weight in 1994. Interpretation of coefficients as effect of independent variables on changes weight is then straightforward. Notation in differences cancels out effects of unobserved characteristics like genetics, attitudes such as self-assurance, and motivation likely to influence both initial body weight and economic insecurity as well. Remaining problems are possible confounding by unobservables between anthropometric changes and economic insecurity experienced over the period 1994-2005 as well as reverse causation. To identify causal effects from the insecurity measures to health outcomes, I follow the strategy of Smith et al. (2009) and employ the method of instrumental variables where in a first stage, the possibly endogenous regressors are regressed on all exogenous variables from the original

estimation equation and a set of instruments. At the second stage, predicted values of the endogenous variables are included in the original regression.

The choice of instruments follows that of Smith et al. (2009), Barnes and Smith (2009) and Rohde et al. (2014b): A first set of instruments is given by regional GDP and unemployment statistics at the oblast level provided by the Russian Federal Statistical Office (Goskomstat). The second set of instruments consists of community-level means of the economic insecurity variables where each household's value has been excluded from the average regional statistic assigned to its members. Regional information about economic conditions and insecurity provides an exogenous source of variation for individual insecurity measures which is arguably not influenced by changes in weight at the individual level. Suitable instruments must not be correlated with error terms from the original regression, i.e. they have to be validly excluded. To test for this, I use Hansen's test of overidentifying restrictions with the null hypothesis that instruments are valid and not correlated with disturbances (i.e. H_0: $E\{\mathbf{Z'}(\mathbf{y}-\mathbf{X}\boldsymbol{\beta})\} = \mathbf{0}$, Cameron and Trivedi 2009, p.185). Additionally, every suitable instrument needs to be strongly correlated with the endogenous regressor, which is tested by an F-test for joint significance of instruments in the first-stage regressions (Cameron and Trivedi 2009, p.190). The performance of instruments based on these tests is discussed along with results in Section 4.4.

Since the number of instruments exceeds that of endogenous variables, the models are overidentified. Therefore, I apply the optimal Generalized Methods of Moments estimator implemented in Stata as **ivregress gmm** and allow standard errors to be clustered by PSU.

4.4. Regression results

Table 3 shows definitions and summary statistics for the variables used in the regression analyses. Between 1994 and 2005, average weight has increased by about 3 kg, BMI by 1.3 kg/m², waist-to-hip ratio by 0.02, and waist circumference by about 3 cm. Maximum and minimum values and the coefficient of variation indicate substantial variation across individuals.

Changes in Body Mass Index

Tables Table **4** and Table **5** depict the results of IV GMM regression for the change in BMI for males and females, respectively[2]. While only few measures of economic insecurity affected male

[2] Regressions with weight change instead of BMI as dependent variable showed more or less the same effects.

BMI changes significantly, results for women indicate that BMI reacts more strongly to several indicators of economic insecurity.

The only variable showing significant effects for both males and females is ***Prob. Poverty***. A ten-percentage-points higher probability of falling below the poverty line increases male BMI by 0.11 kg/m² and female BMI by 0.24 kg/m². This translates into a weight change of about 0.3 kg for a 1.7 m tall man and 0.6 kg for a 1.6 m tall woman. An additional year in which households reported ***no payments*** for more than two months increases female BMI by 0.2 kg/m². Surprisingly, pure income volatility and the number of years where households reported ***unpaid bills*** actually decrease BMI. A ten-percentage-points higher ***volatility*** lowers BMI by 0.4 kg/m² and an additional year with unpaid bills decreases BMI by even 1.6 kg/m².

There are some notable effects of socio-economic controls. First of all, per-capita expenditure has a highly significant and positive effect on BMI growth in men and women, confirming earlier studies that generally find a weight-increasing effect of household resources in Russia (see e.g. Huffman and Rizov 2007, Staudigel 2011). For men, change in BMI shows a negative association with smoking, BMI is increasing more slowly at higher age and increases significantly when living in a partnership (married & living together). Female BMI changes are less sensitive to socioeconomic variables with just a positive effect of per-capita expenditures and a negative effect of being widowed in 2005.

