ECONOMIC GROWTH AND NUTRITION TRANSITION: AN EMPIRICAL ANALYSIS COMPARING DEMAND ELASTICITIES FOR FOODS IN CHINA AND RUSSIA

Christine Burggraf[1], Lena Kuhn[1], Qiran Zhao[1], Thomas Glauben[1], Ramona Teuber[1]

[1] Leibniz Institute of Agricultural Development in Transition Economies

Paper prepared for presentation at the EAAE 2014 Congress
'Agri-Food and Rural Innovations for Healthier Societies'

August 26 to 29, 2014
Ljubljana, Slovenia

ECONOMIC GROWTH AND NUTRITION TRANSITION: AN EMPIRICAL ANALYSIS COMPARING DEMAND ELASTICITIES FOR FOODS IN CHINA AND RUSSIA

Abstract: Given the heterogeneity between Russia and China, we analyze the extent to which income growth as a major driver of nutrition transition has a significant effect on the consumption of different food aggregates. We estimate expenditure elasticities of nine different food aggregates for China and Russian, applying a Quadratic Almost Ideal Demand model. Our results indicate that future income growth in China and Russia will continue to increase meat consumption. Despite being a positive signal for problems of malnutrition in China, this trend might further increase the incidence of chronic diseases with negative cost effects on public health care systems.

Keywords: nutrition transition; food demand; QUAIDS; China; Russia

1 Introduction

Epidemiological experiences in western societies show that the overall structure of dietary patterns shifts with economic growth towards a diet that is high in fat, cholesterol, sugar and other refined carbohydrates but low in polyunsaturated fatty acids and fiber (Popkin 2002). These major dietary changes, usually referred to as nutrition transition, are often characterized by an increasing share of animal food products in the diet (Popkin 2001). Nutrition is an important impact factor of various health conditions and non-communicable diseases, including overweight, obesity, cardiovascular diseases (Hu et al. 2000; Popkin 2007; Shepard et al. 2001), diabetes (Montonen et al. 2005), and various forms of cancer (Popkin 2007; Beydoun and Wang 2008; Popkin 2008). Since there seems to be a strong link between the risks for various chronic diseases and different "westernized" eating or lifestyle patterns, nutrition transition is a worthy target of academic scrutiny (Popkin 2001).

However, nutrition transition is certainly not exclusively taking place in developed countries. Over the last few decades, many emerging and developing countries have experienced the same trends in dietary patterns and their consequences on public health (Popkin 2001). Focusing on the latest developments of emerging economies, economic growth accompanied by nutrition transition patterns tends to evoke serious health problems. For example, in China, where policy makers still primarily focus on the alleviation of malnutrition, an increasing prevalence of diet-related, non-communicable diseases such as obesity can be noted (Tian and Yu 2013). In Russia, cardiovascular diseases, diabetes mellitus or chronic respiratory diseases significantly contribute to the country's worrying morbidity and death rates (Sedik et al. 2003). This steadily increasing incidence of nutrition-related chronic diseases seems to be caused, at least partially, by rapid shifts in food systems, food pricing and marketing.

For design and implementation of public intervention programs, it is important to understand the factors influencing these dynamics (Popkin 2007). As Popkin (2001) pointed out, epidemiological shifts are often accompanied by a great regional heterogeneity as ongoing nutrition transition is closely connected to a country's particular historic and cultural characteristics, which are clearly not transferrable to any other country. Even though there exists extensive literature on food demand and nutrition transition in China (e. g. Huang and Rozelle 1998; Gould 2002; Yen et al. 2004; Gould and Villarreal 2006; Dong and Gould 2004; Liao and Chern 2007; Gale and Huang 2007; Zheng and Henneberry 2009; Zhou et al. 2014), few studies are known to us that contrast Chinese development with another large transition economy like Russia. And those studies are not very recent and do not estimate a

complete demand system (Monteiro et al. 1995; Delgado 2003). In order to close this gap and include the effect of regional heterogeneity in our study, we analyze trends in Chinese and Russian food consumption patterns and compare the results.

A comparison of the Chinese and Russian food demand controls for a considerably wide range of cultural, economic and geographical differences. In both countries, economic growth is mirrored by an increasing gross domestic product (GDP), which can be considered as an indicator of a country's living standards. Although the average growth rate of per capita GDP between 1997 and 2009 was higher in China (15.4% p.a.) than Russia (6.4% p.a.), the per capita GDP was still twice as high in Russia compared to China (13616.2 PPP-US$ and 6206.8 PPP-US$, respectively) (World Bank 2014). Given these differences, we analyze in which way expenditure growth as a major driver of nutrition transition has significantly changed the consumption of different food aggregates, as well as how these effects differ between Chinese and Russian consumers. Therefore, based on a two-stage budgeting process, we estimate the expenditure elasticities of nine different food aggregates and five different meat aggregates for China and Russia, applying a Quadratic Almost Ideal Demand (QAID) model.

The remainder of this paper is structured as follows. In section two, we describe the two data sets that we apply for our analysis. Section three includes a descriptive analysis of the trends in food consumption and its effects on health. In section four, we present the estimation procedure and our empirical results, before drawing a brief conclusion in section five.

2 Data

For our descriptive and empirical analysis, we use the Chinese Health and Nutrition Survey (CHNS, see Carolina Population Center 2014) and the Russia Longitudinal Monitoring Survey (RLMS-HSE) data sets (see RLMS-HSE 2010). Both the CHNS and the RLMS-HSE are organized and coordinated mainly by the Carolina Population Centre. Both data sets provide a wide range of information on socioeconomic characteristics, expenditure on and the production of food at the household level, as well as health status and dietary intakes at the individual level, and are representative for the respective country. We use price and consumption data for a comparable transition period of 12 years. Thereby, CHNS data for 1997-2009 is employed to analyze the Chinese food demand, while we use RLMS-HSE data for 1996-2008 to analyze the Russian food demand. A comparison with additional sources, i.e. data from the Government Committee of Statistics (GKS) for 2008 (see Government Committee of Statistics 2011) or 2009 data from the National Bureau of Statistics China (NBS) (see National Bureau of Statistics 2010) yields comparable average consumption trends and values for both countries across most food items. This underlines the representativeness of the RLMS-HSE and CHNS food consumption data.

However, both data sets have some limitations. First, price data for Chinese communities is only available for five waves between 1997 and 2009 in the CHNS dataset. Regarding the Russian data set, the RLMS-HSE contains a total of eleven waves between 1996 and 2008, which does not include the 1997 and stops with the 2008. Hence, the waves of the Chinese and Russian surveys do not exactly match. However, the length of the observed transition periods, i.e. twelve years, is equal for both countries. Second, the RLMS-HSE food consumption data is only collected during winter months and is therefore not seasonally representative. Likewise, CHNS nutrition data is collected between August and December. However, the survey rounds are comparable to each other, allowing the examination of yearly changes during the winter period, as well as population level changes (Jahns et al. 2003).

