What Guides Risk Mitigation: Perceptions or Statistics?

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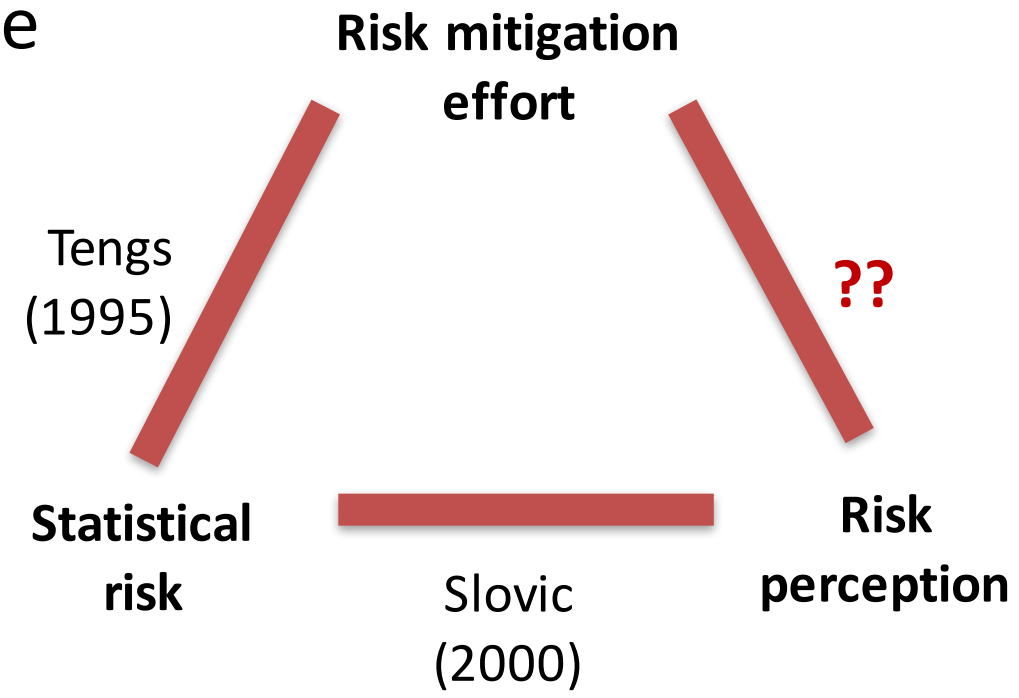
Idea

- Precautionary principle
- Benefit-cost analysis
- Path dependency
- Feasibility
- Historical norms
- Culture



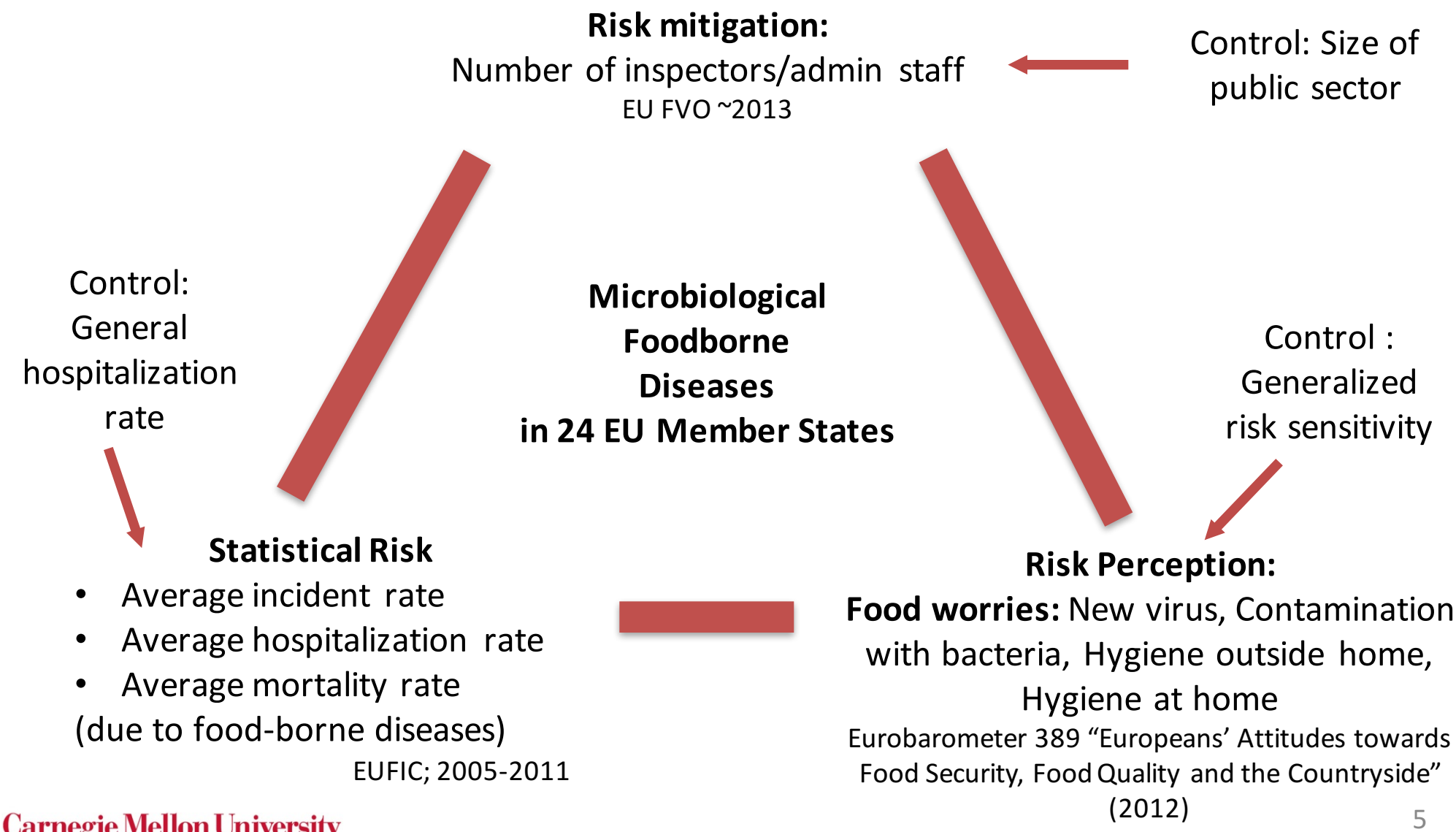
Research Question

- Is the risk mitigation by governments or individuals more informed by statistical risk or by risk perception?
- Are risk mitigation effort, statistical risk and risk perception correlated?
- Case studies
  - Foodborne diseases
  - Cancer

