

Consumer Food Waste: New estimates and approach

Inferring consumption food waste from private expenditure

- June 7th, 2017
- 20th GTAP conference, Purdue University.
- Monika Verma, Linda de Vreede, Martine Rutten, Thom Achterbosch

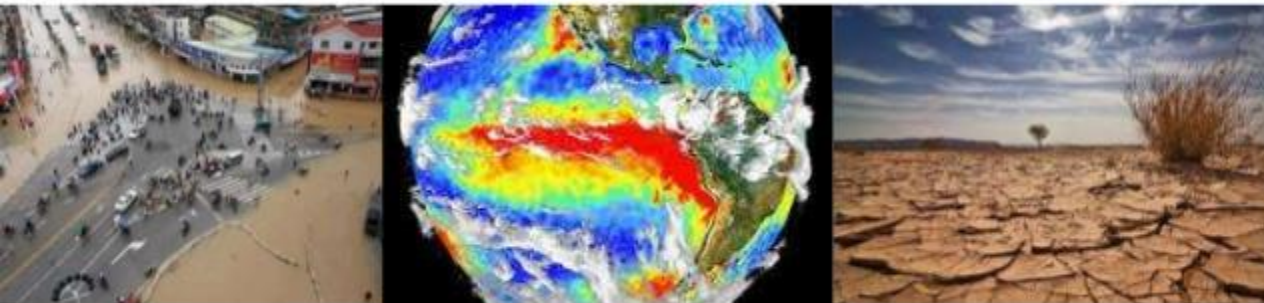
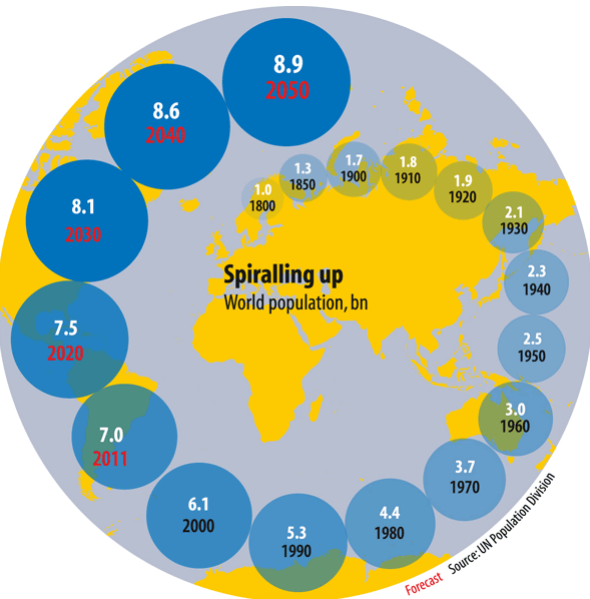
WHY is it important?

Can we produce enough to end hunger (SDG2)?
Maybe... Tech development

For how long? Sustainably?... (SDG13)

Is it the best solution? Efficient resource use

Are we consuming responsibly? (SDG12)



How much can reducing waste contribute? How big is the problem?

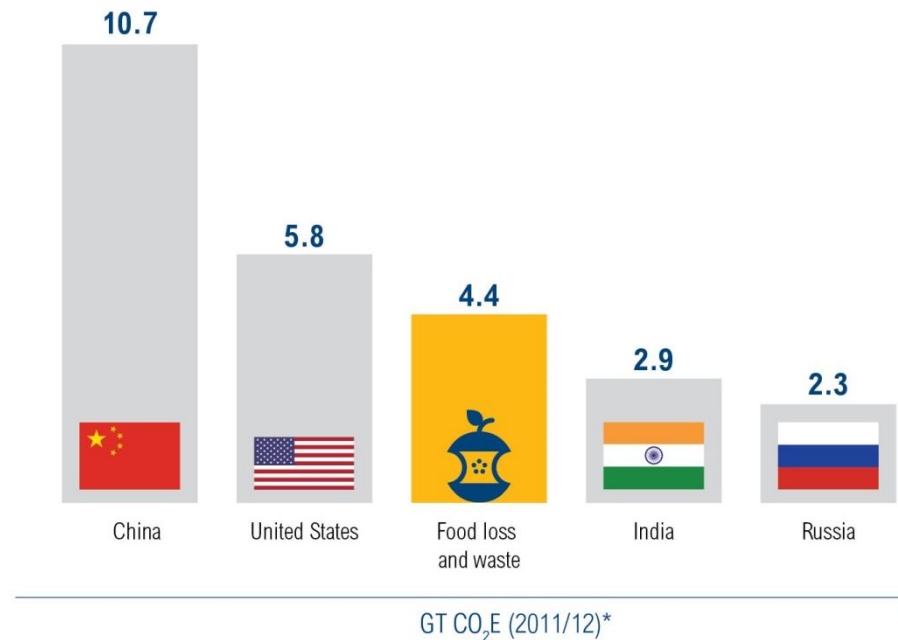
- Impacts of Waste reduction on...

