Exploring Economics of Nutrition

Dr. Kamiljon T. Akramov
IFPRI, Washington, DC, USA

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Outline

- Background
  - Malnutrition: definitions and measurement
  - Prevalence and trends
- Introduction to the Economics of Nutrition
  - Why economics?
  - Intuition of a basic model of economics of malnutrition
- Research findings
  - Economic causes of malnutrition
  - Economic consequences of malnutrition
- Some examples of current research

Definition and types of malnutrition

- Malnutrition refers to deficiencies, excesses or imbalances in intake of calories and/or nutrients

- Two types of malnutrition
  - **Undernutrition:** stunting (low height for age), wasting (low weight for for height), underweight (low weight for age), low birth weight, micronutrient deficiencies (lack of important minerals and vitamins)
  - **Overnutrition:** overweight, obesity, and diet related noncommunicable disease

Measures of malnutrition

- Anthropometric measurements
  - Child anthropometric measures
    - Age, gender, weight, height, and length
    - Gender-specific WHO-guided international reference population
  - Body Mass Index (BMI): calculated by dividing person's weight in kilograms by their height in meters squared
    - BMI<18.5 – undernourished
    - BMI>25 – overweight
    - BMI>30 – obesity for adults
    - BMI>=historic 95th percentile
- Biochemical indicators
  - Medical tests of bodily samples (blood or urine) – iron deficiency, zinc deficiency, etc.
- Clinical signs of malnutrition

