Long-term physician costs associated with obesity

Mustafa Ornek
McMaster University
ornekm@mcmaster.ca

Arthur Sweetman
McMaster University

CAHSPR
May 26, 2015

Adiposity (measure of body fat)

- Body Mass Index (BMI)
  - Convenient & widely used measure

$$BMI = \left(\frac{kg}{m^2}\right)$$

Normal weight : 18.5 ≤ BMI < 25

Overweight : 25 < BMI < 30

Obese : BMI ≥ 30

- Obesity, a risk factor for a number of serious health conditions

Data (1)

- Administrative data on physician costs
- Entire population of Ontario
- Long term longitudinal analysis

McMaster Pilot Project links:

- Canadian Community Health Survey (CCHS) 1.1 (2000/01)

  with

- Ontario Health Insurance Plan (OHIP) 1999/00 to 2009/10

Data (2)

- CCHS: BMI, socio-demographic and socio-economic variables and self-reported health
  - Respondents who gave permission to be linked (~87%)
  - Excluded:
    - Age <18 & >65 (age at the time of the survey)
    - Pregnant and breastfeeding
    - BMI <1% or >99% of the distribution
- OHIP: Physician services, physician type, physician billing for each service received by patient

Setting:

- Observe socio-demographic variables at 2001 and look at their physician costs over a long-term that spans from 1999/00 to 2009/10

Literature: Overall Picture

- Cost of obesity frequently researched
- Compared to normal weight, obese have
  - Higher health care costs
  - More physician visits
- But, difference between normal weight and overweight is not statistically significant

Literature: Ontario Studies

- **Finkelstein (2001)**
  - NPHS (1995/96) with OHIP (1994/95)
  - Physician costs are 2 to 3 times higher for obese
  - Smoking doubles these costs
- **Janssen, Lam, and Katzmarzyk (2009)**
  - CCHS 1.1 (2000/01) with OHIP (2002/03)
  - Physician cost of females higher
  - Physician costs of obese higher & increasing with age
- **Tarride et al. (2012)**
  - CCHS 1.1 + OHIP, DAD IP & DP (1 yr around the survey)
  - Overall women had higher costs
  - Obese have higher annual hospitalization, physician and total costs

Research Question

"*how do the physician costs differ for a person given that he or she had a certain BMI in 2000/01*"

Descriptive Statistics

CCHS 1.1 (Ontario)	Male	Female
N	9,492	10,512
Age	39.6	40.5
BMI	26.2	24.9

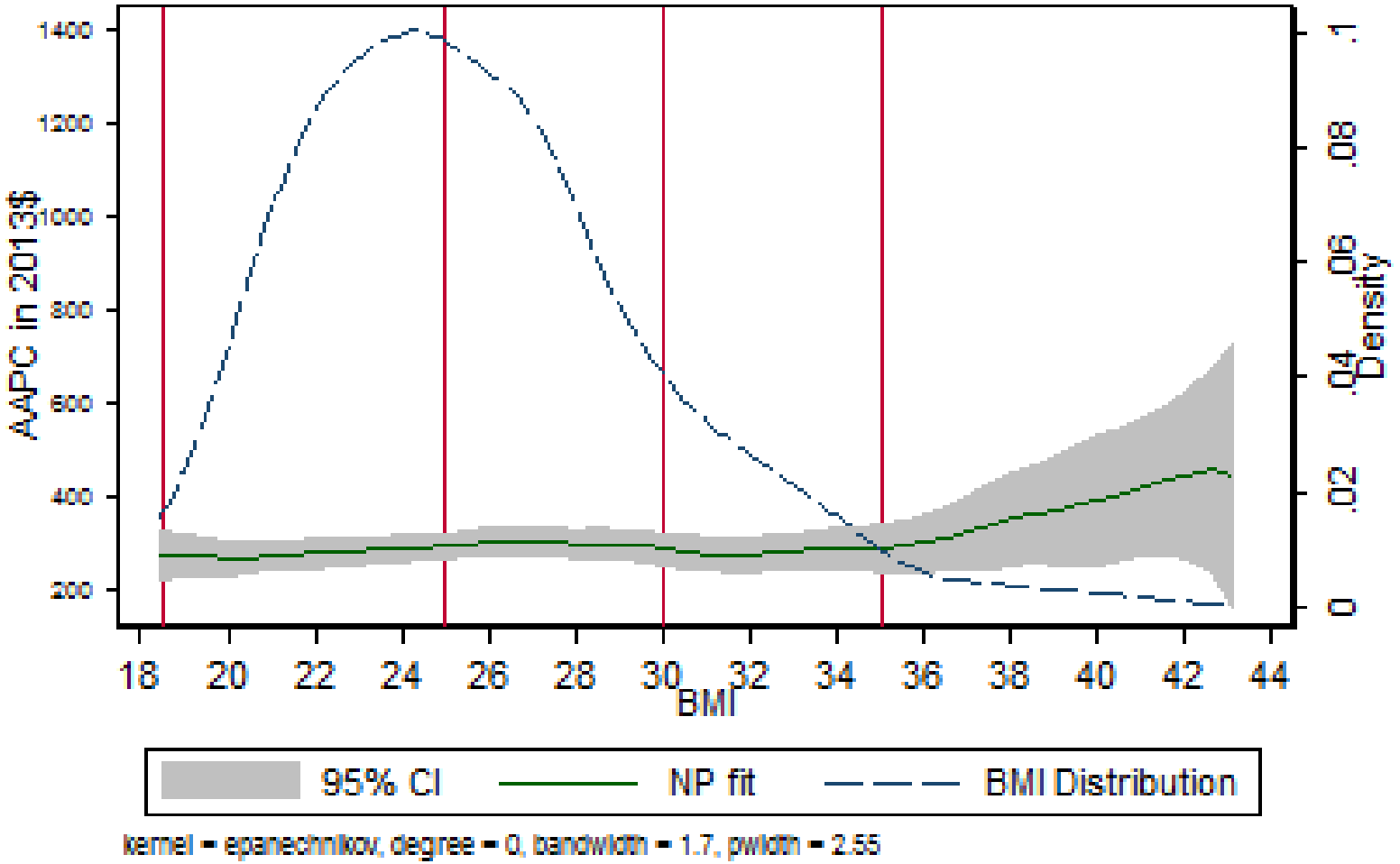
Gender / Age Group	% Obese		% Overweight	
	M	F	M	F
18-29	11	09	30	20
30-45	19	15	44	26
46-65	22	20	45	36