- Food availability
- Food access
- Sustainability /climate

Approaches:

CGE, accounting

If Food Loss and Waste Were its own Country,
it Would Be the Third-Largest Greenhouse Gas Emitter



ORIGINS

I am not happy with what we are doing Food Waste. You have developed a model, would you be willing to share it? Collaborate?



We have, but it's been sitting there. It would be nice to have the income and price elasticities for food waste.

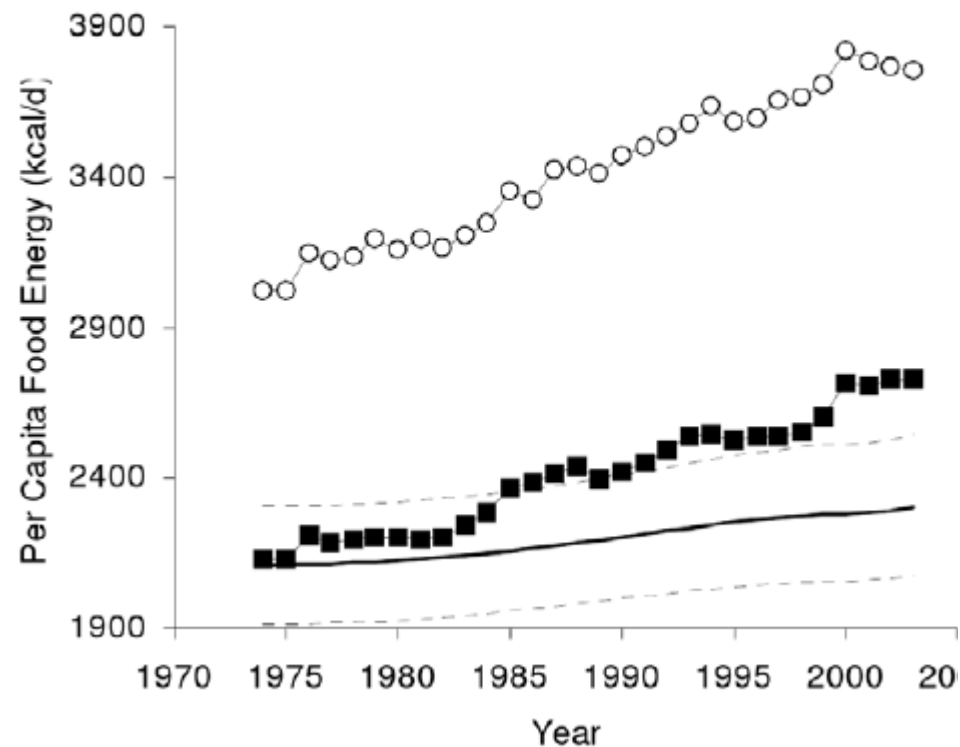
And where would I get data on food waste? In what units? Mass/energy?



BUT

- How much are we “really” wasting?
- FAO estimates – gold standard (based on):
 - Limited data and expert opinions
 - Extrapolated
 - ...
 - Estimates are as good as the data behind it
- If use waste factors (aka FAO approach)...

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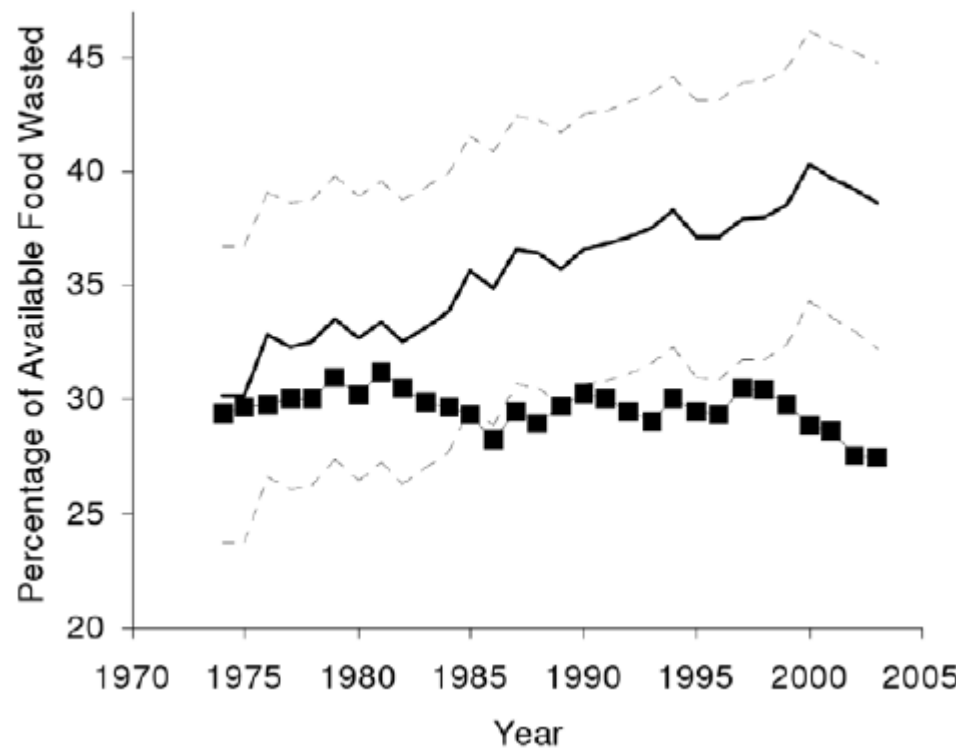