3 Nutrition transition in China and Russia

In this section, we provide insights into the traditional eating habits of China and Russia, as well as current trends in consumption patterns. Furthermore, we describe the prevalence of nutrition-related chronic diseases in these countries.

3.1 Chinese trends in food consumption patterns

In China, nutrition scarcity has been a major issue for the majority of rural population and even urban population over centuries. While energy intake increased after the foundation of the People's Republic of China (1949), it dropped considerably during a series of political and economic upheavals in the late-1950s and early-1960s (Du et al. 2014; Kantha 1990). The subsequent increase in energy intake is generally seen as being closely linked to economic reforms and opening (Tian and Yu 2013). Since 1978, China's economic development has made remarkable achievements, with people's living standards, food consumption and nutritional status having increased along with average income (Feng and Shi 2006).

Traditional Chinese meals usually include rice in southern and pasta in northern counties, vegetables and a small amount of meat (Li 2007). This diet has a low energy density and is high in carbohydrates and dietary fiber. Intake of non-meat proteins is low as Chinese rarely consume milk or other dairy products. Although milk consumption has rapidly increased during recent years and is supplemented by the consumption of beans as an alternative source of proteins, the total consumption of non-meat proteins is still low compared to Russia or western countries such as the US (Zhai 2005). Indeed, as shown in Table 1, we still find a high level of carbohydrates intake (34.7% of total food consumption in 2009), vegetables (28.6 % in 2009) and a low share of dairy (1.6%), other proteins (8.3%), fruits (5.8%) and fats and oils (4.0%) in 2009. Meat and meat products account for a consumption share of 8.1% in the average diet.

Officially, Chinese average annual meat consumption increased from 19.33 kg in 1999 up to 23.96 kg in 2008 (National Bureau of Statistics 2000-2009). In our data, we found an average per capita meat consumption of 77.5 g per day. Even though these numbers varied considerably between urban (91g per capita and day) and rural areas (71g per capita and day), we find that the average meat consumption was still within the boundaries of official Chinese nutrition recommendations (Yang 2005).

Table 1: Chinese mean consumption shares of food groups in total consumed foods

	1997	2000	2004	2006	2009
Carbohydrates	41.0%	37.7%	38.0%	36.5%	34.7%
Vegetables	31.2%	31.4%	30.6%	29.8%	28.6%
Other Proteins	7.5%	7.9%	7.6%	7.9%	8.3%
Meat and meat products	7.3%	8.0%	7.4%	7.5%	8.1%
Other foods	4.5%	5.4%	4.9%	5.0%	5.9%
Oils and fats	3.6%	3.8%	3.9%	3.7%	4.0%
Fish	2.7%	2.6%	2.8%	3.0%	3.0%
Fruits	1.7%	2.3%	3.1%	5.0%	5.8%
Milk and milk products	0.4%	1.0%	1.7%	1.7%	1.6%

Source: Own calculations based on CHNS (1997-2009)

Among our sample households' diets, the consumption share (measured in kilogram) of carbohydrates fell (from 41.0% to 34.7%), whereas the consumption of protein sources and fats steadily increased (meat: 7.3% to 8.1%; dairy: 0.4-1.6%, other proteins: 7.5- 8.3%; oils and fats: 3.6-4.0%) (Table 1). These results support the assumption of an ongoing nutrition transition in China. However, we also find a decreasing consumption share of vegetables from 31.2 - 28.6% during the period of economic transition. This result does not fit into the assumption of an increasing intake of fruits and vegetables during an ongoing nutrition transition, but can possibly be attributed to the relatively high starting level of vegetable consumption in China in 1996.

3.2 Russian trends in food consumption patterns

In contrast to China, serious health problems among the Russian population are mainly caused by an increasing consumption of proteins and fat provided by meat and milk products (Dellava et al. 2010). In general, the base levels of fat and protein intakes in Russia are completely different from other emerging economies, such as China. Indeed, we find a relatively high intake of dairy products (16.49 % of total consumption in 2008) and an increasing consumption share of meat and meat products (11.36 % in 2008) (Table 2).

Table 2: Russian mean consumption shares of food groups in total consumed foods

	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008
Carbohydrates	46.4%	47.0%	47.4%	48.1%	44.1%	44.9%	43.8%	43.0%	43.9%	41.2%	38.1%
Milk and milk products	16.5%	20.3%	16.6%	15.4%	17.0%	15.1%	15.5%	15.8%	15.2%	15.5%	16.5%
Meat and meat products	7.7%	8.2%	6.1%	6.5%	8.3%	8.2%	8.5%	8.9%	9.2%	11.1%	11.4%
Fish	1.3%	1.3%	1.2%	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%	2.0%	2.2%
Other Proteins	2.1%	2.3%	2.0%	2.1%	2.3%	2.3%	2.3%	2.4%	2.4%	2.7%	2.7%
Fruits	6.2%	3.6%	8.0%	7.6%	8.1%	9.0%	8.8%	7.9%	7.6%	8.8%	9.8%
Vegetables	15.5%	12.5%	13.6%	13.5%	12.8%	13.1%	13.5%	14.1%	13.8%	11.9%	13.0%
Fats	2.3%	2.4%	2.2%	2.2%	2.3%	2.1%	2.1%	2.2%	2.0%	2.4%	2.2%
Other foods	2.1%	2.5%	2.8%	3.4%	3.8%	3.9%	3.9%	4.0%	4.3%	4.4%	4.1%

Source: Own calculations based on RLMS-HSE (1996-2008)

Due to the limited available assortment of food products during Soviet times, Russian consumption patterns were primarily motivated by availability and price and less by health concerns, which seems to persist as documented by recent studies on consumer purchase behavior (Honkanen and Frewer 2009). Consumers seem to pay less attention to the vitamin, fiber and mineral content of foods and thus to the positive health effects of these nutrients on their bodies. Moreover, during the former Soviet Union, the consumption of meat and dairy items was promoted in the official five-year plans by subsidizing these sectors. Furthermore, the Soviet Union's medical and nutritional establishments created dietary standards that called for high levels of protein intake. While these nutrition guidelines ended in the late-1980s, the practice seems to prevail since no counter education has been provided (Dellava et al. 2010). This complies with the results of a recent study on eating habits in Russia (Honkanen and Voldnes 2006).

In terms of the dynamics of consumption, Dellava et al. (2010) conclude that steep price increases for meat and dairy products in years of economic crisis did not result in long-term dietary shifts. In fact, after a decrease in meat consumption by 27 % in the period 1990-1995

due to the collapse of the managed economy, accompanied by a reduction of the Russian GDP by 40 %, Russian households reverted to prior consumption patterns as incomes increased. Hence, consumption of meat and meat products increased from 6.10% to 11.36% between 2000 and 2008 with increasing incomes per capita (Table 2). This is in line with Liefert (2004), who states that Russians consider a heavy intake of livestock products as necessary for a healthy diet.