Methodology

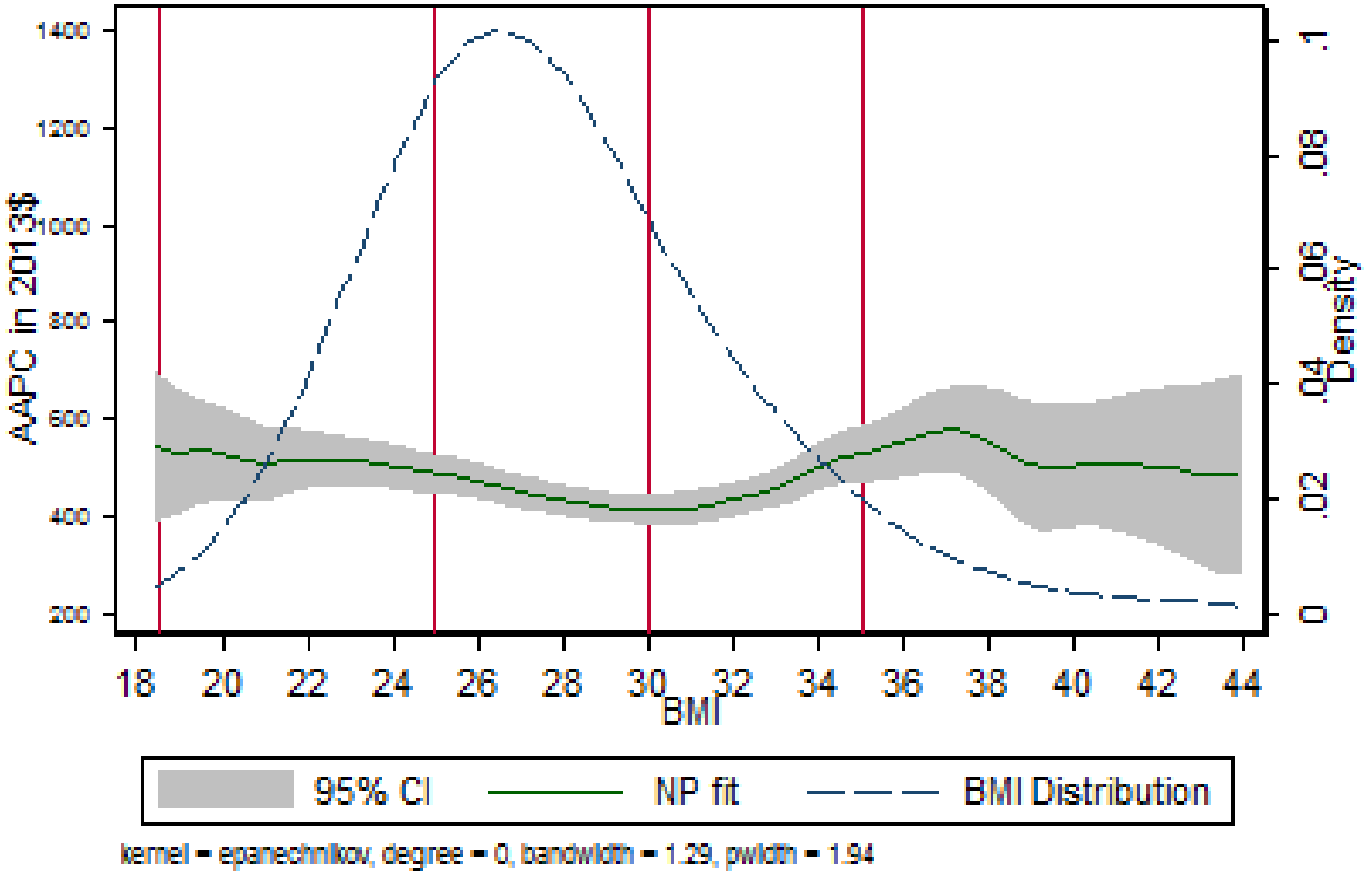
- Self-reported BMI
  - Corrected for measurement error

  (Gorber et al., 2008, Shields et al. 2011)
- Nonparametric Regression
  - Unconditional shape of BMI – long-term physician cost relationship
- Semiparametric Regression
  - Robinson's (1988) semiparametric regression
  - Shape of BMI - MD cost relationship conditional on covariates
- Annual Regressions
  - TPM repeated for each year
  - Power GLM used to evaluate priori assumptions

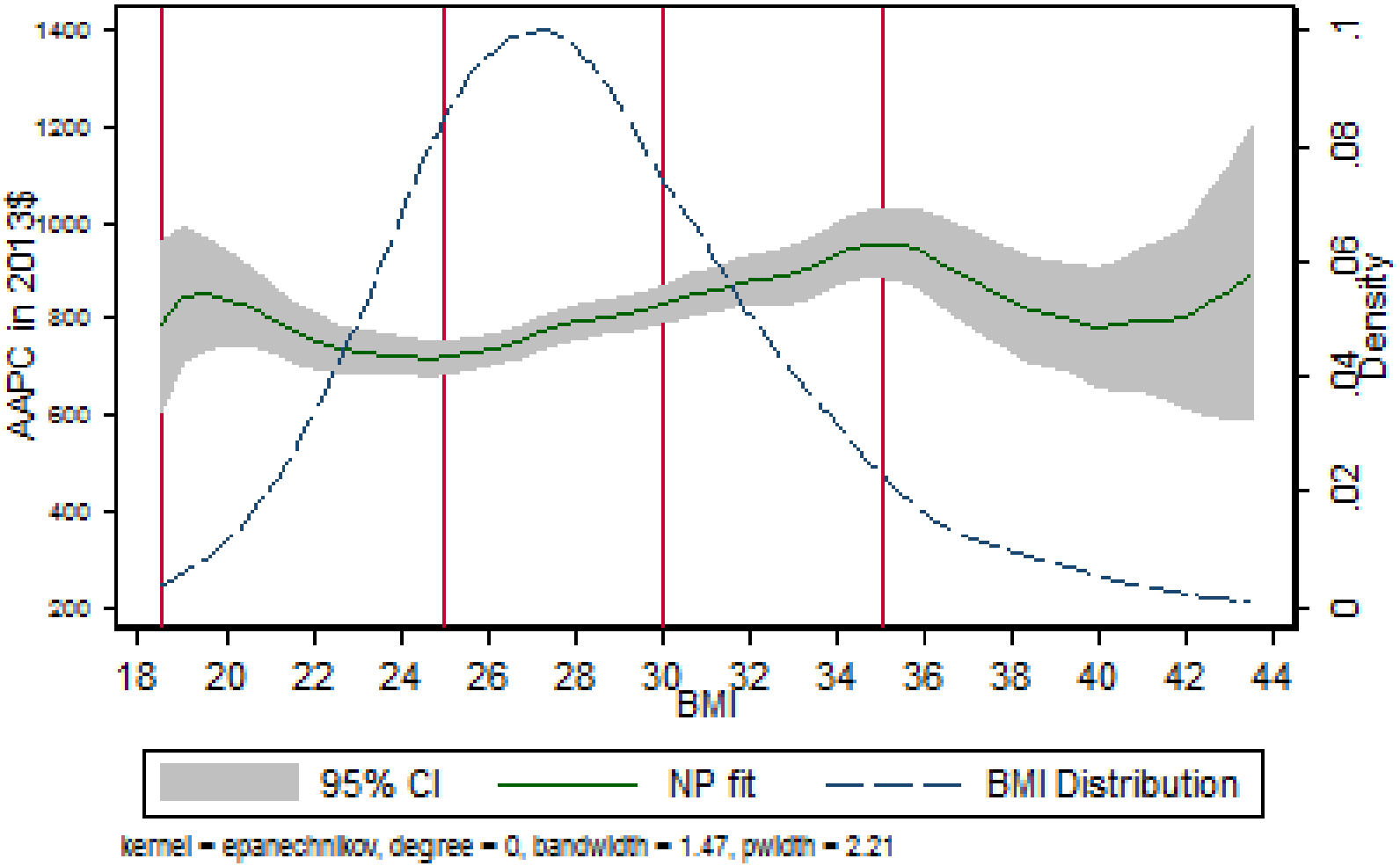
Physician Billing (Males: Ages 18-29)