Foodborne diseases in the EU

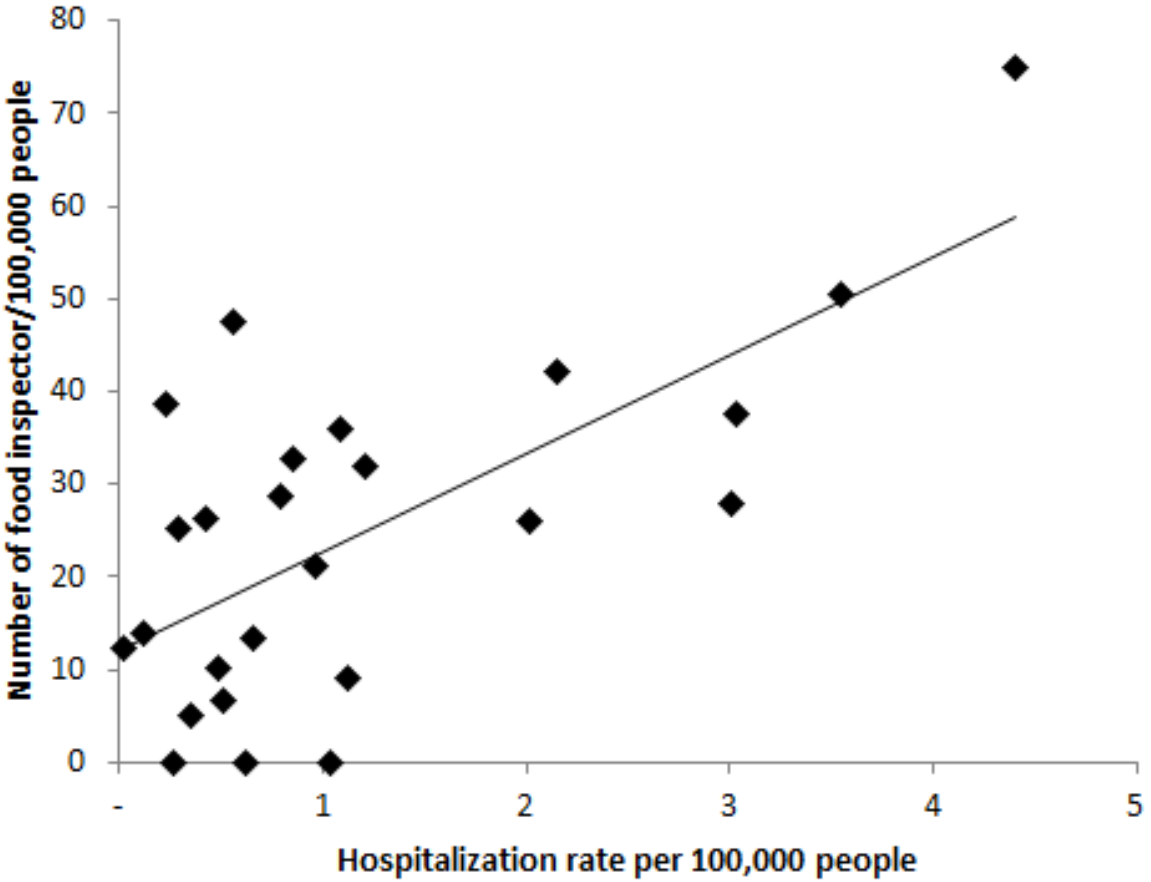
- EC No. 882/2004: "The frequency of official controls should be regular and proportionate to the risk […] *Ad hoc* controls should be carried out in case of suspicion of non-compliance. Additionally *ad hoc* controls could be carried out at any time, even where there is no suspicion of non-compliance."
- "At EU level risk assessment is institutionally separated from risk management. […] Risk communication […] is a shared competence between risk assessors and managers." (EU Food Safety Almanac 2011)

Data: Food-borne Diseases



Number of inspectors is positively correlated with hospitalization rate

Countries with higher hospitalization rates have a higher number of inspectors per 100,000 people.

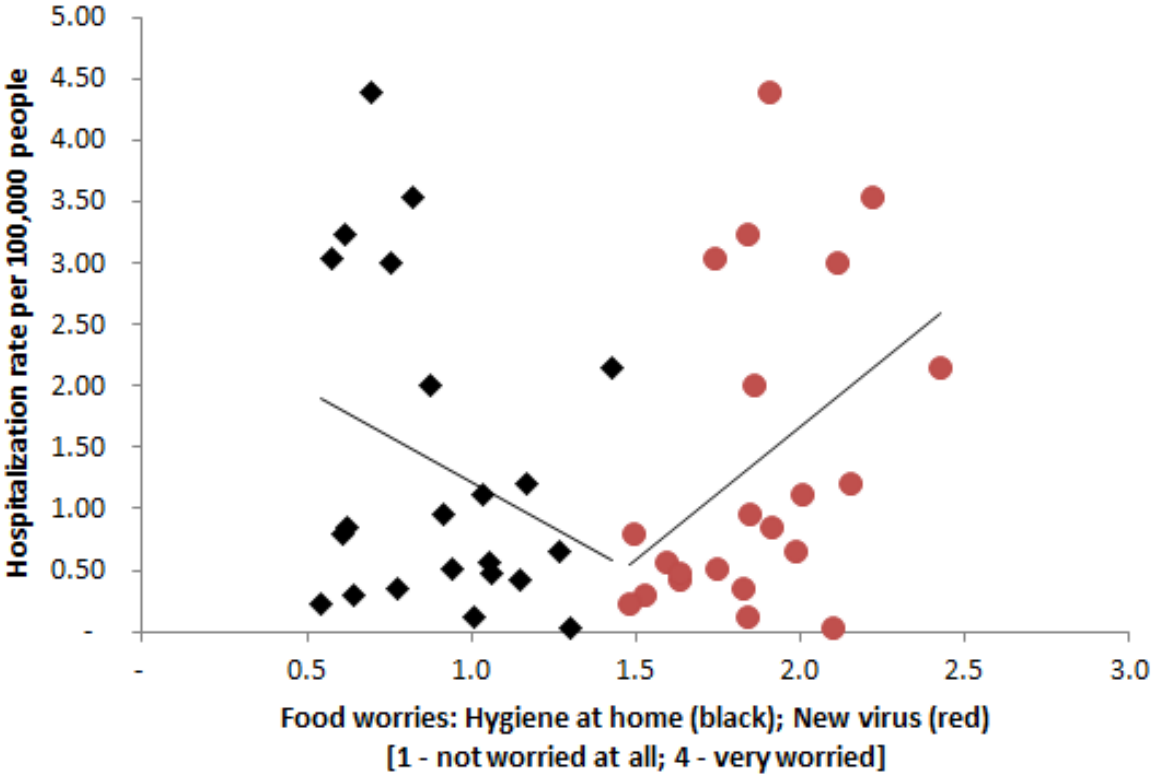


Predictor	Coef	SE
Constant	16.35	8.11
Hospitalization rate	9.72***	2.27
Size of public sector	-0.41	-2.68
R-Sq=49.5%, R-Sq(adj)=43.8%		

Mortality rate and incident rate are not significantly correlated to the number of inspectors.

