Australian National University

Does income growth improve diet diversity in China?

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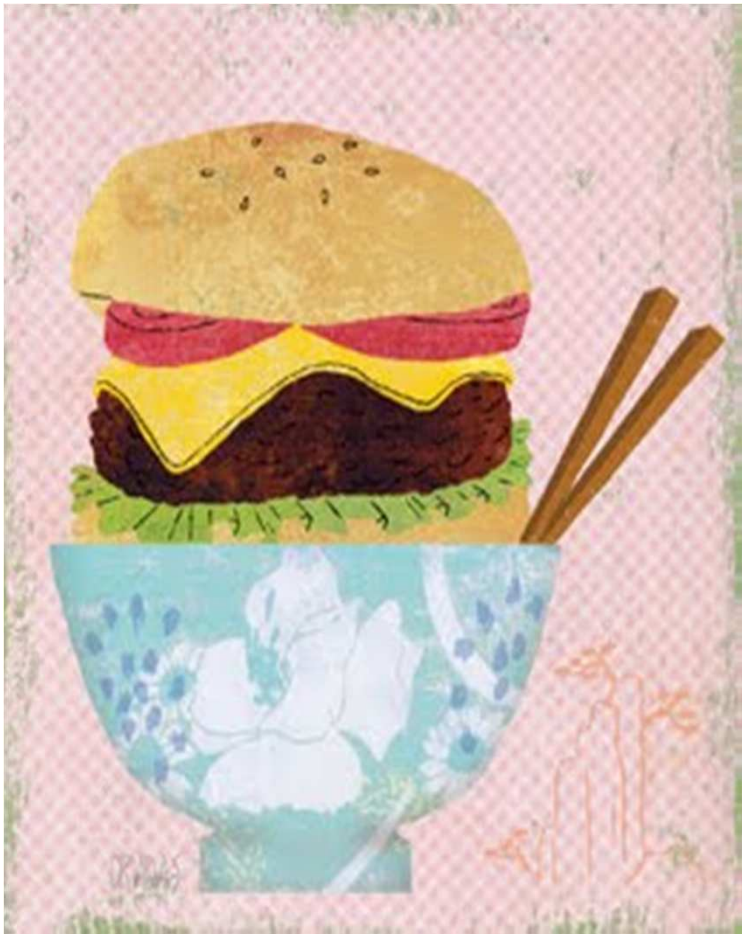
Dietary transition in China



- Structural shift in food consumption patterns
  - Higher consumption of vegetable oil, animal-origin, energy-dense foods
  - Lower consumption of calorie, grains, and vegetables
  - Income rise plays a small role in solving nutrient deficiencies
- Diet diversity matters
  - Direct utility
  - Health benefits

Diet diversity matters

- Unambiguous and well-grounded health benefits
- Studies on dietary consumption quantity are insufficient to inform about how diet *quality* responses to income
- Estimated income elasticities of foods and nutrients vary widely across studies
  - Partly subject to methodology
  - Partly due to non-linear relationship between nutrient intakes and income

Research questions

- Does increase in household income improve diet diversity?
  - Are there income effects? What form do they take?
  - Do income effects change over time?

- Are there education effects?

→ Both questions are important for food and health policies

- First to
  - Examine diet diversity-income relationship in China
  - Address potential endogeneity of income

Data

- China Health and Nutrition Survey 2004, 2006, 2009
  - 9 provinces, approx. 3,800 households/year
  - Pooled sample used in this study: 15,163 adults (18-60 yrs old) from 4,047 households