Changes in waist circumference and waist-to-hip ratio

TablesTable **6** Table 7 display the results for changes in waist circumference. First, notice that *Prob. **Poverty*** is again positive for men and women but is no longer significant, though. Results show that an additional year in which households reported high ***unpaid bills*** increases male waist circumference by 3.9 cm. Female waistlines shrink by 1 cm for an additional ***year with no payment*** reported. For waist-to-hip ratio (Tables 8 and 9), the only significant effect emerges from volatility for men, indicating that a ten-percentage-points higher volatility increases the waist-to-hip ratio by 0.08.

Effects of objective insecurity measures on subjective perceptions

More evidence on the pathway from objective insecurity measures over subjective anxiety and behavior to health or weight outcomes is crucial for strengthening the economic insecurity hypothesis. The results for regressions of individuals' average rating whether their families will be living better or worse on several instrumented insecurity measures give important insights in this

direction (Tables 10 to 13). For both men and women, ***Prob. Poverty*** decreases confidence in the future as measured by the better/worse rating. In contrast, higher ***volatility*** increase better/worse ratings for men and more years with ***high unpaid bills*** does so for women. The average rating of whether people will be able to provide themselves with the pure necessities can be seen as a measure of more immediacy and urgency than the more general better-or-worse question. These regressions find predominantly significant coefficients for men, with higher ***volatility*** and more ***years with high unpaid bills*** leading to less concerns and ***Prob***. ***poverty*** and ***years with no payment*** increasing concerns about getting necessities for daily life.

Tests for instrument validity and relevance

The last two statistics in the regression tables depict the test results for the suitability of instrumental variables. Regrading Hansen's test for instrument validity, I cannot reject H_0 at the 5 %-level for all models and conclude instruments are not correlated with the error terms, hence the overidentifying restrictions are valid. The test for relevance by an F-test for joint significance of instruments in the first-stage regressions indicate that the instruments are strongly correlated for ***Prob***. ***poverty***, ***# of unpaid bills***, ***# of no payment***, and ***volatility***, where the F-statistic exceeds a value of 10. The instruments are rather weak in the case of ***slope***, ***income drops***, and ***job concerns*** and the results need to be interpreted with care here.

5. Discussion and conclusions

This paper examined causal effects of economic insecurity on changes in BMI and waist circumference in Russia from 1994 to 2005. Based on a balanced panel data set from the Russia Longitudinal Monitoring Survey I estimated the effect of several indicators of economic insecurity on anthropometric measures using instrumental variables to control for possible endogeneity. In order to validate these results and to gain more insights into the actual causal chain I ran additional regressions with subjective indicators about future concerns.

Results vary strongly and different measures of insecurity reveal different signs. Compared to the results from Smith et al. (2009) my estimated effects on body weight are somewhat lower in magnitude. This is most likely grounded in the fact that in the U.S. even those suffering from high economic insecurity have considerably better possibilities to purchase large quantities of energy-dense foods than their Russian counterparts during the time period under investigation.

The probability of falling below the poverty line shows the most consistent effects. It reveals a positive and significant effect on BMI, a positive effect on waist measures (although not significant)

and it exerts a negative effect on subjective ratings of anxiety. The most unambiguous results for this particular measure may be explained by its ability to capture a lot of those things that define economic insecurity. Based on the variation around a time trend of income, it has an *uncertainty component* that is then used to compute the *downside risk* of falling below the regional poverty level. Given the huge geographic differences in Russia, the availability of a regional measure may add further to its suitability of expressing economic downside risk.

What happens with a pure uncertainty measure lacking the downside component can be seen by looking at *volatility*. Higher volatility causes higher BMI in Russia and leads to less concerns about the future according to the present results. This measure may be more an indicator for an improving economic situation of an individual what makes sense in Russia, where almost all households experienced dramatic income drops in 1998 that recovered again later on.

The different effects on waist circumference across genders and compared to the BMI may provide further hints on insecurity effects. Most notably, men gain a lot around their waists when their families often report high unpaid bills. But regressions on subjective concerns show that this indicator is actually positively associated with confidence in the near future, probably because you have to be worthy of credit to pay your bills later. This and the other mixed results for the subjective measures emphasize the need to not only look at the direct effects of insecurity measures on weight and health outcomes but always at the pathways as well.

