ASU school of human evolution & social change
ARIZONA STATE UNIVERSITY

Marriage, Income and BMI

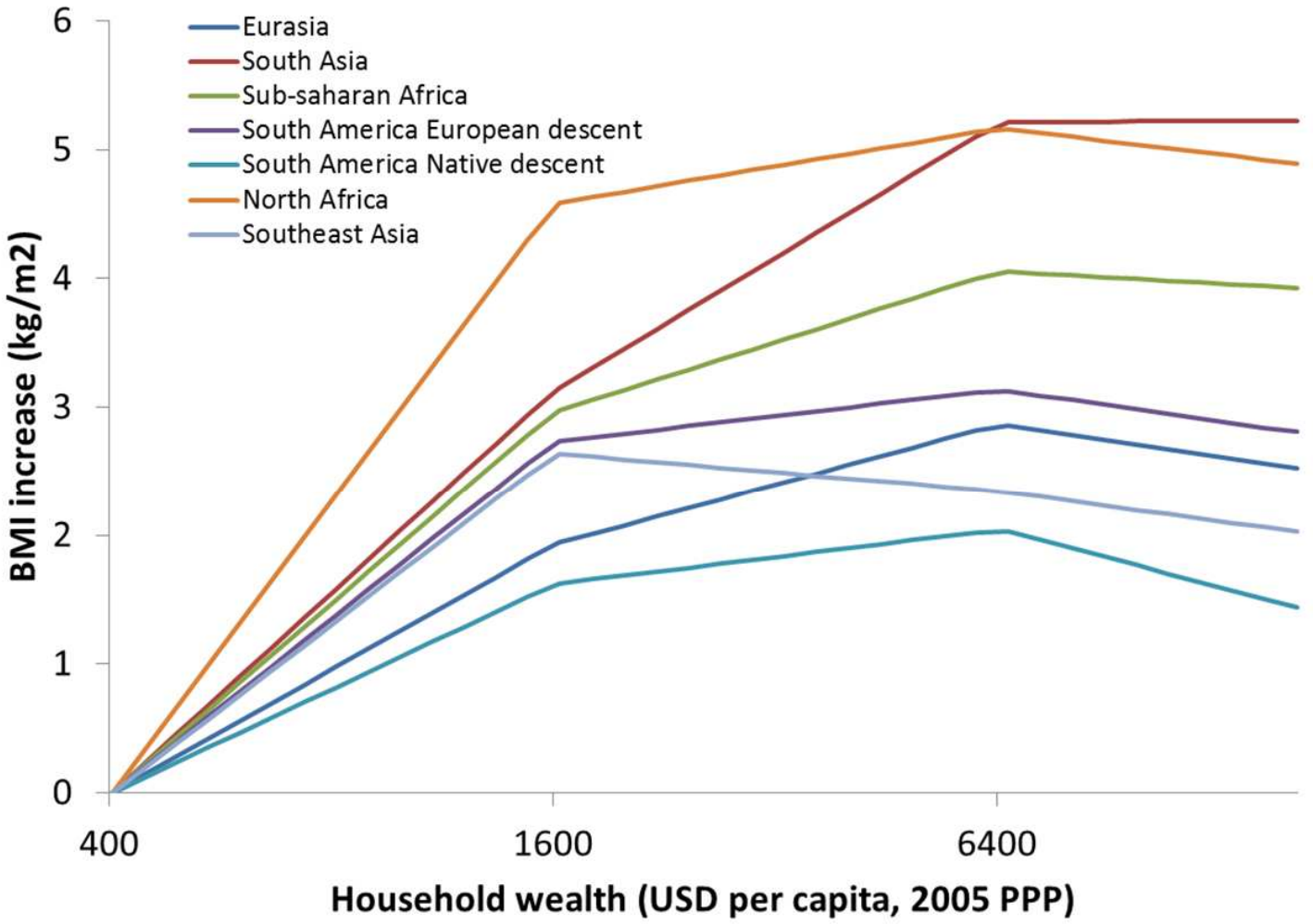
How social sorting contributes to the poverty-obesity paradox

Daniel Hruschka

Social Networks, Social Media and the Economics of Food

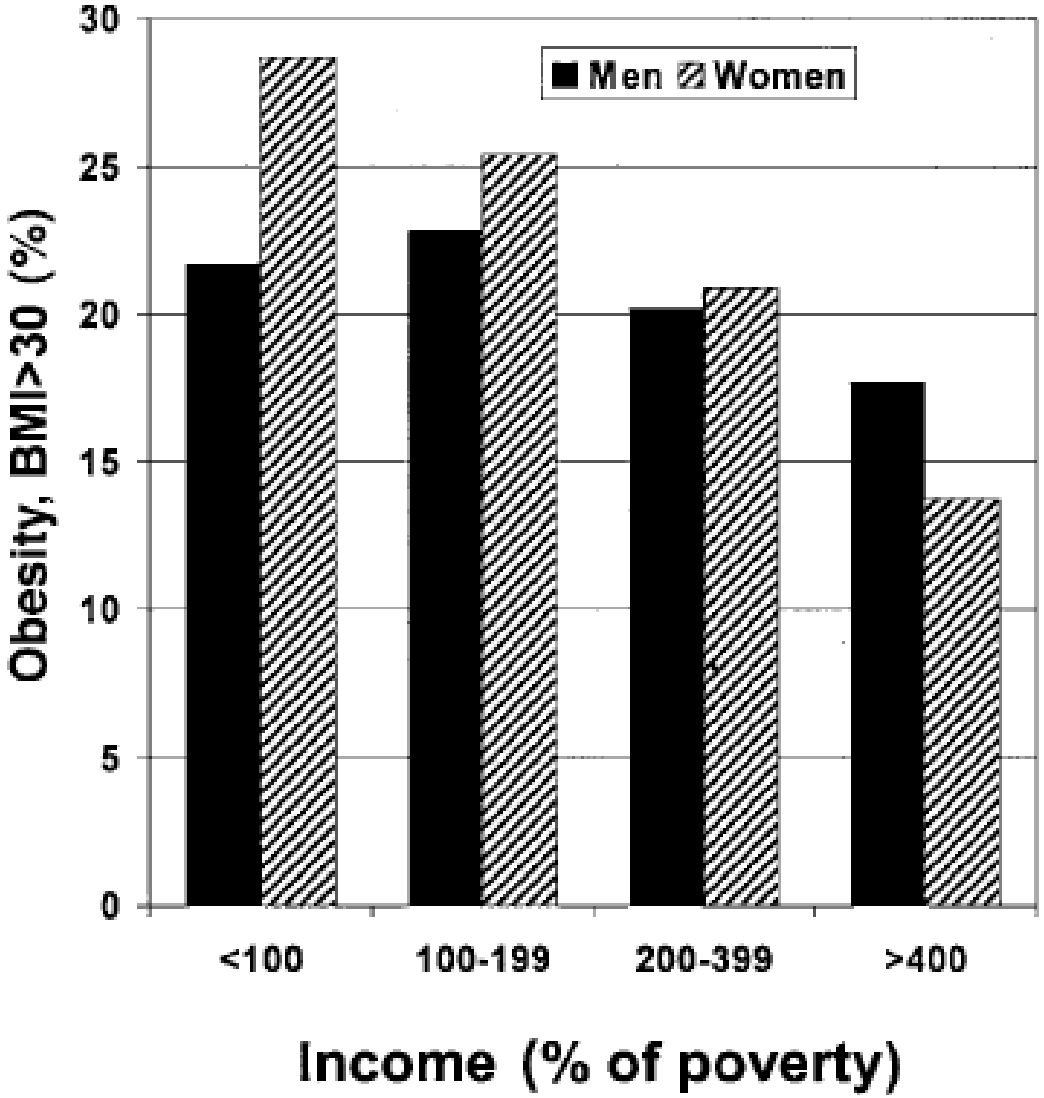
May 30, 2014

The Worldwide BMI Reversal



~500,000 Women 20-49 y from 47 low- and middle-income countries; low education, breastfeeding, non-pregnant, . Hruschka in press

The Poverty-Obesity Paradox



Also,

Hunger-Obesity Paradox

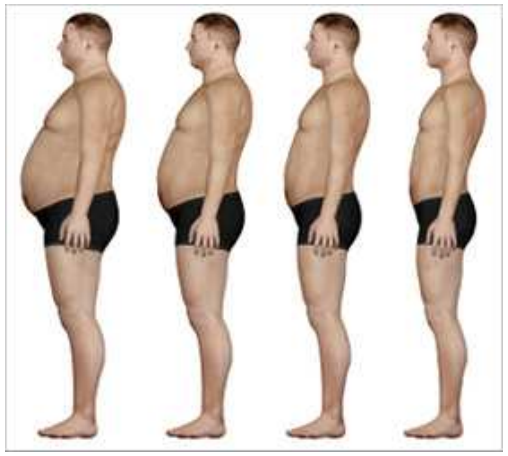
Food insecurity-Obesity Paradox

Figure from Drewnowski and Specter 2004; Dietz 1995, Sobal and Stunkard 1989…

Traditional Hypotheses about Income

- **Resources drive weight**
  - *Nutrition* Dietz 1995, Drewnowski and Specter 2004
  - *Social Science* Sobal and Stunkard 1989, McLaren 2007, Lakwadalla and Philipson 2009

- Mechanisms & Policy Implications
  - Consuming costly, thinning foods: low energy density fruits, veggies and low fat dairy
  - Easier access to leisure exercise
  - Feast-famine microcycles
  - Increases personal demand for thinness



An Alternative Hypothesis

- **Social Sorting via Marriage Markets**
  - A preference for spouses with lower BMI
  - A preference for spouses with higher income and wealth
  - Thinner individuals are matched with spouses (and households) with higher income and wealth
  - This creates a reverse income-BMI gradient

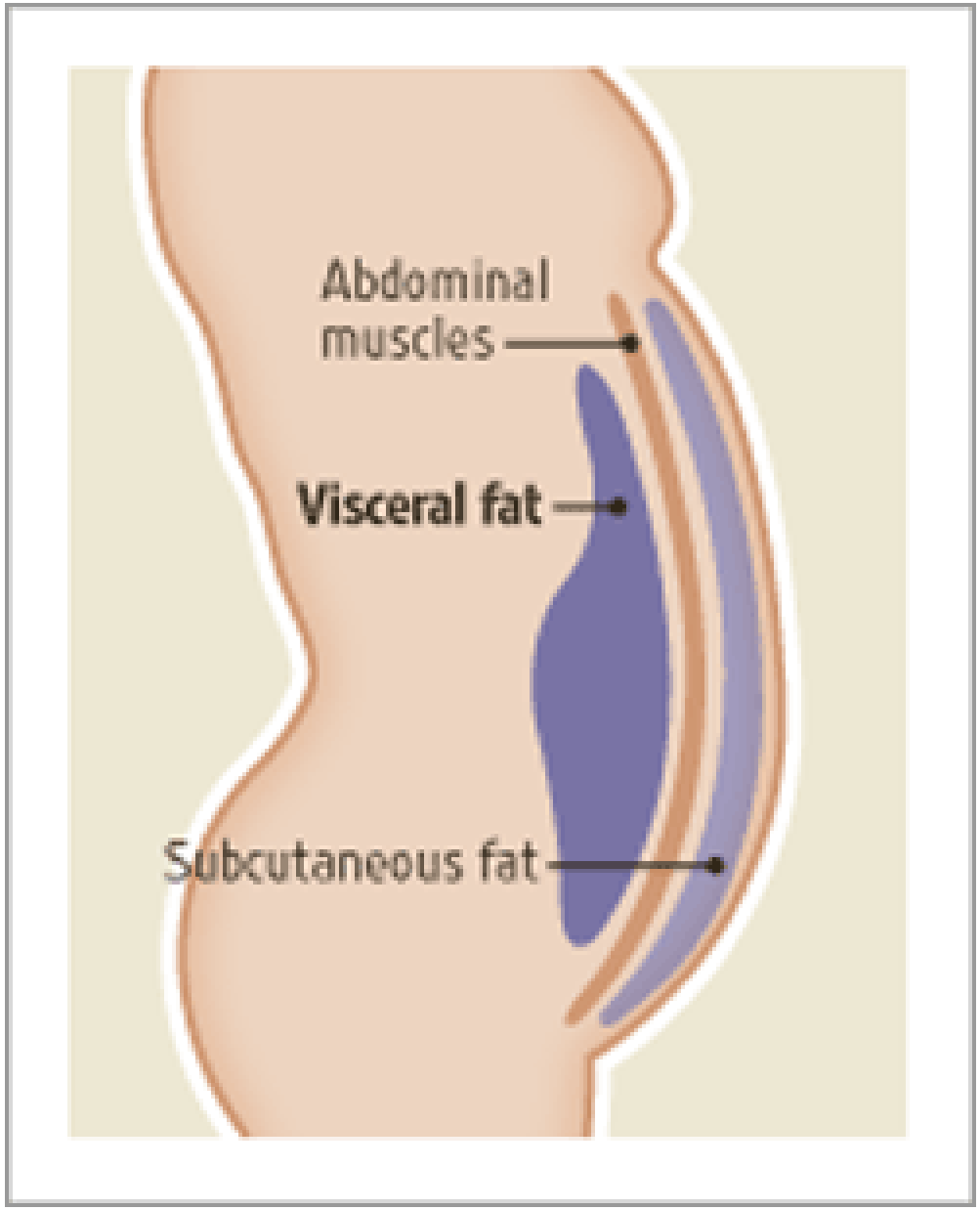
Chiappori, Oreffice, and Quintana-Domeque 2012, Oreffice and Quintana-Domeque 2010