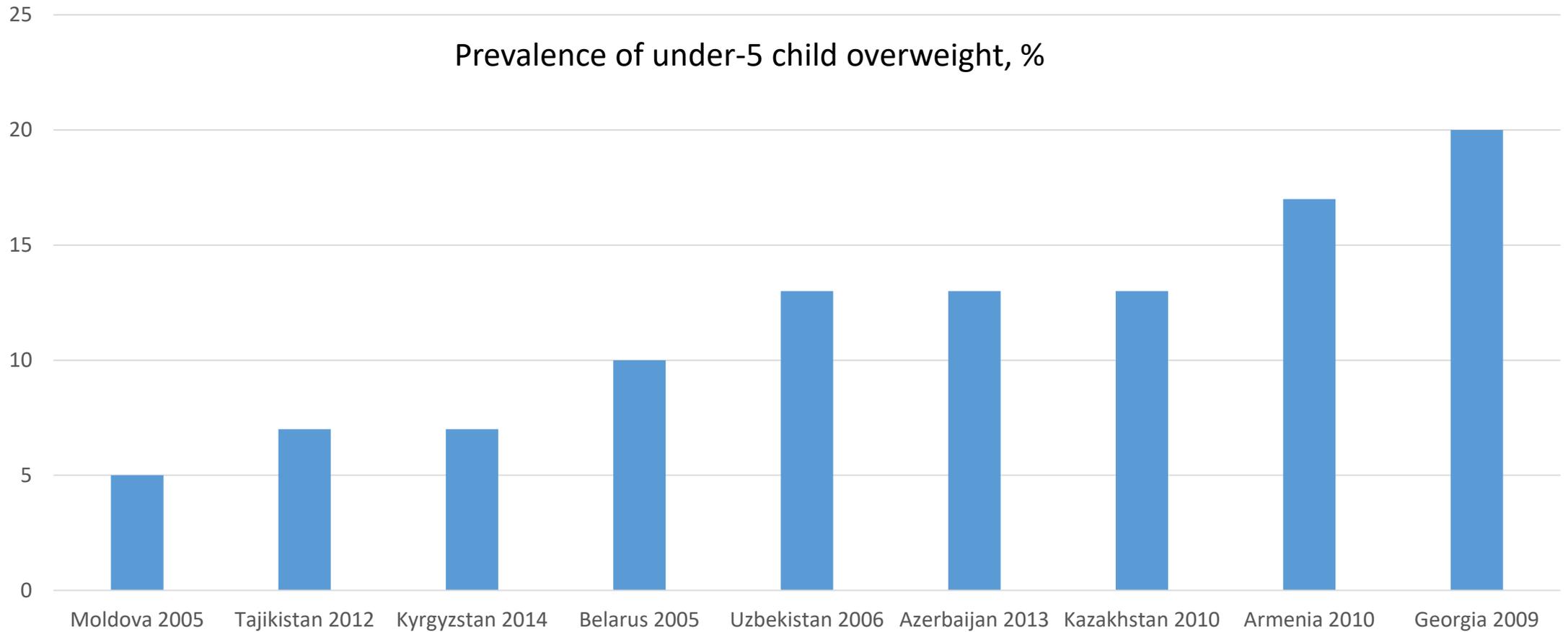# Stunting in selected countries

Prevalence of under-5 child stunting, %
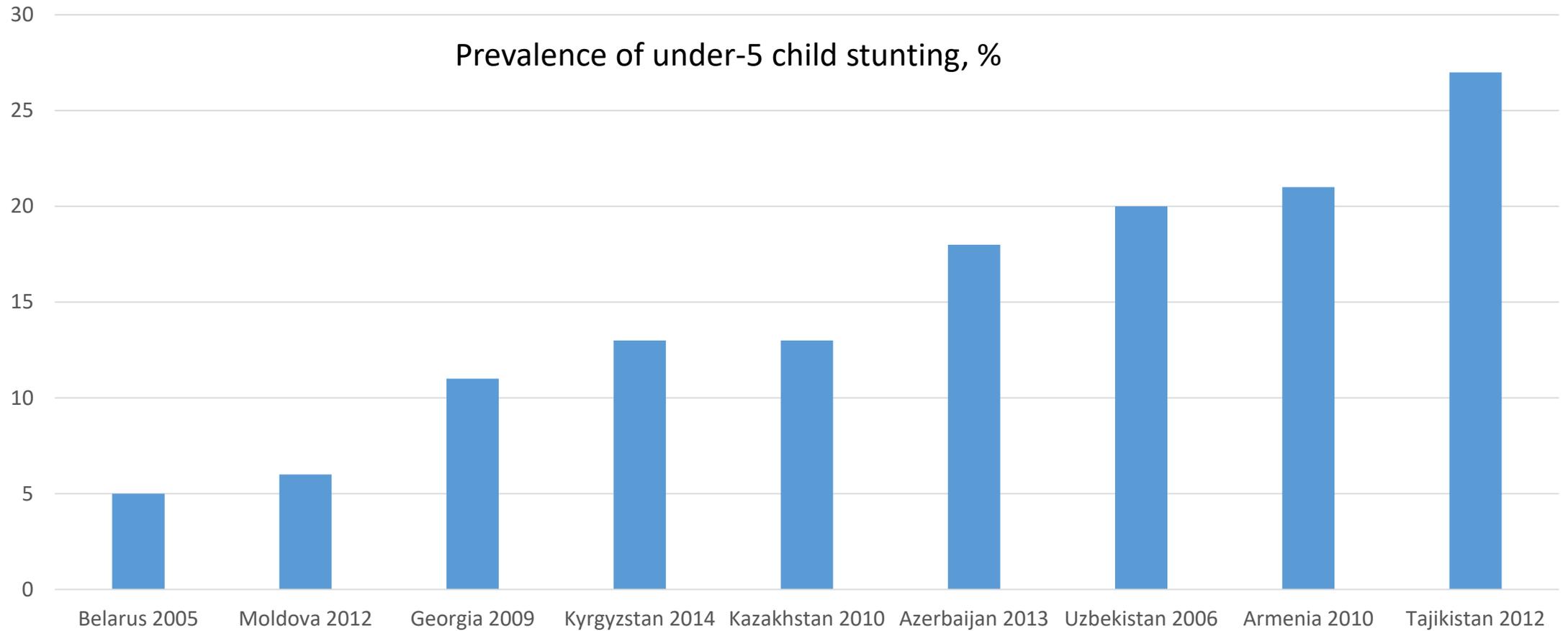
Source: WHO