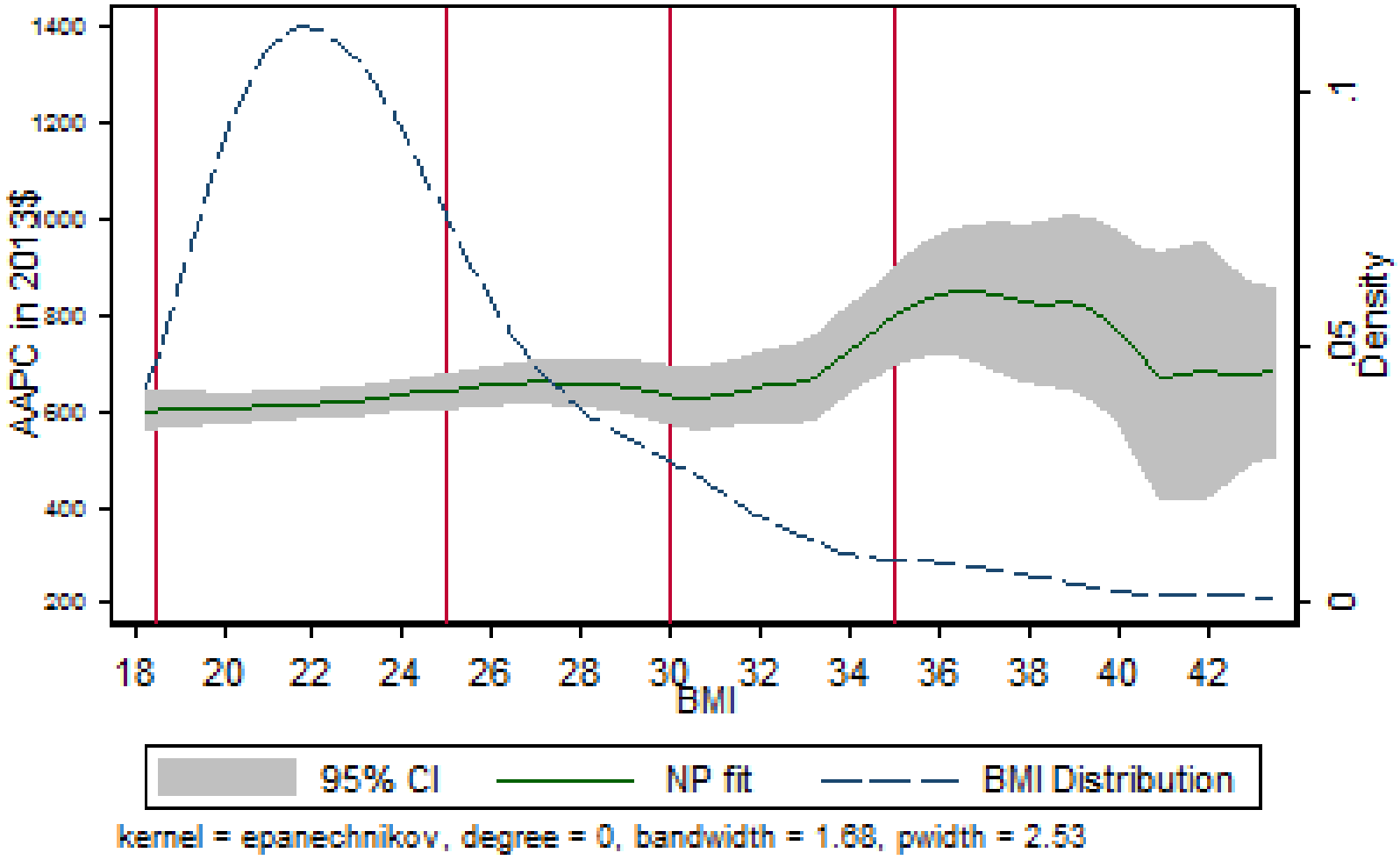
Physician Billing (Males: Ages 30-45)



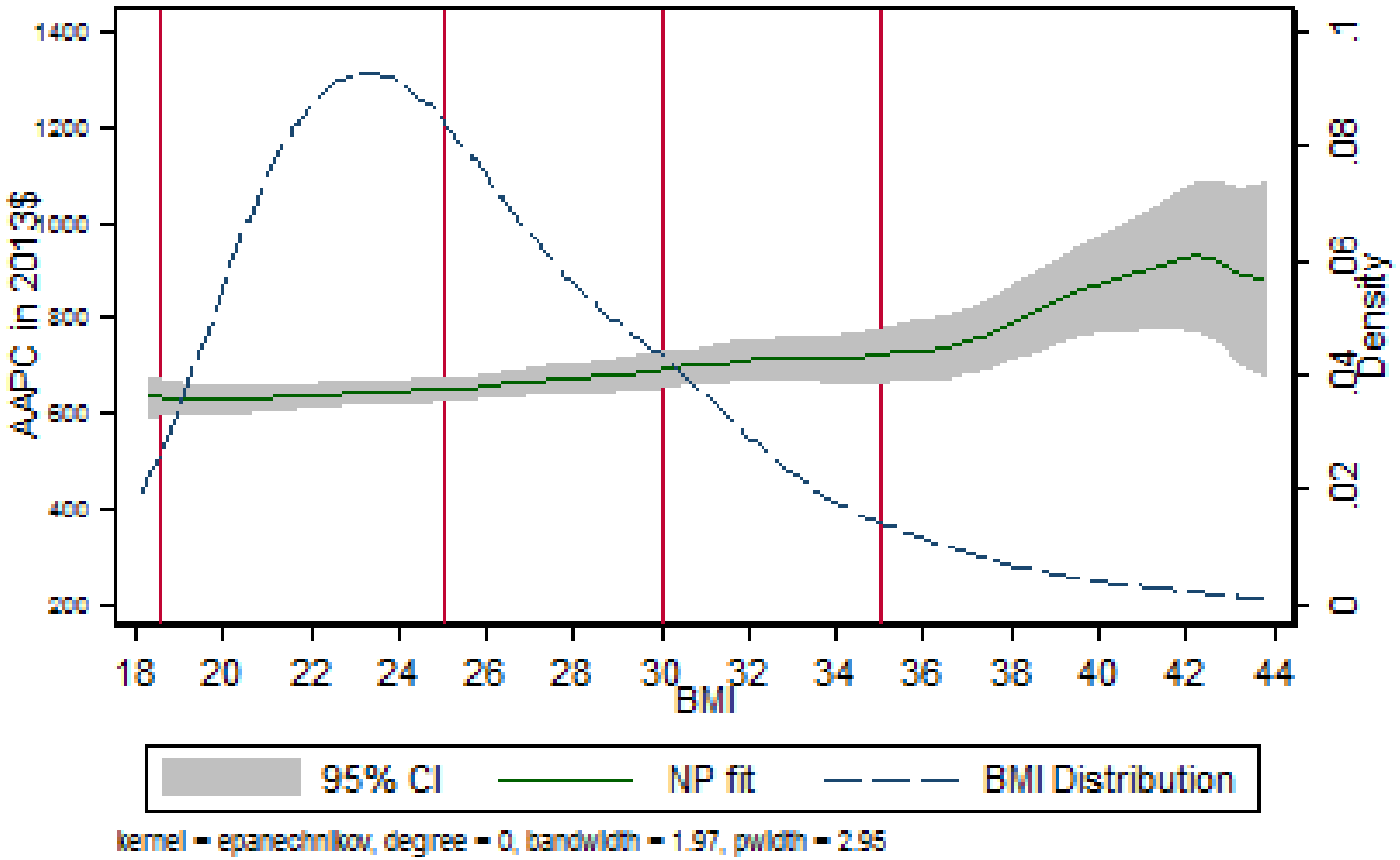
Physician Billing (Males: Ages 46-65)