Outline of Talk

- Body mass index and body fat
- A tour of the worldwide BMI reversal
- Two kinds of theory for the poverty-obesity paradox
- Empirical tests of contrasting predictions

I. Obesity

- Excess body fat
- Indicators
  - Total body fat
  - % body fat
  - Visceral body fat
- Measures
  - Body mass index (BMI)
  - Waist circumference
  - Skinfolds
  - Direct measures



Body Mass Index

$$\text{BMI} = \frac{Wt}{Ht^2}$$

Advantages:

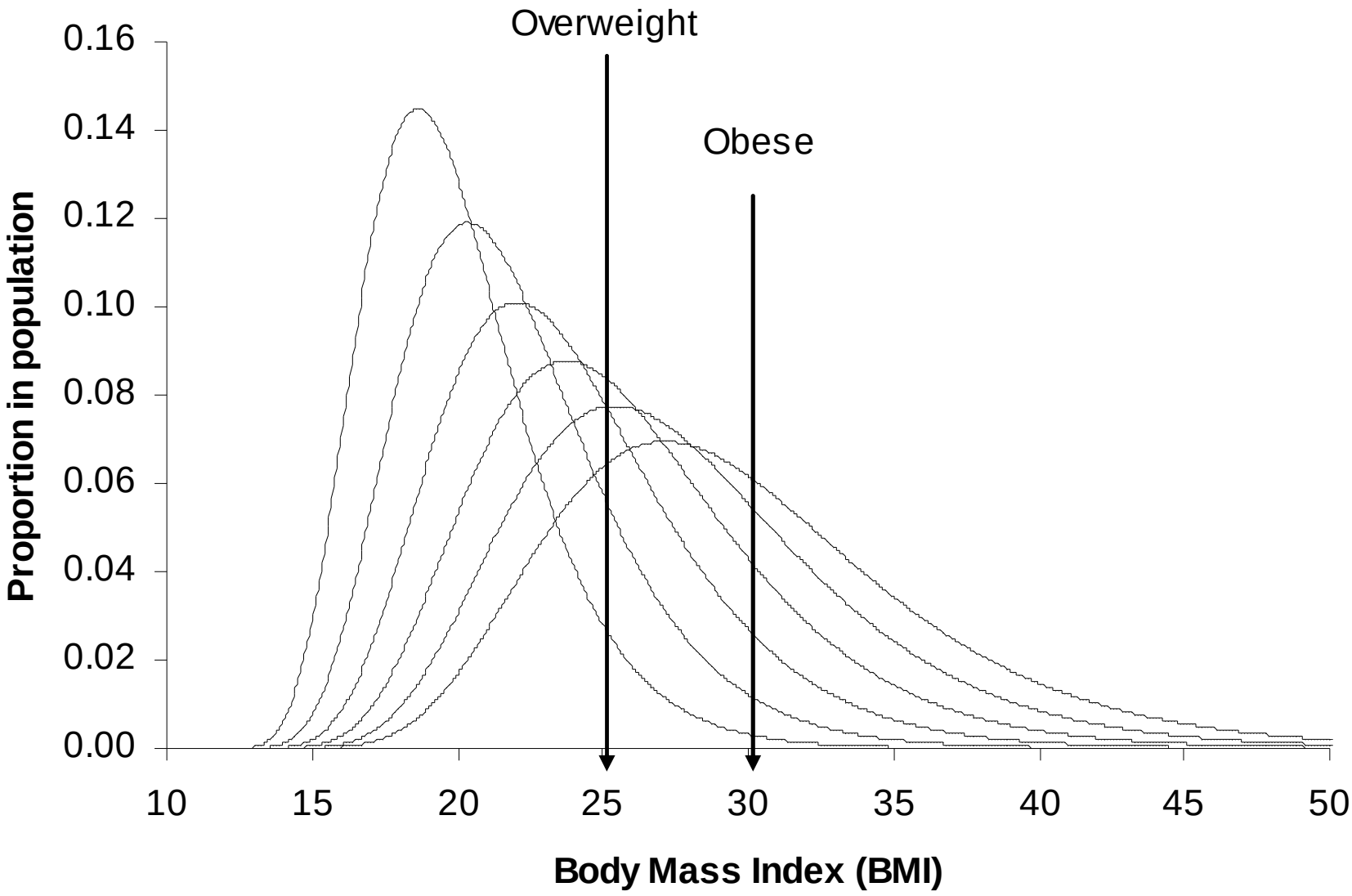
- Easy to measure
- Lots of data

Disadvantages:

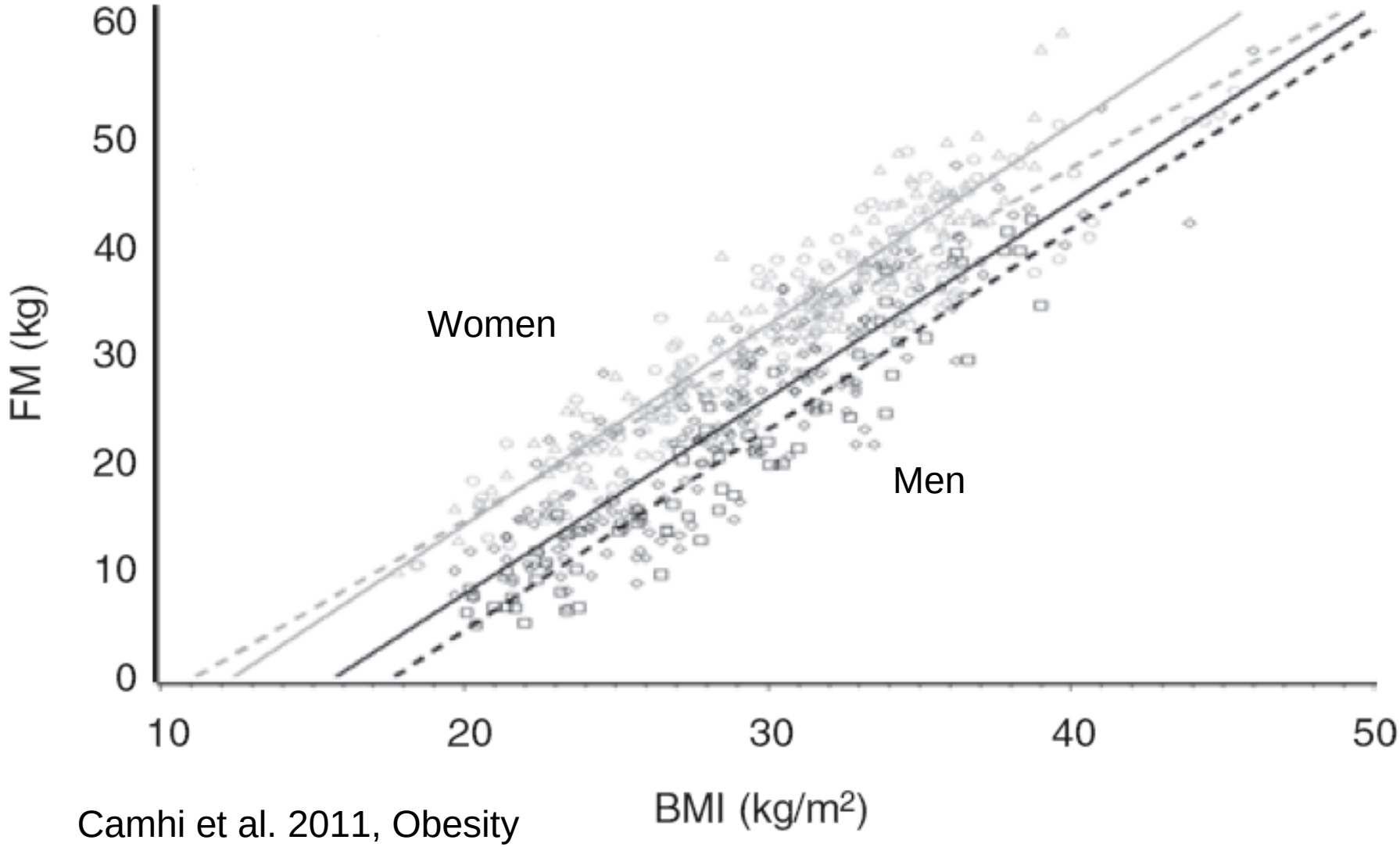
- A fallible proxy

BMI = 31.97
Obese

Overweight and Obesity

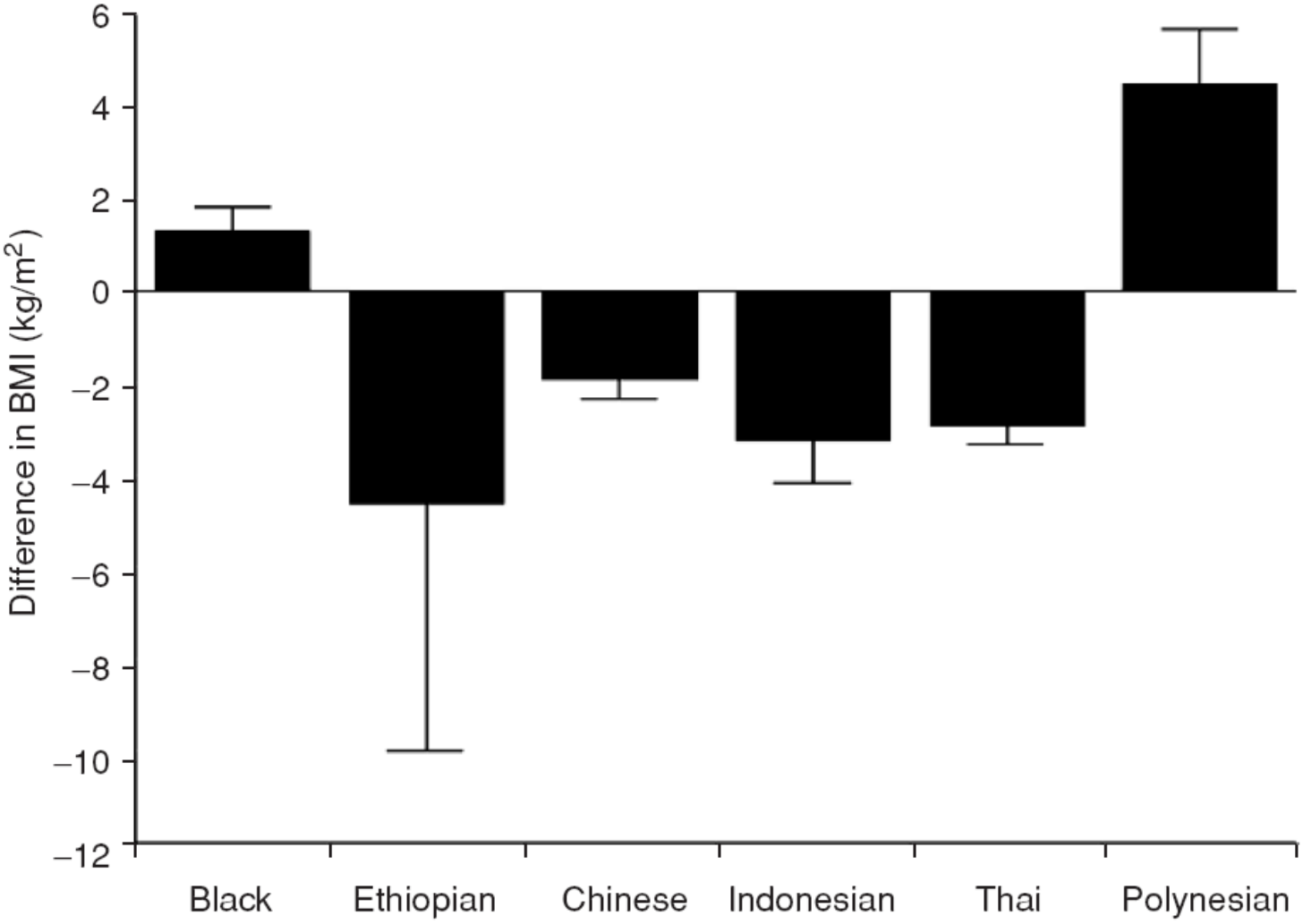


Gender



Camhi et al. 2011, Obesity

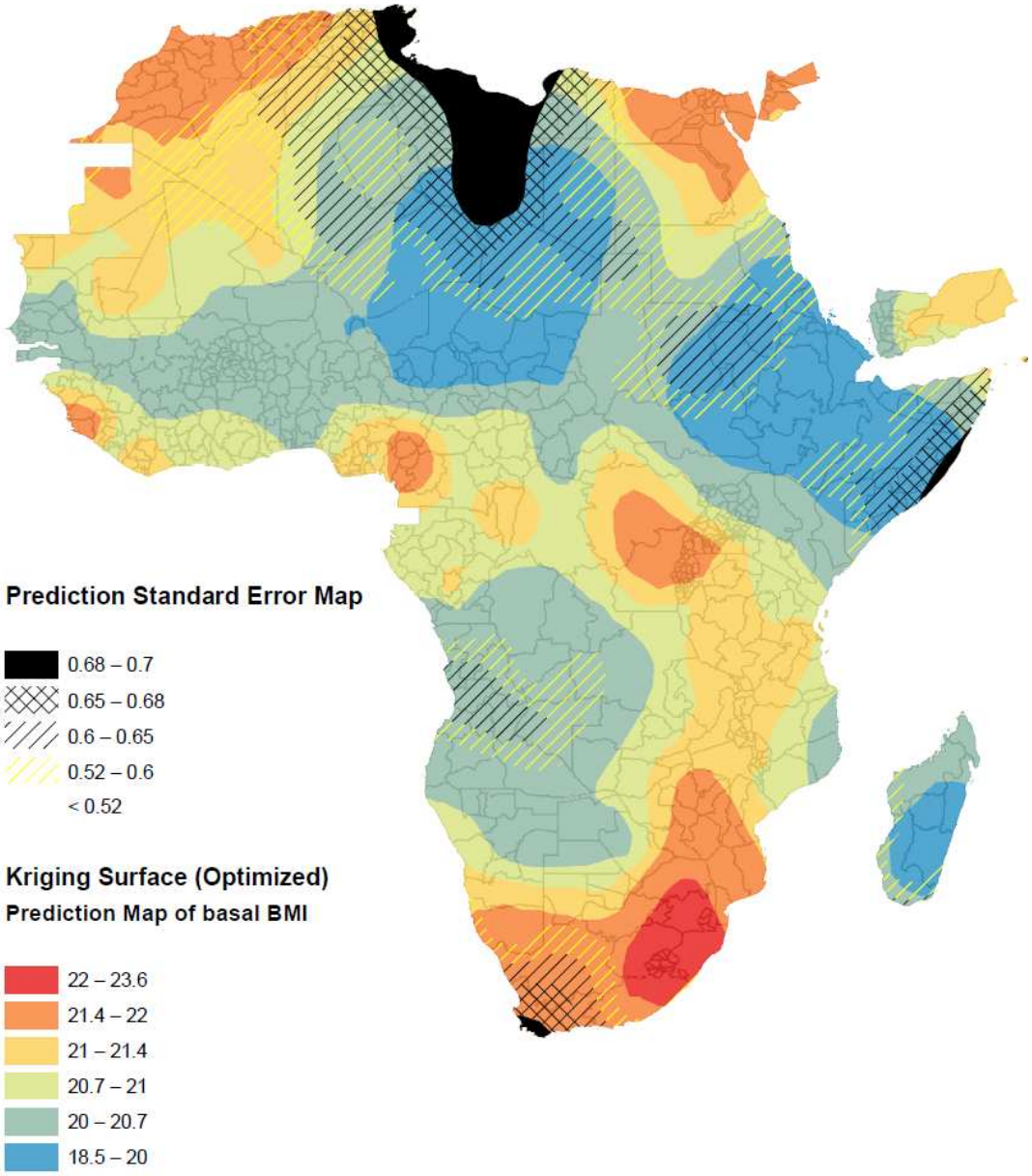
BMI, body fat and ethnicity



Wells 2009

Basal body mass

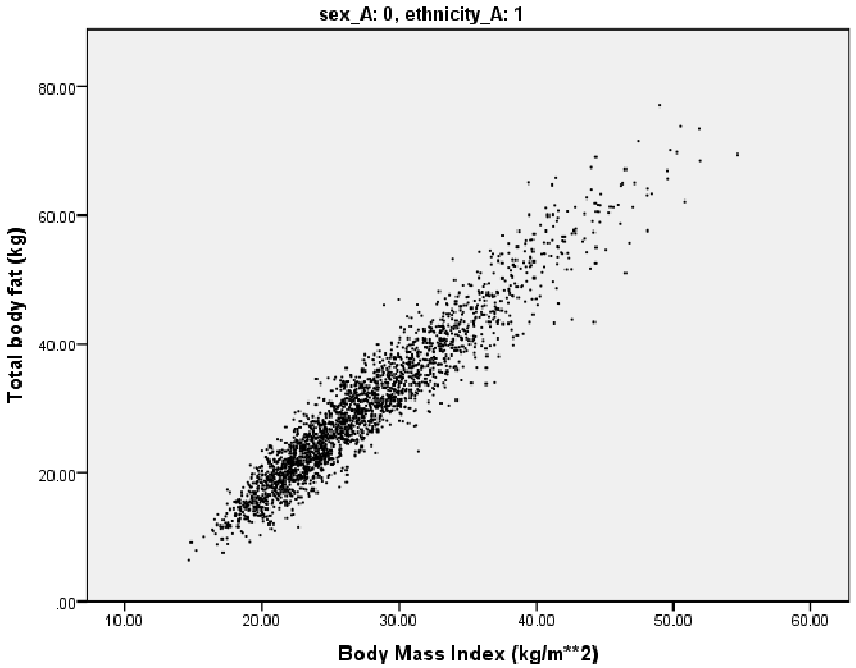
- Unrelated to
  - Diabetes
  - Childhood Illness
- Arises early in development
- Genetic affinity accounts for most variation



Hruschka et al. 2013, Voytyuk and Hruschka in prep, Hadley, Hruschka and Brewis 2014

Tread with caution

- Compare same gender
- Need to standardize for ethnic background.
- Age-standardized comparisons


sex_A: 0, ethnicity_A: 1
Total body fat (kg)
.00
20.00
40.00
60.00
80.00
10.00
20.00
30.00
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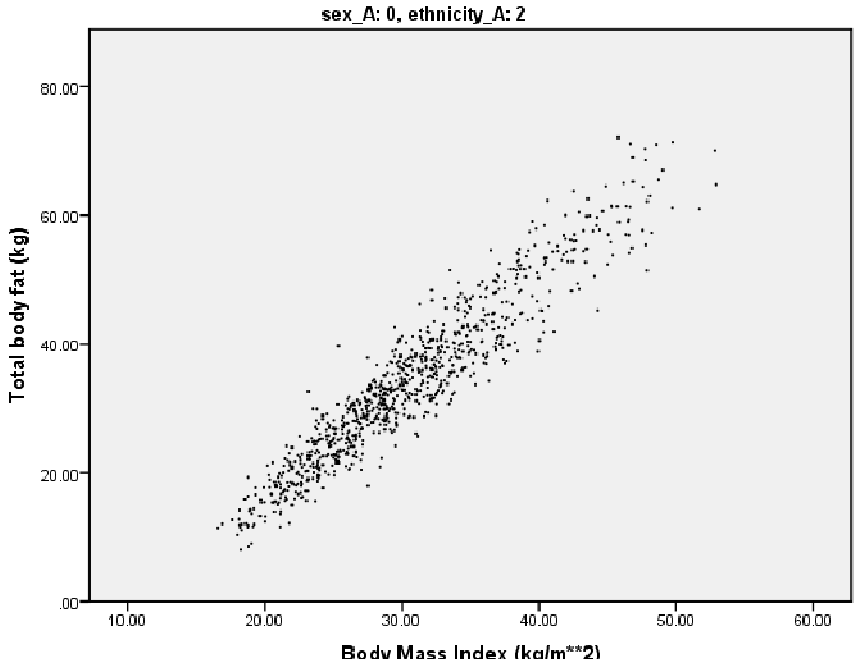
Body Mass Index (kg/m**2)


sex_A: 0, ethnicity_A: 2
Total body fat (kg)
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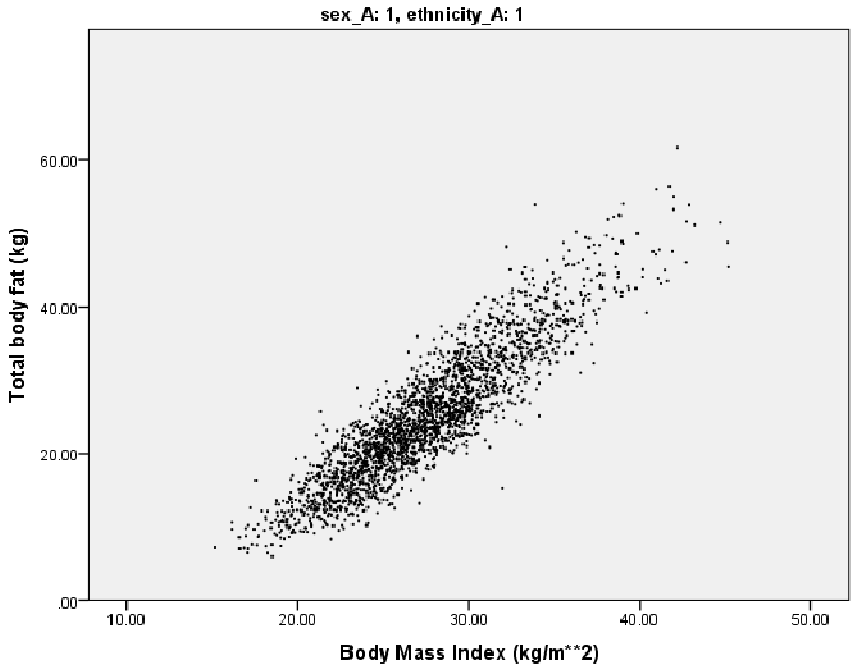
Body Mass Index (kg/m**2)