There are important political and societal implications should the hypothesis of economic insecurity triggering higher levels of obesity (and other diseases) harden further. Policies that directly or indirectly affect individual stress levels should also be evaluated in regard to their effects on obesity and health and associated costs. Special attention should be devoted to the case of middle- and low-income countries where the common notion is that body weight and obesity is a positive function of income and wealth. In case of an independent effect of economic insecurity on weight, however, also the poor in these countries may suffer more and more from obesity, leading to phenomena such as the double-burden households where underweight and obese people share a common home.

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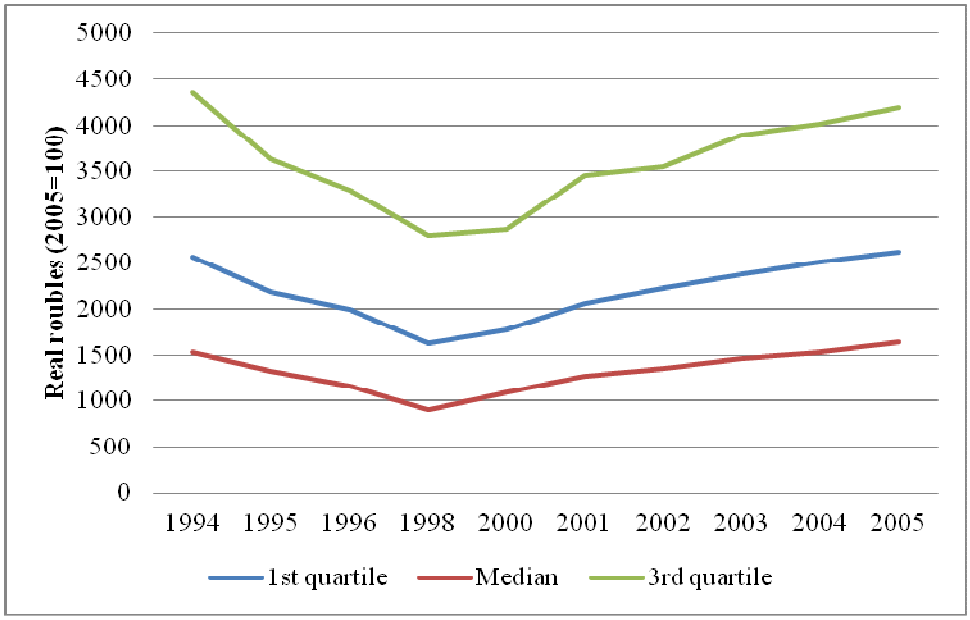
Figures

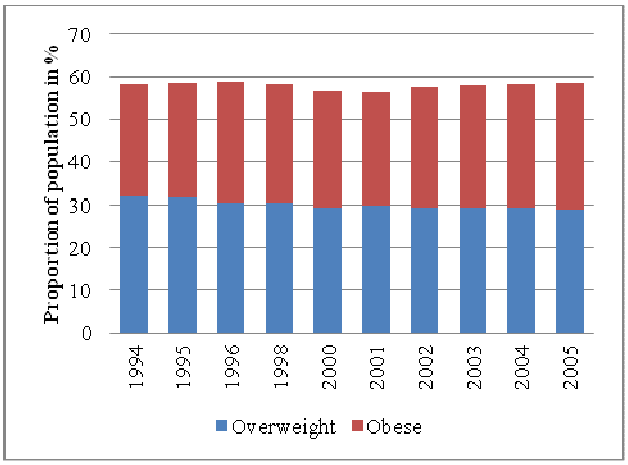
Figure 1: Real per capita household expenditures in the Russian Federation from 1994 to 2005



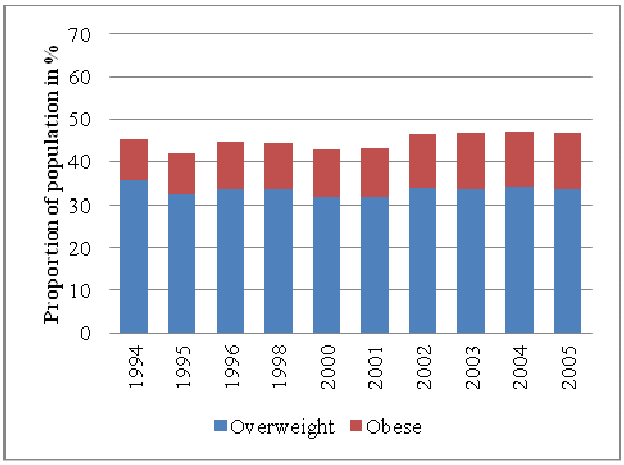
Source: Own computations based on RLMS data 1994-2005.

