



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# **Meat Demand Analysis in Urban China: To Include or Not to Include Meat Away from Home?**

**Junfei Bai** (Center for Chinese Agricultural Policy, CAS)  
**Thomas Wahl** (Dept. of Agribusiness & Applied Econ, NDSU)  
**James Seale Jr.** (Food & Resource Economics, UF)  
**Bryan Lohmar** (U.S. Grains Council China)

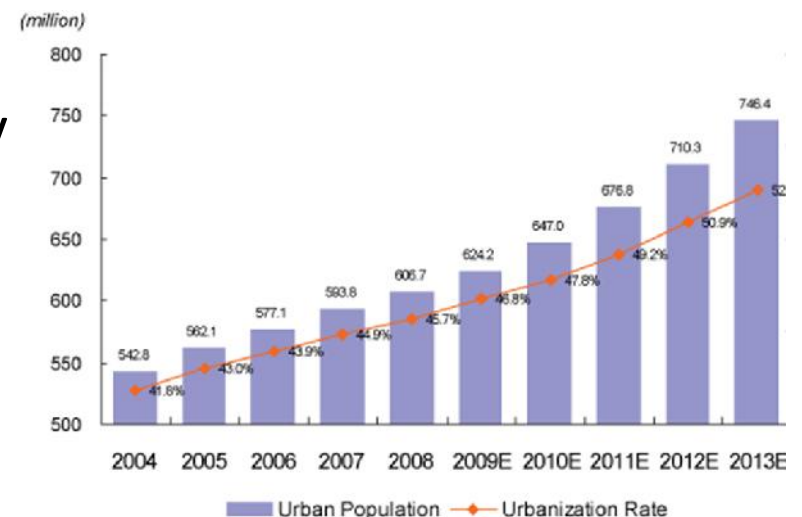
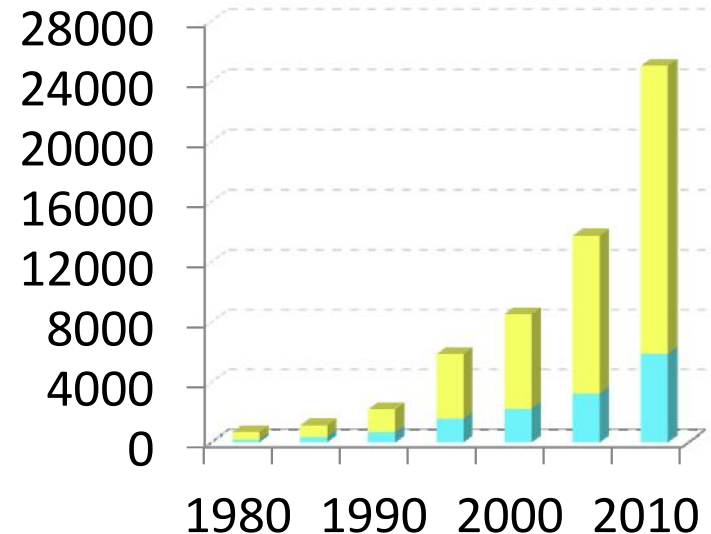
Presented at 2012 IATRC Conference, San Diego, CA  
December 10, 2012

# Content

- Background and motivation
- Survey and data
- Methodology
- Empirical results discussion
- Conclusions

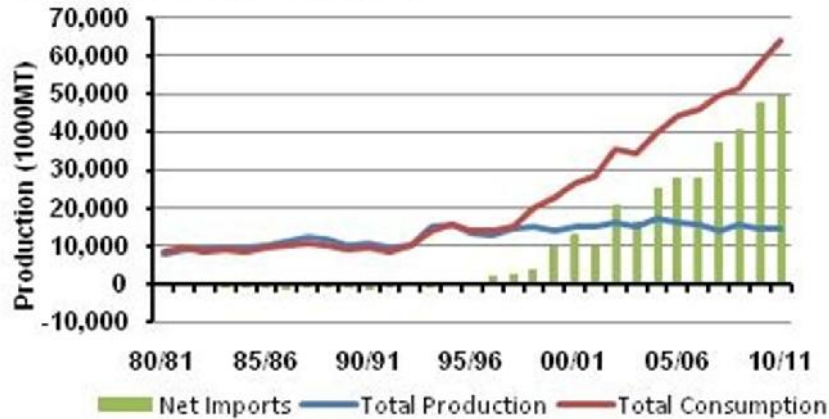
# Background & Motivation

- Economic growth over the last three decades;
- Urbanization (50% of population live in urban);
- Chinese diet is shifting rapidly from the one centered on staple foods to the one incorporated with more animal products, which raises concerns:
  - China's ability to feed animals, or rely on the world market for feed purchases?
  - Self-sufficient rate of meat?



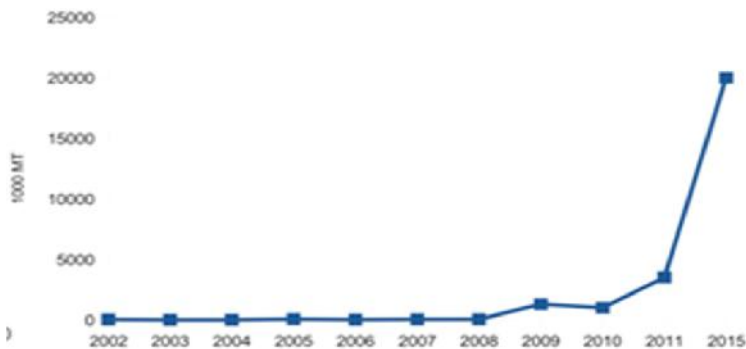
# Background & Motivation

China Soybean Supply Demand



Source: USDA Foreign Agricultural Service

China's maize imports



Sources: USDA, gov.cn, Olam

- China has been importing soybean for many years, most of soy meal used for livestock feed;
- China has started importing maize from world market since 2009, and maize imports have increased rapidly since then.