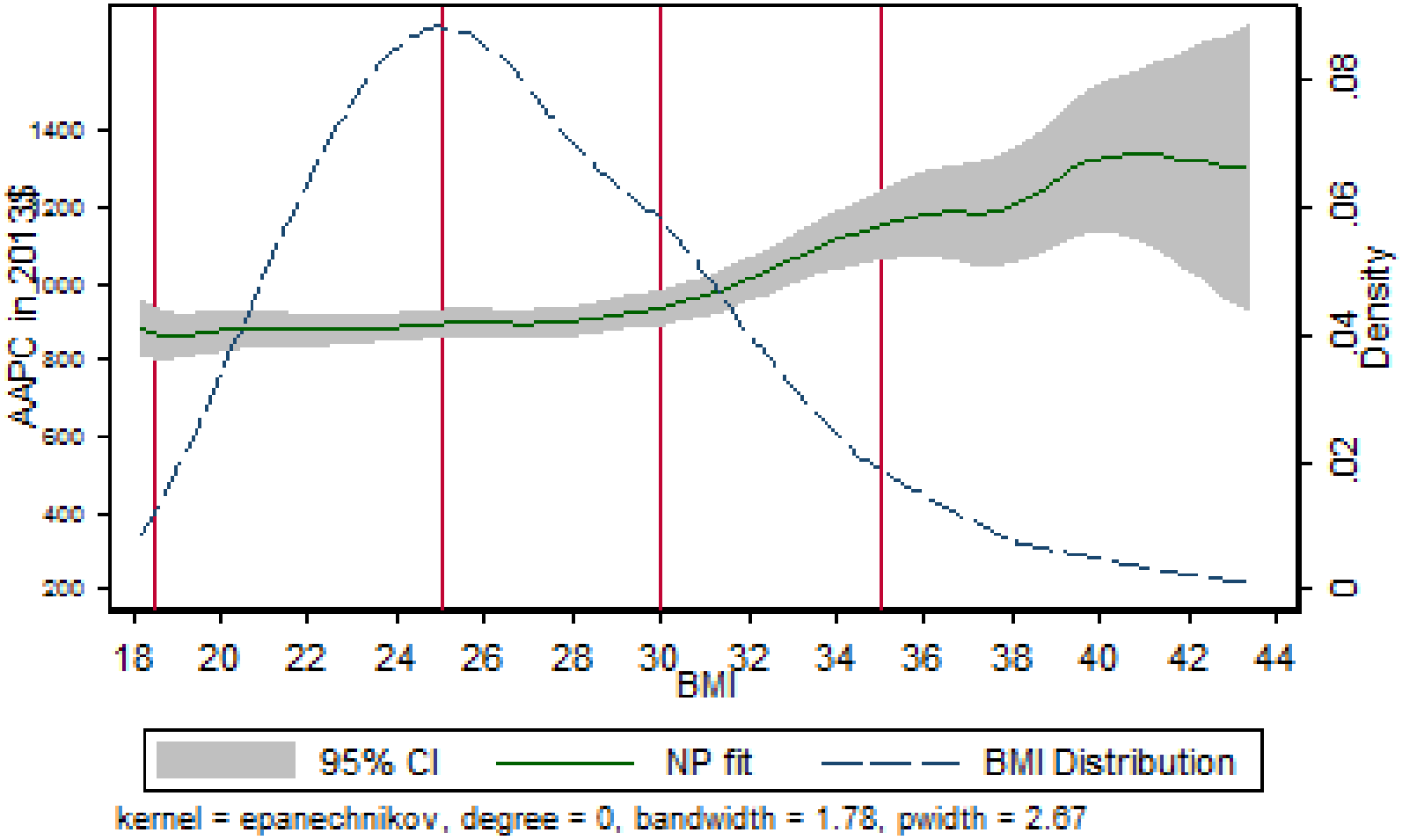
Phys. Billing (Females: Ages 18-29)



Phys. Billing (Females: Ages 30-45)



Phys. Billing (Females: Ages 46-65)



Semiparametric Results

NP equivalent: $Log(AAPC_i) = \gamma_0 + \beta_{Ai} Age_i + f(BMI_i) + \varepsilon_i$

Ctrl for X_i : $Log(AAPC_i) = \gamma_0 + \beta_{Ai} Age_i + \delta_i S_i + \theta_i H_i + f(BMI_i) + \varepsilon_i$

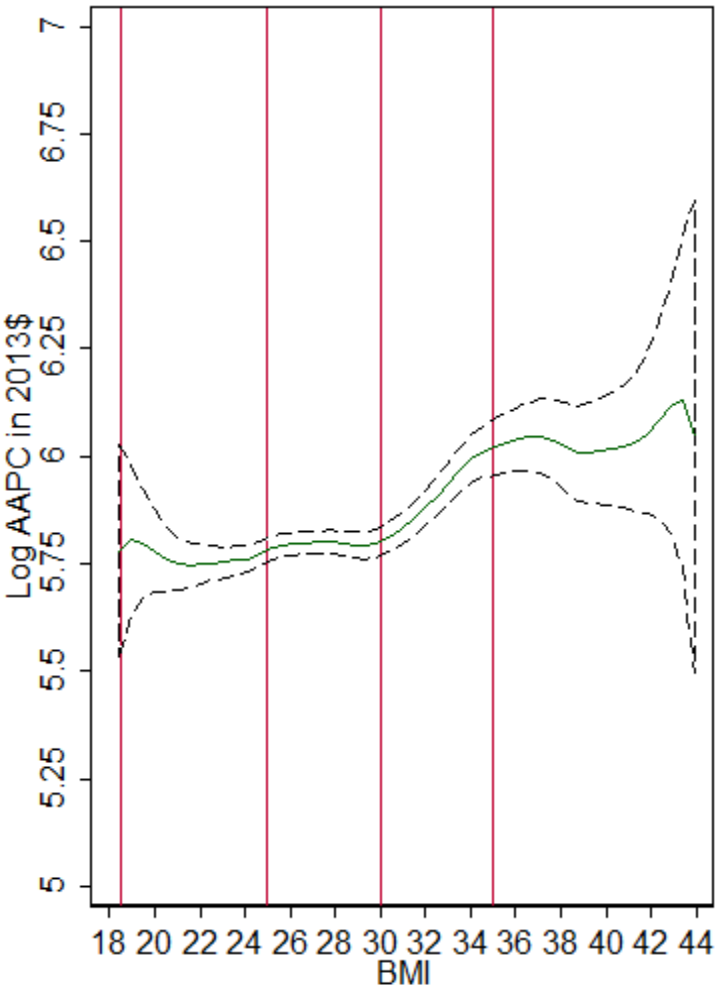
- Controlling for covariates doesn't affect the shape of the relationship, but lowers its magnitude

Physician Billing (Males)

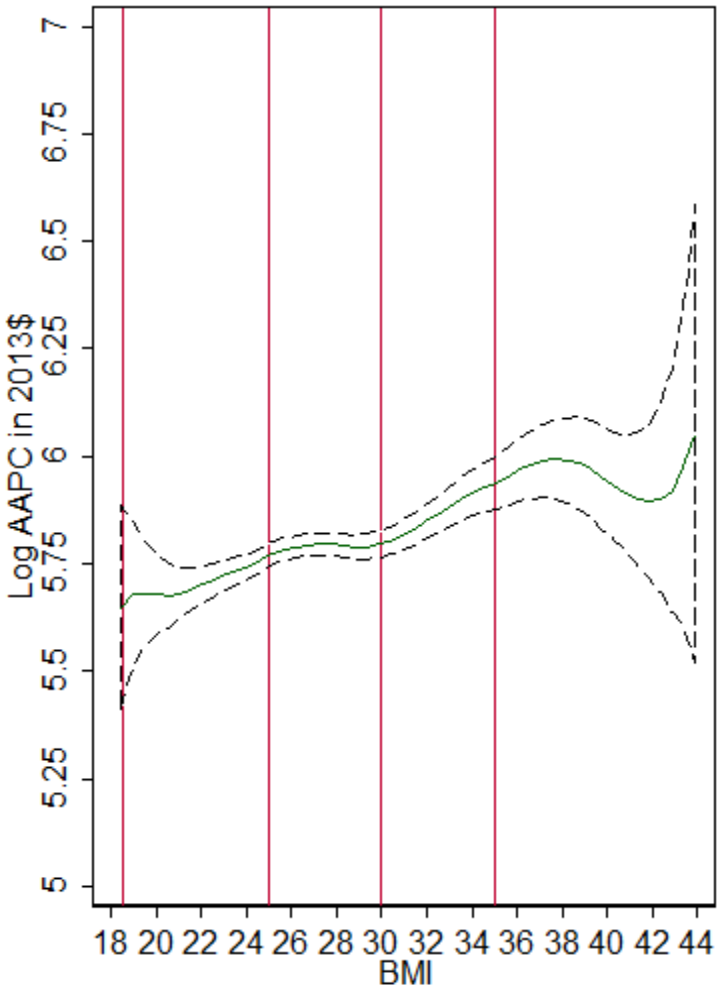
Only Statistically Significant Estimates	
Diabetes	.310***
	(-0.053)
Heart Disease	.329***
	(-0.06)
Cancer	.466***
	(-0.117)
Chronic Disease	.390***
	(-0.032)
Born in Canada	-.219***
	(-0.037)
Urban	.1699***
	(-0.031)
Self-perceived Health (Poor)	.475***
	(-0.048)
Adj_R2	0.263