Furthermore, as is generally found in times of increasing incomes, the consumption of carbohydrates decreased, and especially that of fiber by 9.84 %. In addition, we find a comparatively low share of fruits and vegetables in total consumption (22.82% in 2009), which is in line with the results of Paalanen (2011). This might be due to the difficulty of growing fruits and vegetables in the Russian climate (Brainerd and Cutler 2005). Despite an increase in fruit consumption during the period of economic growth from 1998 up to 2008, the average per capita fruit and vegetable consumption in Russia of 146.33 kg (in 2008) is still much lower than that in western countries (Brainerd and Cutler 2005).

We notice that Russian meat consumption (72.83 kg per capita in 2008), is noticeably higher than that of China (28.29 kg per capita in 2009). This difference between actual meat intakes in China and Russia is also reflected in the difference between officially recommended meat intakes for these two countries. Official Chinese sources recommend a per capita intake of only 18-37 kg per year (Yang 2005). In contrast, the Ministry of Health and Social Development of the Russian Federation (2010) recommends a consumption of 70-75 kg meat and meat products per year. The recommended minimum meat consumption for adults lies between 54kg up to 70.4 kg per year, depending on the geographical area in Russia (Government of the Russian Federation 2013).[1]

3.3 Nutrition transition and health effects

For the Chinese and Russian diets, the overall development during economic growth seems to be in line with the term nutrition transition. For China, the intake of cereals decreased and the intake of animal foods and oils increased, leading to a western-style diet that is higher in fatty acids yet lower in fiber. The same is true for Russia, with a higher priority towards meat products. However, it can also be observed that the Russian diet has shifted towards a more varied diet, with an increasing consumption of fruits and vegetables.

As described above, one major characteristic of an ongoing nutrition transition is the emergence of overweight, obesity, diabetes and cardiovascular diseases. Although parts of the Chinese society might still be affected by malnutrition[2], in this study we focus on the prevalence of overweight and obesity to deal with the growing obesity and chronic disease epidemic during nutrition transition.[3] Several studies attest an increasing prevalence of obesity and chronic diseases in both countries (Kalichman et al. 2006; Wu 2006; Wang et al. 2007; Abegunde and Stanciole 2008; Nugent 2008; Yang et al. 2008), which indeed can be affirmed by our data. In Russia, more than 50% of the population can be considered overweight or obese (Figure 1). Furthermore, Figure 1 shows that in 2000/2001, i.e. shortly after the year of a stark economic crisis in 1998, the prevalence of overweight or obesity was lower compared to the time periods before and thereafter. During this period of tremendous

[1] Russian recommendations also exceed nutritional intake recommendations for Americans or Germans: US dietary guidelines recommend a maximum intake of 62 kg per capita per annum (USDA 2010: 9). In Germany, an annual maximum meat intake of about 31.3 kg is recommended (Deutsche Gesellschaft für Ernährung 2013).

[2] On the occurrence of malnutrition in current China, see Wang (2005).

[3] The World Health Organization (2013) defines overweight as an BMI>25 and obesity as an BMI>30.

economic stress, a large reduction in the energy density of the average Russian diet occurred (Wang et al. 2002). This reduced energy density of the average Russian diet resulted in a lagged lowering of overweight and obesity occurrence. These findings are in accordance with the results of Stillman and Thomas (2008), who state that transitory changes in expenditures are positively and significantly associated with total caloric intake and fat intake, as well as a (delayed) adult BMI. Additionally, Figure 1 shows that even though obesity and overweight rates are still considerably low in China, there is a rapid shift towards increased obesity among the Chinese population, which is in line with the findings of Popkin (2001) and Du et al. (2002).

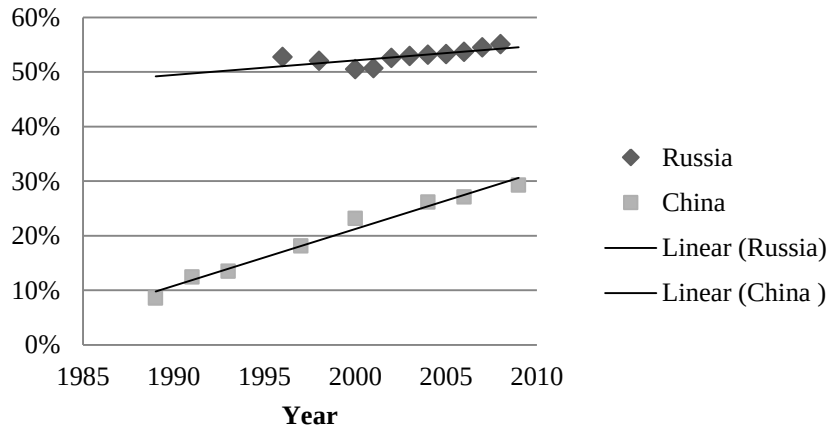

Figure 1: Prevalence of overweight or obesity [in % of sample]

Source: Own calculations based on RLMS-HSE (1996-2008) and CHNS (1989-2009)

Furthermore, several studies show that the incidence of chronic diseases such as diabetes, gallstones, hypertension and heart disease increases with the degree of overweight (Field et al. 2001; Mokdad et al. 2003; Sowers 2003; Hedley et al. 2004). In this study, we consider the incidence of diabetes to account for trends in nutrition-related chronic diseases. However, interpretation of the trends in the prevalence of diabetes is not as straightforward as the incidence of obesity, due to a lagged incidence of nutrition-related chronic diseases. However, as presented in Figure 2, the prevalence of diabetes increases overall in Russia and China over the observed transition period, with a higher rate in the former. This result indicates an increasing risk of nutrition-related chronic diseases such as diabetes with growing household incomes.

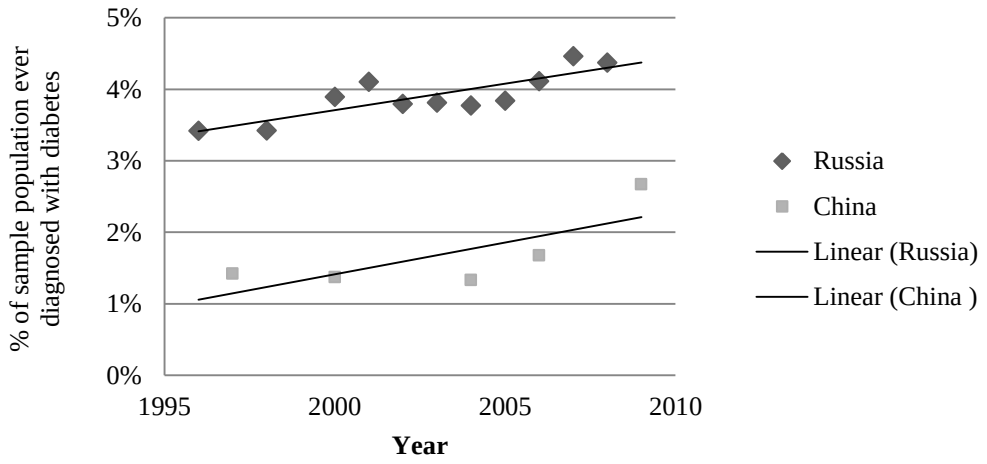

Figure 2: Prevalence of diabetes [in % of sample population]

Source: Own calculations based on RLMS-HSE (1996-2008) and CHNS (1989-2009)

In summary, nutrition-related chronic diseases in China are still considerably lower than in Russia. However, higher growth rates of the occurrence of overweight or obesity in China suggest a certain catching-up effect and increasing problems with chronic diseases in the longer run.