# Background & Motivation

- Meat demand?
  - Zhong *et al.* (1997): “be careful of NBS meat data”
  - Ma *et al.* (2006): “Discrepancy between production and consumption reported by NBS—pork supply is likely 45% higher than demand”
- Most of related researches are based on the NBS-UHIE survey data in which meat consumed away from home is very likely underestimated (Fan *et al.*, 1995; Gao *et al.* 1997; Huang *et al.* 1999; Dong *et al.* 2010).

# Objectives

- To empirically answer how much meat is consumed away from home (MAFH);
- To re-estimate expenditure and price elasticities by incorporating MAFH into a demand system ;
- To test effects of demographic and socioeconomic factors on meat demand

# Data

- Overview of the survey—subset of NBS-UHIE households by stratified and random sampling in six cities:

---

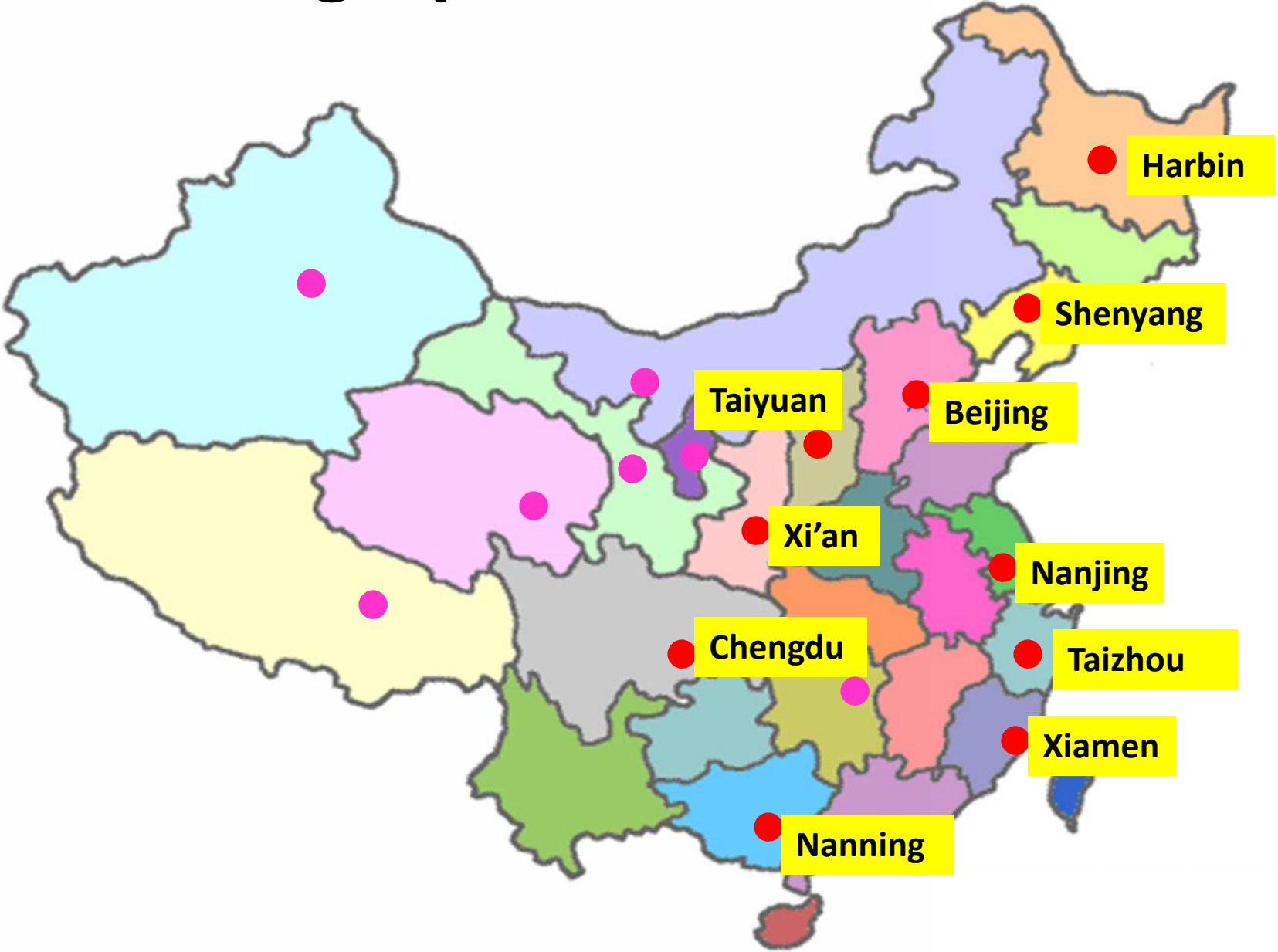
City	Year	Sample Size	City	Year	Sample Size
Beijing	2007	315/1,000HH	Harbin	2012	200HH
Nanjing	2009	246/700HH	Taiyuan	2012	200HH
Chengdu	2010	208/700HH	Nanning	2012	200HH
Xi'an	2011	215/600HH	Taizhou	2012	180HH
Shenyang	2011	149/300HH	Lanzhou	2012	200HH
Xiamen	2011	207/600HH			