Physician Billing (Males)

Controlling for only age



Ctrl. for health conditions

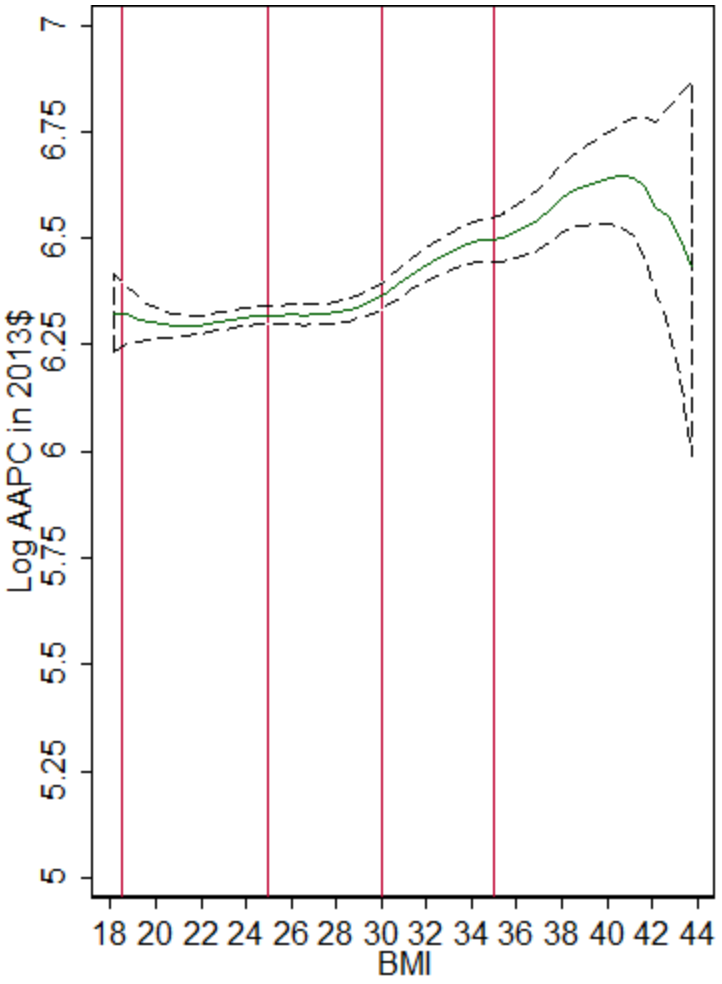


Physician Billing (Females)

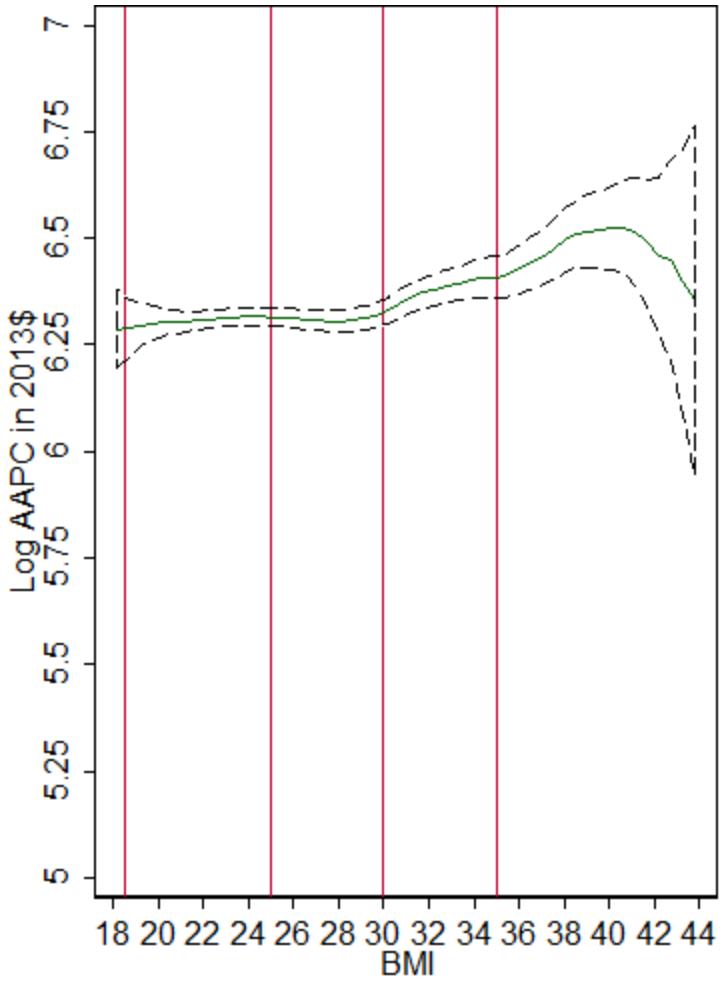
Only Statistically Significant Estimates	
Diabetes	.254***
	(-0.054)
Heart Disease	.262***
	(-0.057)
Cancer	.307***
	(-0.072)
Chronic Disease	.399***
	(-0.028)
Born in Canada	-.124***
	(-0.027)
Urban	.203***
	(-0.027)
Self-perceived Health (Poor)	.427***
	(-0.035)
Adj_R2	0.162

Physician Billing (Females)