sex_A: 1, ethnicity_A: 1
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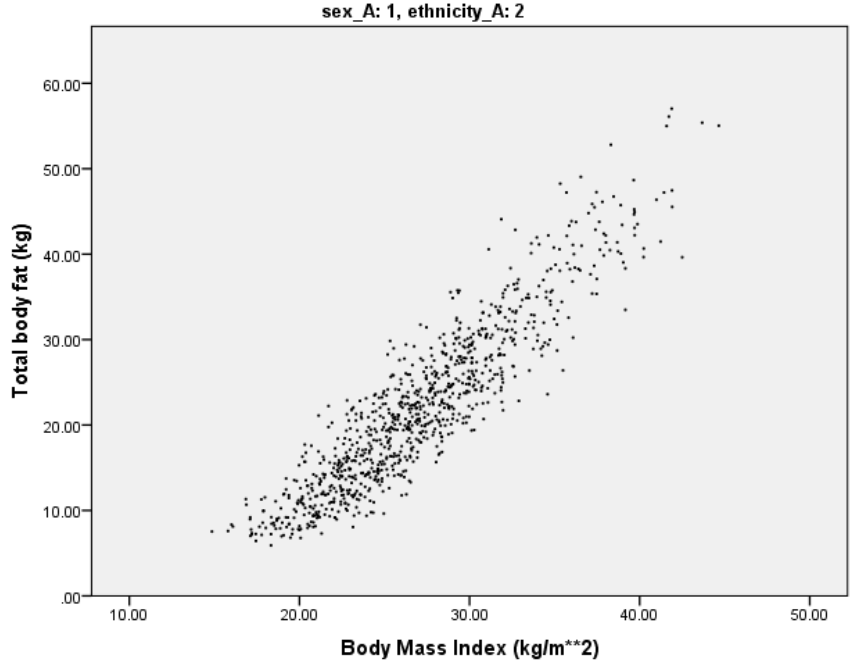
sex_A: 1, ethnicity_A: 2
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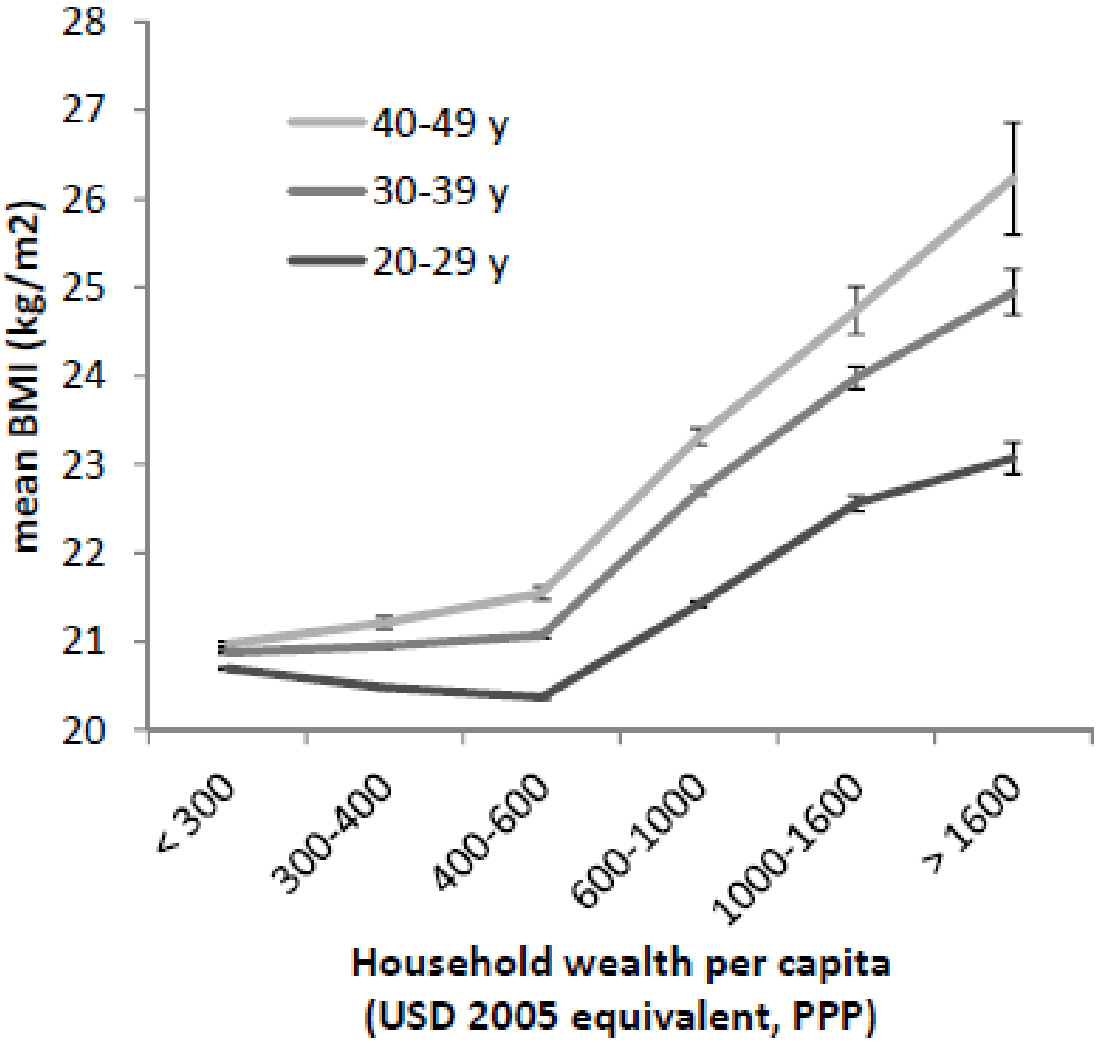
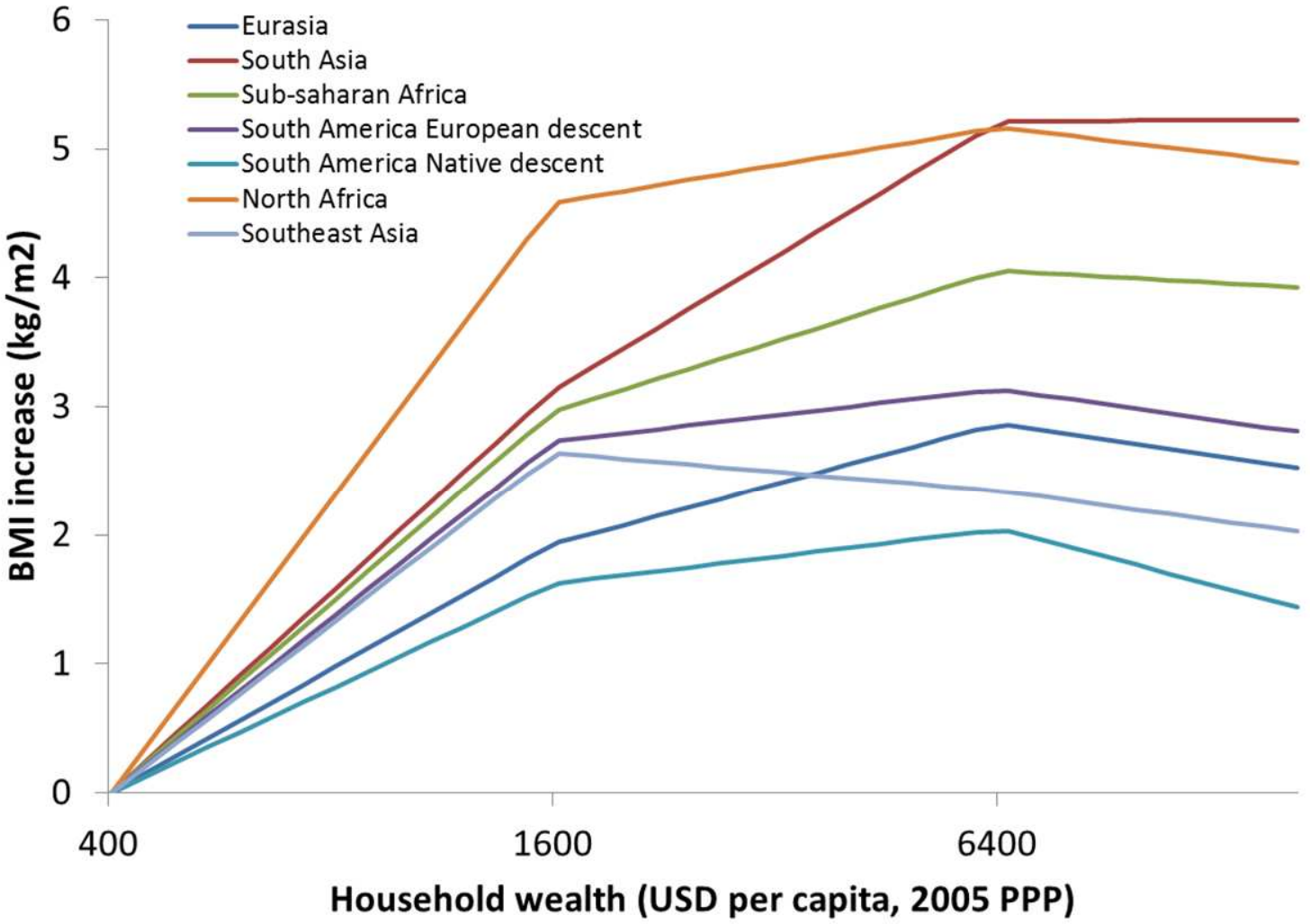
Body Mass Index (kg/m**2)

2. Worldwide BMI Reversal



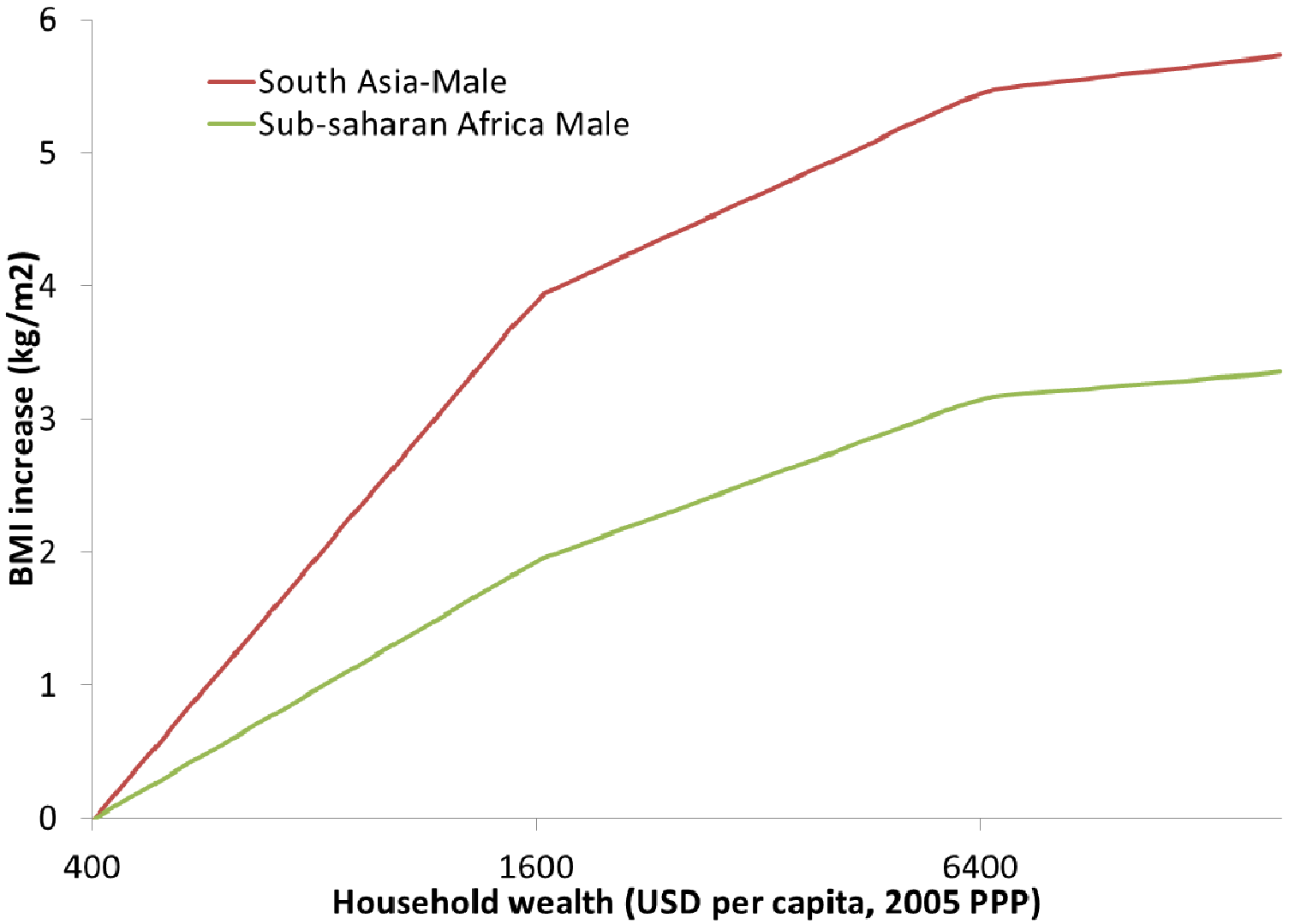
Women 20-49 y from 47 low- and middle-income countries, Hruschka et al. 2013