4 Empirical Analysis

To analyze trends in expenditure and price elasticity of food demand, we apply the Quadratic Almost Ideal Demand System (QUAIDS) of Banks et al. (1997), which provides more flexibility than the standard Linear Approximation Almost Ideal Demand System (LA/AIDS) of Deaton and Muellbauer (1980) by incorporating additional terms of income. It allows expenditure share Engel curves that are quadratic in the logarithm of expenditures. As with the LA/AIDS model, QUAIDS is derived as a generalization of the price-independent generalized logarithmic (PIGLOG) demand system. Demographic scaling used in this study is based on the work of Ray (1985) and Poi (2002; 2012). Based on the assumption of weak separability of preferences and an aggregation of products based on similar nutrient compositions, we employ a two-stage budgeting model according to Deaton and Muellbauer (1980).

4.1 Estimation procedure and elasticity calculation

Expenditure elasticities are estimated by iterated feasible generalized nonlinear least squares estimation via STATA 13. In the first stage, the model reproduces the allocation of total expenditure on foods and non-foods. Since this study focuses on food consumption and also due to data limitations, we do not estimate the first stage decision process. In the second stage, we distinguish between nine food aggregates: (i) carbohydrates, (ii) milk and dairy products; (iii) meat and meat products; (iv) fish; (v) eggs and other protein sources; (vi) fruits; (vii) vegetables; (viii) oils and fat; and (ix) other foods. In the third stage, we distinguish between five meat aggregates: (i) beef; (ii) pork; (iii) poultry; (iv) mutton; and (v) other meats. The problem of zero observations is controlled for by applying the Generalized Heckman procedure (Heien and Wessells 1990).

In order to provide expenditure elasticities that are comparable with other studies, we calculate unconditional expenditure and price elasticities for each of the nine food aggregates by following the approach of Carpentier and Guyomard (2001). We assume a first stage food

expenditure elasticity of 0.672 for Russia and 0.775 for China, respectively, as well as a Marshallian food own-price elasticity of -0.605 for Russia and -0.730 for China, respectively. These elasticities are taken from the international study of Muhammad et al. (2011) for 2005. We evaluate expenditure, own-price and cross-price elasticities at sample means. Thereby, expenditure elasticities of food and meat aggregates are taken as indicators to measure the effect of expenditure growth on food demand in both China and Russia. Through demographic scaling, we control for five socio-demographic variables: land use, household size, number of children aged 0-14 years, settlement type and geographic region. We do not include a time trend variable since we are particularly interested in the changes over time.

4.2 Empirical results

We first provide unconditional expenditure elasticities for our nine food aggregates and five meat aggregates. To analyze changes over time, we provide yearly demand elasticities for each of the food and meat aggregates. Subsequently, we present the calculated own-price elasticities, again on a yearly basis. Due to a mixture of different foods in the 'other food' aggregate, we will not discuss the results concerning this food aggregate.

Table 3. Expenditure elasticities of Chinese households (1997-2009)

Year	1997	2000	2004	2006	2009
Food aggregates					
Carbohydrates	**0.45**	**0.46**	**0.41**	**0.39**	**0.44**
Meat	**1.34**	**1.13**	**1.33**	**1.27**	**1.21**
Fish	**1.40**	**1.26**	**1.42**	**1.54**	**1.28**
Fruits	**1.30**	**1.44**	**1.18**	**1.17**	**0.91**
Oils and Fats	**0.45**	**0.42**	**0.51**	**0.53**	**0.59**
Eggs and other proteins	**0.74**	**0.77**	**0.67**	**0.66**	**0.64**
Vegetable	**0.49**	**0.51**	**0.49**	**0.54**	**0.49**
Milk and dairy	**1.36**	**1.54**	**1.02**	**0.60**	**1.11**
Other foods	**0.79**	**1.17**	**0.79**	**0.80**	**0.81**
Meat aggregates					
Beef	**1.79**	**1.61**	**1.81**	**2.22**	**2.27**
Poultry	**1.99**	**1.73**	**1.98**	**2.03**	**1.35**
Mutton	**1.98**	**1.71**	**1.70**	**2.47**	**3.00**
Pork	**1.21**	**1.01**	**1.20**	**1.08**	**1.09**
Other meat	**2.88**	**2.24**	**2.49**	**2.06**	**2.61**

Source: CHNS, 1997-2009
Note: All numbers significant at the 5%-level are printed in bold letters.

Table 4. Expenditure elasticities of Russian households (1996-2008)

Year	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008
Food Aggregates											
Carbohydrates	**0.43**	**0.43**	**0.55**	**0.58**	**0.55**	**0.55**	**0.50**	**0.53**	**0.52**	**0.54**	**0.52**
Milk and dairy	**0.87**	**0.81**	**0.73**	**0.66**	**0.62**	**0.61**	**0.60**	**0.60**	**0.59**	**0.58**	**0.64**

Meat	**0.86**	**0.86**	**0.81**	**0.81**	**0.85**	**0.84**	**0.87**	**0.84**	**0.81**	**0.82**	**0.78**
Fish	**0.87**	**0.85**	**0.78**	**0.70**	**0.67**	**0.69**	**0.73**	**0.74**	**0.81**	**0.82**	**0.72**
Eggs & other proteins	**0.82**	**0.70**	**0.64**	**0.56**	**0.63**	**0.53**	**0.57**	**0.55**	**0.59**	**0.59**	**0.60**
Fruits	**0.70**	**0.72**	**0.65**	**0.69**	**0.69**	**0.70**	**0.74**	**0.67**	**0.72**	**0.69**	**0.69**
Vegetables	**0.63**	**0.67**	**0.64**	**0.60**	**0.63**	**0.68**	**0.70**	**0.64**	**0.65**	**0.67**	**0.68**
Fats and oils	**0.77**	**0.83**	**0.73**	**0.63**	**0.56**	**0.53**	**0.53**	**0.53**	**0.55**	**0.53**	**0.55**
Other foods	**0.80**	**0.55**	**0.79**	**1.07**	**1.22**	**1.29**	**1.17**	**1.24**	**1.24**	**1.07**	**1.48**
Meat Aggregates											
Beef	**1.03**	**1.04**	**1.15**	**1.24**	**1.17**	**1.21**	**1.28**	**1.36**	**1.29**	**1.38**	**1.40**
Pork	**0.94**	**0.91**	**0.81**	**0.84**	**0.91**	**0.86**	**0.92**	**0.86**	**0.78**	**0.76**	**0.76**
Poultry	**0.56**	**0.51**	**0.65**	**0.57**	**0.52**	**0.59**	**0.56**	**0.61**	**0.64**	**0.65**	**0.56**
Other meat	**0.79**	**0.77**	**0.70**	**0.72**	**0.79**	**0.78**	**0.78**	**0.69**	**0.76**	**0.72**	**0.64**

Source: RLMS-HSE, 1998-2008
Note: All numbers significant at the 5%-level are printed in bold letters.
The category 'mutton' was not included in Russian analysis due to this food's low consumption share among the meat aggregate (less than 5%).