---

- Method: 3-meal/7-day diary record



# Geographic Distribution



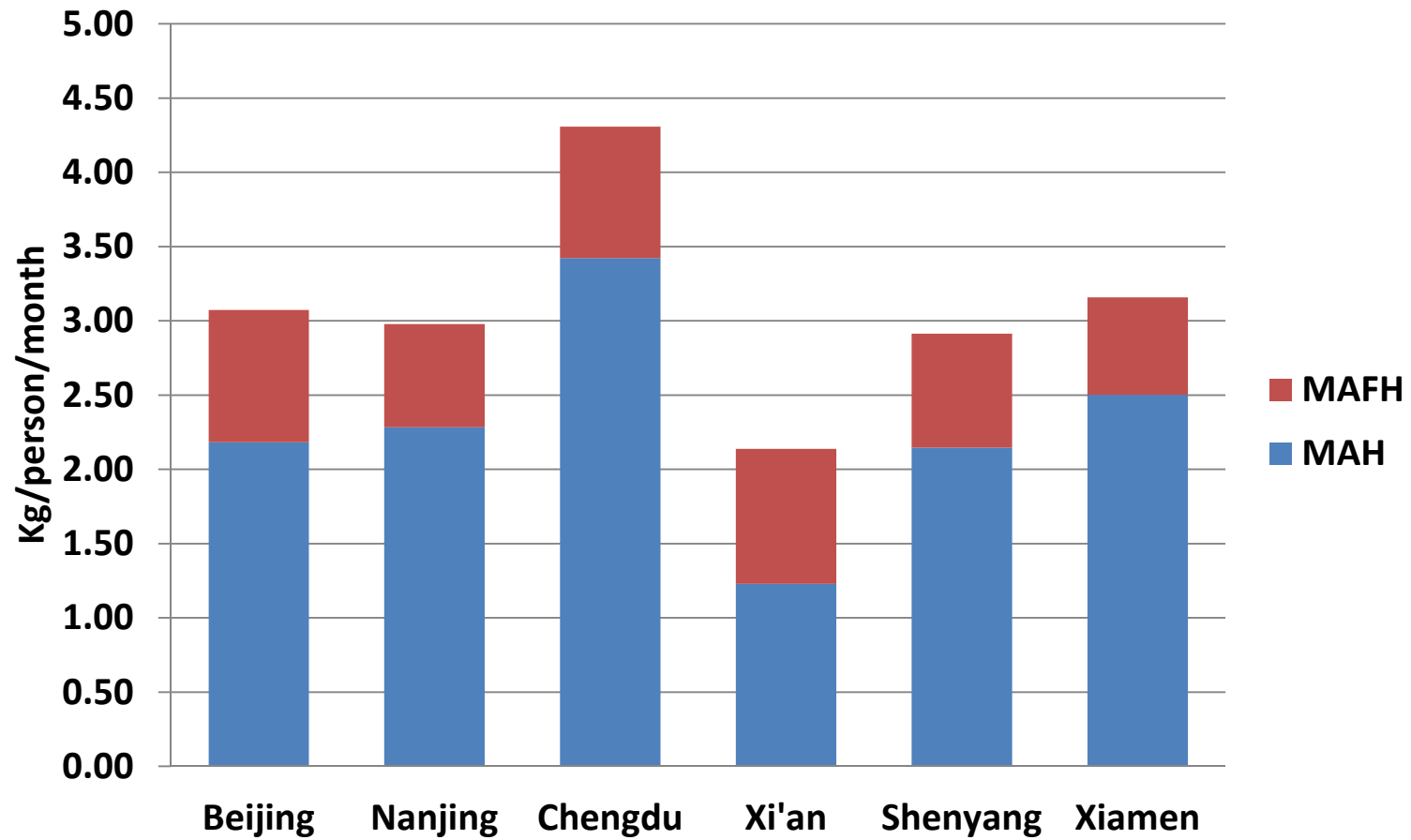
# Mapping Dishes Into 79 Commodities



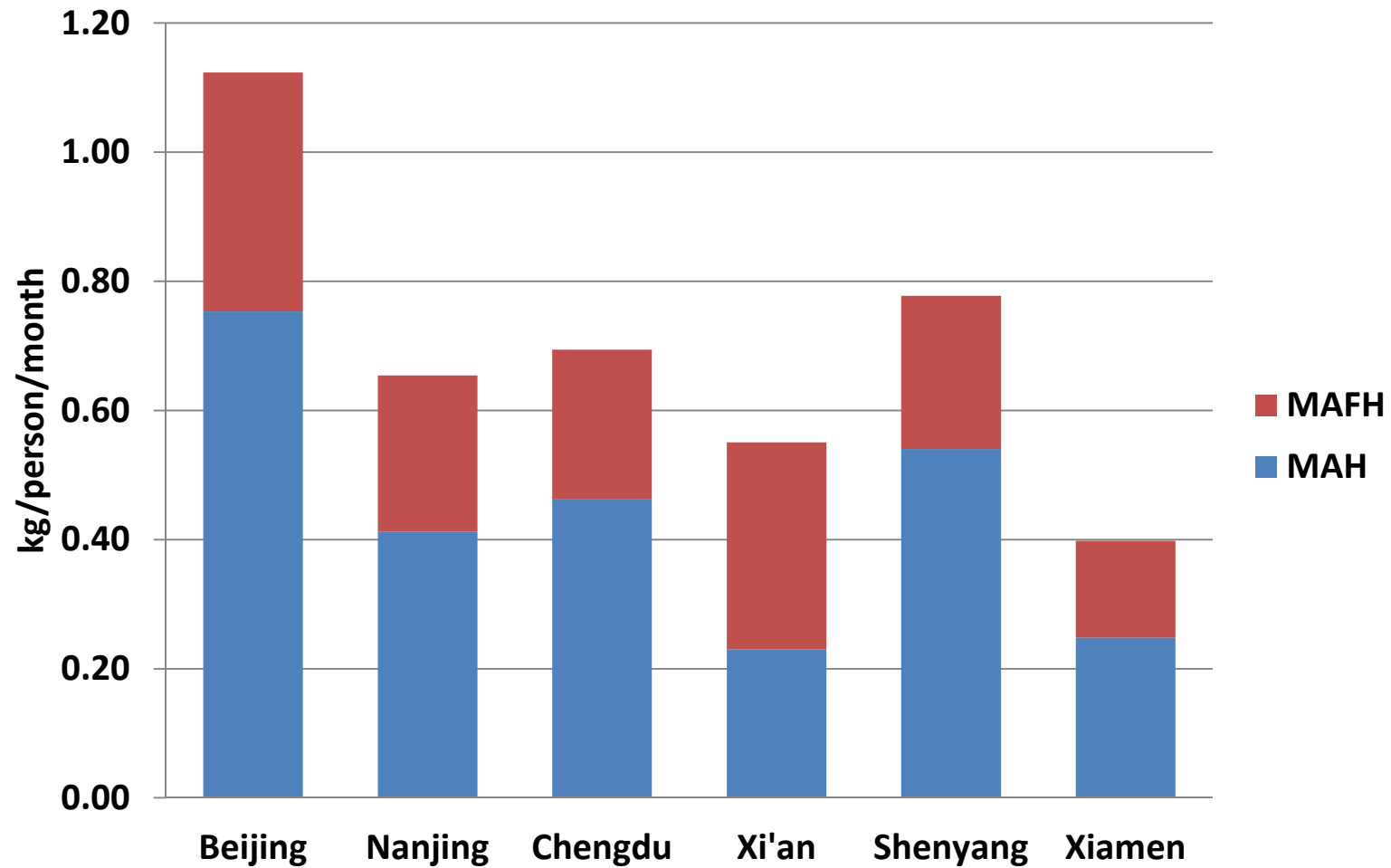
**Recipe Matrix**  
(1) 32 different cook books, about 9000+ recipes  
(2) 50 chef surveys for unknown recipes & parameter estimation to adjust weight by type of food facility