- Share of food wasted (■)
Standard Approach (about constant)

- Share of food wasted (-)
Hall et al.(2009) (↑)

- Food Availability for consumption (FBS)
- USDA Adjusted (■) ~ intake
- Unadjusted (○) ~ supply
- Estimated Food intake (-)

D



- Focus on consumers, because
 - Individual instead of supply chain bottlenecks
 - Biggest proportion in developed supply chains
 - Urbanization and increasing pop will make it worse
 - ‘Consumerism’(SDG12)
- What is waste?
 - Definitional issues
 - Depends on question and focus: FAO(food security), EC(resource efficiency)
 - Landfill yes but what about fed to pets?

WHAT is waste?



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Peter Dazeley via Getty Images

WHAT is waste?



FAO, FBS

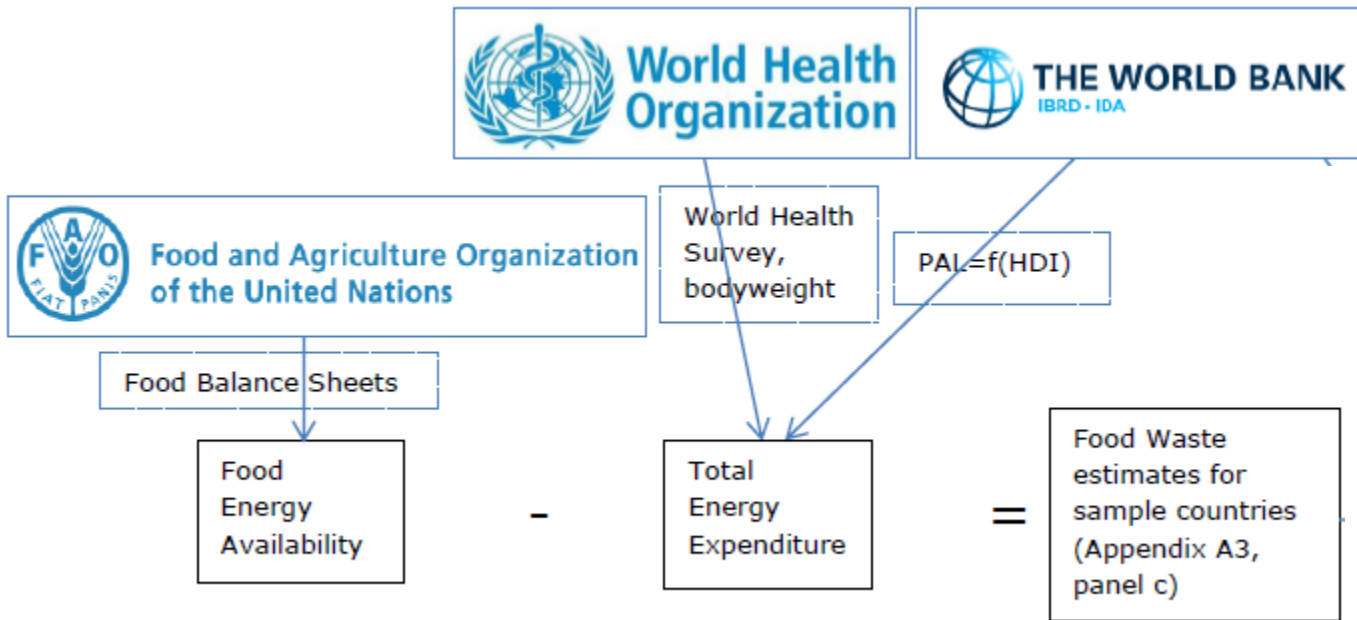
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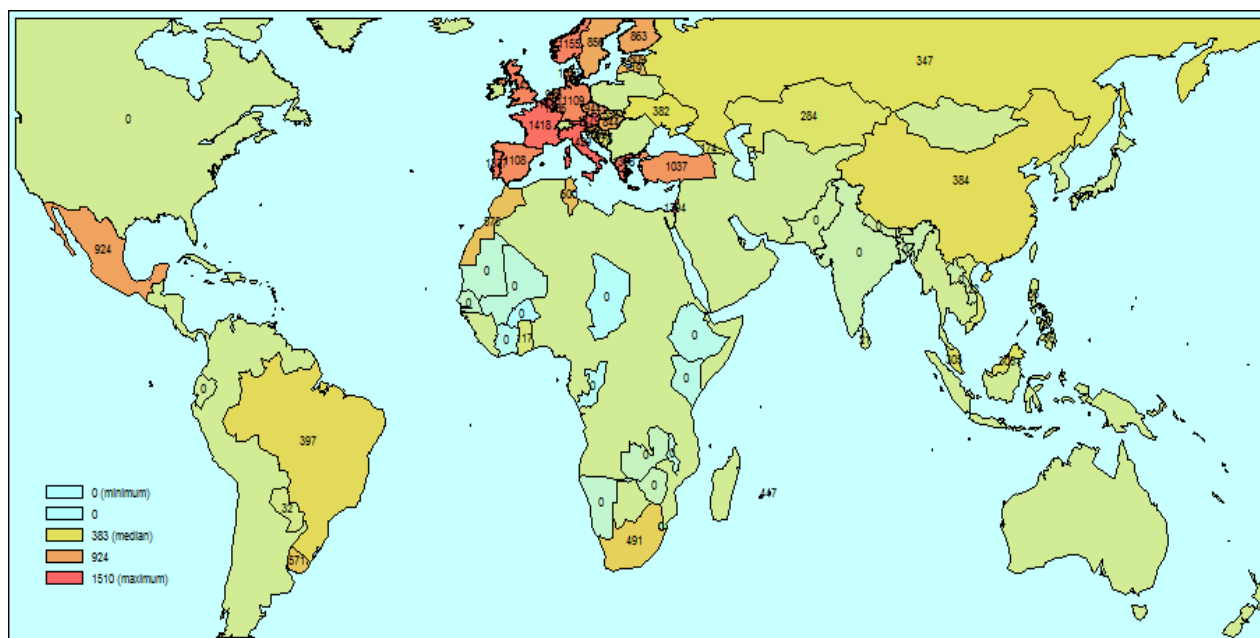
Peter Dazeley via G