As presented in Table 3 and Table 4, our estimates of the Russian and Chinese expenditure elasticities for our food aggregates are all plausible, considering the magnitude, order and relative magnitude among the eight food aggregates.[4] All food aggregates in both countries are positive and normal goods, meaning that demand increases (decreases) with increasing (decreasing) expenditure and constant prices. Products of basic demand such as fats and carbohydrates, including cereals and potatoes, have the lowest demand expenditures. In both countries, highest elasticities can be found for fruits and the meat and fish group. The expenditure elasticities of the different meat products vary considerably, with the lowest elasticity for pork in China and poultry in Russia. On the other hand, beef and mutton are both meat products of relatively high elasticity. As mentioned, the 'other meat' group is hardly comparable between the two countries for their different composition. Compared with the results of other studies on Chinese food demand (Huang and Rozelle 1998; Gould 2002; Yen et al. 2004; Gould and Villarreal 2006; Dong and Gould 2004; Liao and Chern 2007; Gale and Huang 2007, Zheng and Henneberry 2009; Zhou et al. 2014), we find that meat exhibits the highest expenditure elasticity, whereas the majority of the comparison studies indicate dairy products as having the highest expenditure elasticities (see table A1 in appendix).

Comparing our Chinese results with the Russian results, we can state that while the relative order for the food aggregates is very similar for both countries, the magnitude of expenditure elasticities is not equivalent. Following (Muhammad et al. 2011), we expect expenditure elasticities to be higher in countries with lower average income, apart from carbohydrates. Indeed, all food aggregates in Russia (except 'other foods') are necessity goods as their average expenditure elasticity falls below 1. In China, meat, fish and dairy products are still luxury products. For these product groups, we measure expenditure elasticity as being larger than 1, meaning that the demand for these food items increases disproportionally with rising household expenditure. Whereas most meat products were necessity goods in Russia, only pork came close to 1 in China. Therefore, the findings above support our assumption concerning the connection between average income and expenditure elasticities: Much more products, especially meat products, were still luxury goods in China, which also implies that China might still be at an earlier stage of nutrition transition.

[4] We will not interpret our results of the 'other foods' and the 'other meats' aggregates since these groups' compositions are not consistent across both countries.

Analyzing the trend over the considered period, we can state that expenditure elasticities were constant or decreased for all food groups in China, apart from oils and fats. This anomaly might be due to either data misspecification or a consequence of major food scandals triggered by contaminated cooking oil (Pei et al. 2011). Similar scandals connected to milk products around 2008 might have caused the rather high volatility of the elasticity in this group. For Russia, expenditure elasticities sank for all groups apart from carbohydrates and vegetables, which both had very low initial elasticities. In the meat group, expenditure elasticities fell for poultry and pork and increased for mutton and beef. This situation is quite similar to Russia, where beef demand elasticity increased, poultry remained stable and pork elasticity declined. These results underline the change of pork and poultry into a necessity good, whereas the other meats tend to turn into luxury goods.

Table 5: Price elasticities of food groups in China

Year	1997	2000	2004	2006	2009
Food Aggregates					
Carbohydrates	0.05	-0.03	**-0.66**	**-0.34**	**-0.57**
Milk and dairy	**-1.24**	**-1.30**	**-0.89**	**-0.92**	**-0.61**
Meat	**-0.79**	**-0.79**	**-1.15**	**-0.60**	**-0.97**
Fish	**-1.05**	**-0.74**	**-0.51**	**-0.55**	**-0.41**
Eggs & other proteins	**-0.68**	**-0.47**	**-0.45**	**-0.55**	**-0.83**
Fruits	**0.54**	**0.97**	**-0.16**	**-0.56**	**-0.24**
Vegetables	**-0.20**	**-0.18**	**-0.29**	**-0.18**	**-0.16**
Fats and oils	**-0.57**	**-0.21**	**-0.22**	**-0.15**	**-0.27**
Other foods	**-0.28**	**-0.37**	**-0.54**	**-0.46**	**-0.67**
Meat Aggregates					
Beef	**-1.15**	**-1.08**	**-2.14**	**-0.72**	**-0.82**
Pork	**-0.43**	**-0.22**	**-0.38**	**-0.21**	**-0.22**
Mutton	**-0.81**	**-1.95**	**-1.32**	**-0.90**	**-0.19**
Poultry	**-2.08**	**-0.72**	**-1.46**	**-1.19**	**-0.73**
Other meat	**-21.15**	**-27.07**	**-19.40**	**-7.80**	**-15.59**

Source: CHNS, 1997-2009
Note: All numbers significant at the 5%-level are printed in bold letters.

Table 6: Price elasticities of food groups in Russia

Year	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008
Food Aggregates											
Carbohydrates	**-0.97**	**-0.84**	**-0.92**	**-1.17**	**-1.10**	**-0.97**	**-0.94**	**-0.95**	**-1.04**	**-1.11**	**-0.88**
Milk and dairy	**-0.97**	**-1.02**	**-1.01**	**-0.90**	**-1.19**	**-0.80**	**-0.92**	**-1.09**	**-0.74**	**-1.22**	**-1.17**
Meat	**-1.77**	**-1.17**	**-1.35**	**-1.19**	**-1.66**	**-1.27**	**-1.20**	**-1.17**	**-1.26**	**-1.19**	**-1.44**
Fish	**-1.06**	**-0.73**	-0.21	**-0.63**	**-0.71**	**-0.76**	**-0.82**	**-0.78**	**-1.54**	-0.35	-0.44
Eggs & other proteins	**-1.20**	**-0.86**	**-1.01**	0.66	**-1.32**	**-0.71**	**-1.12**	-0.45	-0.40	-0.28	-0.43

Fruits	**-0.90**	**-0.81**	**-0.97**	**-0.72**	**-0.97**	**-0.79**	**-0.94**	**-0.66**	**-0.71**	**-0.67**	**-1.09**
Vegetables	**-1.05**	**-0.29**	**-0.52**	**-1.00**	**-1.35**	**-1.01**	**-1.23**	**-0.83**	**-0.67**	**-1.21**	**-0.98**
Fats and oils	**-1.23**	**-1.05**	**-0.53**	**0.60**	**-1.03**	**-0.75**	-0.29	0.61	**-0.94**	**-0.76**	-0.49
Other foods	**-0.53**	**-0.76**	**-1.00**	**-1.17**	**-1.10**	**-1.08**	**-0.79**	**-0.83**	**-1.10**	**-1.03**	**-1.01**
Meat Aggregates											
Beef	**-2.20**	**-1.86**	**-1.64**	**-2.18**	**-1.94**	**-2.32**	**-1.05**	**-2.15**	-0.62	**-1.17**	**-1.31**
Pork	**-1.04**	**-1.07**	**-0.94**	**-0.95**	**-0.94**	**-0.98**	**-0.94**	**-1.03**	**-0.99**	**-1.02**	**-0.96**
Poultry	**-1.43**	**-0.92**	**-0.92**	**-1.06**	**-0.84**	**-1.18**	**-0.86**	**-1.07**	-0.53	**-0.55**	**-0.66**
Other meat	**-0.95**	**-0.94**	**-0.93**	**-0.94**	**-1.00**	**-1.00**	**-1.01**	**-1.03**	**-1.01**	**-1.01**	**-1.00**

Source: RLMS-HSE, 1998-2008.
Note: All numbers significant at the 5%-level are printed in bold letters.
The category 'mutton' was not included in Russian analysis due to this food's low consumption share among the meat aggregate (less than 5%).