Methodology

- Diet diversity: measured by 3-day average no. of food groups consumed

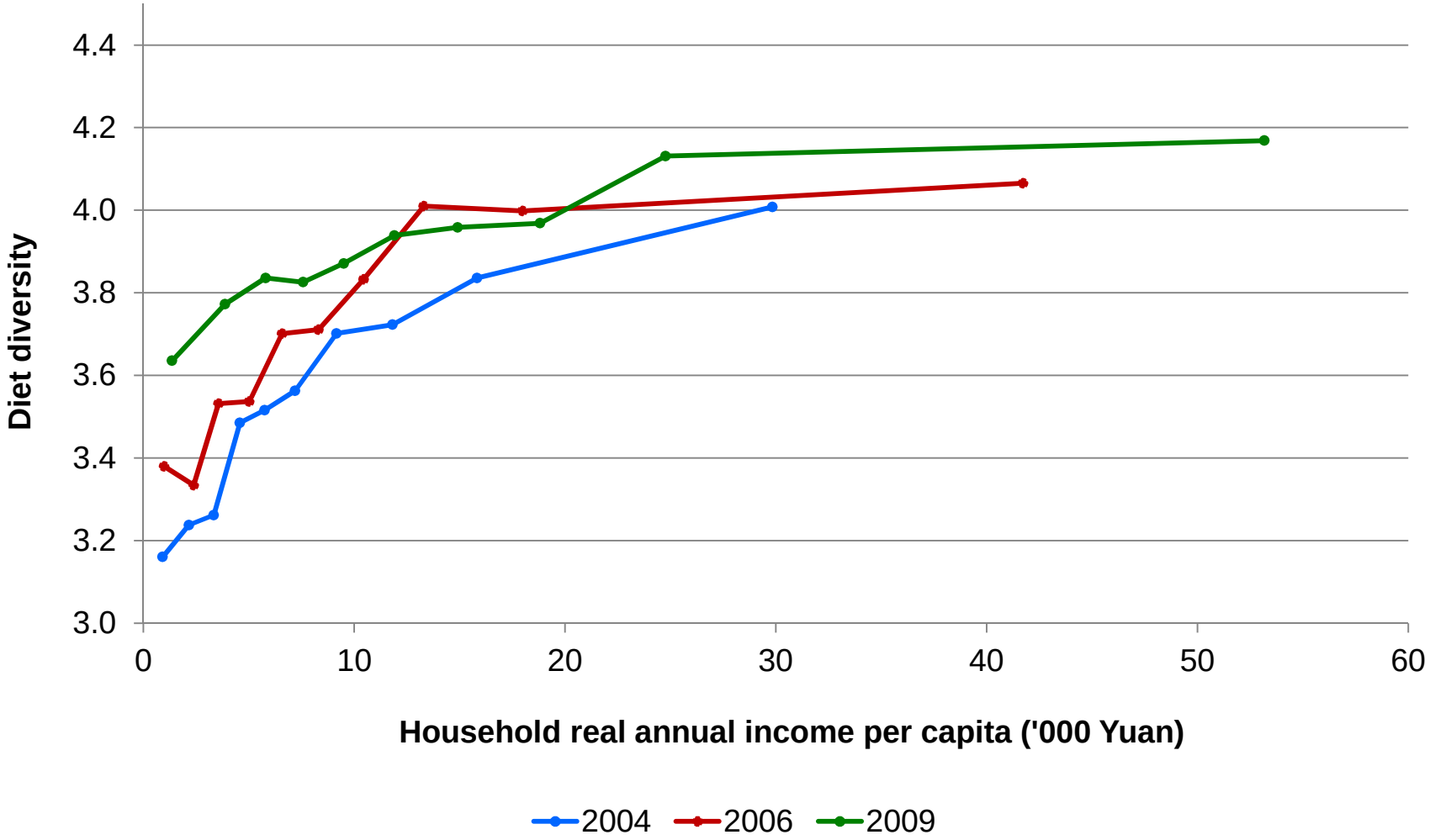
- OLS repeated cross-sectional regression models

$$Variety_{ijk} = \beta_1 + \beta_2.food_{ijk} + \beta_3.Y_{jk} + \beta_4.Edu_{ijk} + \beta_5.I_{ijk} + \beta_6.H_{jk} + \beta_7.C_k + \varepsilon_{ijk}$$