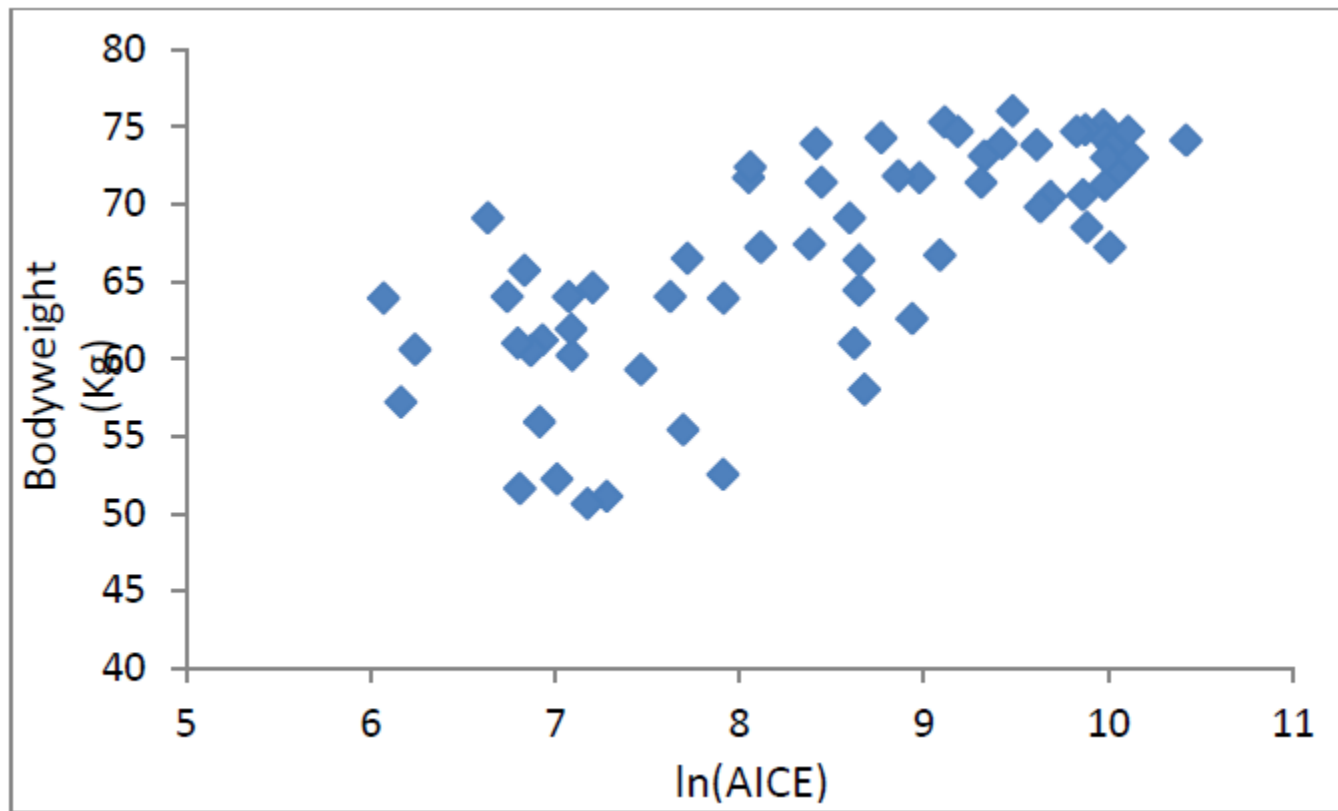
Anthropometry
data (AD)