Wasting in selected countries

Prevalence of under-5 child wasting, %
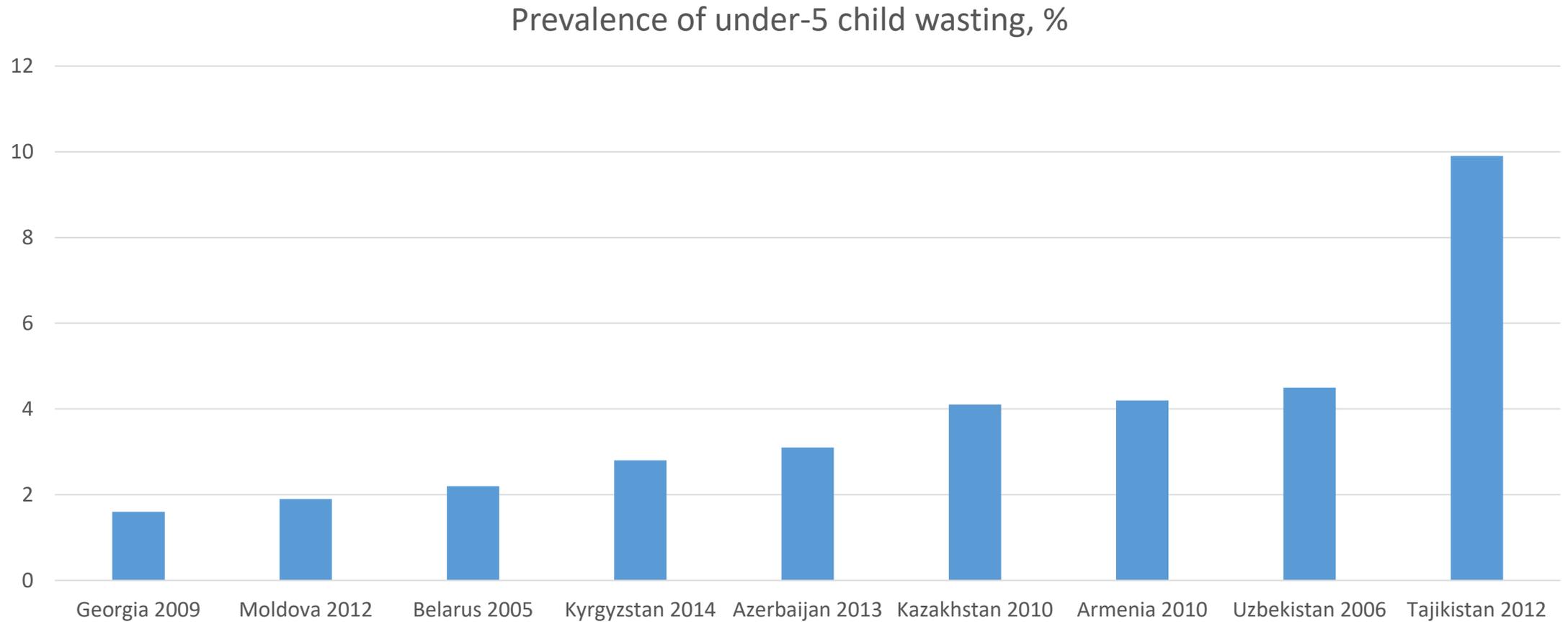
Source: WHO