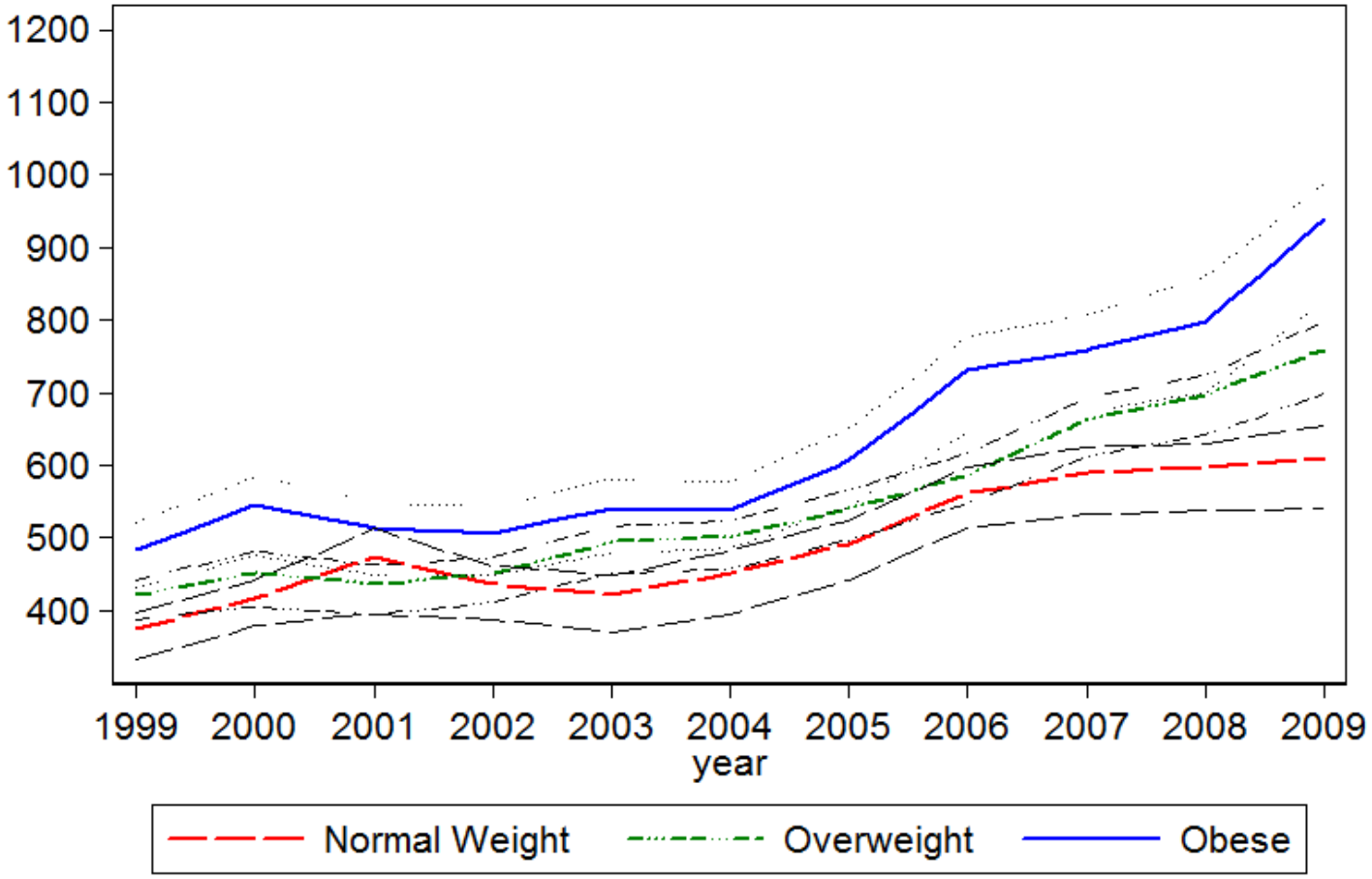
Controlling for only age



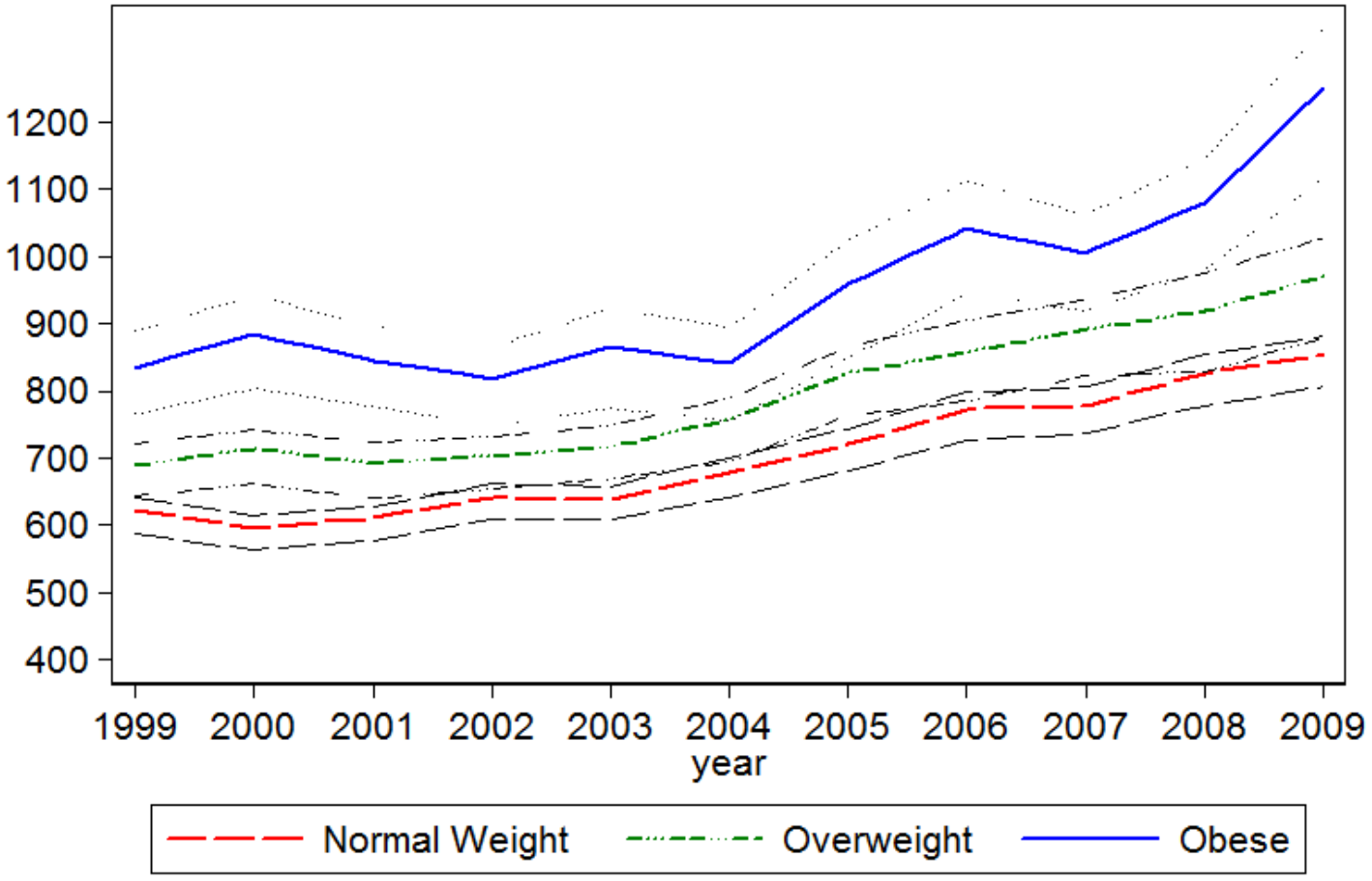
Ctrl. for health conditions



Annual Regressions (Males)



Annual Regressions (Females)



Conclusion

- Morbid obesity is associated with higher physician costs in both genders
- Higher BMI is associated with higher physician costs
  - only at older ages in males
  - at all ages in females
- These are confirmed in annual regressions as well
- Controlling for existing health conditions does not alter the shape of the relationship between BMI and physician costs