*evolution is different

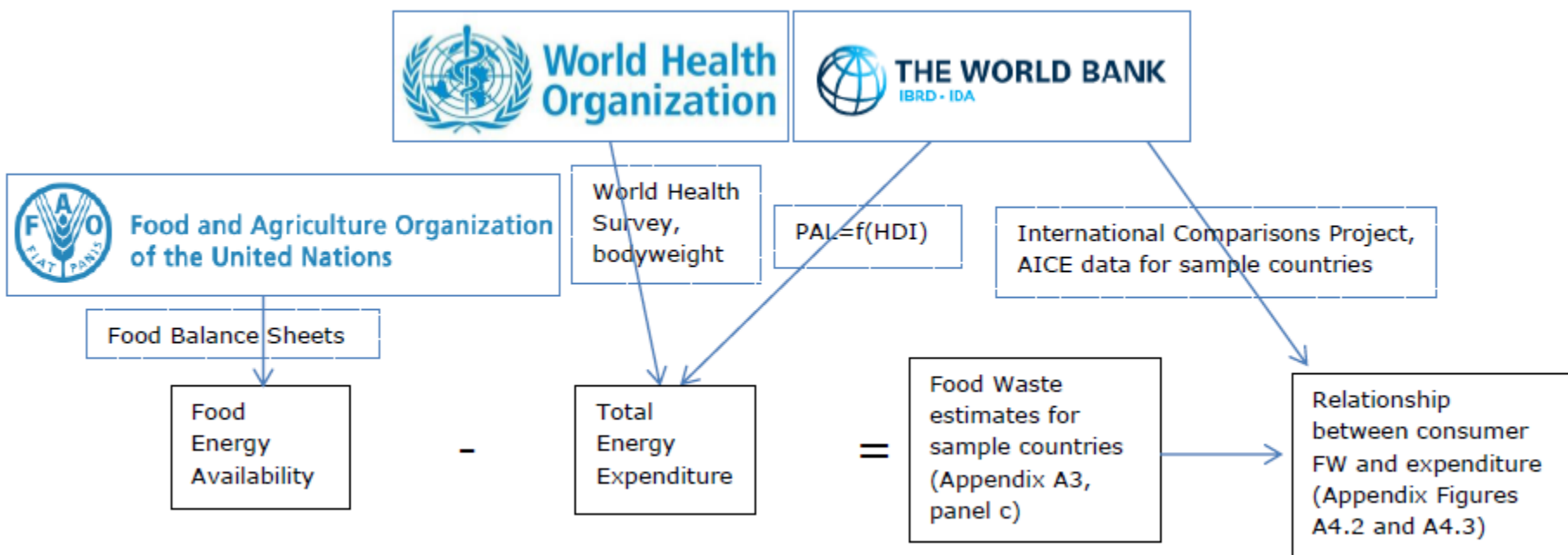


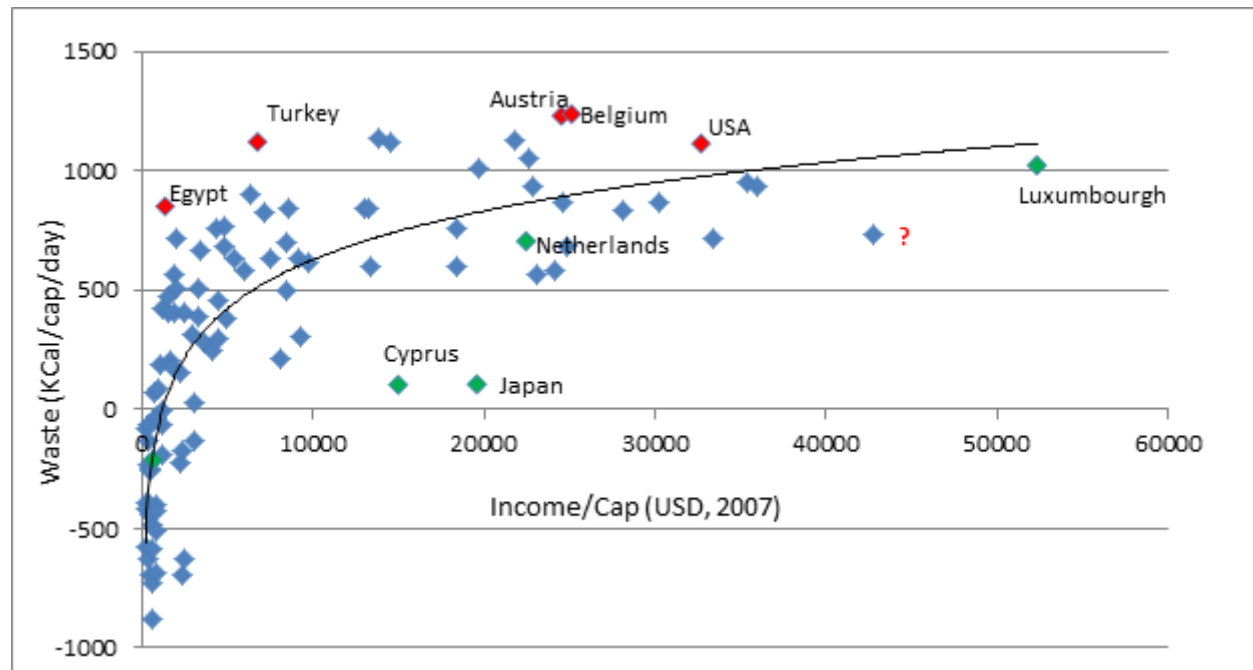
Variable	Body weight (K.g. 2003)	Food availability (kcal/cap/day, 2003)	Food waste (kcal/cap/day, 2003)	Annual Actual Individual Consumption Expenditure (international\$, 2005)
Mean	59.6	2704	326	4272
Minimum	50.6	1,868	21	434
Maximum	76	3,757	1510	33684
Standard deviation	7.12	525	451	8584