Adult overweight in selected countries

Adult overweight and obesity, %
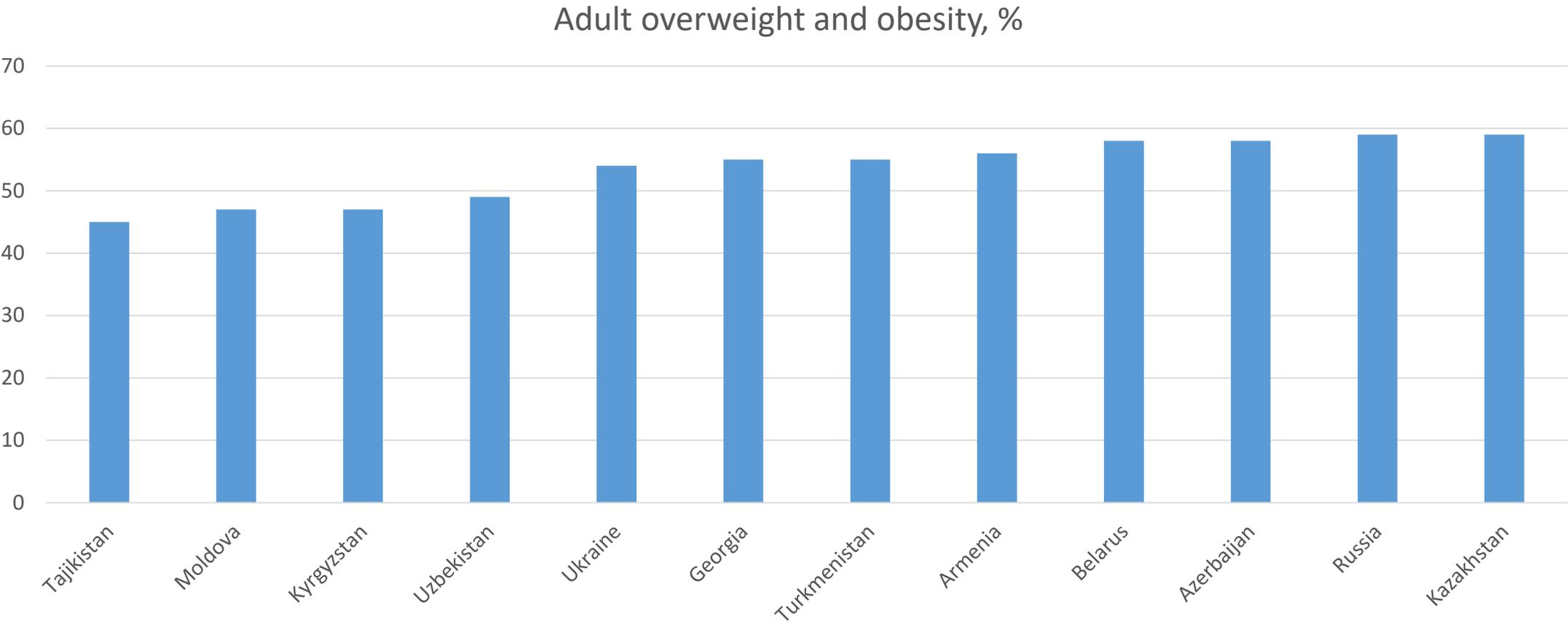
Why Economics?

- During last couple of decades it has been applied to the study of malnutrition
  - Sizeable literature on advanced and developing countries
  - Very limited evidence on Central Asian countries
  - Still lot of applications to be made
- Economics is a social science – a study of human decision-making
- It doesn't explain everything but provides very valuable perspective
- Merging nutrition and economics disciplines to assess the linkages between socioeconomic factors, public expenditures, health, and nutrition outcomes

Usefulness of Economics in Studying Nutrition

- Offers widely-accepted theoretical framework to understand human behavior
  - Asks different questions and generates different predictions
  - Focus on different causes: prices, income, shocks, and tradeoffs
- Provides clearly-defined rationales for government intervention
- Offers useful methods for estimating causal effects , not just correlations
  - Determining causes and consequences of malnutrition
  - Determining how well interventions and policies work
  - Measures causal effects using randomized experiments, natural experiments, and nonexperimental identification strategies

Intuition behind Basic Economic Model of Obesity (Cawley 2004 and 2011)

- Individuals choose their diets (quantity, quality) and physical activity in order to maximize their utility (happiness)
  - Body weight a function of historic calorie surpluses, i.e., it is a result of these decisions

- Money and time are limited, so in order to maximize their utility people consider costs and benefits, and the relevant tradeoffs

Implications of Economic Model

- Individuals may accept higher body weight in exchange for other things they value
  - Fact that person is clinically obese is not proof they are irrational

- To understand malnutrition, we need to understand why some people find it optimal to engage in health behaviors that lead to obesity
  - Low income?
  - High prices of healthy food items?
  - High time cost to acquire fresh fruits and vegetables?
  - High opportunity costs of time (children, paid work)?