Hospitalization rate weakly correlates with food worries

- Countries where people are more worried about **hygiene at home** have lower hospitalization rates.
- People in countries with higher hospitalization rates are more afraid of **new viruses.**



Predictor	Coef	SE
Constant	2.73	9.27
Food worry: Hygiene at home	-2.50*	0.95
Food worry: New Virus	2.87*	1.31
General Hospitalization Rate	$9*10^{-5}$	$7*10^{-5}$
Generalized risk sensitivity	2.23	3.06
R-Sq=53.7%, R-Sq(adj)=42.1%		

Unlikely that there is causality between hospitalization rates and food worries

Hosp. rate ~ f(Hygiene at home)

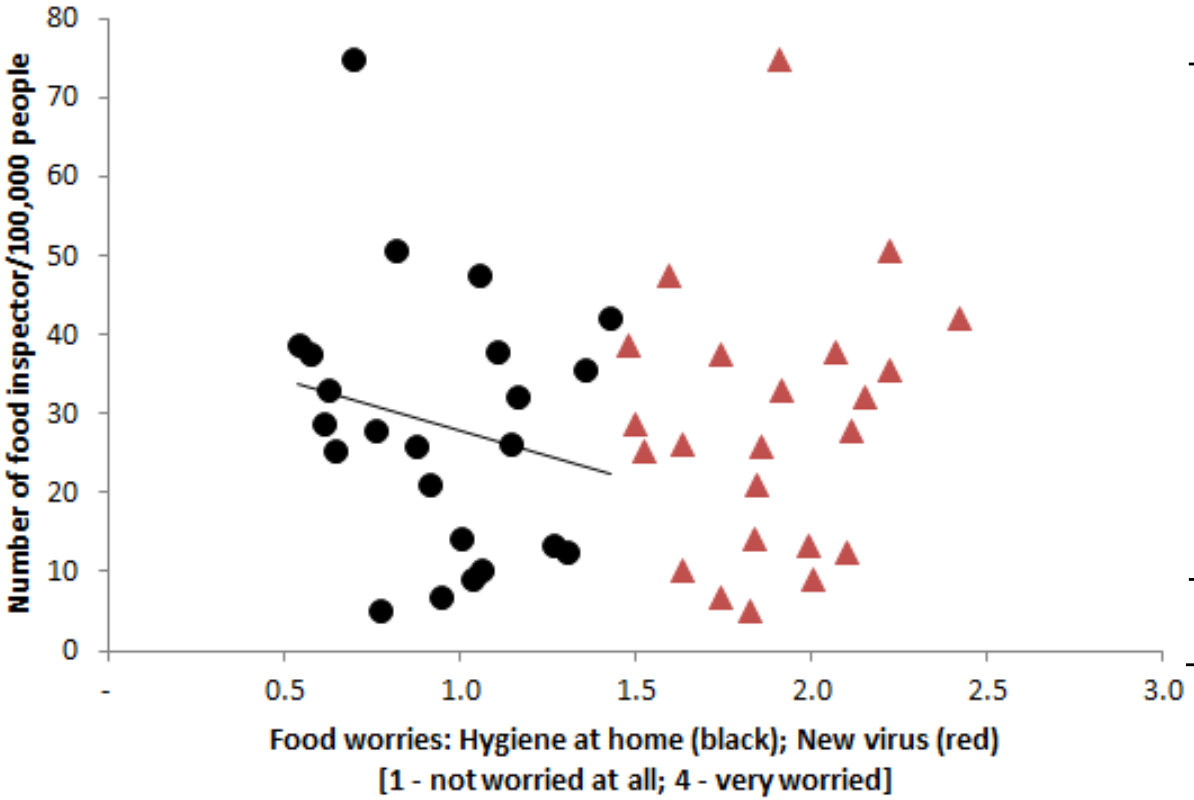
Predictor	Coef	SE
Constant	15.09**	4.89
Food worry: Hygiene at home	-1.41	0.91
Generalized risk sensitivity	5.81**	1.73
General Hospitalization Rate	$17*10^{-5}$**	$5*10^{-5}$
R-Sq=43.9%, R-Sq(adj)=34.0%		

New virus ~ f(Hosp. rate)

Predictor	Coef	SE
Constant	4.61***	0.57
Hospitalization Rate	0.05	0.03
Generalized risk sensitivity	1.08***	0.22
R-Sq=56.5%, R-Sq(adj)=51.9%		