- More weight causes more consumption expenditure? OR
- Higher consumption expenditure causes higher bodyweights?





– Supports a logarithmic approximation

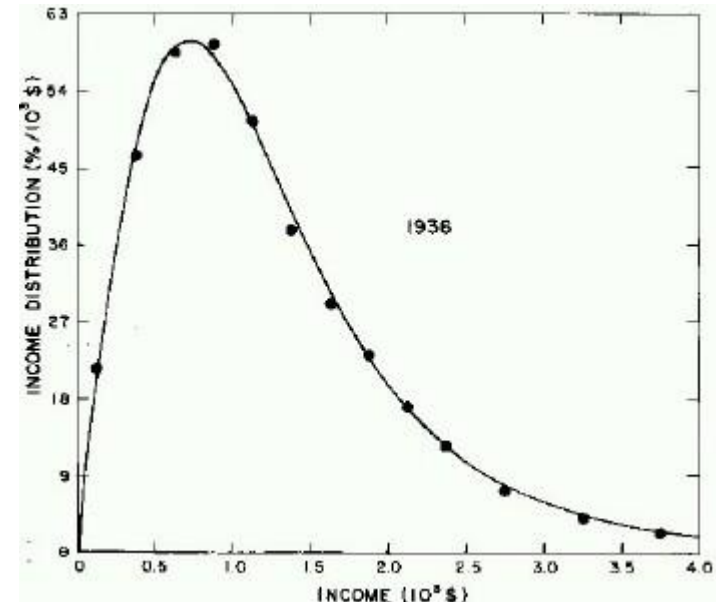
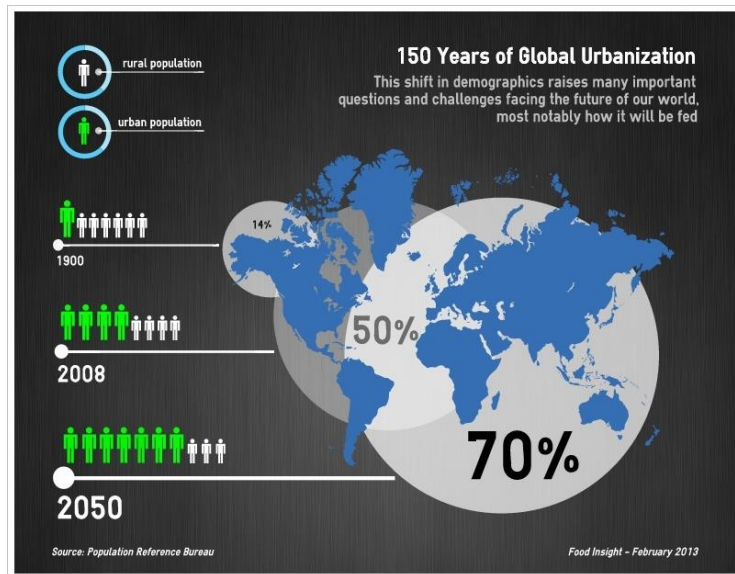
	FAO/Hic (World)	Buzby/Hall (US)	Current (world/US)
Method	Factors/AD	Factors/AD	AD
Estimate (Kcal/cap/day)	214 (2005-07)/ 510 (2010)	1249 (2010)/ 1400 (2003)	475-665(2003-11)/ 1376-1460 (2003-11)

Issues tackled

- Consumer food waste correctly identified as biggest but grossly underestimated
 - No determinants and hence no evolution as part of economic system
 - Limited data to get initial estimates, in absence of survey data
- (survey data not internationally comparable...)

Cons still remaining...

- Missing factors



- Assuming everybody has reached stable weights*

Other insights?