Figure 2: Overweight and obesity rates across gender in the Russian Federation, 1994-2005

(1) Females



(2) Males



Source: Own computations based on RLMS data 1994-2005.

Tables

Table 1: Selected indicators of economic pressure in the Russian Federation, 1994-2005

	1994	1998	2005
Unemployment (self-reported) (%)	7.1	10.6	8.8
Wage delays? (%)	9.8	11.0	3.9
Debts? (%)	n.a.	36.2	24.2
Amount of debt (1000 roubles)	n.a.	25.9	31.4
Unpaid housing bills? (%)	22.4 (1995)	39.1	17.4
Medical insurance? (%)	44.0	73.7	94.5

Source: Own computations based on RLMS data 1994-2005.

Table 2: Measures of subjective insecurity and satisfaction in the Russian Federation from 1994 to 2005.

	1994	1998	2005
Proportion (in %) of respondents who...			
…are very or a little concerned about their ability to get the necessities in the next 12 months:			
Males	72.9	82.5	67.1
Females	79.4	87.9	74.6
… think that their family will live much or somewhat worse in the next 12 months:			
Males	43.4	51.2	12.6
Females	47.3	57.4	13.4
… are not at all or less than satisfied with their lives at present:			
Males	62.8	68.5	31.9
Females	68.0	73.2	40.4
… are very or a little concerned about losing their jobs:			
Males	51.8	65.7	52.6
Females	62.1	71.7	55.5
… absolutely or fairly uncertain about finding another job:			
Males	50.8	60.8	38.5
Females	70.6%	74.6	50.6

Source: Own computations based on RLMS data 1994-2005.

Table 3: Variable definitions and summary statistics

Variable	Definition	Mean	Stand. Dev	Min	Max	CV
Dependent variables						
BMI	Respondent's BMI in kg/m² in 2005	27.84	5.46	14.39	52.32	0.20
Weight	Respondent's weight in kg in 2005	75.04	15.16	34.40	136.40	0.20
WHR	Respondent's WHR in 2005	0.87	0.09	0.56	2.00	0.10
Waist circ.	Respondent's waist circumference in 2005	90.93	13.50	58.00	163.00	0.15
Δ BMI	Change in BMI 1994-2005	1.33	3.25	-10.66	17.79	2.44
Δ Weight	Change in Weight 1994-2005	2.93	8.71	-32.30	42.20	2.97
Δ WHR	Change in WHR 1994-2005	0.02	0.08	-0.88	1.17	3.40
Δ Waist circ.	Change in waist circumference 1994-2005	2.97	10.48	-56.80	67.00	3.53
Insecurity measures						
# Income drops	Number of income drops > 25 % and > average income over time	2.26	1.09	0.00	6.00	0.48
Volatility	Volatility of income (1-R² of trend regression on inc. p.c.)	0.75	0.22	0.04	1.00	0.30
Income change	Income change (coefficient of trend regression)	103.29	239.50	-1,385.81	2,907.83	2.32
Prob. poverty	Probability of being below poverty line in 2005	0.49	0.26	0.00	0.88	0.54
# Unpaid bills	Number of years with unpaid bills > 2 x monthly income	0.34	0.79	0.00	8.00	2.35
# No payment	Number of years owed money by employer > 2 months	1.43	1.84	0.00	10.00	1.28
*I**	Downward instability of household income	0.02	0.05	-0.02	0.62	2.58
Job concerns	Mean of “Concerned about job loss?” (1=very; 5=not at all)	2.47	1.00	1.00	5.00	0.40
Better/worse	Mean of “Living better or worse next 12 months?” (1=much worse; 5=much better)	2.68	0.52	1.00	4.40	0.20