Number of inspectors weakly correlated with perception of hygiene in home

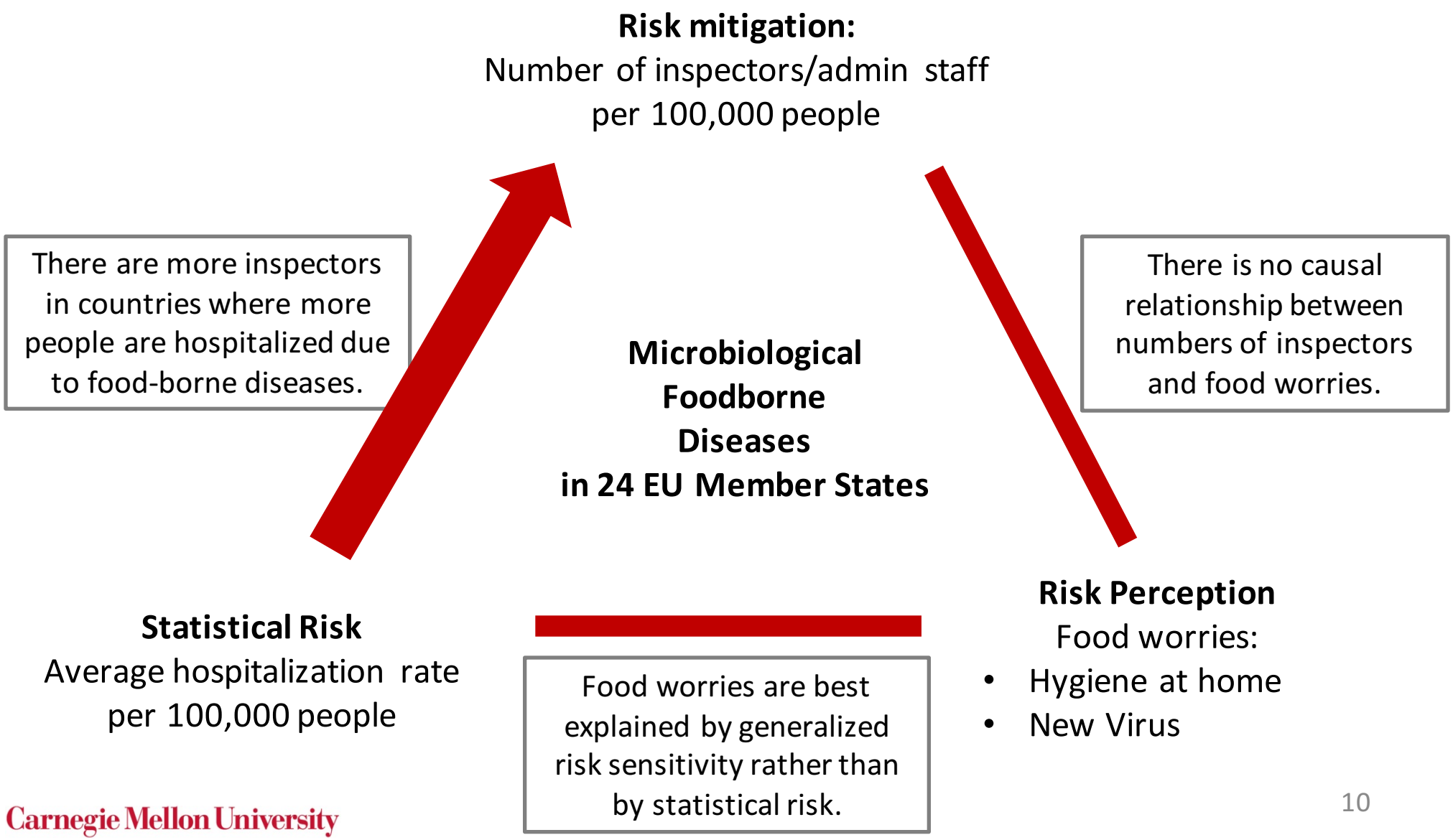
Countries where people are more worried about hygiene at home have a lower number of inspectors per 100,000 people. The correlation is weak and probably bears no causality.



Predictor	Coef	SE
Constant	177.93*	72.06
Food worry: Hygiene at home	-38.6*	14.58
Generalized risk sensitivity	48.37	23.78
Size of public sector	5.65	3.23
R-Sq=30.6%, R-Sq(adj)=20.3%		

Worries about food contamination, viruses and hygiene outside home are not significantly correlated to the number of inspectors.