The Worldwide BMI Reversal



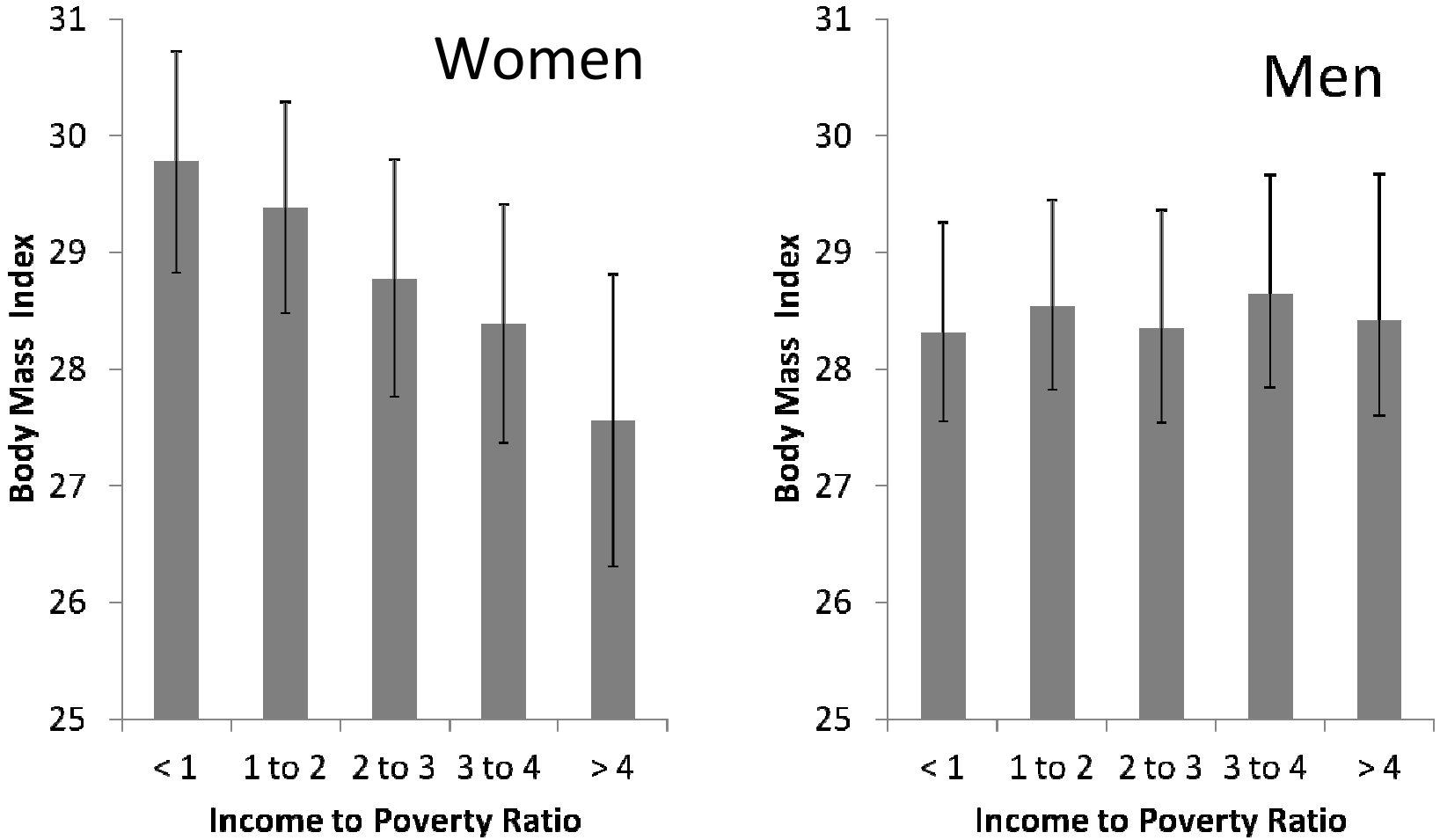
Women 20-49 y w/ low education from 47 low- and middle-income countries, Hruschka in press

But, not for men



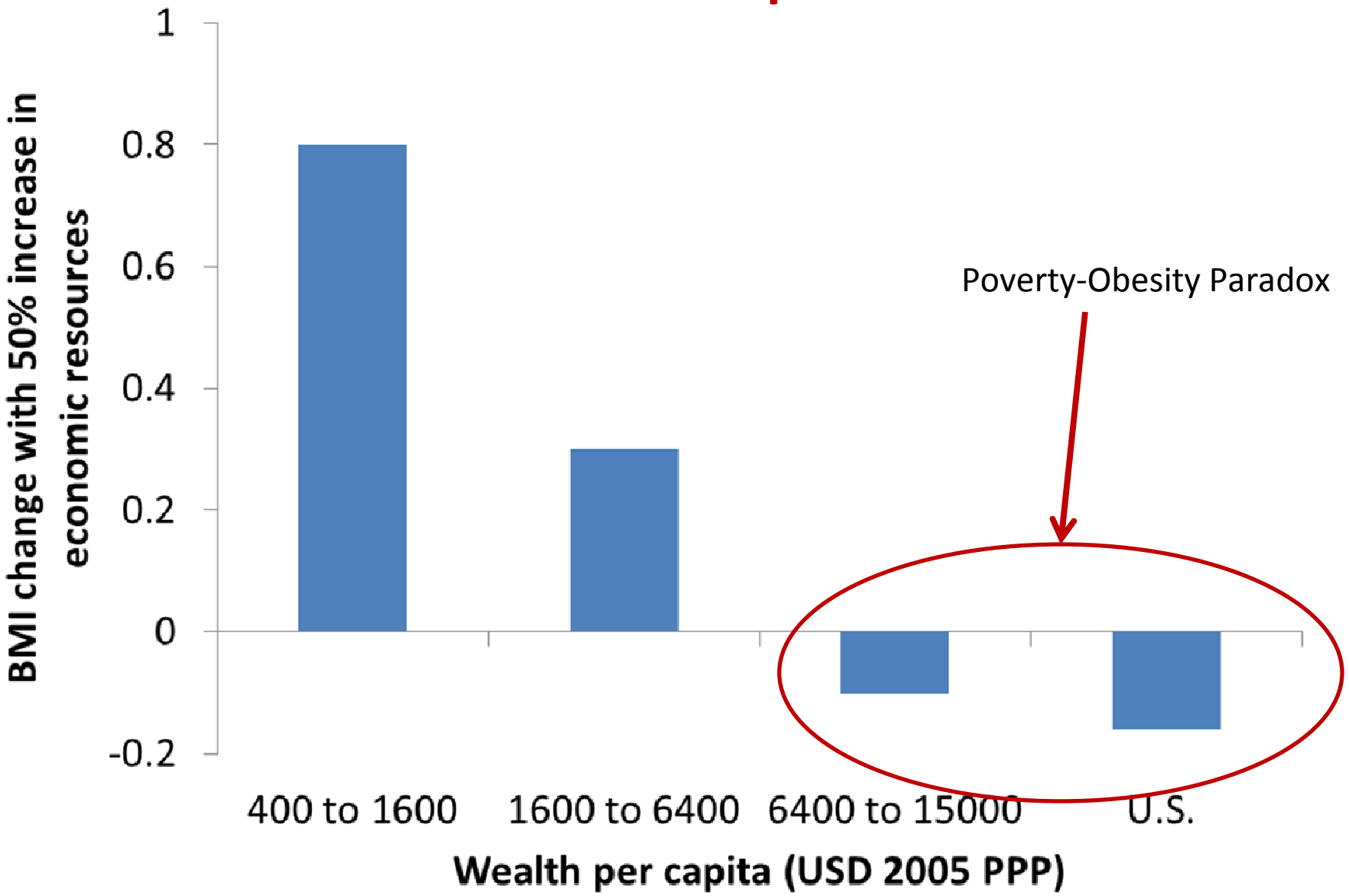
Men 20-49 y from 19 low- and middle-income countries, Hruschka in press

Moving on up



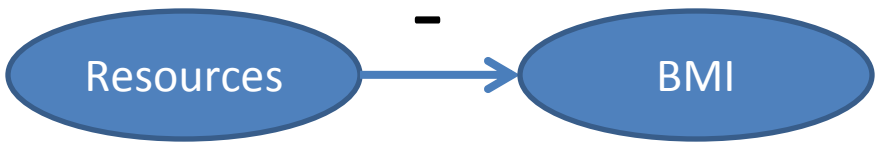
U.S. non-hispanic whites, National Health and Nutrition Evaluation Survey, 2003-2012
Adjusting for Age and Education. Values for 30-35 y with highest degree = high school

In Global Perspective



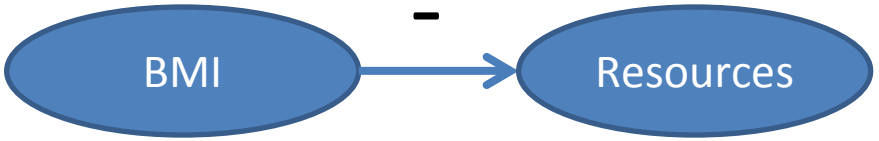
3. Two accounts for the poverty-obesity paradox

- Resource-driven
  - Nutrition Dietz 1995, Drewnowski and Specter 2004
  - Social Science Sobal and Stunkard 1989, McLaren 2007



Consumption

- Social sorting
  - Economics
    - Marriage and Labor markets



Social sorting

Two accounts

- Resource-driven
  - Consumption of thinning foods
  - Greater opportunity for leisure exercise
  - Greater personal demand for thinness
- Social sorting
  - Sorting in into households of different incomes via marriage markets

Strategy

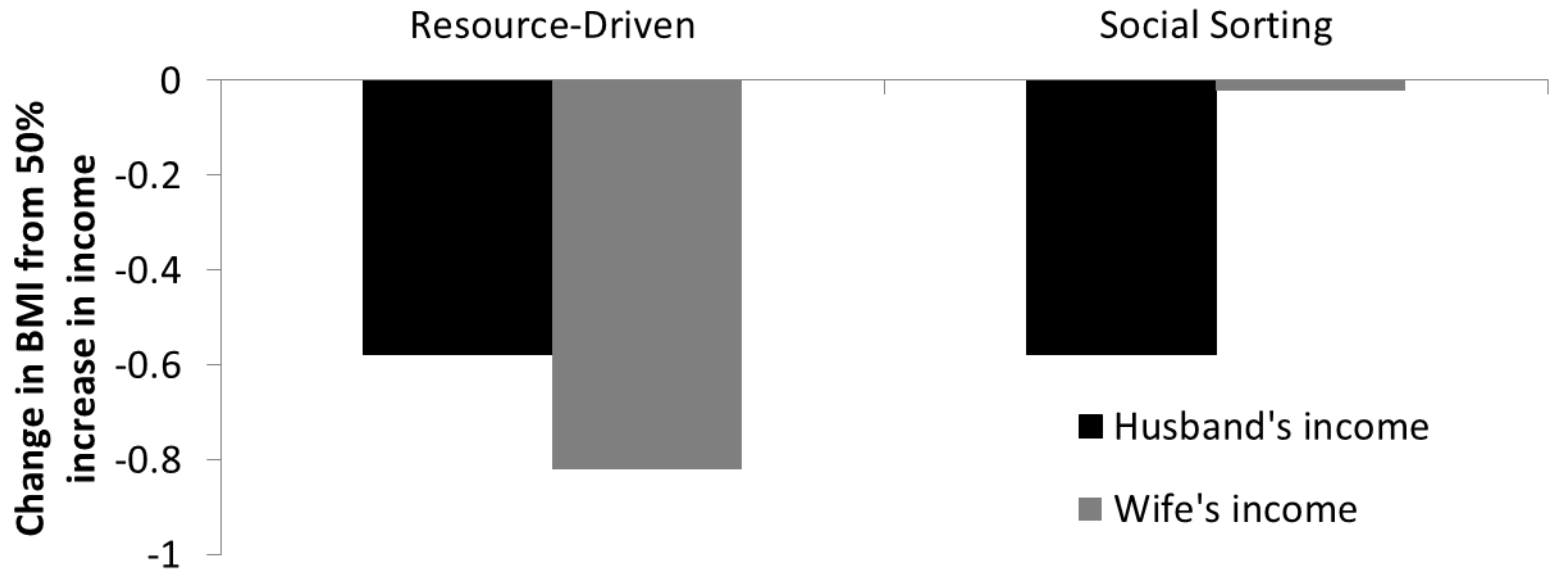
- Crude BMI by household income can't discriminate between these two accounts
  - Identify contrasting predictions and assess with finer-grained data
  - Non-experimental data can **never** definitively establish causality, **but** we can show which hypotheses are most plausible and which ones can be thrown out (or at least have to be revised)
- Focus on group where paradox is consistently found—U.S. White, non-hispanic women

4. Contrasting Predictions

Resources reduce BMI via consumption	BMI reduces resources via marriage markets
Total household income should reduce a wife's BMI, and the effect should be strongest for the income she controls.	A wife's BMI should be negatively correlated with husband's income but not with her own income.
The household income-BMI gradient should be strongest among **never married women** since they presumably control the entire household income.	The household income-BMI gradient should occur primarily among **married women**, and not among those who have never married.