Implications of Economic Model

- When costs and benefits change, people will alter their choices
  - Suggests explanations for recent rise of obesity
    - Falling real prices of energy-dense food items
    - Increased entertainment options
    - More sedentary employment options

- Telling people they "should" behave differently will have no effect
  - If you want to change people's behavior, you need to make it in *their interest to change* – alter the tradeoffs that they face, incentivize behavior change

Possible economic causes of malnutrition

- Prices of food
  - Real prices of coke and fast food pizza fell 34.9% and 18% during 1990-2007, respectively (Christian and Rashad 2009)
  - At the same time, cost of fresh fruits and vegetables rose faster than inflation
  - RCT of 10% price increase of non-nutritious relative to nutritious food: no significant change in grocery purchases (Just et al. 2015)
  - Natural experiment of changes in minimum wages: no evidence fast food prices affect consumption of fast food (Cotti and Tefft 2013)
  - Food prices went up significantly during 2007-2008 food crises, which led to significant changes in composition of household expenditures

Food and financial crises strongly impacted households

- Share of Tajikistan's export earnings used to finance its food imports went up from 20% to 40%

- Transmission of global food prices into domestic prices significantly accelerated: 1% increase in global wheat prices causes more than 1.1% increase in domestic wheat prices

- Crisis had strong negative impact on poverty and household welfare

  - Extreme (food) poverty rate, especially in southern and mountain regions, increased

  - Most households were affected by the crisis due to reduced remittances and job loss

  - Most affected households reduced their staple food consumption and health expenditures

Household responses to food and financial crises

■ Tajikistan ■ Central Asia, excluding Tajikistan ■ Transition countries
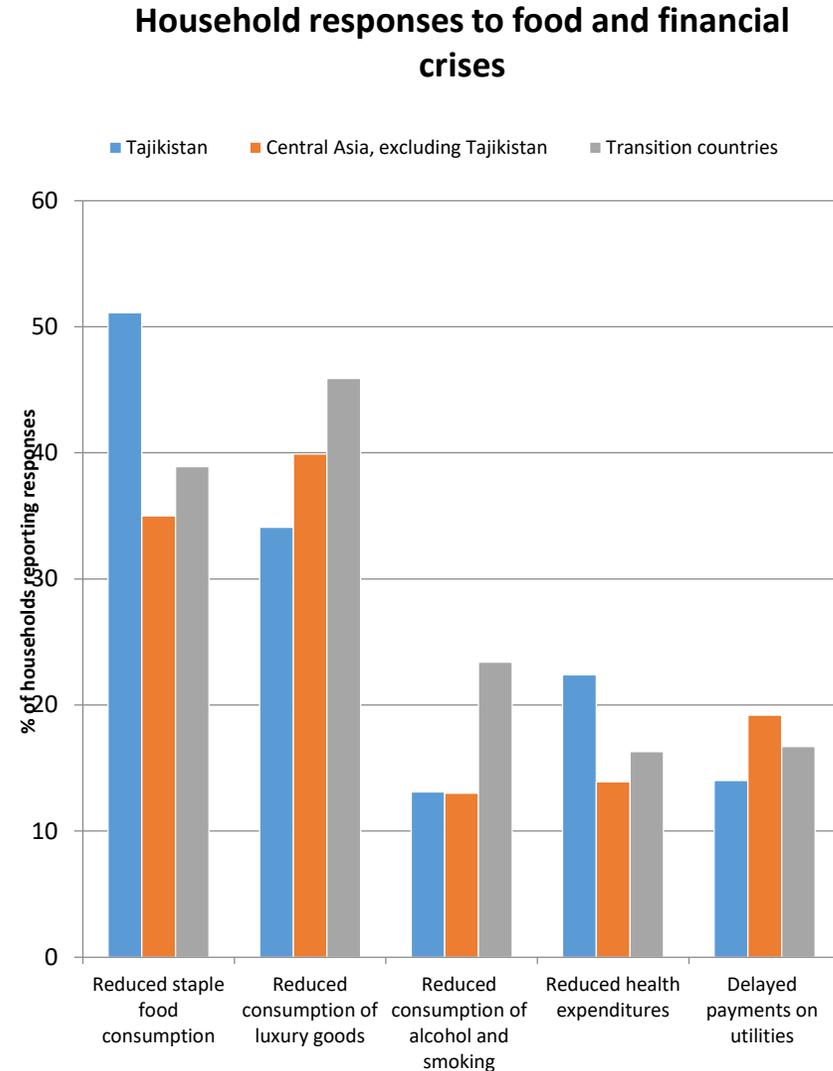
Source: Akramov and Shreedhar (2012) using data from EBRD (2011) Life in Transition Survey. Note: Central Asia includes Kazakhstan, Kyrgyzstan and Uzbekistan