Table **5** and Table 6 show the compensated own-price elasticities, which are calculated as unconditional elasticities. We would generally expect low absolute elasticities for foods that are a necessary part of the daily diet and high elasticities for items with existing substitutes or luxury character.

In general, the own-price elasticities in absolute values are lower for China than Russia. While overall meat price elasticities are too volatile to suggest a trend, elasticities for different kinds of meat, especially pork and poultry, have been decreasing, which underlines their new importance for the average diet. The elasticity of other animal products such as milk and milk products, fish and fats and oil likewise decreased. The positive price elasticities for fruits, certainly not a Giffen good, might be explained by the imputation of fruit prices that was necessary for some periods. Vegetables and carbohydrates did not change much and remained rather inelastic, if we omit insignificant observations. Overall, unconditional price elasticities also hint at an ongoing nutrition transition in China.

In Russia, meat and dairy products have the highest own-price elasticity in absolute terms. Considering the unconditional meat price elasticities, beef has the highest price elasticity. The low absolute demand elasticities for poultry imply a rather inelastic demand for this good. Price elasticities in Russia are relatively volatile over the entire period, which makes it difficult to identify a trend. However, ignoring fluctuation between 1996 and 2008, we can observe an absolute decrease in the price elasticity of products connected to animal products, such as meat, fish, dairy products and eggs, as well as other proteins that would be typical for a western-style diet resulting from a nutrition transition. However, many results are not significant for the most recent waves, which renders it difficult to test for a nutrition transition with figures of price elasticity in this country.

Our calculated own-price elasticities for meat in China are similar to the estimates reported by other studies in China (Huang and Rozelle 1998; Gould 2002; Yen et al. 2004; Gould and Villarreal 2006; Dong and Gould 2004; Liao and Chern 2007; Zheng and Henneberry 2009; Zhou et al. 2014) (see Table A2 in appendix). However, own-price elasticities for other foods are smaller in absolute value compared to those reported by past studies. Considering own-price elasticities in Russia, the absolute values are smaller for food groups such as carbohydrates and fats, but larger for meats, fruits and vegetables.

5 Conclusions

Considering the observed period of economic growth, our data implies a nutrition transition taking place in both China and Russia. Whereas the historical nutrition patterns in these countries influence details of this nutrition transition, the consumption of animal products and fruits increased in both countries, whereas the demand for carbohydrates decreased. From this development we might first deduct that the magnitude and speed of dietary changes is indeed influenced by country-specific nutrition characteristics. Second, some fundamental trends like the decrease of carbohydrates and increase of animal products is a development that is typical for nutrition transition and rather independent from prior dietary patterns. Consequently, the prevalence of overweight and obesity, as well as nutrition-related chronic diseases increased.

Given our results concerning the expenditure and price elasticities, it is possible to suggest some insights into the effects of future economic growth on food consumption patterns. Considering our calculated expenditure elasticities, we can suggest that with rising household expenditure the demand for meat and fish will increase in Russia and China by relatively larger proportions than the other food aggregates. Furthermore, rising expenditure will also have a relatively strong positive effect on fruit consumption in both countries. As in other transition countries, the demand growth for carbohydrates can be expected to further decrease. While rising fruit and meat consumption provides a positive signal for problems of malnutrition, e.g. iron deficiencies in China, this trend might also increase the incidence of chronic diseases. Thereby, nutrition-related chronic diseases in China are still considerably lower than in Russia. However, higher growth rates of the occurrence of overweight or obesity in China suggest an increasing problem with chronic diseases, if we assume similar developments to those in Russia. Even though demand for meat products in general, and especially beef, still is quite price elastic, we could find evidence for low price elasticity for specific products like pork or fats and oils in China. For these rather unhealthy products, taxing would not efficiently decrease demand. This implies that beyond the potential influence of governmental intervention strategies on household budgets and food prices, governments have to focus on information strategies by increasing nutritional education due to low nutrition literacy in both countries. Analyzing nutrition transition for rural and urban areas separately, a task which we decided not to cover in the present study, would allow to further specify government strategies and is most certainly an interesting topic for future research.

References

Abegunde, D. O., & Stanciole, A. E. 2008. The economic impact of chronic diseases: How do households respond to shocks? Evidence from Russia. *Social Science & Medicine*, **66**(11), 2296–2307.

Banks, J., Blundell, R., & Lewbel, A. 1997. Quadratic Engel Curves and Consumer Demand. *The Review of Economics and Statistics*, **79**(4), 527–539.

Beydoun, M. A., & Wang, Y. 2008. How do socio-economic status, perceived economic barriers and nutritional benefits affect quality of dietary intake among US adults? *European Journal of Clinical Nutrition*, **62**(3), 303–313.

Brainerd, E., & Cutler, D. M. 2005. Autopsy on an empire: Understanding mortality in Russia and the former Sowjet Union. *The Journal of Economic Perspectives*, **19**(1), 107–130.

Carolina Population Center. 2014. *Website of the China Health and Nutrition Survey*. Retrieved from http://www.cpc.unc.edu/projects/china

Carpentier, A., & Guyomard, H. 2001. Unconditional Elasticities in Two-Stage Demand Systems: An Approximate Solution. *American Journal of Agricultural Economics*, **83**(1), 222–229.

Deaton, A., & Muellbauer, J. 1980. An Almost Ideal Demand System. *The American Economic Review*, **70**(3), 312–326.

Delgado, C. L. 2003. Rising Consumption of Meat and Milk in Developing Countries Has Created a New Food Revolution. *Journal of Nutrition*, **133**(11), 39075–39105.

Dellava, J. E., Bulik, C. M., & Popkin, B. M. 2010. Price Changes Alone Are Not Adequate to Produce Long-Term Dietary Change. *Journal of Nutrition*, **140**(10), 1887–1891.

Deutsche Gesellschaft für Ernährung. 2013. *Vollwertig essen und trinken nach den 10 Regeln der DGE*. Retrieved from http://www.dge.de/pdf/10-Regeln-der-DGE.pdf

Dong, D. & Gould, B. W. 2004. *Product Quality and the Demand for Food: The Case of Urban China* (China's Agricultural Trade: Issues and Prospects, Conference Proceedings, International Agricultural Trade Research Consortium, Beijing, China).