Continued on next page

Table 3 continued

Control variables						
Exp. p.c.	Real monthly expenditure p.c. in 1000 roubles (2005=100)	3.09	2.66	0.14	53.67	0.86
Height	Height in cm	164.32	8.93	136.00	192.50	0.05
Height²	(Height in cm)²	27,080.86	2,955.19	18,496.00	37,056.25	0.11
Male	= 1 if respondent is male	0.37	0.48	0	1	1.31
Smoker	= 1 if respondent smokes	0.26	0.44	0	1	1.71
Age	Age in years	54.61	14.28	29.03	93.79	0.26
Age²	(Age in years)²	3,186.12	1,633.17	842.93	8,796.88	0.51
Never married	= 1 if never been married (*Reference*)	0.04	0.20	0	1	4.68
Married	= 1 if married	0.62	0.49	0	1	0.79
Living together	= 1 if living together, not registered	0.06	0.23	0	1	4.04
Divorced	= 1 if divorced	0.09	0.29	0	1	3.19
Widowed	= 1 if widowed	0.19	0.39	0	1	2.05
Urban	= 1 if respondent lives in an urban area (*Reference*)	0.62	0.49	0	1	0.79
PGT	= 1 if respondent lives in a PGT	0.06	0.24	0	1	3.84
Rural	= 1 if respondent lives in a rural area	0.32	0.47	0	1	1.45
University	= 1 if respondent has a diploma from university	0.18	0.39	0	1	2.12
Some higher	= 1 if respondent has some higher education but no diploma?	0.03	0.18	0	1	5.47
Technical/medical	= 1 if respondent attended technical/medical school	0.20	0.40	0	1	2.03
Secondary	= 1 if respondent has secondary education	0.12	0.32	0	1	2.72
Vocational	= 1 if respondent attended vocational school	0.23	0.42	0	1	1.83
Primary or less	= 1 if respondent has primary school or less (*Reference*)	0.24	0.43	0	1	1.78

Source: Own computations based on RLMS data 1994-2005.

Table 4: IV GMM regression for ΔBMI, males

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	0.110					
	(0.08)					
Slope	-0.001					
	(0.52)					
Income drops		-0.038				
		(0.14)				
Prob. poverty			1.139			
			(2.28)**			
# unpaid bills				-0.179		
				(0.88)		
# no payment					0.137	
					(1.38)	
Job concerns						0.785
						(3.26)***
Exp. p.c.	0.131	0.071	0.065	0.067	0.083	0.079
	(2.25)**	(1.87)*	(1.68)*	(1.94)*	(2.78)***	(2.56)**
Smoker	-1.332	-1.384	-1.316	-1.354	-1.429	-1.503
	(9.07)***	(10.45)***	(11.12)***	(11.08)***	(10.07)***	(9.15)***
Age	-0.222	-0.249	-0.255	-0.245	-0.270	-0.156
	(3.69)***	(5.64)***	(6.68)***	(5.20)***	(4.85)***	(2.36)**
Age²	0.001	0.002	0.002	0.002	0.002	0.001
	(2.64)***	(4.33)***	(5.03)***	(3.94)***	(3.73)***	(1.23)
Married	1.141	1.193	1.321	0.951	0.786	1.151
	(3.30)***	(3.10)***	(3.03)***	(2.23)**	(1.72)*	(2.25)**
Living together	2.004	1.759	1.663	1.408	1.318	1.787
	(4.39)***	(3.58)***	(3.81)***	(2.82)***	(2.52)**	(2.68)***
Divorced	0.207	0.160	-0.055	-0.043	-0.379	0.629
	(0.49)	(0.32)	(0.11)	(0.08)	(0.75)	(0.96)
Widowed	0.457	0.523	0.399	0.211	0.184	0.084
	(0.87)	(0.92)	(0.67)	(0.35)	(0.31)	(0.14)
PGT	0.501	0.446	0.419	0.559	0.284	0.949
	(2.48)**	(2.11)**	(2.26)**	(2.98)***	(1.07)	(3.48)***
Rural	-0.127	0.033	0.006	0.059	-0.177	0.319
	(0.89)	(0.15)	(0.05)	(0.49)	(0.73)	(1.90)*
University	-0.140	-0.045	-0.122	-0.012	-0.149	-0.334
	(0.43)	(0.18)	(0.44)	(0.05)	(0.58)	(0.80)
Some higher	0.592	1.044	0.974	1.277	0.708	1.336
	(1.71)*	(2.98)***	(2.82)***	(3.29)***	(2.41)**	(3.08)***
Technical/medical	0.058	0.172	0.019	0.220	0.125	0.525
	(0.18)	(0.52)	(0.06)	(0.71)	(0.44)	(1.48)
Secondary	-0.411	-0.249	-0.309	-0.166	-0.332	-0.290
	(1.89)*	(1.13)	(1.35)	(0.74)	(1.43)	(0.99)
Vocational	-0.046	0.067	-0.029	0.095	0.018	0.039
	(0.23)	(0.34)	(0.14)	(0.47)	(0.09)	(0.14)
Constant	7.918	8.700	8.529	8.711	9.313	4.241
	(4.84)***	(6.96)***	(8.26)***	(7.48)***	(6.72)***	(2.16)**
Adjusted R²	0.13	0.14	0.12	0.13	0.13	0.09
N	661	661	661	661	682	602
Hansen's J (χ^2)	14.6	18.3	14.8	16.0	18.6	18.4
p-value	.56	.37	.61	.53	.35	.30
F-value of IV, 1st stage	30.0/3.7	11.2	42.4	70.5	89.0	5.7
p-value	.00/.00	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU).