Possible causes of malnutrition

- Low income
- Low education
- Peer/neighborhood effects
- Low dietary diversity

Consequences of malnutrition

- 45% of all child deaths from poor nutrition (GNR 2014)
- Noncommunicable diseases
  - Obesity responsible for (Eckel 2003; Calle and Kaaks 2004)
    - 61% of diabetes
    - 17.3% of CVD
    - 24% of all osteoarthrosis
    - 42.5% of kidney cancer …
- Negative impact on earning potential due to deficiencies in physical and cognitive development
- 10% of median income lost to obesity in US
- Lower wages due to obesity: 10% increase in BMI lowers wages of females and males 1.9% and 3.3%, respectively (Brunello and d'Hombres 2007)
- Effects on intergenerational equity

Some examples of research on Central Asia

Empirical research on nutrition

- Quality research can
  - Quantify and assess the state of malnutrition in a population
  - Provide evidence-based information to identify priority areas for intervention
  - Shed insight on innovative strategies to improve community nutrition
  - Evaluate interventions and determine the best strategies to combat undernutrition in a particular region
  - Track progress towards reaching nutrition goals, such as targets of the Sustainable Development Goal
- Areas and types of research
  - Social, political, economic, behavioral aspects of nutrition, and food security
  - Qualitative and quantitative approaches

Agricultural Diversity, Dietary Diversity, and Nutritional Outcomes: Empirical Evidence from Tajikistan

Kamiljon Akramov (IFPRI)

Mehrab Malek (Georgetown University)

Motivation

- Despite recent improvements, Central Asian countries continue to experience overlapping burdens of malnutrition
- Tajikistan (stunting, underweight & WRA); Kazakhstan, Kyrgyzstan, and Uzbekistan (overweight, underweight & WRA)
- Stunting among children under 5 remains relatively high, varying between 13% in Kazakhstan to 27% in Tajikistan (WHO/UNICEF/World Bank 2015)
- Significant share of calorie intake comes from cereals (wheat)
- Agricultural production systems, especially in Tajikistan and Uzbekistan, are dominated by wheat and cotton

Motivation (continued)

- The current strategies of national governments and development partners include promotion of agricultural diversification to ensure food and nutrition security

- These interventions could be very beneficial given the fact that Central Asian countries have less diversified agricultural production systems

- However, there is little evidence regarding the linkages between agricultural diversity, dietary diversity and nutritional outcomes in Central Asian context

Objective and research questions

- The study aims to fill this gap by examining the relationship between agricultural diversity, dietary diversity and nutritional outcomes in Tajikistan

- Three interrelated research questions

  - How is agricultural diversity linked with household dietary diversity?

  - Does dominance of cotton and wheat in agricultural production systems affect household dietary diversity?

  - How is household dietary diversity linked with child nutritional outcomes?

Related literature: Dietary diversity

- Dietary diversity (DD) is measured as a count of different food groups consumed over a specified reference period

- DD is widely recognized as an important indicator of nutritional outcome (WHO/FAO 2003; Arimond and Ruel 2004; etc.)