Du, S., Lu, B., Zhai, F., & Popkin, B. M. 2002. A new stage of the nutrition transition in China. *Public Health Nutrition*, **5**(1a).

Du, S. F., Wang, H. J., Zhang, B., Zhai, F. Y., & Popkin, B. M. 2014. China in the period of transition from scarcity and extensive undernutrition to emerging nutrition-related non-communicable diseases, 1949-1992. *Obesity Reviews*, **15**(1), 8–15.

Feng, Z., & Shi, D. 2006. Chinese food consumption and nourishment in the last 20 years. *Resources Science*, **28**(1), 2–8.

Field, A. E., Coakley, E. H., Must, A., Spadano, J. L., Laird, N., Dietz, W. H., …Colditz, G. A. 2001. Impact of overweight on the risk of developing common chronic diseases during a 10-year period. *Archives of Internal Medicine*, **161**(13), 1581–1586.

Gale, F. & Huang, K. 2007. *Demand for Food Quantity and Quality in China* (US Department of Agriculture, Economic Research Service, Economic Research Report No. 32). Washington DC.

Gould, B. W. 2002. Household composition and food expenditures in China. *Agribusiness*, **18**(3), 387–407.

Gould, B. W., & Villarreal, H. J. 2006. An assessment of the current structure of food demand in urban China. *Agricultural Economics*, **34**(1), 1–16.

Government Committee of Statistics (GKS). 2011. *Federal State Statistics Service Russia*. Retrieved from http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/main/

Government of the Russian Federation. 2013. *Постановление Правительства РФ от 28 января 2013 г. N 54 "Об утверждении методических рекомендаций по определению потребительской корзины для основных социально-демографических групп населения в субъектах Российской Федерации* [Government Regulation of the Russian Federation dated February 28, 2013 No. 54 "Statement of methodical recommendations for determining the consumer basket of main socio-demographic population strata in subjects of the Russian Federation"]. Retrieved from http://base.garant.ru/70308360

Hedley, A. A., Ogden, C. L., Johnson, C. L., Carroll, M. D., Curtin, L. R., & Flegal, K. M. 2004. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *Jama*, **291**(23), 2847–2850.

Heien, D. M., & Wessells, C. R. 1990. Demand systems estimation with microdata: A censored regression approach. *Journal of Business & Economic Statistics*,

Honkanen, P., & Frewer, L. 2009. Russian consumers' motives for food choice. *Appetite*, **52**(2), 363–371.

Honkanen, P. & Voldnes, G. 2006. *Russian consumers' food habits: Results from a qualitative study in Moscow* (Rapport/Report No. 27).

Hu, F. B., Stampfer, M. J., Manson, J. E., Grodstein, F., Colditz, G. A., Speizer, F. E., & Willett, W. C. 2000. Trends in the incidence of coronary heart disease and changes in diet and lifestyle in women. *The New England Journal of Medicine*, **343**(8), 530–537.

Huang, J., & Rozelle, S. 1998. Market development and food demand in rural China. *China Economic Review*, **9**(1), 25–45.

Jahns, L., Baturin, A., & Popkin, B. M. 2003. Obesity, diet, and poverty: trends in the Russian transition to market economy. *European Journal of Clinical Nutrition*, **57**(10), 1295–1302.

Kalichman, L., Livshits, G., & Kobyliansky, E. 2006. Indices of body composition and chronic morbidity: A cross‐sectional study of a rural population in central Russia. *American Journal of Human Biology*, **18**(3), 350–358.

Kantha, S. S. 1990. Nutrition and health in China, 1949 to 1989. *Progress in Food & Nutrition Science*, **14**(2-3), 93–137.

Li, Z. 2007. Jin 50 nian Zhongguo jumin shiwu xiaofei zu yingyang fezhan de bianhua tedian [Change of Chinese Inhabitant's Food Consumption and Nutrition Development in the Last 50 Years]. *Resources Science*, **29**(1), 27–35.

Liao, H. & Chern, W. S. 2007. *A Dynamic Analysis of Food Demand Patterns in Urban China* (Paper Presented at American Agricultural Economics Association Annual Meeting, Portland, Oregon, USA.).

Liefert, W. 2004. *Food Security in Russia: Economic Growth and Rising Incomes are Reducing Insecurity* (Food Security Assessment, ERS, USDA), pp. 35–43.

Ministry of Health and Social Development of the Russian Federation. 2010. *ПРИКАЗ от 2 августа 2010 г. N 593н: Об утверждении рекомендаций по рациональным нормам потребления пищевых продуктов, отвечающим современным требованиям здорового питания* [Decree dated August 2, 2010 No. 593n: On approval of recommendations of regional norms of food consumption, meeting the modern requirements of healthy nutrition]. Retrieved from http://www.rg.ru/2010/10/15/pitanie-dok.html

Mokdad, A. H., Ford, E. S., Bowman, B. A., Dietz, W. H., Vinicor, F., Bales, V. S., & Marks, J. S. 2003. Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *Jama*, **289**(1), 76–79.

Monteiro, C., Mondini, L., Souza, A. L. de, & Popkin, B. M. 1995. The nutrition transition in Brazil. *European Journal of Clinical Nutrition*, **49**(2), 105–113.

Montonen, J., Jarvinen, R., Heliovaara, M., Reunanen, A., Aromaa, A., & Knekt, P. 2005. Food consumption and the incidence of type II diabetes mellitus. *European Journal of Clinical Nutrition*, **59**(3), 441–448.

Muhammad, A., Seale, James L. Jr., Meade, B., & Regmi, A. 2011. *International Evidence on Food Consumption Patterns: An Update Using 2005 International Comparison Program Data* (Technical Bulletin No. 1929). Retrieved from http://www.ers.usda.gov/publications/tb-technical-bulletin/tb1904.aspx#.UukwgrTBNcU

National Bureau of Statistics. 2000-2009. *China Statistical Yearbook*. Beijing: China Statistics Press.

National Bureau of Statistics. 2010. *Rural Households Survey Yearbook of China*. Beijing: China Statistics Press.

Nugent, R. 2008. Chronic diseases in developing countries. *Annals of the New York Academy of Sciences*, **1136**(1), 70–79.

Paalanen, L., Prattala, R., Palosuo, H., & Laatikainen, T. 2011. Socio-economic differences in the consumption of vegetables, fruit and berries in Russian and Finnish Karelia: 1992-2007. *The European Journal of Public Health*, **21**(1), 35–42.

Pei, X., Tandon, A., Alldrick, A., Giorgi, L., Huang, W., & Yang, R. 2011. The China melamine milk scandal and its implications for food safety regulation. *Food Policy*, **36**(3), 412–420.