4a. Heterosexual Married Households

Resources reduce BMI via consumption	BMI reduces resources via marriage markets
Total household income should reduce a wife's BMI, and the effect should be strongest for the income she controls.	A wife's BMI should be negatively correlated with husband's income but not with her own income.



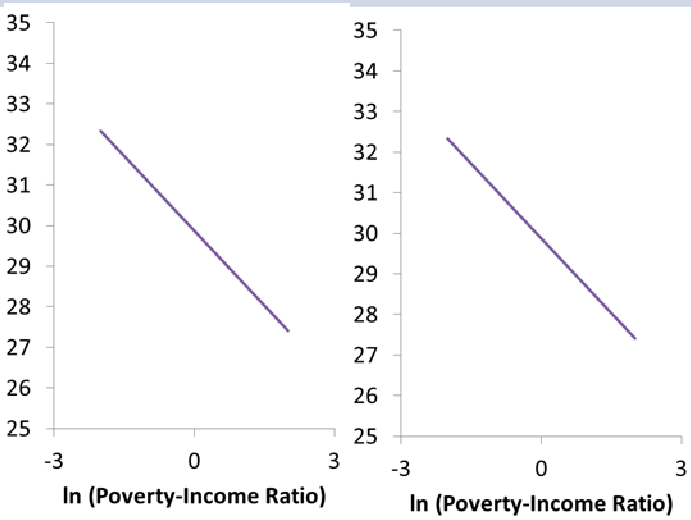
Heterosexual Married Households

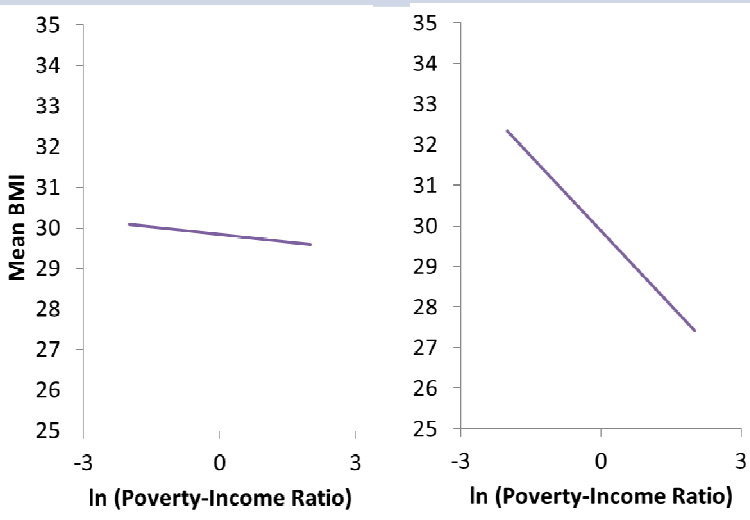
Chiappori, Oreffice, and Quintana-Domeque 2012, Oreffice and Quintana-Domeque 2010

Hruschka in press, Arcuri & Hruschka in prep

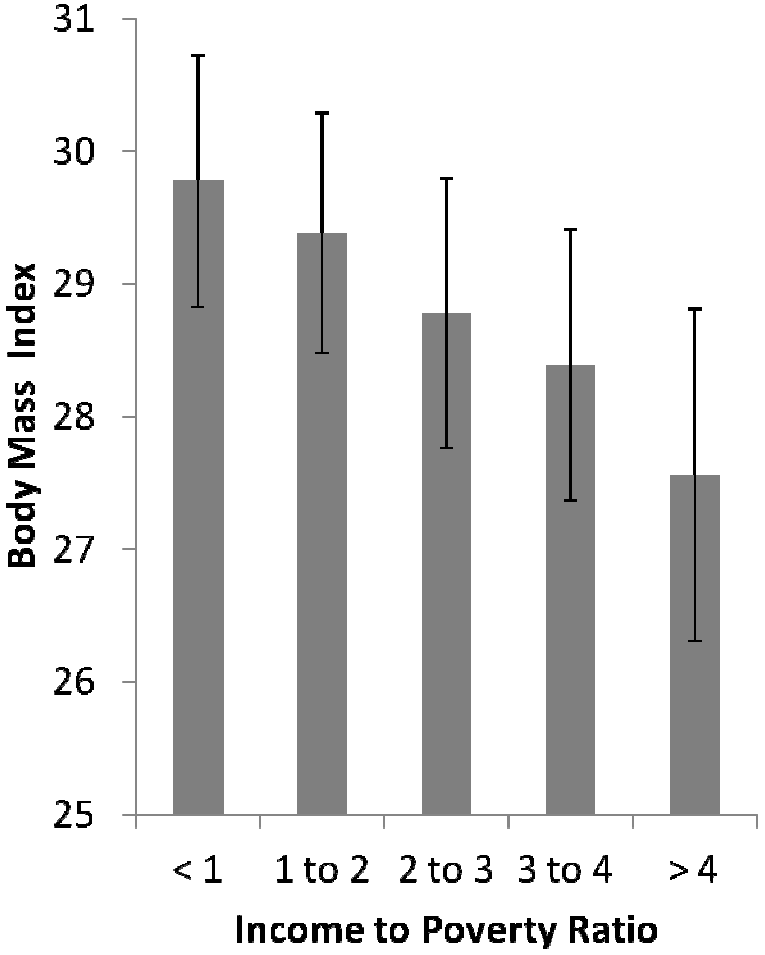
4b. Married vs. Never Married

Resources reduce BMI via consumption	BMI reduces resources via marriage markets
The household income-BMI gradient should be strongest among **never married women** since they presumably control the entire household income.	The household income-BMI gradient should occur primarily among **married women**, and not among those who have never married.





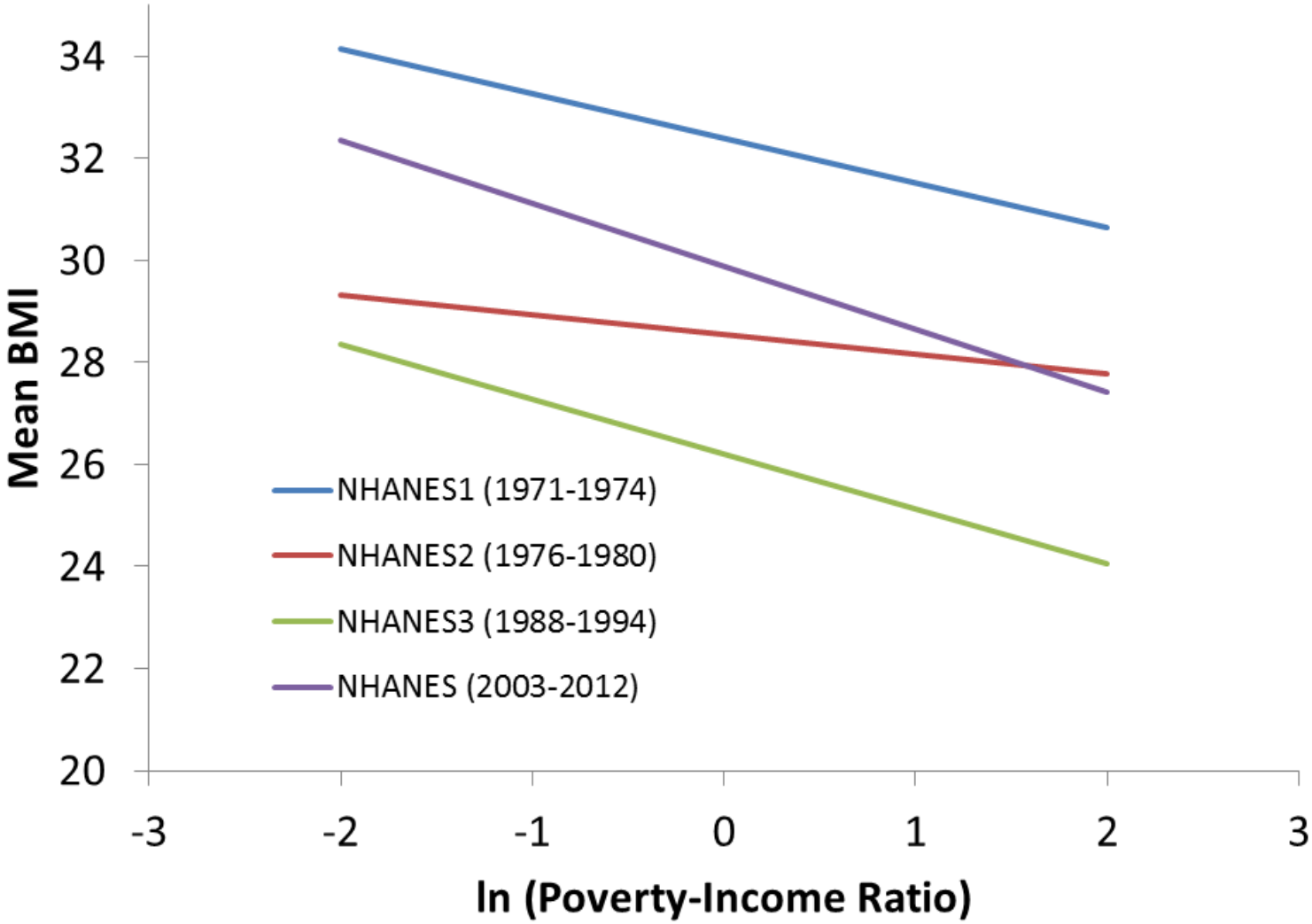
National Health and Nutrition Examination Survey



- Nationally representative sample
- Shows reverse gradient for non-hispanic White women
- Sufficiently large sample of ever-married and never-married
- Income to Poverty Ratio available
- Here, we adjust for education and age
- Snapshots of past 40 years