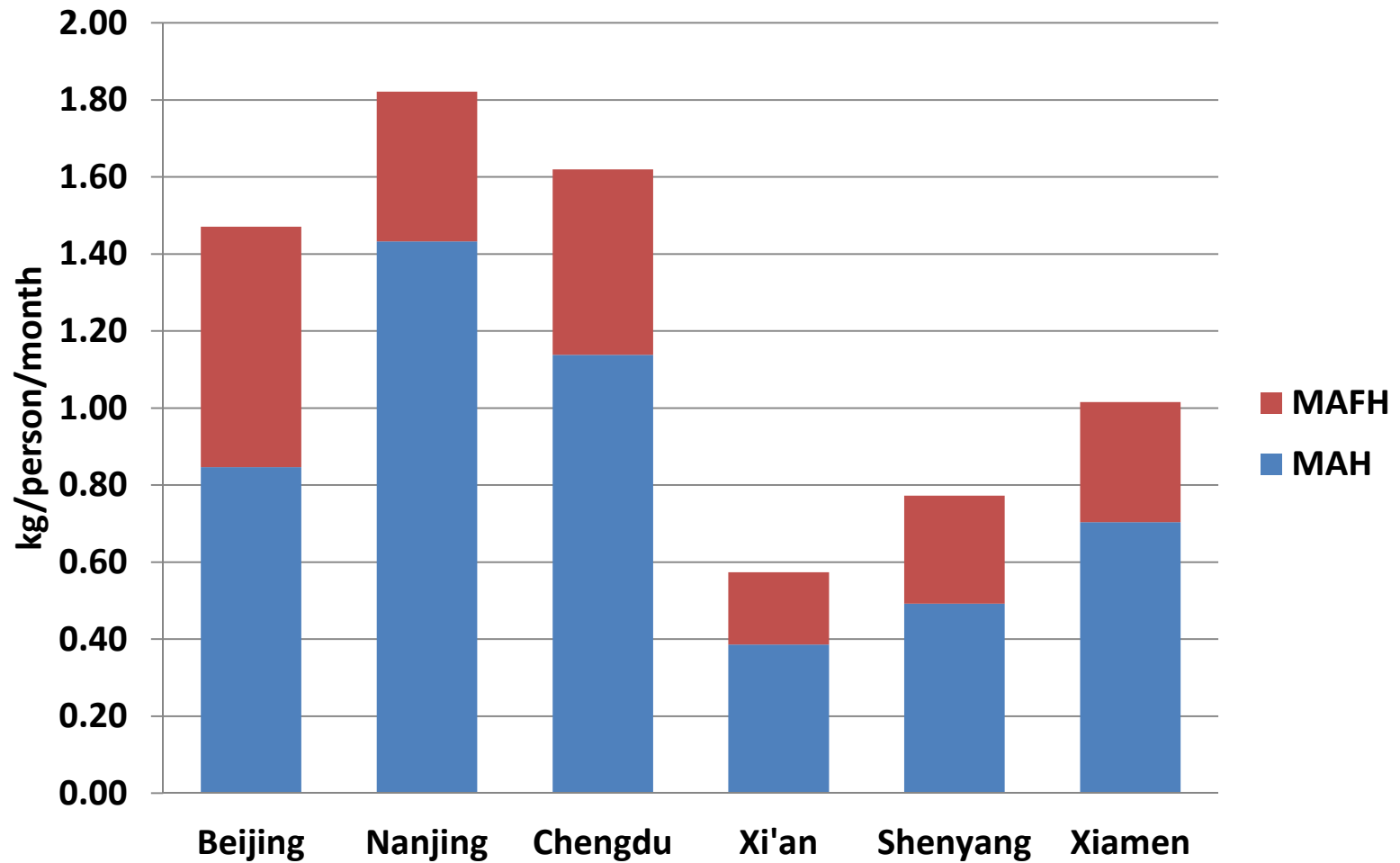
# Role of MAFH-Pork



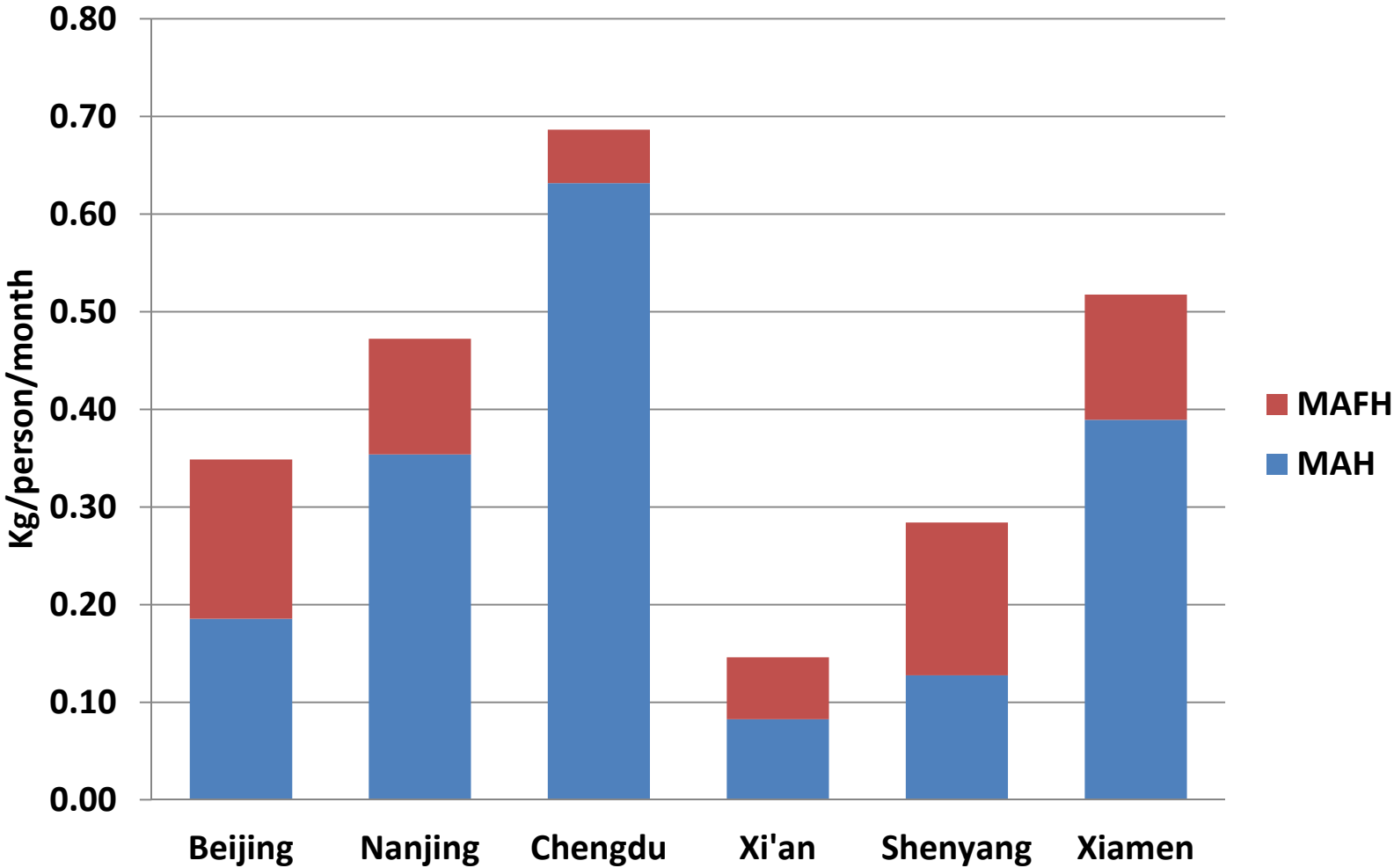