Results: Food-borne Diseases

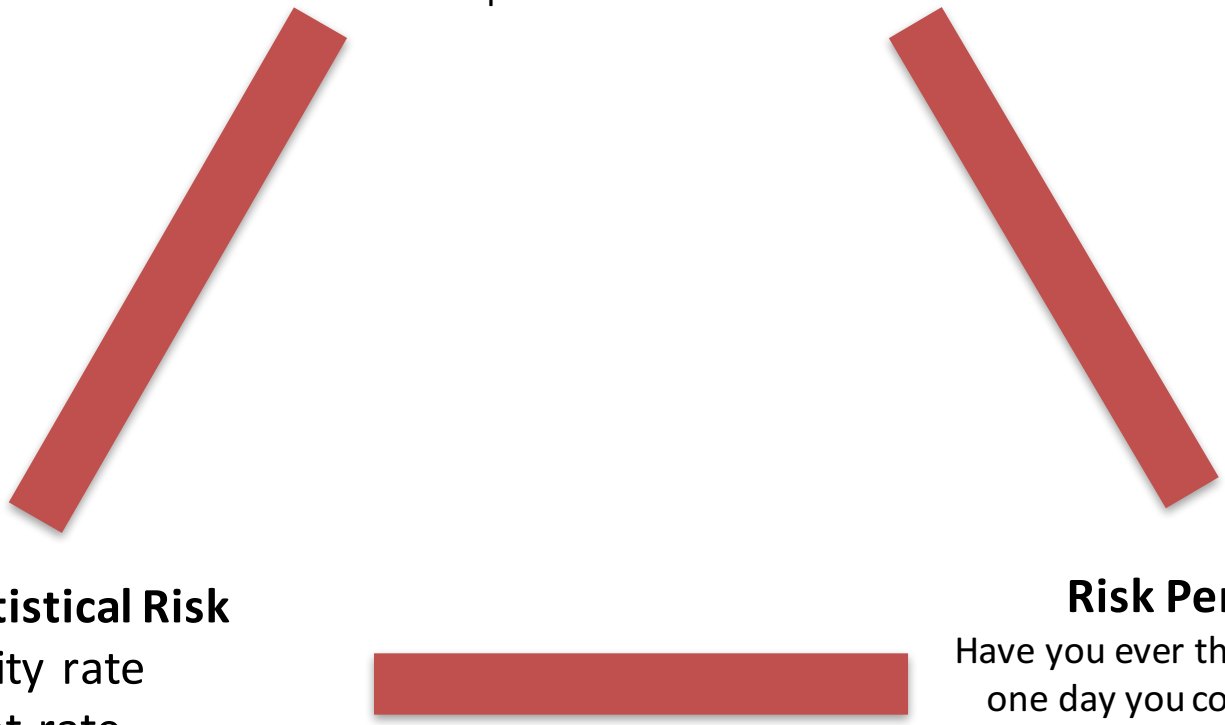


Data: Breast & Cervical Cancer

Risk mitigation

Frequency of screening

European Commission 2008



Statistical Risk

- Mortality rate
- Incident rate

European Commission 2008

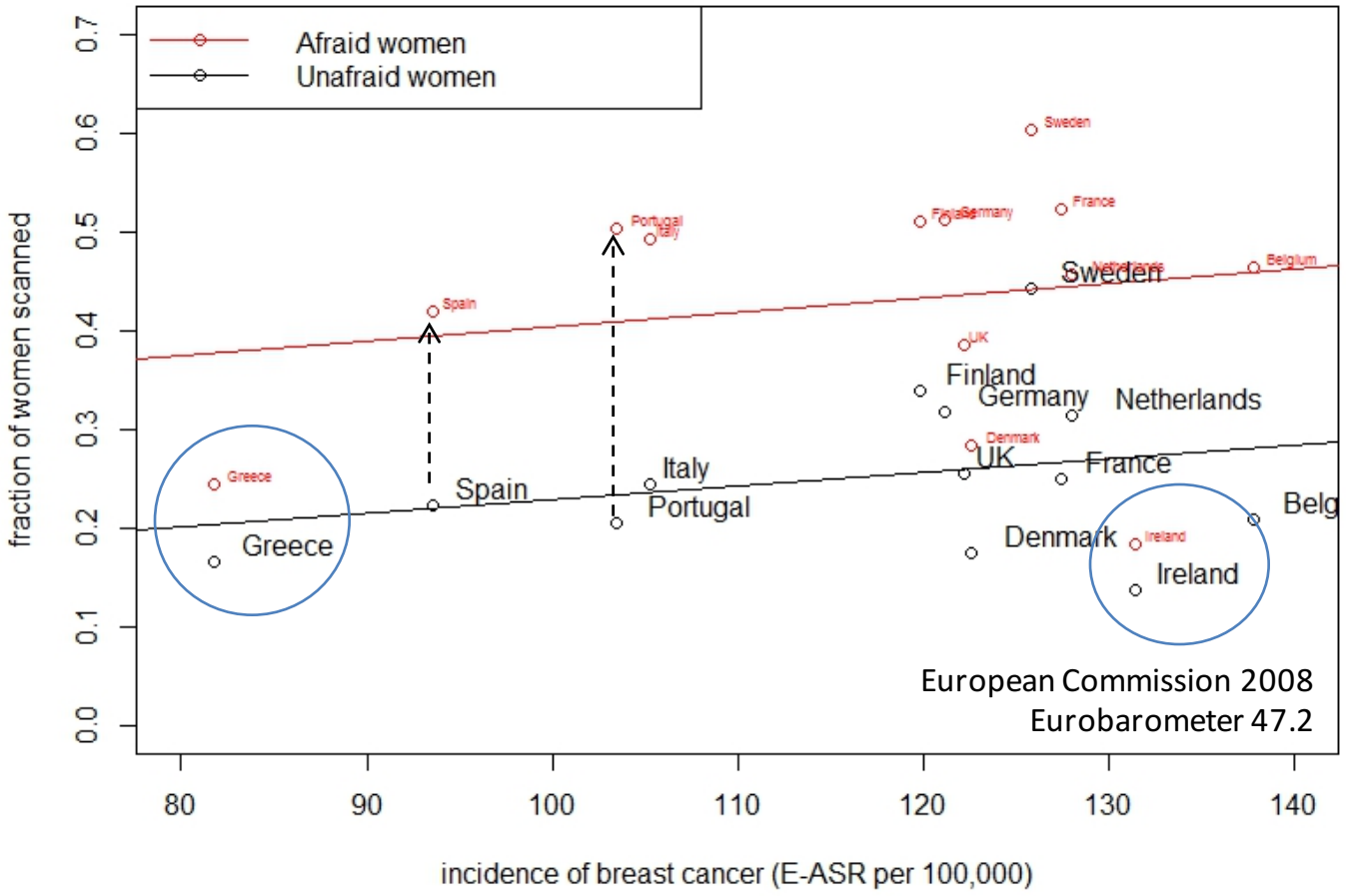
Risk Perception

Have you ever thought or not that one day you could have breast cancer or cervical cancer?

Eurobarometer 47.2 1997

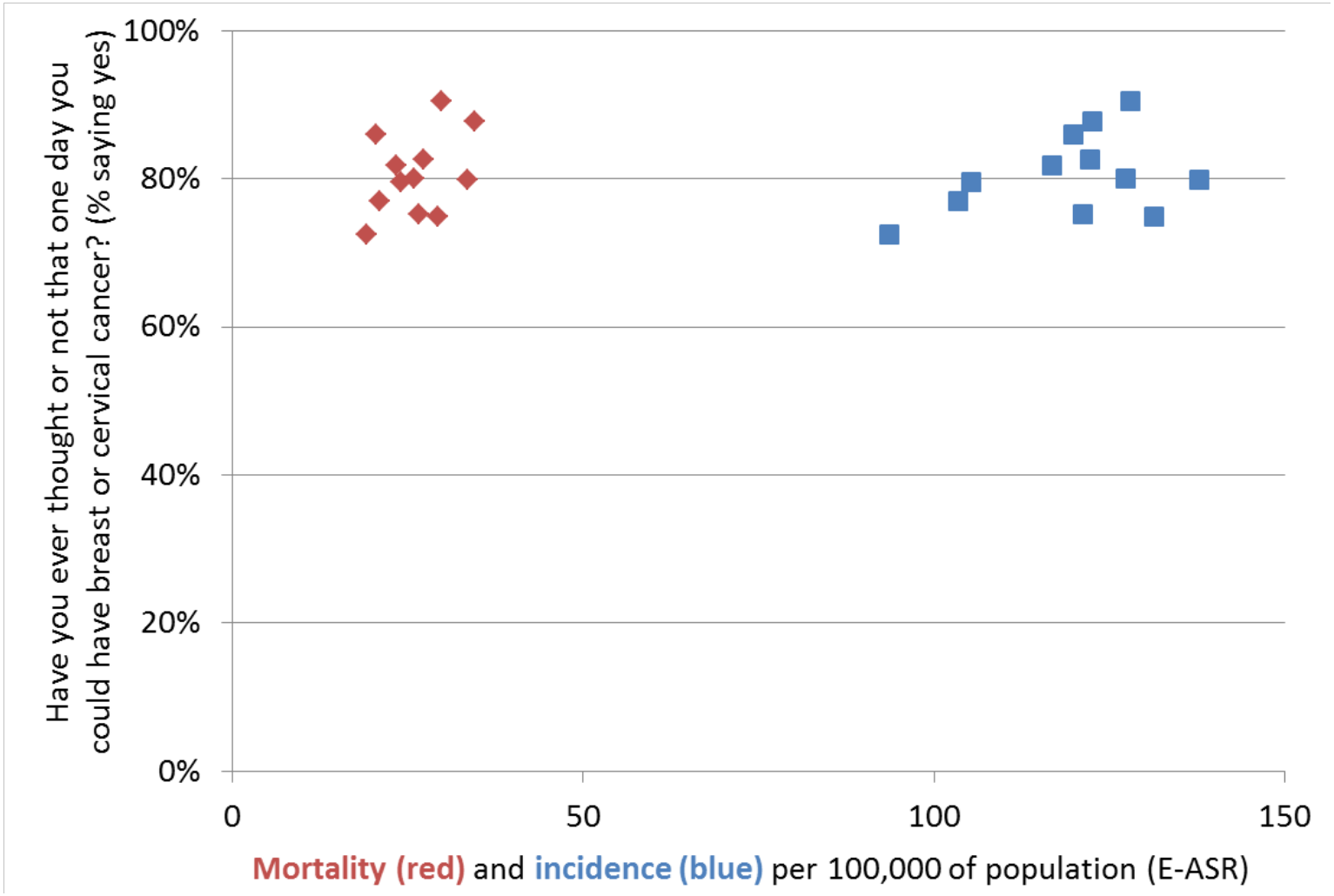
Breast cancer: Women who are afraid twice as likely to get mammograms