- Household DD is strongly correlated with per capita calorie consumption, dietary energy adequacy and nutrition indicators such as anthropometrics (Ruel 2003; Ruel et al. 2013)

- Dietary diversity is a strong predictor of dietary quality in terms of (micro)nutrient intake and adequacy (Ruel et al. 2013)

- Households will only diversify their diets into higher-value micronutrient-rich foods when they have satisfied their basic calorie needs

Related literature: Agricultural diversity

- There is broad literature which claims the importance of agricultural diversity for nutritional outcomes (Allen et al. 2014; Fanzo et al. 2013; Haywood 2012; etc.)

- Agricultural diversification plays an important role in sustaining agriculture and agriculture-based livelihoods (Jayne et al. 2010; Bigsten and Tengstam 2011)

- Diversification may help to reduce farmers production and market risks and improve household welfare (Fafchamps 1992; DiFalco and Chavas 2009)

- Farmers diversifying toward high-value crops are less likely to be poor (Birthal, Roy and Negi 2015)

- Positive effect of diversification into vegetables for poverty reduction is more pronounced (Wienberger and Lumpkin 2007)

Theoretical considerations

- In case od subsistence agriculture, agricultural diversity of farm household will have direct impact on dietary diversity

- If there is a market, link between agricultural diversity and dietary diversity is not trivial
  - Farm households may aim to maximize their income by allocating land for different crops
  - Tradeoff between specialization and diversification
  - The choice made by farmers ultimately depend on subjective assessment of risk-return tradeoffs

Theoretical considerations (continued)

- Farmers crop choice decisions also depend on
  - Availability of various inputs (seeds, seedlings, fertilizer, chemicals, etc.)
  - Existing institutional arrangements for linking farmers with markets
  - Transaction (transportation) costs for market access

- In some cases, government policies may restrict the choices made by farmers

- If integration across sub-regional markets is weak and transportation costs are high, the diversity of agricultural production systems of individual regions may become an important determinant of household dietary diversity

Empirical methodology

- Two interrelated equations: dietary diversity and nutritional outcomes

- Dietary diversity equation
    - <u>Dependent variables:</u> HH dietary diversity score, with maximum of 12 food groups (count) and its modifications
    - <u>Key independent variables:</u> agricultural diversity scores at HH and district levels; share of cotton and wheat in total land area at district level
    - <u>Control variables:</u> Household and community characteristics, market access, region and village fixed effects

Empirical methodology (Continued)

- Nutritional outcome equation
  - <u>Dependent variables:</u> Height-for-age z-scores and binary variable for child stunting
  - <u>Key independent variables:</u> Household dietary diversity score
  - <u>Control variables:</u> Child and maternal characteristics, household and community characteristics, region and village fixed effects
  - Impact of dietary diversity on stunting depends on child's age

Empirical methodology (Continued)

- Estimation methods
  - OLS, multilevel mixed effects and nearest neighbor matching methods
- Data sources
  - Tajikistan Living Standards Survey (TLSS) 2007
    - Agricultural households – 3062
    - Households with children under 5 - 2310
  - District level population and land allocation data (Regions of Tajikistan database, National Agency on Statistics, 2011)

Measuring agricultural and dietary diversity

- Dietary diversity
  - Count based household DD score with 12 food groups was developed using FAO's (2011) guidelines
  - Calorie intake and food expenditure based indexes capture richness and evenness
  - Calorie intake and food expenditure based log-abundance indexes captures richness and abundance

- Agricultural diversity
  - Count based household level agricultural diversity score
  - Land allocation based and population-weighted agricultural diversity scores were calculated at the district level
  - Share of cotton and wheat in total sown are at the district level

Summary of key findings

- Key empirical results suggest that
  - Agricultural diversity is positively associated with dietary diversity
  - Dietary diversity is in turn correlated with child nutritional outcomes and this relationship depends on child's age
- Findings also suggest that there is a strong negative association between household dietary diversity and share of land allocated to cotton and wheat at district level
- Households in communities located further away from urban centers tend to have lower dietary diversity