Source: Own computations based on RLMS data 1994-2005.

Table 5: IV GMM regression for ΔBMI, females

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	-4.166					
	(2.47)**					
Slope	-0.007					
	(2.08)**					
Income drops		0.733				
		(1.68)*				
Prob. poverty			2.391			
			(1.87)*			
# unpaid bills				-1.607		
				(3.53)***		
# no payment					0.207	
					(1.83)*	
Job concerns						-0.526
						(0.80)
Exp. p.c.	0.234	0.112	0.065	0.035	0.084	0.102
	(3.17)***	(5.13)***	(2.88)***	(1.01)	(4.00)***	(3.14)***
Smoker	-0.924	-0.706	-0.178	0.101	-0.374	-0.205
	(2.17)**	(2.08)**	(0.67)	(0.28)	(1.51)	(0.68)
Age	0.016	-0.067	-0.108	-0.053	-0.061	-0.061
	(0.30)	(1.39)	(2.03)**	(1.28)	(1.37)	(0.50)
Age²	-0.001	0.000	0.000	-0.000	0.000	0.000
	(1.55)	(0.22)	(0.32)	(0.57)	(0.04)	(0.01)
Married	-0.022	-0.200	0.465	-0.462	-0.124	0.102
	(0.09)	(1.18)	(1.13)	(1.81)*	(0.70)	(0.31)
Living together	-0.319	-0.818	-0.088	0.159	-0.747	-0.804
	(0.61)	(2.06)**	(0.14)	(0.31)	(1.72)*	(1.60)
Divorced	-0.557	-0.776	-0.344	-0.162	-0.535	-0.141
	(1.45)	(2.92)***	(1.07)	(0.39)	(1.93)*	(0.30)
Widowed	-0.944	-1.003	-0.544	-0.595	-0.862	-0.893
	(2.68)***	(3.99)***	(1.52)	(1.76)*	(3.60)***	(2.39)**
PGT	0.038	-0.519	-0.044	0.461	-0.262	-0.780
	(0.11)	(1.35)	(0.12)	(1.22)	(0.81)	(1.69)*
Rural	0.012	-0.549	0.166	-0.147	-0.286	0.049
	(0.06)	(1.80)*	(0.98)	(1.14)	(1.92)*	(0.21)
University	0.200	-0.109	-0.006	0.024	-0.203	-0.071
	(0.75)	(0.48)	(0.03)	(0.10)	(0.74)	(0.18)
Some higher	-0.120	-0.596	-0.627	-0.251	-0.438	-0.676
	(0.24)	(1.38)	(1.29)	(0.46)	(1.01)	(1.18)
Technical/medical	-0.170	-0.299	-0.321	-0.045	-0.205	-0.335
	(0.71)	(1.36)	(1.24)	(0.21)	(0.95)	(1.20)
Secondary	-0.052	-0.168	-0.457	-0.105	-0.404	-0.337
	(0.16)	(0.60)	(1.75)*	(0.31)	(1.48)	(0.86)
Vocational	0.208	0.132	0.073	0.423	0.118	0.222
	(0.76)	(0.66)	(0.28)	(1.91)*	(0.51)	(0.59)
Constant	6.441	3.877	5.755	5.967	4.994	6.278
	(4.21)***	(2.54)**	(4.36)***	(5.10)***	(4.08)***	(1.52)
Adjusted R²	.	0.07	0.08	.	0.10	0.04
N	1,143	1,143	1,143	1,143	1,173	869
Hansen's J (χ^2)	19.8	17.4	14.6	13.9	20.6	12.1
p-value	.28	.42	.62	.68	.24	.74
F-value of IV, 1st stage	12.8/7.1	5.8	31.8	40.5	27.0	4.5
p-value	.00/.00	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU).