Women who live in countries where the incidence of breast cancer is high are *not significantly* more likely to get mammograms



	Unafraid	Afraid	Total
Untested	75%	56%	4,804
	(1,106)	(3,698)	
Tested	25%	44%	3,263
	(375)	(2,888)	
	1,481	6,586	8,067

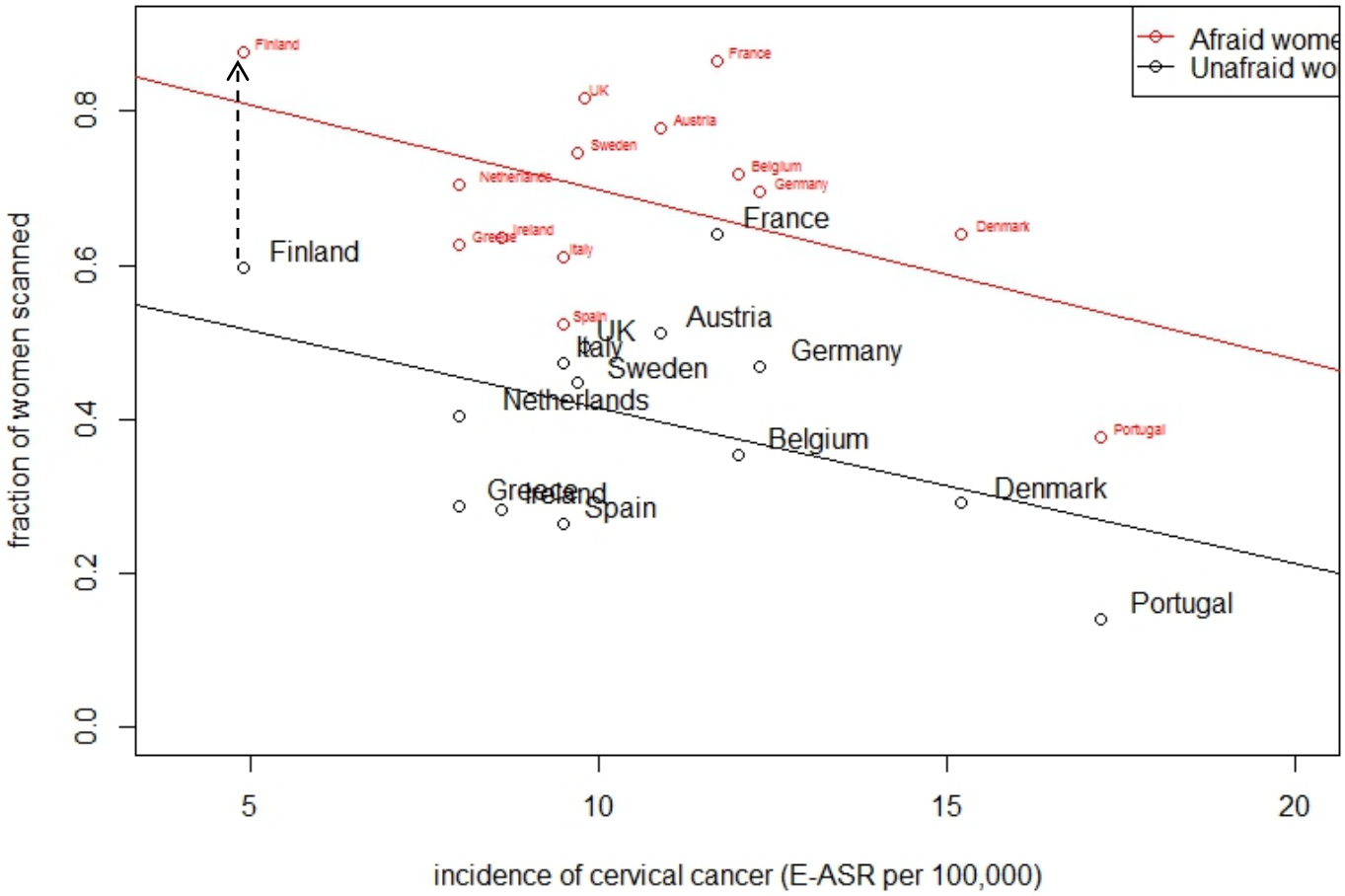
Breast cancer: Fear of breast cancer not correlated with incidence or mortality



European Commission 2008
Eurobarometer 47.2

Cervical cancer: Women who are afraid almost twice as likely to get cervical smears