# Role of MAFH-Beef & Mutton



# Role of MAFH-Poultry

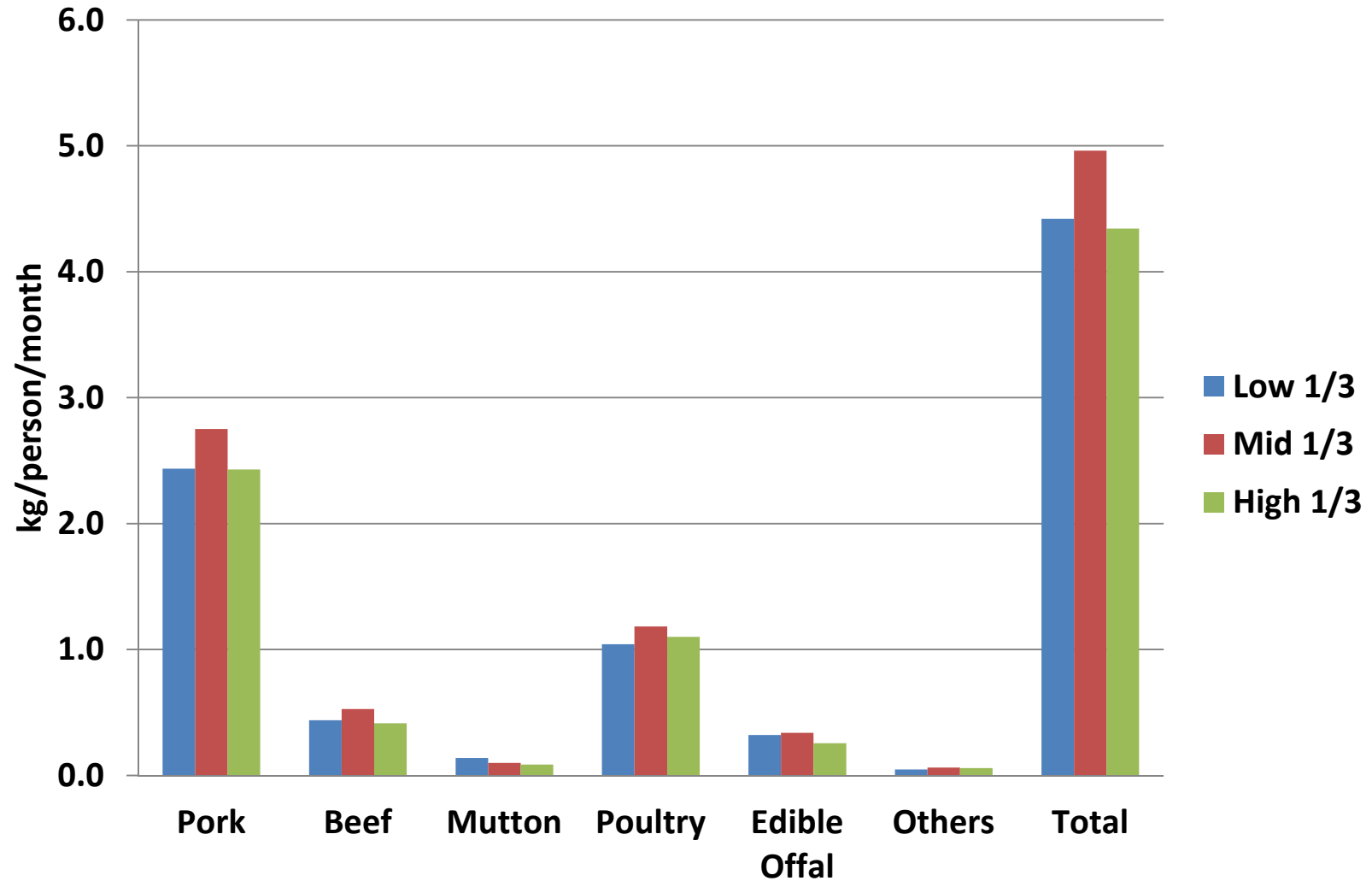