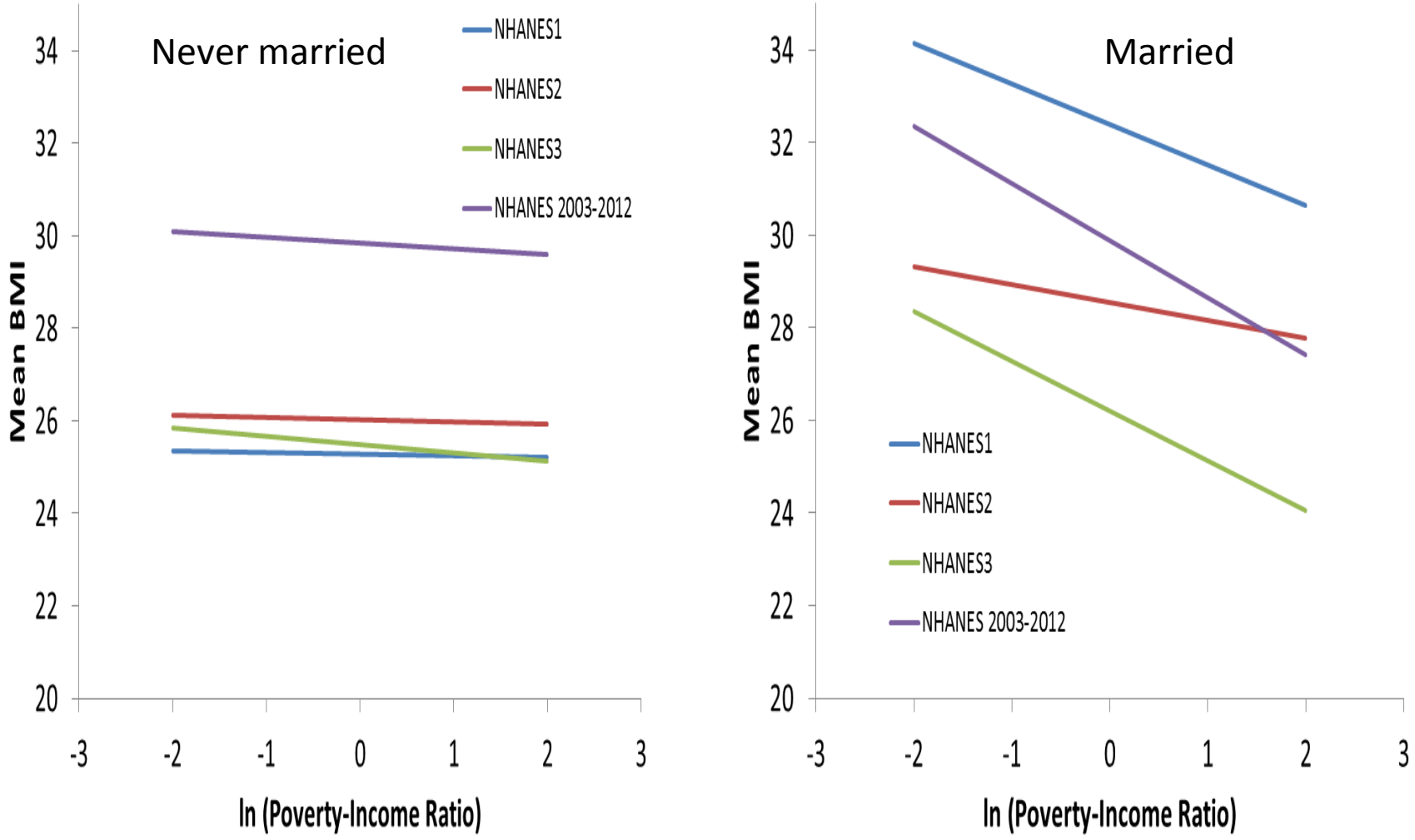
U.S. non-hispanic white women (20-49 y), National Health and Nutrition Evaluation Survey, 2003-2012 Adjusting for Age and Education.

Effect of income—married women



White, non-Hispanic women (20-49). Arcuri & Hruschka in prep

But for never married?

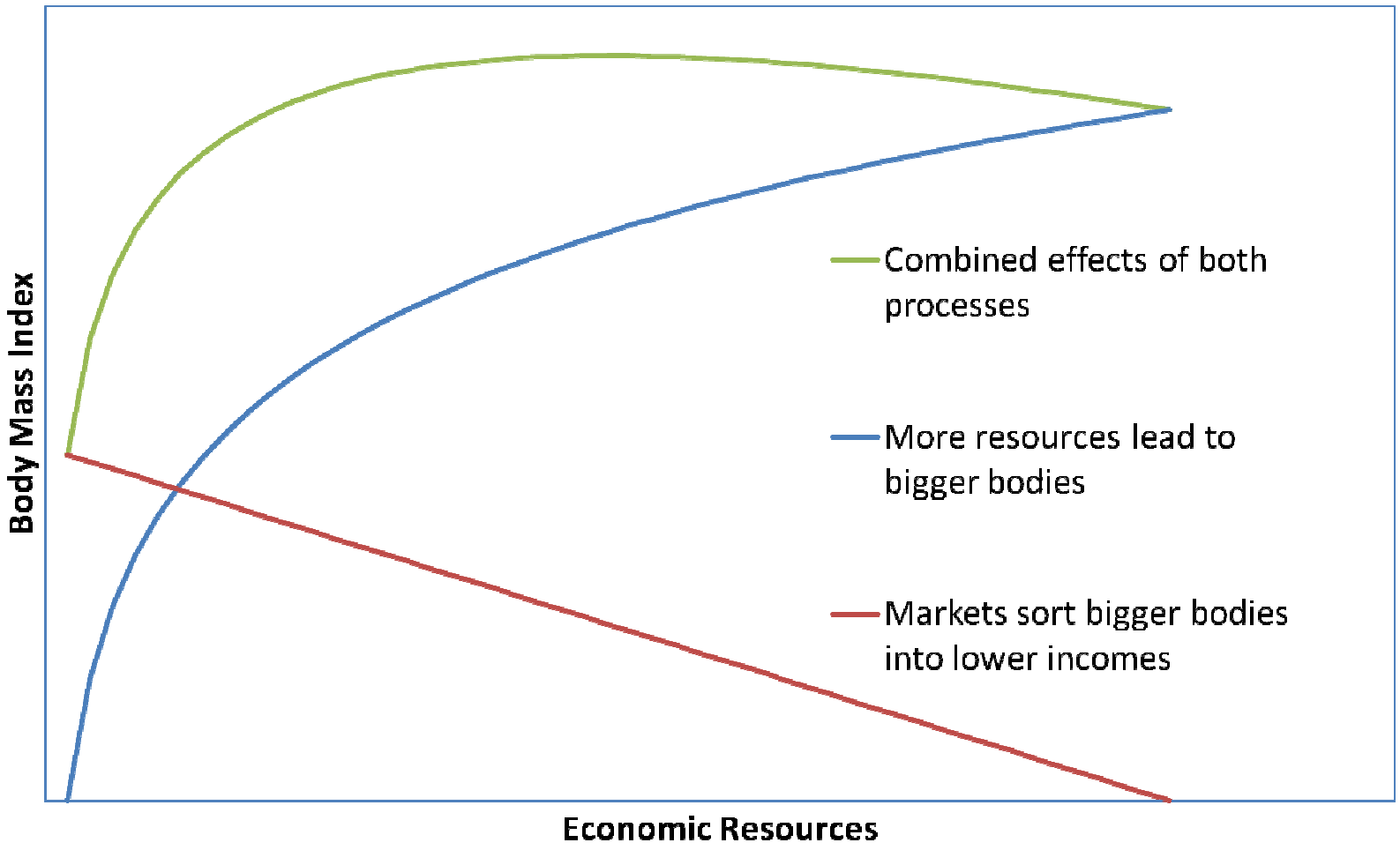


Interactions for NHANES 1, 3 & 2003-2012 are significant at alpha = 0.05, Arcuri & Hruschka in prep

Conclusions

- Current data is more consistent with two predictions of social sorting
  - Within-household correlations between BMI and gender-specific income
  - Comparisons of gradients among married and never-married women
- These same data show little support for current articulations of resource-driven theories

A simple dual process model



Open Questions

- Markets for lean and fat mass
  - Dual x-ray absorptiometry measures of body composition from NHANES
- Do we see the same effects in other ethnic groups?
- What effect do marriage markets have on income-BMI relationships in low resource settings.
  - Future work in Bangladesh, Bolivia

Implications

- Theoretical
  - Social process can shape biology, but biology can also shape social process.
  - Need to open dialogue between alternative theories and develop discriminating predictions.
- Practical
  - Myth of personal agency in weight reduction
  - Policies related to the poverty-wealth paradox
  - Turns attention to broader structural inequality

Thank you

- Symposium organizers
- Alexandra Brewis
- Craig Hadley
- Alesandro Arcuri
- Mariya Voytyuk
- NHANES
- DHS Measure, participating countries, and survey participants

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Sample sizes

Sample	Married women	Never Married women
NHANES (2003-2012)	1238	542
NHANES 3	1004	219
NHANES 2	3960	1128
NHANES 1	3992	557

Apportioning Household Wealth

- DHS asset factor score provides ranking of individuals on wealth.
- Gini coefficient gives us approximate function of how much of total wealth is allocated to the ith person.
- Total wealth is wealth per capita estimated from Davies et al. 2009 multiplied by number of people in distribution.

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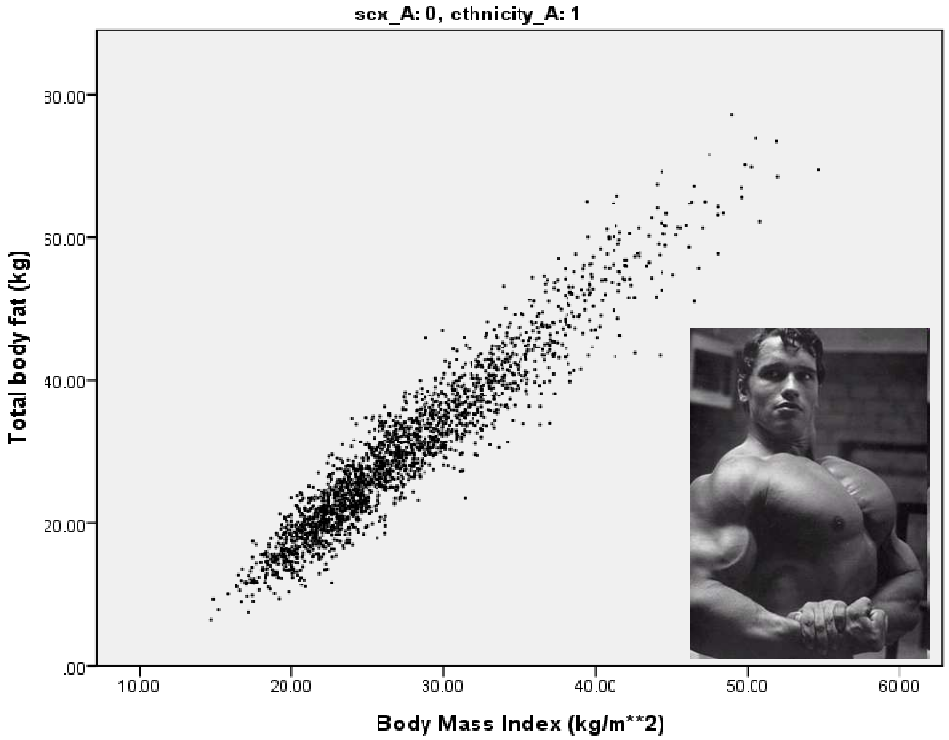
Notable studies with kids

- NHANES 3. No significant effect of food insufficiency on childhood or adolescent overweight after controlling for other factors (Alaimo et al. 1999).
- Recent

Null Model

- Outcome—body mass index (kg/m^2)
- Fixed Effects
  - Age (y)
  - Education
  - Ln(household budget per cap per day)
- Random Effects
  - Subdistricts
- Split samples by HH budget
  - < 2, 2-6, & > 6 USD



Hruschka, Rush & Brewis, AJPA, 2013
Hruschka & Brewis, EHB, 2012
Hruschka, Hadley & Brewis, submitted

BMI and fatness

	Correlation (rho)
Total Body Fat	0.90-0.96
% Body Fat	0.80-0.85
Visceral Body Fat	0.61-0.69

Camhi et al. 2011, Obesity. Rush et al. 2009, British Journal of Nutrition. Barriera et al. 2011, JAMA.