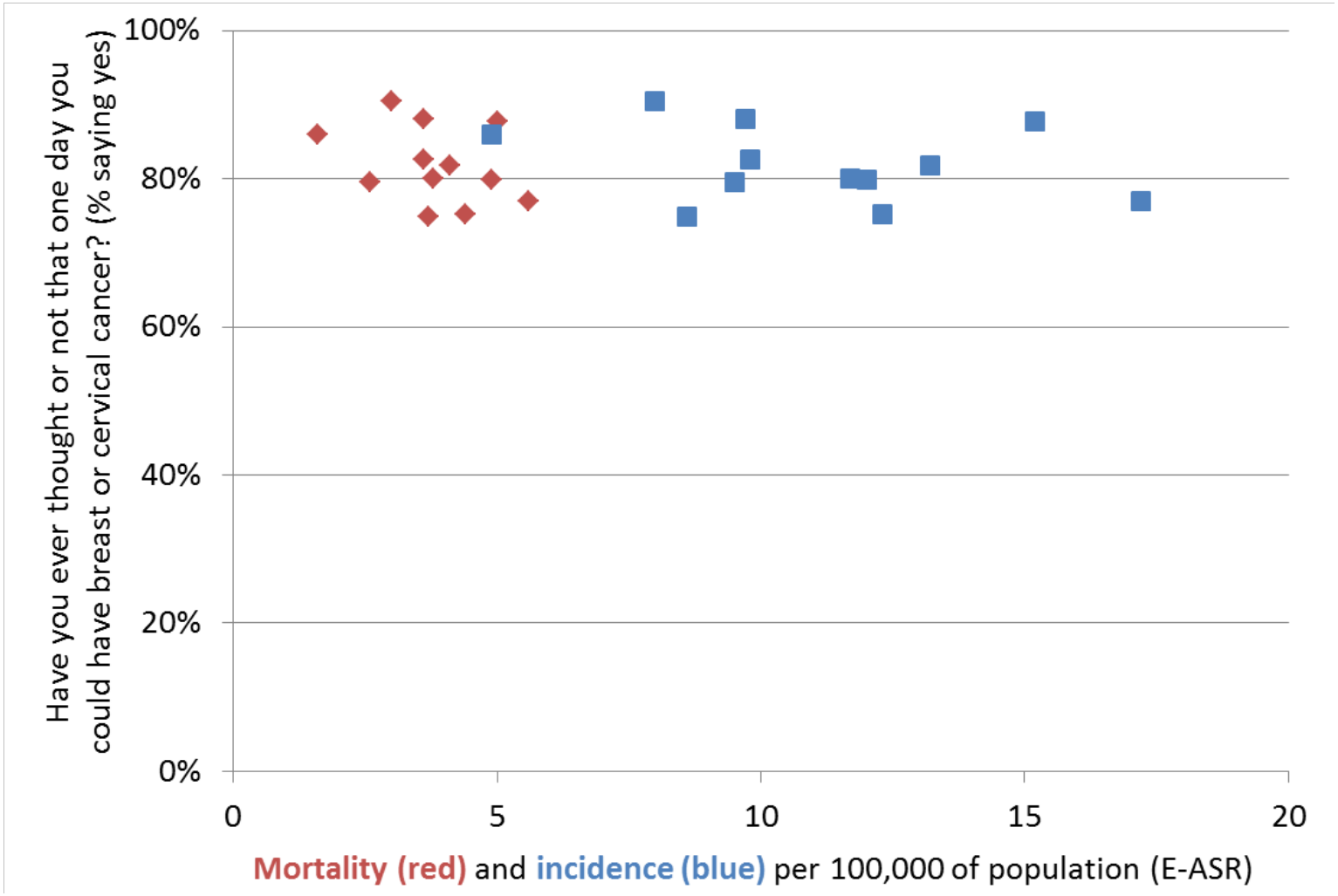
Women who live in countries where the incidence rate of cervical cancer is high are (slightly) less likely to get cervical smears



	Unafraid	Afraid	Total
Untested	59%	30%	2,813
	(868)	(1,945)	
Tested	41%	70%	5,254
	(613)	(4,641)	
	1,481	6,586	8,067

European Commission 2008
Eurobarometer 47.2

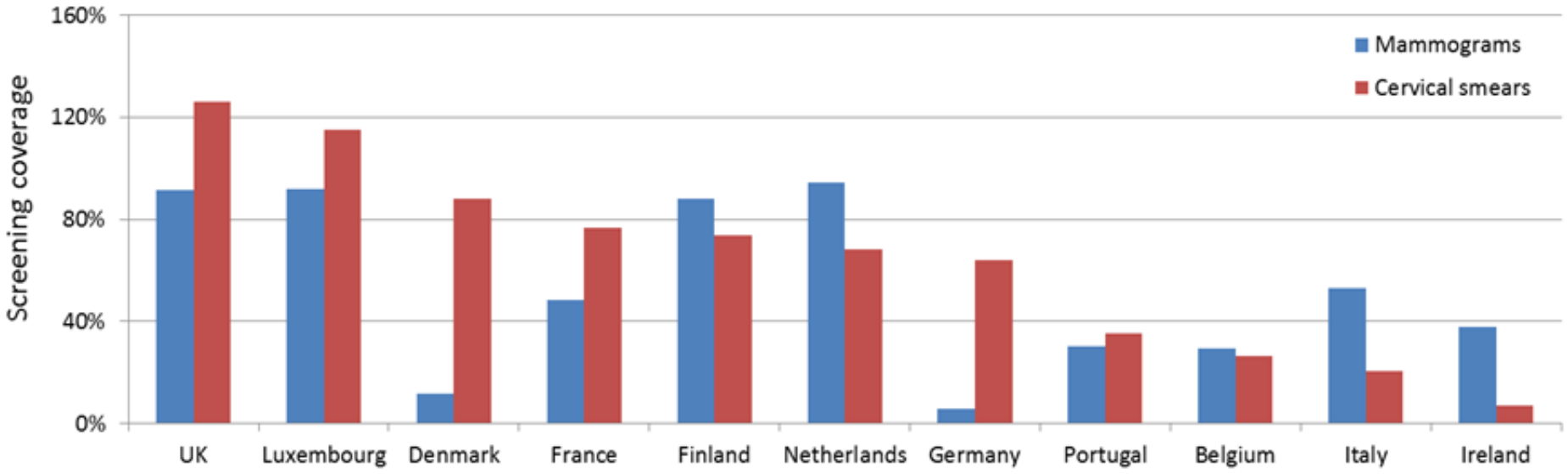
Cervical cancer: Fear of cervical cancer not correlated with incidence or mortality