# Role of MAFH-Other Meats



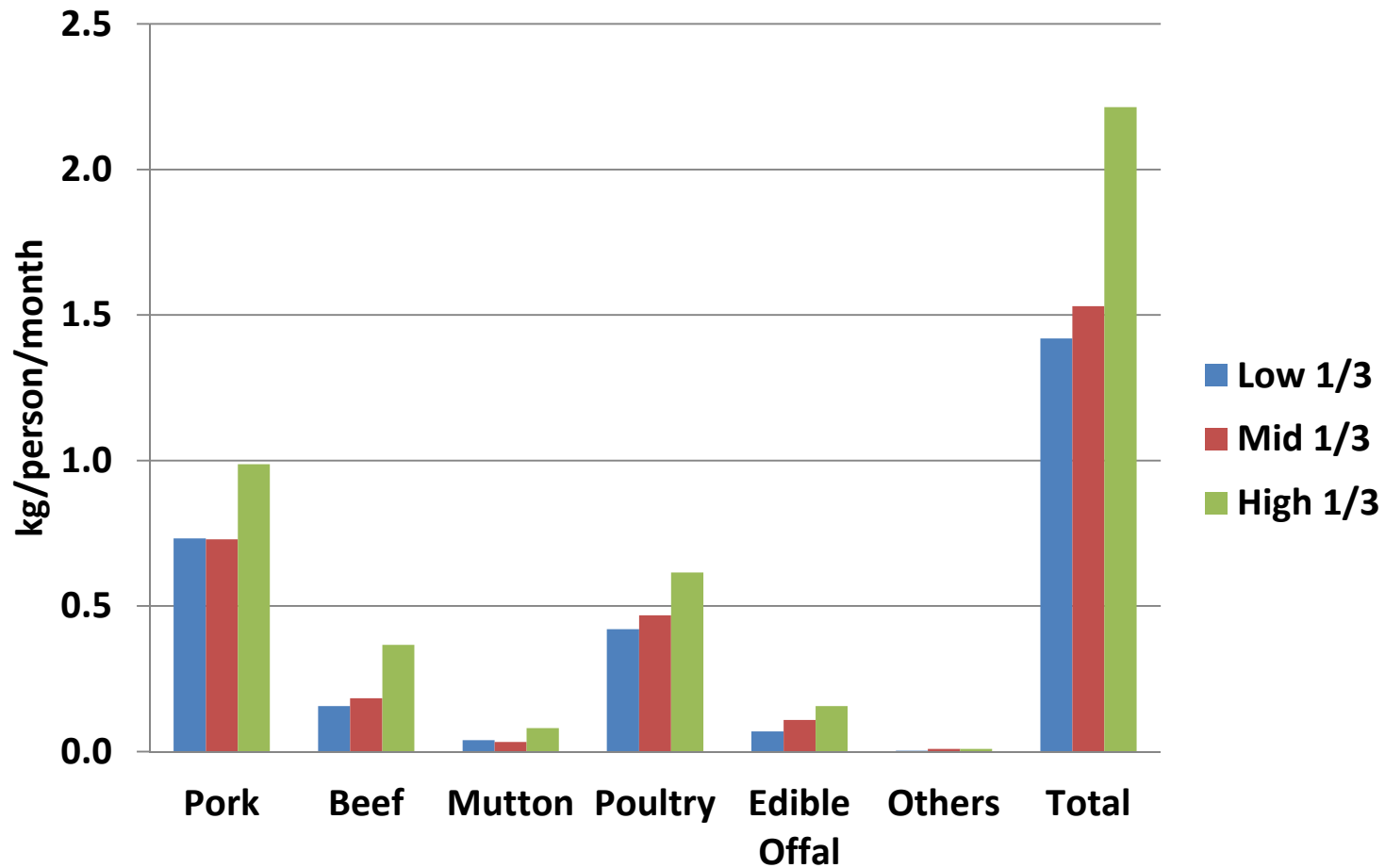
# Income Effect:

## Inverted-U shape for MAH



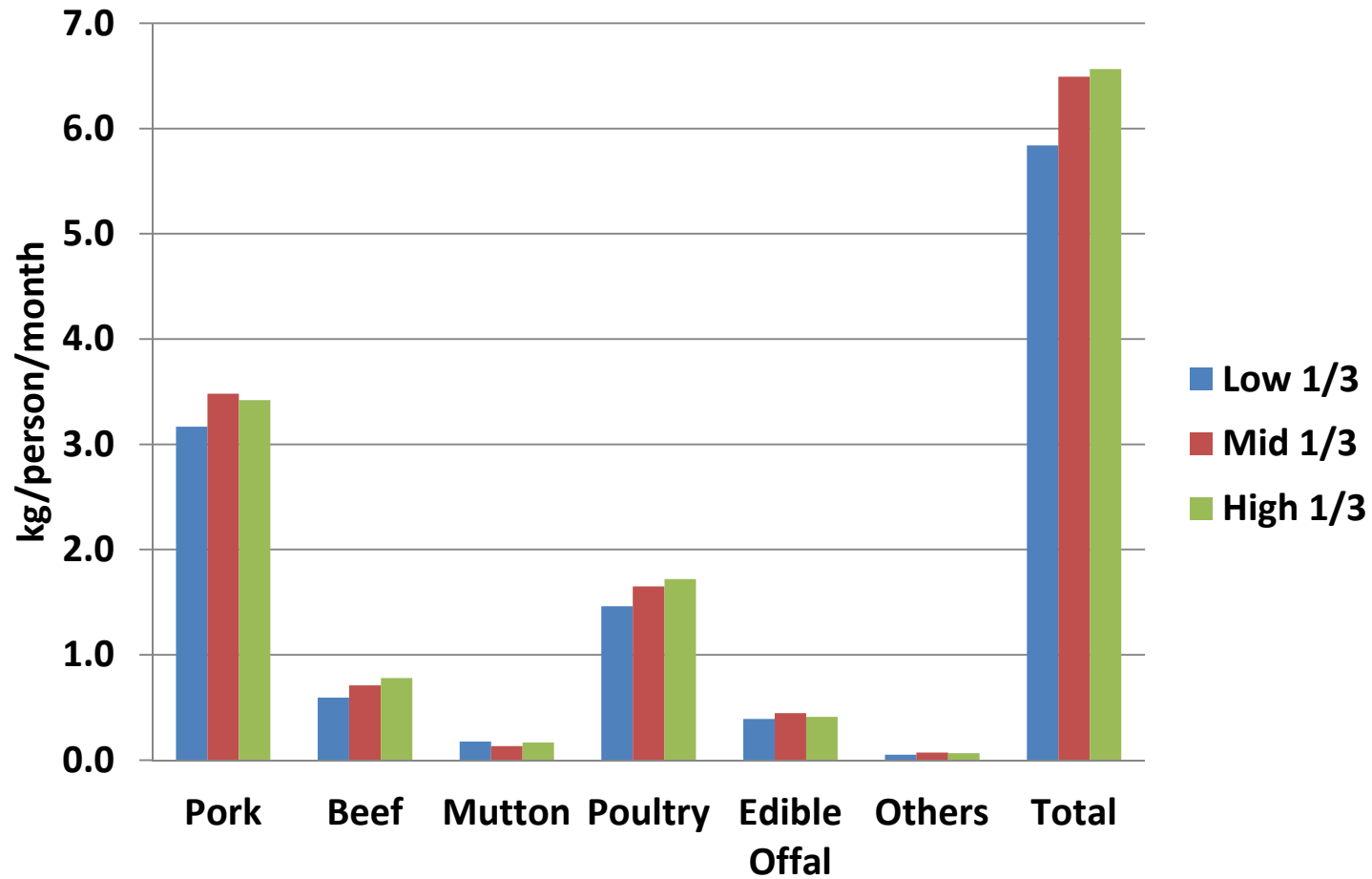
# Income Effect:

**Monotonously increasing for MAFH**





# Income Effect: **Increasing** for MAH & MAFH



# Methodology

Quadratic Almost Ideal Demand System (QUAIDS)  
(Deaton and Muellbauer 1980; Banks *et al.* 1997):

$$w_i = \alpha_i + \beta_i \ln\left(\frac{M}{P}\right) + \frac{\gamma_i}{b} \left[ \ln\left(\frac{M}{P}\right) \right]^2 + \sum_{j=1}^n x_{ij} \ln p_j + v_i$$

$$b = \prod_{i=1}^n p_i^{\alpha_i}$$

$$\ln P = r_0 + \sum_{j=1}^n \alpha_j \ln p_j + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n \ln p_i \ln p_j$$

$$\sum_{i=1}^n \alpha_i = 1, \quad \sum_{i=1}^n \beta_i = 0, \quad \sum_{i=1}^n \gamma_i = 0, \quad \text{and} \quad \sum_{i=1}^n x_{ij} = 0$$

$$\sum_{j=1}^n x_{ij} = 0 \quad x_{ij} = x_{ji} \quad \forall i, j$$

# Methodology

- Two-step estimator for censored demand system (Shonkwiler and Yen, 1999)

$$w_{it}^* = f(\mathbf{x}_{it}, \beta_i) + v_{it}, \quad d_{it}^* = \mathbf{z}_{it}' \gamma_i + \hat{\epsilon}_{it}$$

$$d_{it} = \begin{cases} 1 & \text{if } d_{it}^* > 0 \\ 0 & \text{if } d_{it}^* \leq 0 \end{cases} \quad w_{it} = d_{it} w_{it}^*$$

$$(i = 1, \dots, n, t = 1, \dots, T)$$

$$E(w_{it} | \mathbf{x}_{it}, \mathbf{z}_{it}) = \Phi(\mathbf{z}_{it}' \gamma_i) f(\mathbf{x}_{it}, \beta_i) + \lambda_i \{ \mathbf{z}_{it}' \gamma_i \}$$

$$w_{it} = \Phi(\mathbf{z}_{it}' \gamma_i) f(\mathbf{x}_{it}, \beta_i) + \lambda_i \{ \mathbf{z}_{it}' \gamma_i \} + g_{it}$$

# Estimated Exp. & Own-price Elasticities

	8-equation system		4-equation system	
	Expenditure	Unconditional Marshallian	Expenditure	Unconditional Marshallian
<i>FAH</i>				
Pork	0.676 *** (0.02)	-0.814 *** (0.02)	0.871 *** (0.01)	-0.856 *** (0.02)
Beef & Mutton	0.936 *** (0.06)	-1.266 *** (0.13)	1.408 *** (0.04)	-1.553 *** (0.11)
Poultry	1.239 *** (0.06)	-0.453 *** (0.07)	1.280 *** (0.04)	-0.634 *** (0.07)
Other meat	0.784 *** (0.12)	-0.623 *** (0.19)	1.030 *** (0.06)	-1.639 *** (0.23)
<i>FAFH</i>				
Pork	1.129 *** (0.03)	-0.998 *** (0.06)		
Beef & Mutton	1.624 *** (0.06)	-1.310 *** (0.13)		
Poultry	1.601 *** (0.07)	-0.878 *** (0.12)		
Other meat	1.887 *** (0.16)	-1.014 *** (0.27)		

# Comparison of Expenditure Elasticities

---

	Exp. Elas. (4-eq.)	Weighted Exp. Elas. (8-eq.)
Pork	0.871	0.861
Beef & Mutton	1.408	1.330
Poultry	1.280	1.435
Other meat	1.030	1.367

---

# Own- & Cross-Price Elasticities

	Pork	Beef& Mutton	Poultry	Other meat	Pork	Beef& Mutton	Poultry	Other meat
Pork	<b>-0.553***</b>	1.510***	0.157	2.218***	0.677***	1.143***	1.308***	1.867***
Beef & Mutton	0.138***	<b>-1.185***</b>	0.045	-1.076***	0.117**	-0.022	0.021	-0.956***
Poultry	-0.026	0.406**	<b>-0.308***</b>	-0.070	0.123**	0.350**	0.255**	0.723*
Other meat	0.049**	-0.598***	-0.348***	<b>-0.590***</b>	0.016	-0.289**	-0.220**	-1.283***
Pork	0.092***	0.164*	-0.082	0.100	<b>-0.795***</b>	-0.191*	-0.470***	-0.609*
Beef & Mutton	0.094***	0.071	0.106*	-0.128	-0.025	<b>-1.178***</b>	-0.092	-0.046
Poultry	0.138***	0.244**	0.164**	0.315**	-0.063	0.109	<b>-0.752***</b>	0.303
Other meat	0.057***	-0.103	0.119***	-0.223*	0.027	0.070	-0.003	<b>-0.960***</b>

# Summary

- MAFH accounts for a significant proportion of meat consumption. Projection based on data excluding MAFH could be inaccurate and misleading.
- MAFH have consistently higher expenditure elasticities and own-price elasticities, suggesting that with income and total meat expenditure increases, MAFH consumption will increase more than proportionately to total meat expenditure.

# Summary

- Household expenditure on poultry, beef and mutton will increase more than proportionately to total meat expenditure with income increases.
- MAFH consumption is more price-responsive than MAH, especially for beef & mutton



# Acknowledgement

- This project is jointly funded by NSF of China, USDA AFRI and EMP grants, and Chinese Academy of Sciences.
- Team includes:
  - Chinese Academy of Sciences
  - North Dakota State University
  - University of Florida
  - Washington State University
  - Economic Research Services & Foreign Agricultural Service, USDA