Two theories for the reversal

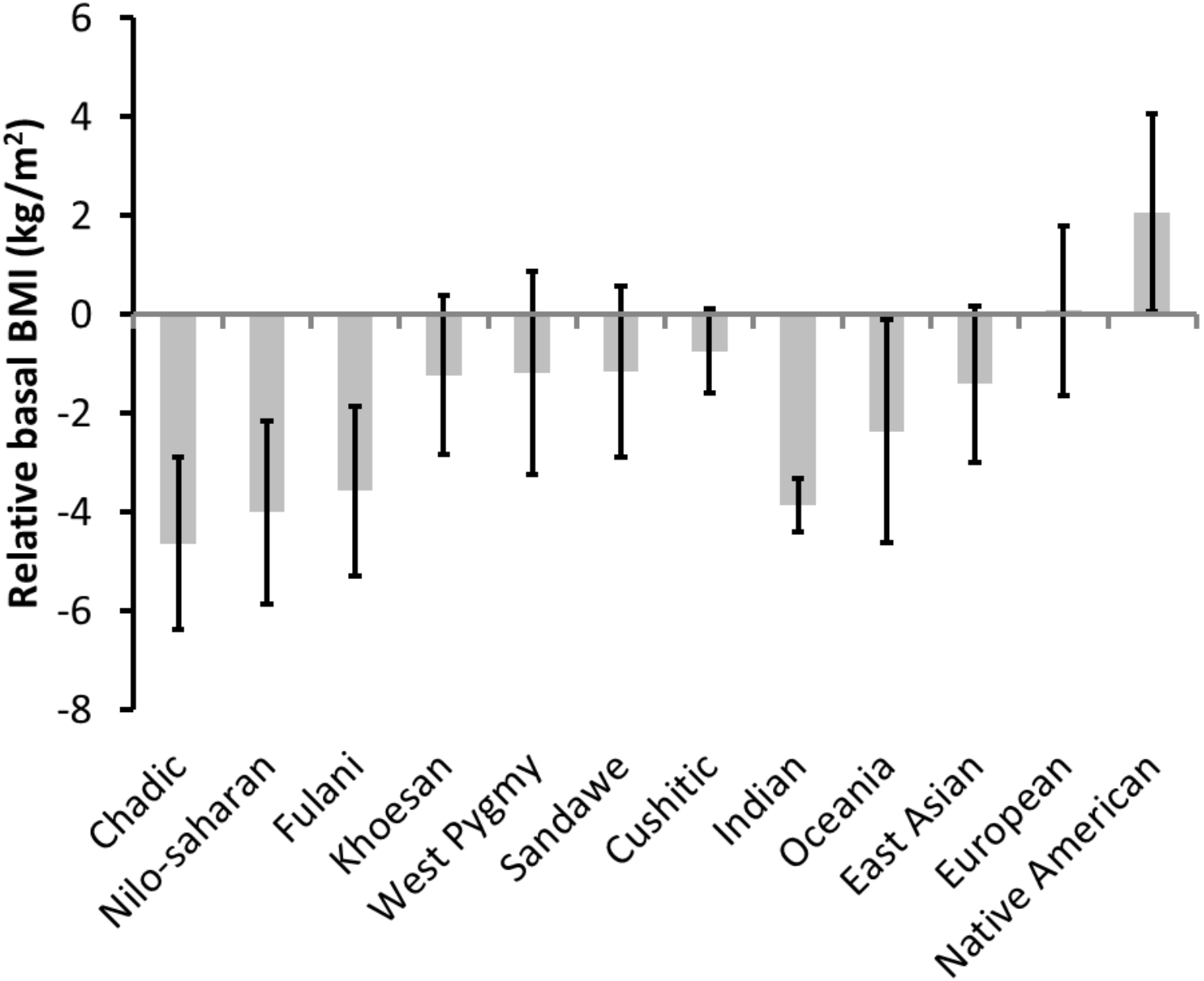
- ***Resource-driven Theories.*** *Income and wealth reduce female body size through a direct effect on food consumption and exercise behavior.* Specifically, women with more household economic resources are more able to achieve the slim body ideal in a high wealth society.
- ***Body size-driven Theories.*** Women with thinner bodies are able to achieve greater household income and wealth through **marriage** and labor markets where lower BMI is given a premium.

A prediction

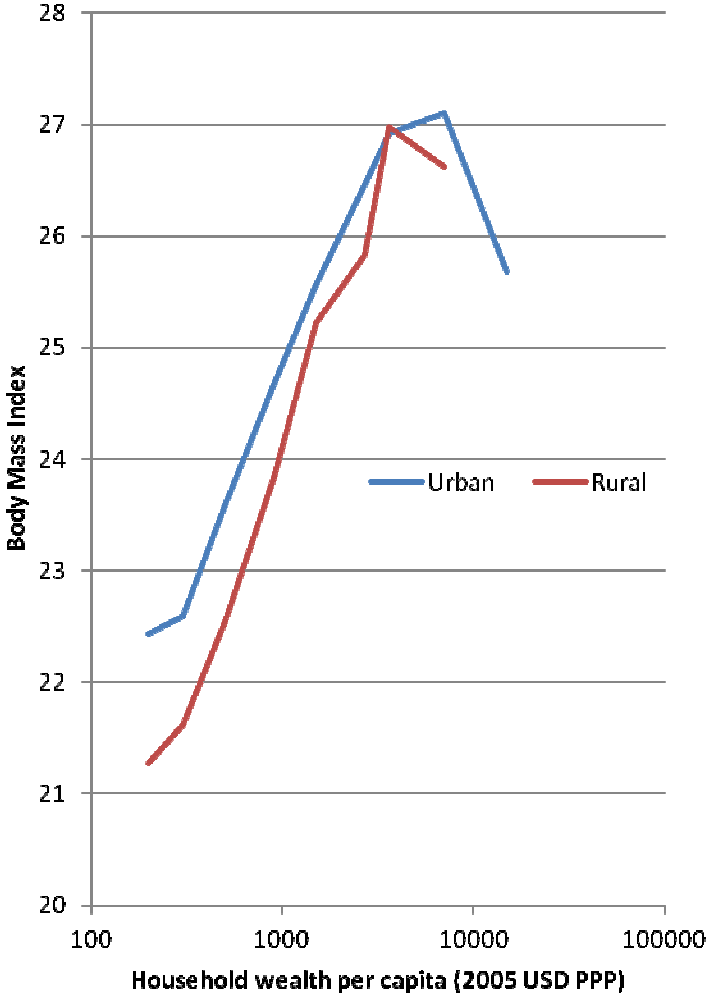
"People . . . are going to economize, and as they save money on food they will be eating more empty calories or foods high in sugar, saturated fats and refined grains, which are cheaper. Things are going to get worse. Obesity is a toxic result of a failing economic environment.“

A. Drewnowski quote in Jan. 2009 Reuters article

Slide showing how wealth is allocated.



Hruschka et al. 2013, Hadley, Hruschka and Brewis 2014, Hruschka et al. submitted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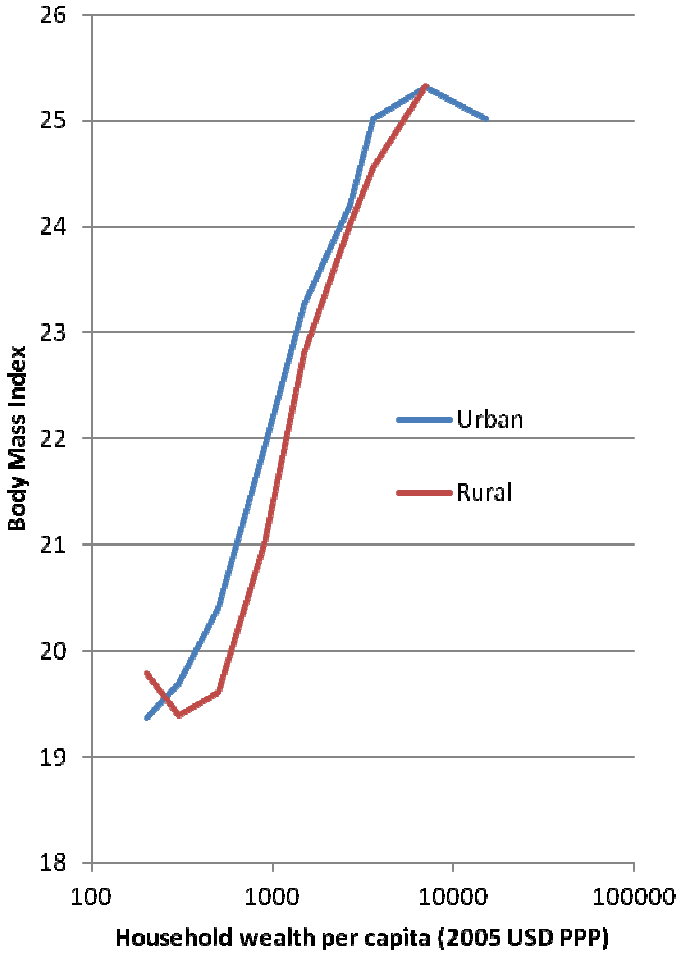
Body Mass Index
Urban
Rural
100
1000
10000
100000
Household wealth per capita (2005 USD PPP)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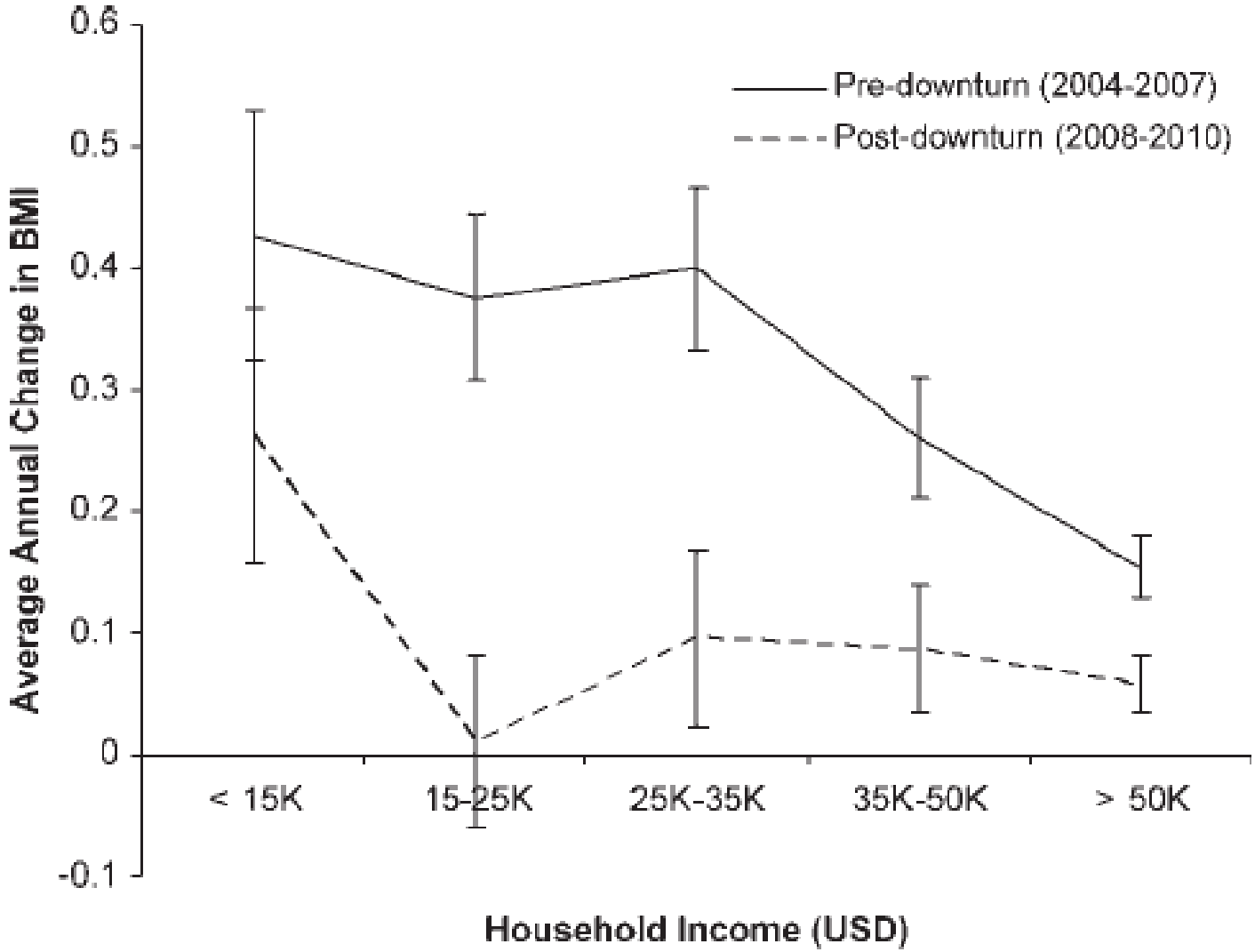

Fig. 2. Average annual changes in BMI before and after the 2008 downturn. Error bars are 95% confidence intervals for change estimates.

Hruschka 2012, data from BRFSS

Longitudinal studies

- **Low-income:** post-Soviet Cuba (Franco et al. 2007)
- **Middle-income:** post-Soviet eastern Europe (Silventoinen et al. 2004)
- **High-income:** U.S. economic downturns (1987-2000) (Ruhm 2005)