- 2SLS models
  - Instruments: number of household durable assets
  - First-stage equation:

$$\log(income)_{ijk} = \gamma_1 + \gamma_2.IV_{ijk} + \gamma_3.food_{ijk} + \gamma_4.Edu_{ijk} + \gamma_5.I_{ijk} + \gamma_6.H_{jk} + \gamma_7.C_k + v_{ijk}$$

Income vs. diversity



Income effect – OLS estimates

Model	Variable	2004	2006	2009
1	Income	0.078***	0.013*	0.009**
2	Income	0.189***	0.083***	0.031***
	Income squared	-0.022***	-0.005***	-0.001***
3	Quintile 2	0.092***	0.103***	0.036
	Quintile 3	0.157***	0.191***	0.062*
	Quintile 4	0.237***	0.253***	0.045
	Quintile 5	0.307***	0.274***	0.151***
4	Log of income	0.090***	0.067***	0.039***

* p < 0.10, ** p < 0.05, *** p < 0.01

Income effect – 2SLS estimates

Model	Variable	2004	2006	2009
4 (OLS)	Log of income	0.0898***	0.0673***	0.0386***
5 (IV1)	Log of income	0.587***	0.277***	0.386***
6 (IV2)	Log of income	0.623***	0.233***	0.382***
7 (IV3)	Log of income	0.501***	0.137***	0.384***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

- Robust positive and significant income effects
- 2SLS estimates are considerably larger than OLS estimates

Income effect – 2SLS estimates

	2004	2006	2009
Marginal impact of 1000 additional Yuan as % of mean diet diversity, at			
Sample mean income	1.83%	0.70%	0.67%
Mean income of quintile 1	**13.77%**	**5.47%**	**6.58%**
Mean income of quintile 2	4.51%	1.93%	1.60%
Mean income of quintile 3	2.59%	1.05%	0.96%
Mean income of quintile 4	1.52%	0.62%	0.59%
Mean income of quintile 5	0.65%	0.24%	0.24%
Estimated increase in diversity when income doubles, as percentage of sample mean diversity	16.67%	7.53%	10.03%

Education effects – OLS estimates

Education level	2004	2006	2009
Primary	0.122***	0.0259	0.113***
Secondary	0.258***	0.192***	0.165***
High school	0.398***	0.300***	0.255***
Vocational training	0.587***	0.492***	0.387***
University & above	0.572***	0.398***	0.405***

Difference only significant at 10% level

Education effects – 2SLS estimates

Model	Education level	2004	2006	2009
5 (IV1)	Primary	0.076*	0.006	0.042
	Secondary	0.140***	0.140***	0.056
	High school	0.186***	0.218***	0.062
	Vocational training	0.213***	0.343***	0.145**
	University & above	0.078	0.120***	0.077
	Prob > F	0.000	0.000	0.281
6 (IV2)	Primary	0.073	0.010	0.042
	Secondary	0.132***	0.151***	0.057
	High school	0.171***	0.235***	0.064
	Vocational training	0.185**	0.374***	0.148**
	University & above	0.043	0.241***	0.080
	Prob > F	0.002	0.000	0.307
7 (IV3)	Primary	0.084**	0.019	0.042
	Secondary	0.161***	0.175***	0.057
	High school	0.223***	0.273***	0.063
	Vocational training	0.277***	0.443***	0.147**
	University & above	0.164*	0.333***	0.079
	Prob > F	0.000	0.000	0.304

OLS vs. 2SLS – Possible explanations

- Omitted variable bias
  - Unobserved preference for food diversity: positively correlated with education, yet negatively correlated with income

- Partial correlation between education and income in first-stage regression
  - part of income effect falsely attributed to education under OLS

Conclusion

- Higher income improves diet diversity
  - Income growth can partly offset harmful effects of the nutrition transition on labor health, esp. among the poorest quintile
  - Income effect appears to fall over time

- Important to detect and address endogeneity
  - Role of education appear to depend on treatment of income
  - OLS might mislead resource allocation in designing food and health policies

Thank you