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$$CP_i = CC_i + CW_i$$

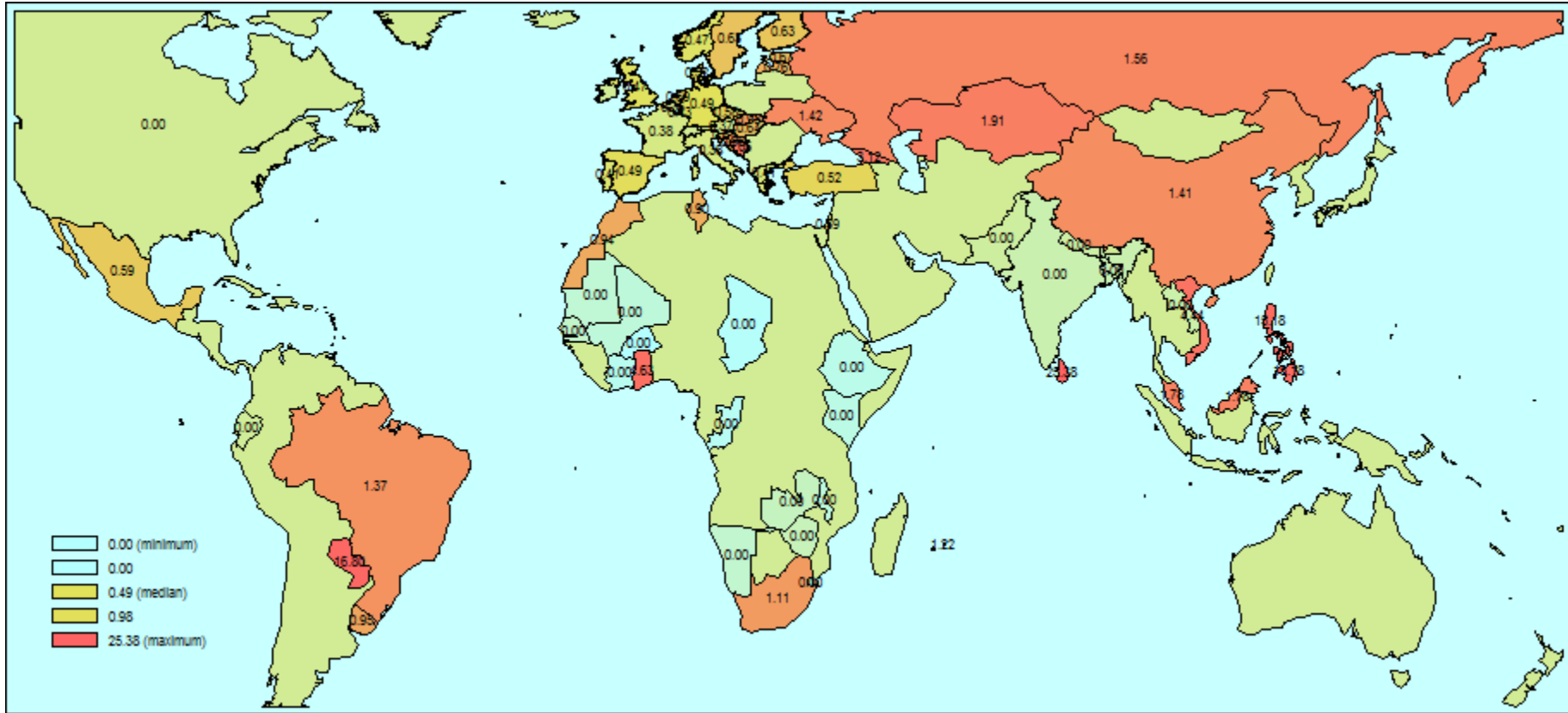
$$\alpha_i QP_i = \alpha_i QC_i + \alpha_i QW_i$$

$$\eta_y^p = \theta \eta_y^c + (1 - \theta) \eta_y^w$$

Affluence elasticity
of FW

(we are overestimating consumption, particularly in rich countries)

Affluence elasticities of food waste



- High affluence elasticity in fast growing regions signals a looming food waste problem
- An affluence based food tax might be a promising policy response
Around 2450/cap (international 2003 USD) is the threshold

Concerns in CGE world...

- Problem of 'exploding' people... as countries grow richer
 - It's not the complete solution but it is a part
 - Another is quality of food (also suggested by log approximation)

How do you include it in, say GTAP?

- Approach 1: residual income elasticity of consumption
- Knowns: η_y^p and η_y^w ; get η_y^c (EYC)

Formula (all,i,FOOD)(all,s,WCON_REG)

$$\text{EYC}(i,s) = (\text{EY}(i,s) - \text{SCCW}(i,s) * \text{EYW}(i,s)) / (1 - \text{SCCW}(i,s));$$

Equation E_qpw (all,i,FOOD)(all,r,WCON_REG)

$$\text{qpw}(i,r) - \text{pop}(r) = \text{sum}(k, \text{TRAD_COMM}, \text{EP}(i,k,r) * \text{pp}(k,r)) + \text{EYW}(i,r) * [\text{yp}(r) - \text{pop}(r)] \\ + \text{wcomreg}(i,r) - \text{wcomregave}(r);$$

Equation E_qpc (all,i,FOOD)(all,r,WCON_REG)

$$\text{qpc}(i,r) - \text{pop}(r) = \text{sum}(k, \text{TRAD_COMM}, \text{EP}(i,k,r) * \text{pp}(k,r)) + \text{EYC}(i,r) * [\text{yp}(r) - \text{pop}(r)];$$

Equation E_qpf (all,i,FOOD)(all,r,WCON_REG)

$$\text{qp}(i,r) = \text{SCCW}(i,r) * \text{qpw}(i,r) + (1 - \text{SCCW}(i,r)) * \text{qpc}(i,r);$$