European Commission 2008
Eurobarometer 47.2

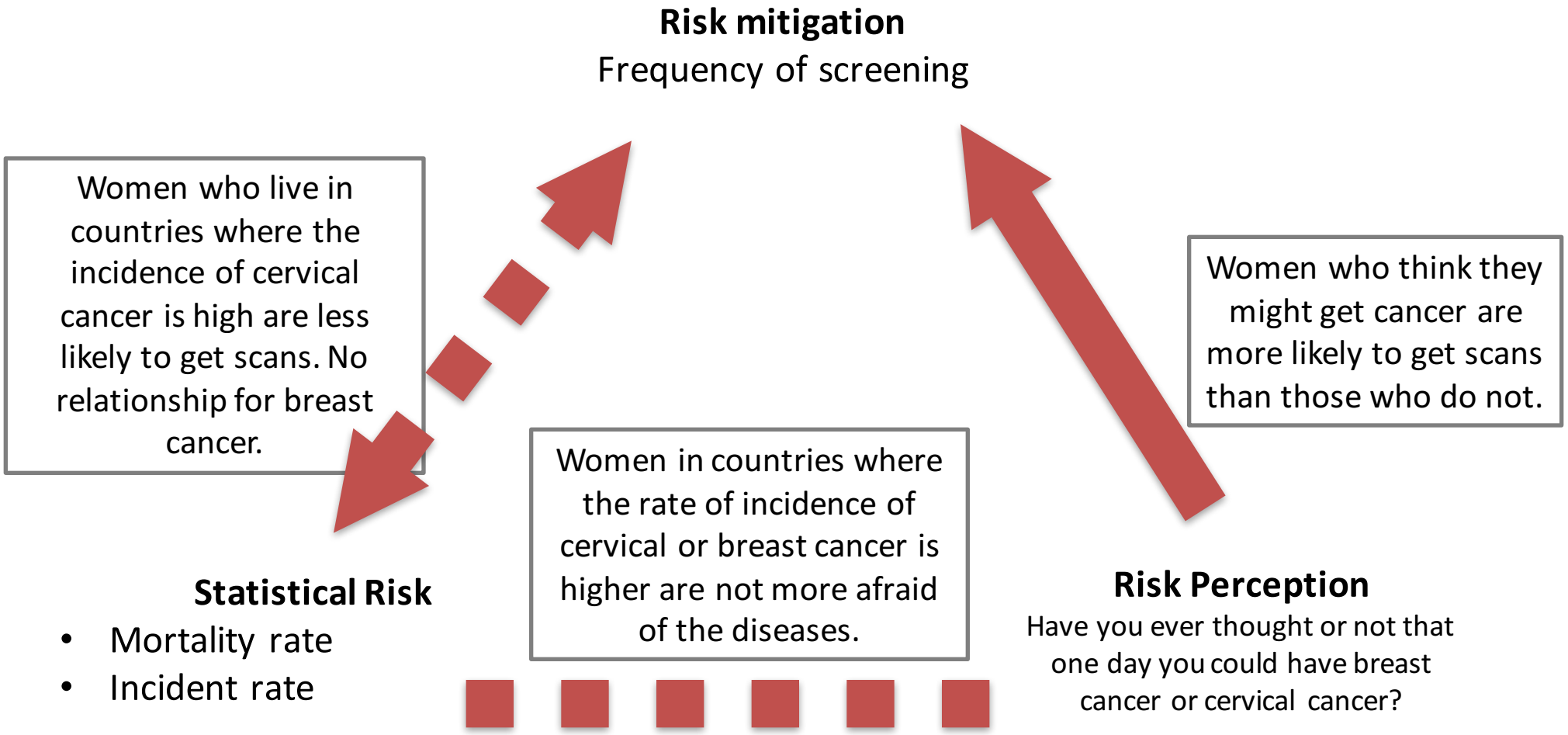
Screening rates for the two diseases vary widely in most countries

- This holds even after correcting for the different levels of fear that people feel about contracting each form of cancer
- and despite the fact that both types of screening are equally cost-effective (~$36,000 per QALY) (Robertson et al. 2011, Stout et al. 2006, van Rosmalen et al. 2012)



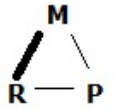
European Commission 2008

Data: Breast & Cervical Cancer

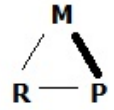


Conclusions

- **Large differences between different risks**
- **Food-borne Diseases: Statistical risk drives risk mitigation**



  - There are more inspectors in countries with high hospitalization rates due to foodborne diseases.
  - Food worries about hygiene at home and new viruses are driven by generalized risk sensitivity rather than by statistical risk.
  - **Relevance to policy:** European states should communicate actual risk to citizens better.
- **Breast & Cervical Cancer: Risk perception drives risk mitigation**



  - Screening rates not higher in countries where the rate of incidence is higher
  - Screening rates higher for individuals who believe they are at risk
  - Individuals who live in high-risk countries not likely to believe they are at a higher risk
  - **Relevance to policy:** European states should strive to correct misalignments.
- **Limited data**
  - Cancer perception
  - Food inspection rates
  - Money spent on risk mitigation

Work to be done

Foodborne diseases:

- Longitudinal inspection data

Cancer:

- More recent measures of perception of risk
- More detailed accounting of policy: what frequency of scans do people's / states' insurance policies support?

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References

European Commission, 2008. Cancer screening in the European Union: Report on the implementation of the Council Recommendation on cancer screening, Available at: http://ec.europa.eu/health/ph_determinants/genetics/documents/cancer_screening.pdf.

Eurobarometer 47.2: Women and Cancer, the European Parliament, and Expectations of the European Union, April-June 1997 Available at: http://einstein.library.emory.edu/eurolinks

Hohl, K. and Gaskell, G. (2008), "European Public Perceptions of Food Risk: Cross-National and Methodological Comparisons." *Risk Analysis*, 28: 311–324. doi: 10.1111/j.1539-6924.2008.01021.x

Tengs, T. O., Adams, M. E., Pliskin, J. S., Safran, D. G., Siegel, J. E., Weinstein, M. C. and Graham, J. D. (1995), "Five-Hundred Life-Saving Interventions and Their Cost-Effectiveness." *Risk Analysis,* 15: 369–390. doi: 10.1111/j.1539-6924.1995.tb00330.x

Slovic, P (2000), *The perception of risk*. Risk, society, and policy series. London, England: Earthscan Publications.

Henning, K.J., Graf, B.A., Kaus, S., Böl, G.F. (2011), *EU Food and Safety Almanac,* Federal Institute for Risk Assessment (BfR), Berlin, Germany (www.bfr.bund.de)

Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules, *OJ L 165, 30.4.2004, p. 1–141.*

Robertson, C. et al., 2011. The clinical effectiveness and cost-effectiveness of different surveillance mammography regimens after the treatment for primary breast cancer: systematic reviews registry database analyses and economic evaluation. Health technology assessment (Winchester, England), 15(34), pp.v–vi, 1–322.

Stout, N.K. et al., 2006. Retrospective cost-effectiveness analysis of screening mammography. *Journal of the National Cancer Institute*, 98(11), pp.774–782.

Van Rosmalen, J., de Kok, I.M.C.M. & van Ballegooijen, M., 2012. Cost-effectiveness of cervical cancer screening: cytology versus human papillomavirus DNA testing. BJOG: an international journal of obstetrics and gynaecology, 119(6), pp.699–709.