Source: Own computations based on RLMS data 1994-2005.

Table 6: IV GMM regression for ΔWaist circumference, males

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	-5.856					
	(0.94)					
Slope	-0.003					
	(0.32)					
Income drops		0.509				
		(0.39)				
Prob. poverty			4.185			
			(1.47)			
# unpaid bills				3.826		
				(4.01)***		
# no payment					-0.073	
					(0.13)	
Job concerns						1.921
						(1.42)
Adjusted R²	0.07	0.07	0.06	.	0.07	0.02
N	652	652	652	652	672	595
Hansen's J (χ^2)	20.1	20.8	20.9	21.2	17.9	21.3
p-value	.22	.23	.23	.22	.40	.17
F-value of IV, 1st stage.	15.4/2.3	8.1	45.2	69.4	140.3	6.5
p-value	.00/.02	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU). Each regression includes the same control variables as in the BMI regressions plus height and height squared.

Source: Own computations based on RLMS data 1994-2005.

Table 7: IV GMM regression for ΔWaist circumference, females

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	-0.825					
	(0.16)					
Slope	0.002					
	(0.16)					
Income drops		-1.711				
		(2.11)**				
Prob. poverty			5.560			
			(1.59)			
# unpaid bills				-0.668		
				(0.49)		
# no payment					-1.008	
					(2.54)**	
Job concerns						-0.998
						(1.36)
Adjusted R²	0.05	0.03	0.04	0.05	0.03	0.01
N	1,131	1,131	1,131	1,131	1,161	863
Hansen's J (χ^2)	12.8	16.1	20.1	15.9	17.9	16.2
p-value	.69	.51	.24	.53	.40	.44
F-value 1st stage	10.4/4.9	4.9	34.2	40.2	21.6	4.2
p-value	.00/.00	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU). Each regression includes the same control variables as in the BMI regressions plus height and height squared.

Source: Own computations based on RLMS data 1994-2005.

Table 8: IV GMM regression for Waist-hip ratio, males

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	0.082					
	(1.84)*					
Slope	0.000					
	(2.10)**					
Income drops		-0.004				
		(0.43)				
Prob. poverty			0.019			
			(0.55)			
# unpaid bills				0.006		
				(0.68)		
# no payment					-0.003	
					(0.69)	
Job concerns						-0.007
						(0.52)
Adjusted R²	.	-0.03	-0.03	-0.02	.	-0.02
N	652	652	652	652	672	595
Hansen's J (χ^2)	9.0	14.1	12.4	14.3	12.7	12.1
p-value	.88	.66	.78	.64	.76	.73
F-value of IV, 1st stage	15.9/2.3	8.1	45.2	69.4	140.3	6.5
p-value	.00/.00	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU). Each regression includes the same control variables as in the BMI regressions plus height and height squared.

Source: Own computations based on RLMS data 1994-2005.

Table 9: IV GMM regression for Waist-hip ratio, females

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	0.035					
	(0.91)					
Slope	0.000					
	(0.93)					
Income drops		-0.014				
		(1.88)*				
Prob. poverty			-0.002			
			(0.11)			
# unpaid bills				0.011		
				(1.34)		
# no payment					-0.005	
					(1.40)	
Job concerns						0.012
						(3.33)***
Adjusted R²	-0.02	.	0.00	-0.01	-0.00	.
N	1,131	1,131	1,131	1,131	1,161	863
Hansen's J (χ^2)	13.3	16.0	12.3	18.6	13.6	10.0
p-value	.65	.53	.78	.35	.70	.87
F-value of IV, 1st stage	10.4	4.9	34.2	40.2	21.6	4.2
p-value	.00	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU). Each regression includes the same control variables as in the BMI regressions plus height and height squared.