Poi, B. P. 2002. *Dairy Policy and Consumer Welfare: In: Three Essays in Applied Econometrics, Chapter II, Doctoral Thesis. Department of Econometrics, University of Michigan.*

Poi, B. P. 2012. Easy demand-system estimation with quaids. *Stata Journal*, **12**(3), 433–446. Retrieved from http://EconPapers.repec.org/RePEc:tsj:stataj:v:12:y:2012:i:3:p:433-446

Popkin, B. M. 2001. The Nutrition Transition and Obesity in the Developing World. *The Journal of Nutrition*, **131**(3), 871–873.

Popkin, B. M. 2002. The shift in stages of the nutrition transition in the developing world differs from past experience. *Public Health Nutrition*, **5**(1a), 205–214.

Popkin, B. M. 2007. Understanding global nutrition dynamics as a step towards controlling cancer incidence. *Nature Reviews Cancer*, **7**(1), 61–67.

Popkin, B. M. 2008. Will China's Nutrition Transition Overwhelm Its Health Care System And Slow Economic Growth? *Health Affairs*, **27**(4), 1064–1076.

Ray, R. 1985. Specification and time series estimation of dynamic Gorman Polar Form demand systems. *European Economic Review*, **27**(3), 357–374.

RLMS-HSE. 2010. *"Russia Longitudinal Monitoring survey, RLMS-HSE», conducted by Higher School of Economics and ZAO "Demoscope" together with Carolina Population Center, University of North Carolina at Chapel Hill and the Institute of Sociology RAS*. Retrieved from http://www.cpc.unc.edu/projects/rlms-hse, http://www.hse.ru/org/hse/rlms

Sedik, D., Sotnikov, S., & Wiesmann, D. 2003. *Food security in the Russian Federation*. Rome: Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/docrep/007/y5069e/y5069e00.htm#Contents

Shepard, T. Y., Weil, K. M., Sharp, T. A., Grunwald, G. K., Bell, M. L., Hill, J. O., & Eckel, R. H. 2001. Occasional physical inactivity combined with a high-fat diet may be important in the development and maintenance of obesity in human subjects. *The American Journal of Clinical Nutrition*, **73**(4), 703–708.

Sowers, J. R. 2003. Obesity as a cardiovascular risk factor. *The American Journal of Medicine*, **115**(8), 37–41.

Stillman, S., & Thomas, D. 2008. Nutritional Status during an Economic Crisis: Evidence from Russia. *The Economic Journal*, **118**(531), 1385–1417.

Wang, L. 2005. *On the investigation of citizens' nutrition and health in China. General report 2002*. Beijing: People's Medical Publishing House.

Wang, Y., Mi, J., Shan, X. Y., Wang, Q. J., & Ge, K. Y. 2007. Is China facing an obesity epidemic and the consequences?: The trends in obesity and chronic disease in China. *International Journal of Obesity*, **31**(1), 177–188.

Wang, Y., Monteiro, C., & Popkin, B. M. 2002. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *The American Journal of Clinical Nutrition*, **75**(6), 971–977.

World Bank. 2014. *World DataBank*. Retrieved from http://databank.worldbank.org/data/home.aspx

World Health Organization. 2013. *Fact Sheet Obesity and Overweight*. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/index.html

Wu, Y. 2006. Overweight and obesity in China. *British Medical Journal*, **333**(7564), 362–363.

Tian, X., & Yu, X., 2013. The Demand for Nutrients in China. *Frontiers of Economics in China*, **8**(2), 186–206.

Yang, G., Kong, L., Zhao, W., Wan, X., Zhai, Y., Chen, L. C., & Koplan, J. P. 2008. Emergence of chronic non-communicable diseases in China. *The Lancet*, **372**(9650), 1697–1705.

Yang, Y. 2005. *Zhongguo shiwu chengfen biao 2004* [China Food Composition Tables 2004]. Beijing: Beijing Medical University Press.

Yen, S. T., Fang, C., & Su, S.-J. 2004. Household food demand in urban China: A censored system approach. *Journal of Comparative Economics*, **32**(3), 564–585.

Zhai, F. 2005. Study on the current status and trend of food consumption among Chinese population. *Chinese Journal of Epidemiology*, **26**(7), 485–488.

Zheng, Z., & Henneberry, S. R. 2009. An analysis of food demand in China: A case study of urban households in Jiangsu Province. *Review of Agricultural Economics*, **31**(4), 873–893.

Zhou, D., Yu, X., & Herzfeld, T. 2014. *Transformation of Global Agri-Food Systems: Trends, Driving Forces, and Implications for Developing Countries* (GlobalFood Discussion Papers No. 33). Retrieved from https://www.uni-goettingen.de/de/213486.html

Appendix

Table A1: Expenditure elasticity comparisons with other studies in China

	Expenditure Elasticities									
Commodity	Huang and Rozelle (1993,1994)	Gould (1995-1997)	Yen,Fang and Su (2000)	Dong and Gould (2001)	Gould and Villarreal (2001)	Gale and Huang (2002-2003)	Liao and Chern (2002-2003)	Zheng and Henneberry (2004)	Zhou, Yu and Herzfeld (1995-2010)	This Study (2004)
Grains	0.51	1.3	0.82	0.97	1.16	0.06	0.54	0.79	0.15	0.41
Oils and Fats			0.98	1.22	1.34	0.23	0.78	0.72	0.59	0.51
Meats	0.85						1.34	1.04	0.55	1.33
Pork		1.16	0.94	1.28	1.2	0.24				1.2
Dairy/egg		1.36								
Dairy			1.19	1.19	1	0.7		1.37	1.69	1.02
Egg			1.04					0.82	-0.11	0.67
Vegetables	1.4	1.03	0.83	0.95	0.95		0.74	0.81	0.74	0.49
Fruit	2.32	1.07	0.6	0.72	0.85	0.35	1.07	0.98	1.14	1.18

Note: the years in parentheses are the years of data using.

Table A2: Own-price elasticity comparisons with other studies in China

Commodity	Own-Price Elasticities								
	Huang and Rozelle (1993,1994)	Gould (1995-1997)	Yen,Fang and Su (2000)	Dong and Gould (2001)	Gould and Villarreal (2001)	Liao and Chern (2002-2003)	Zheng and Henneberry (2004)	Zhou, Yu and Herzfeld (1995-2010)	This Study (2004)
Grains	-0.57	-0.91	-0.9	-0.63	-0.64	-0.73	-1.22	-0.62	-0.66
Oils and Fats			-0.55	-0.71	-0.75	-1.08	-1.31	-0.35	-0.22
Meats	-0.74						-0.85	-0.62	-1.15
Pork		-1.44	-0.21	-0.58	-0.66	-0.82			-0.38
Dairy/egg		-1.15							
Dairy			-1.4	-0.41	-0.39		-1.21	-0.45	-0.89
Egg			-0.7				-0.85	-0.53	-0.45
Vegetables	-0.82	-1.38	-0.72	-0.68	-0.66	-0.62	-0.5	-0.77	-0.29
Fruit	-0.54	-1.21	-0.76	-0.7	-0.71	-0.69	-0.86	-0.84	-0.16

Note: the years in parentheses are the years of data using.