Thank you

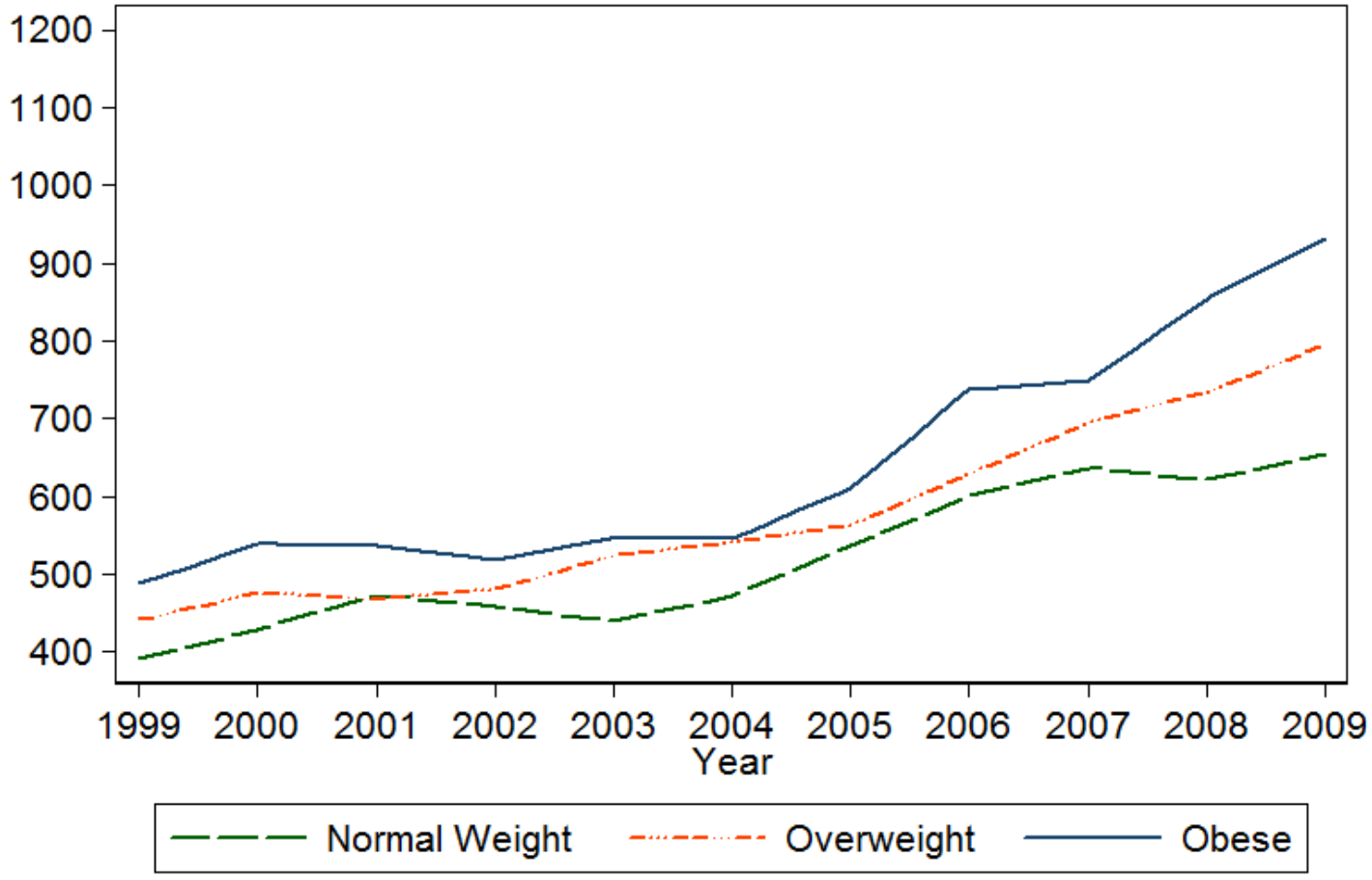
ornekm@mcmaster.ca

References

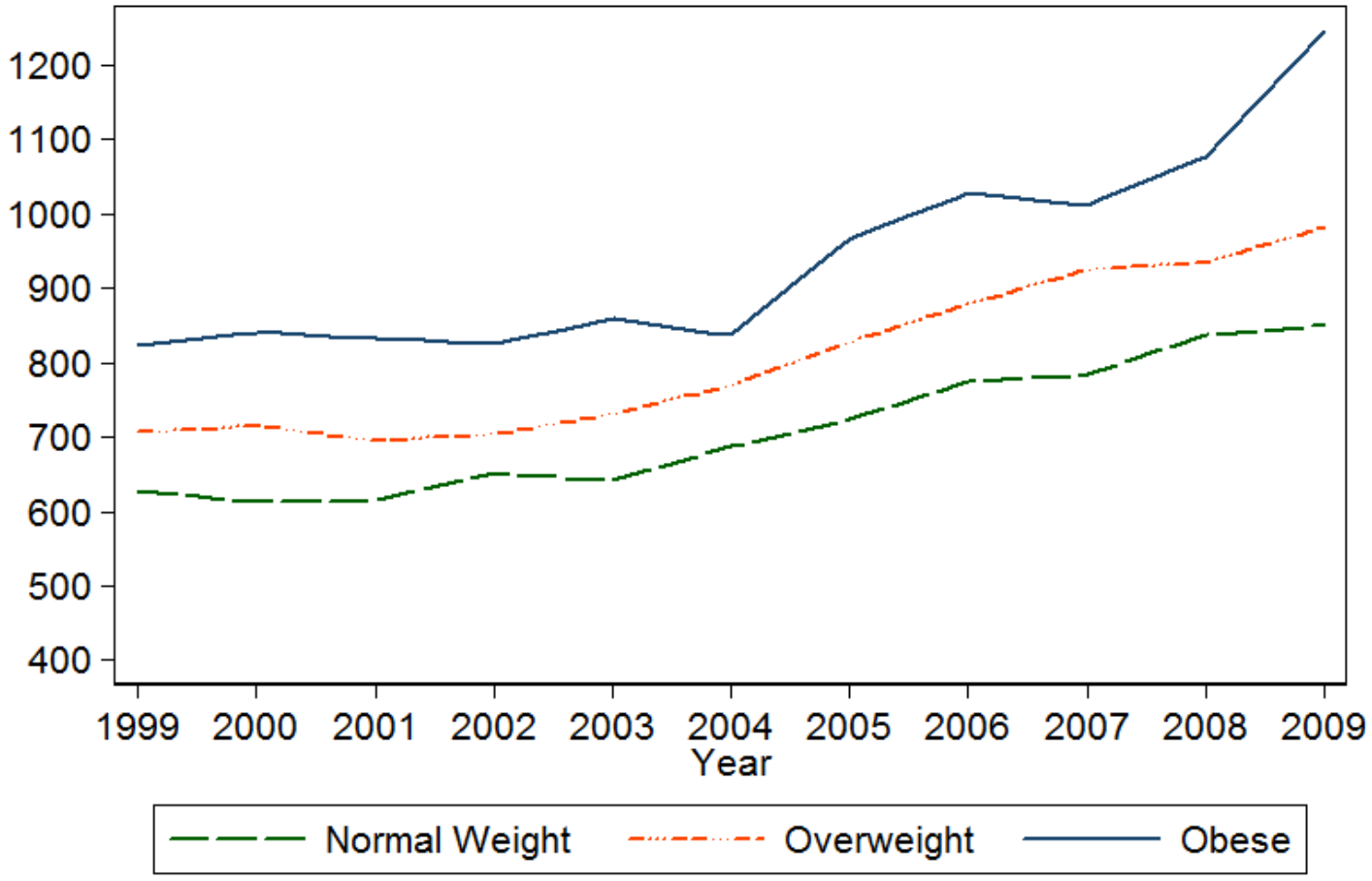
- Finkelstein, M M. 2001. “Obesity, Cigarette Smoking and the Cost of Physicians’ Services in Ontario.” *Canadian Journal Of Public Health Revue Canadienne De Sante Publique* 92: 437–40.
- Gorber, Sarah Connor, M Tremblay, D Moher, and B Gorber. 2007. “A Comparison of Direct vs. Self-Report Measures for Assessing Height, Weight and Body Mass Index: A Systematic Review.” *Obesity Reviews : An Official Journal of the International Association for the Study of Obesity* 8 (4): 307–26. doi:10.1111/j.1467-789X.2007.00347.x. http://www.ncbi.nlm.nih.gov/pubmed/17578381.
- Janssen, I, M Lam, and P T Katzmarzyk. 2009. “Influence of Overweight and Obesity on Physician Costs in Adolescents and Adults in Ontario, Canada.” *Obesity reviews : an official journal of the International Association for the Study of Obesity* 10(1): 51–57.
- Shields, Margot, Sarah Connor Gorber, Ian Janssen, and Mark S Tremblay. 2011. “Bias in Self-Reported Estimates of Obesity in Canadian Health Surveys : An Update on Correction Equations for Adults.” *Health Reports / Statistics Canada, Canadian Centre for Health Information = Rapports Sur La Santé / Statistique Canada, Centre Canadien D’information Sur La Santé* 22 (3): 1–11.
- Tarride, Jean-Eric;, Mahbubul; Haq, Valerie H.; Taylor, Arya M.; Sharma, Hamid Reza; Nakhai-Pour, Daria; O’Reilly, Feng; Xie, Lisa; Dolovich, and Ron Goeree. 2012. “Health Status, Hospitalization, Day Procedures, and Physician Costs Associated with Body Mass Index (BMI) Levels in Ontario , Canada.” *ClinicoEconomics and Outcomes Research* 4: 21–30.
- Verardi, Vincenzo, and Nicolas Debarsy. 2012. “Robinson ’ S Square Root of N Consistent Semiparametric Regression Estimator in Stata.” *The Stata Journal*, no. 12: 726–35.