- Consumption elas is no longer CDE but residual

Nature of results

- Impact of waste reduction on P, C, W (2007-50)

Aggregate Quantity Index for Food Commodities for which waste reduction is targeted

	Baseline (no waste reduction)			Waste reduction old approach	Waste reduction new approach		
	Purchase	Consumption	Waste	Purchase/consumption/waste	Purchase	Consumption	Waste
USA	68	75	46	58	53	76	-25
EU28	38	41	25	31	23	42	-34
ROE	53	53	56	46	43	53	-16
OCE	107	115	85	94	76	117	-5

– **Wasting less \neq consuming less**
(implications for nutrient intake)

- Impact on consumer prices

	<u>Old Approach</u>		<u>New Approach</u>	
	Food Aggregate	Wasted Commodities Aggregate	Food Aggregate	Wasted Commodities Aggregate
USA	-2.2	-2.9	-3.3	-4.3
EU28	-1.7	-2.1	-2.9	-3.5
ROE	-1.4	-1.9	-2.1	-2.8
OCE	-1.4	-2.0	-2.4	-3.4
ROW	-2.3	-3.2	-3.5	-4.9

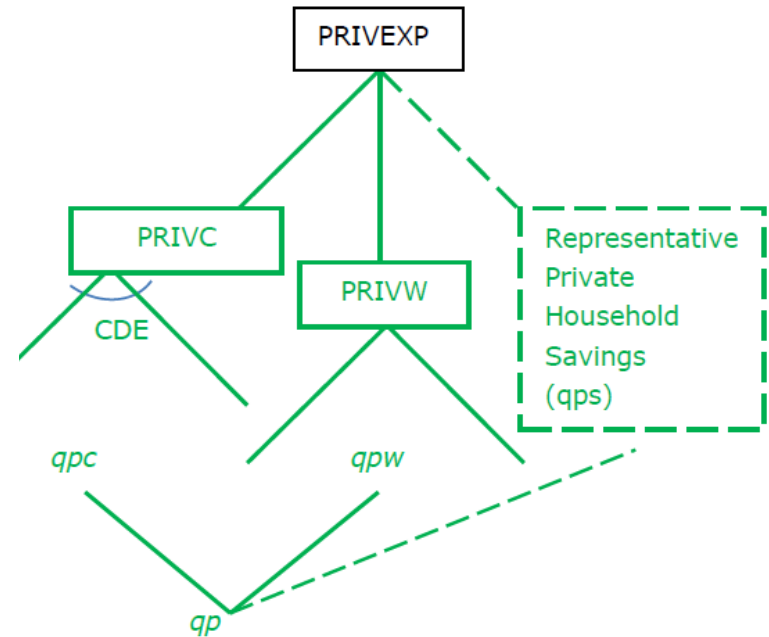
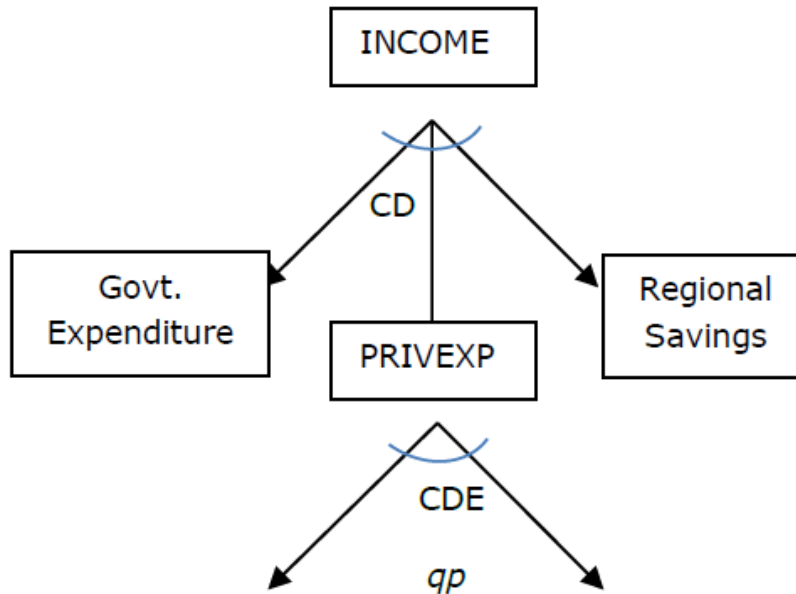
- Impact on land demand and price

	Land demand		Land price	
USA	-1.34	-2.71	-55	-79.2
EU28	-0.44	-1.19	-63.4	-111.3
ROE	0.13	0.06	-35.9	-51.1
OCE	-0.02	-0.57	-61.7	-109.1

» Impacts are more pronounced

Alternatives?

- Approach 2:



- Approach 3: no regional household (bottom up approach – private hhld + government)

The MyGTAP way (Walmsley 2014)

Next burning issues...

- Refine
- Additions:
 - Urbanization
 - Inequality (income distribution)
 - Cost of achieving the reduction...

Questions/suggestions/ideas/future
collaboration all are very welcome!

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