Source: Own computations based on RLMS data 1994-2005.

Table 10: IV GMM regression for mean of „better or worse“, males

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	0.865					
	(2.69)***					
Slope	0.001					
	(0.92)					
Income drops		0.143				
		(1.64)				
Prob. poverty			-0.887			
			(4.81)***			
# unpaid bills				0.173		
				(0.97)		
# no payment					-0.029	
					(0.97)	
Job concerns						0.075
						(0.84)
Adjusted R²	0.08	0.09	0.14	0.13	0.16	0.19
N	657	657	657	657	678	600
Hansen's J (χ^2)	22.1	23.1	23.2	19.2	22.5	24.1
p-value	.14	.15	.14	.32	.17	.09
F-value of IV, 1st stage	14.2/2.2	8.4	43.2	67.3	141.4	6.2
p-value	.00/.02	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU). Each regression includes the same control variables as in the BMI regressions plus height and height squared.

Source: Own computations based on RLMS data 1994-2005.

Table 11: IV GMM regression for mean „better or worse“, females

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	0.366					
	(1.24)					
Slope	0.001					
	(3.21)***					
Income drops		-0.075				
		(0.98)				
Prob. poverty			-1.095			
			(4.92)***			
# unpaid bills				0.239		
				(1.69)*		
# no payment					-0.002	
					(0.14)	
Job concerns						0.144
						(2.17)**
Adjusted R²	.	0.08	.	.	0.10	0.15
N	1,139	1,139	1,139	1,139	1,169	868
Hansen's J (χ^2)	16.2	15.3	16.5	15.7	16.2	19.2
p-value	.44	.57	.49	.54	.51	.26
F-value of IV, 1st stage	10.4/6.2	5.3	29.0	40.1	21.5	4.1
p-value	.00/.00	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU). Each regression includes the same control variables as in the BMI regressions plus height and height squared.

Source: Own computations based on RLMS data 1994-2005.

Table 12: IV GMM regression for mean of „necessities“, males

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	1.754					
	(2.72)***					
Slope	0.003					
	(2.64)***					
Income drops		-0.089				
		(1.08)				
Prob. poverty			-0.469			
			(2.75)***			
# unpaid bills				0.122		
				(2.56)**		
# no payment					-0.189	
					(6.42)***	
Job concerns						0.481
						(6.25)***
Adjusted R^2	.	0.12	0.10	0.10	-0.00	0.38
N	657	657	657	657	678	600
Hansen's J (χ^2)	14.0	24.1	18.3	17.2	18.7	13.6
p-value	.60	.12	.38	.44	.34	.63
F-value of IV, 1st stage	14.2/2.2	8.4	43.2	67.3	141.4	6.2
p-value	.00/.02	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU). Each regression includes the same control variables as in the BMI regressions plus height and height squared.

Source: Own computations based on RLMS data 1994-2005.

Table 13: IV GMM regression for mean of „necessities“, females

	(1)	(2)	(3)	(4)	(5)	(6)
Volatility	0.882					
	(3.13)***					
Slope	0.002					
	(2.76)***					
Income drops		-0.124				
		(1.32)				
Prob. poverty			-0.504			
			(1.55)			
# unpaid bills				0.118		
				(1.59)		
# no payment					-0.018	
					(0.81)	
Job concerns						0.373
						(4.61)***
Adjusted R²	.	0.05	0.06	0.04	0.09	0.23
N	1,140	1,140	1,140	1,140	1,170	869
Hansen's J (χ^2)	13.8	13.2	13.5	21.7	13.1	17.3
p-value	.61	.72	.70	.20	.73	.37
F-value of IV, 1st stage	10.4/6.2	5.3	28.9	40.2	21.5	4.1
p-value	.00/.00	.00	.00	.00	.00	.00

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$; z-statistics in brackets based on standard errors clustered by primary sampling units (PSU). Each regression includes the same control variables as in the BMI regressions plus height and height squared.

Source: Own computations based on RLMS data 1994-2005.