Appendix Section

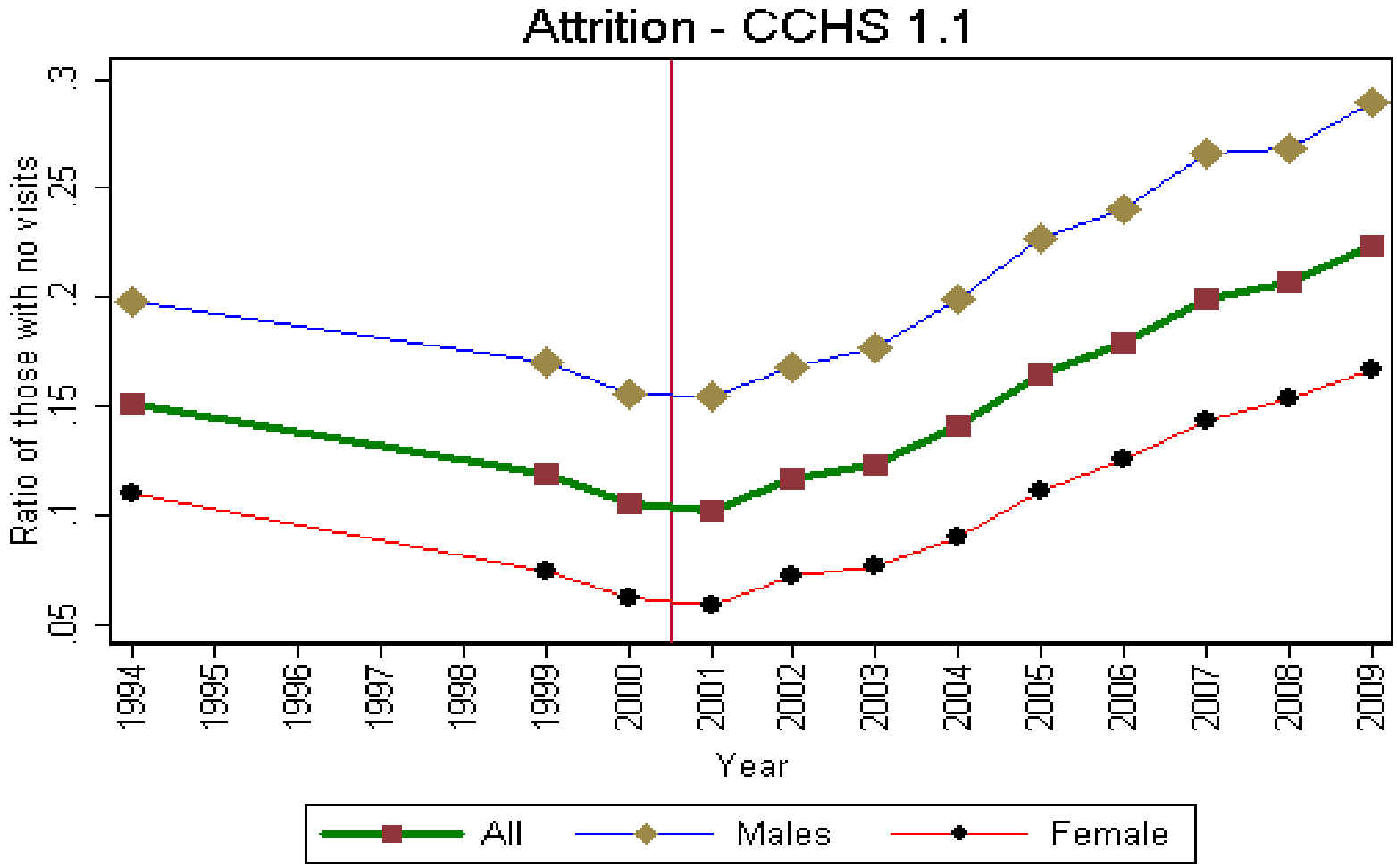
TPM with PGLM (Males)



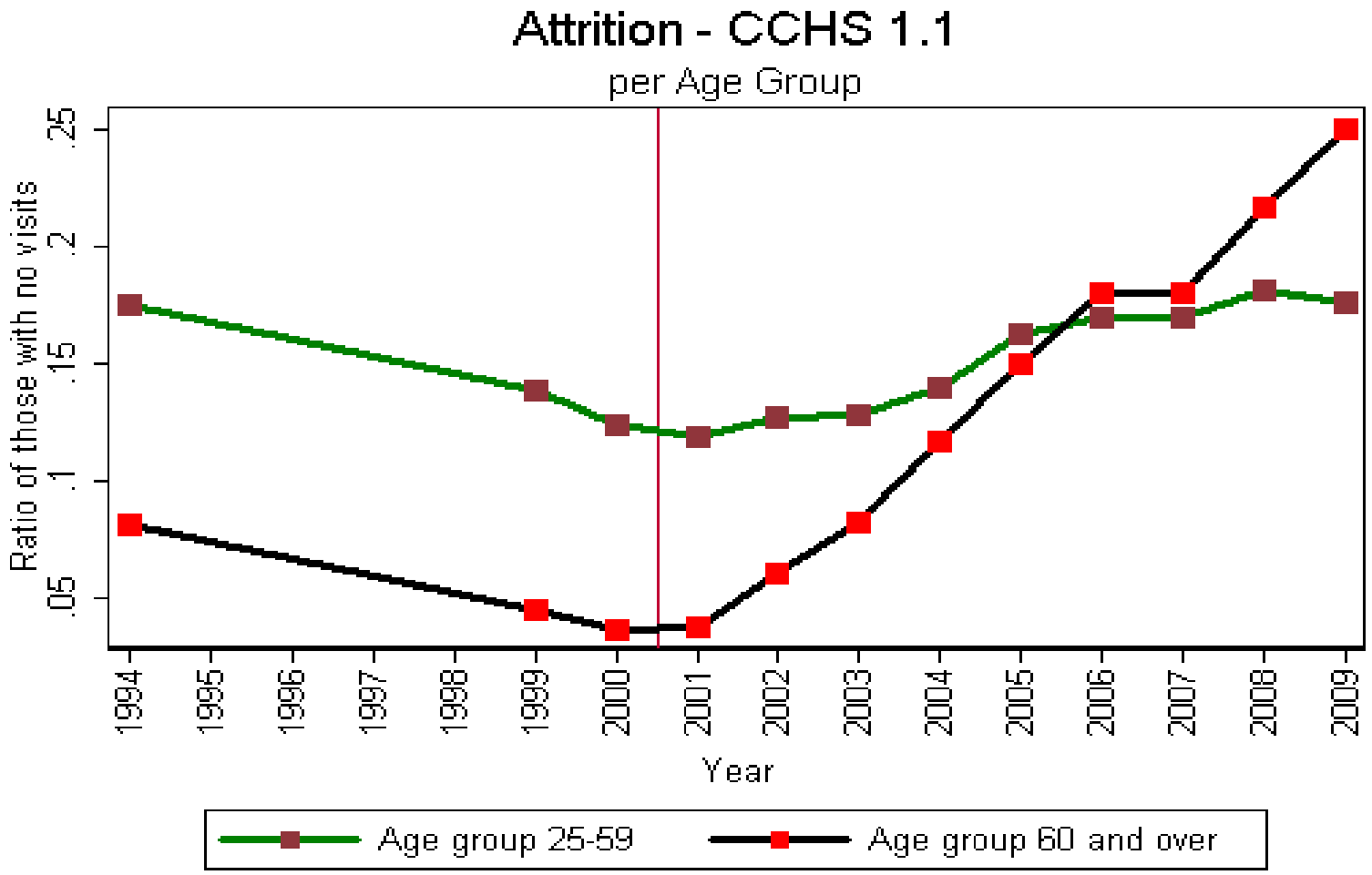
TPM with PGLM (Females)



Attrition Issue – Age censored at 85



Attrition per age group



After our solution