Intertemporal Substitution in Response to Non-Linear Health Insurance Contracts

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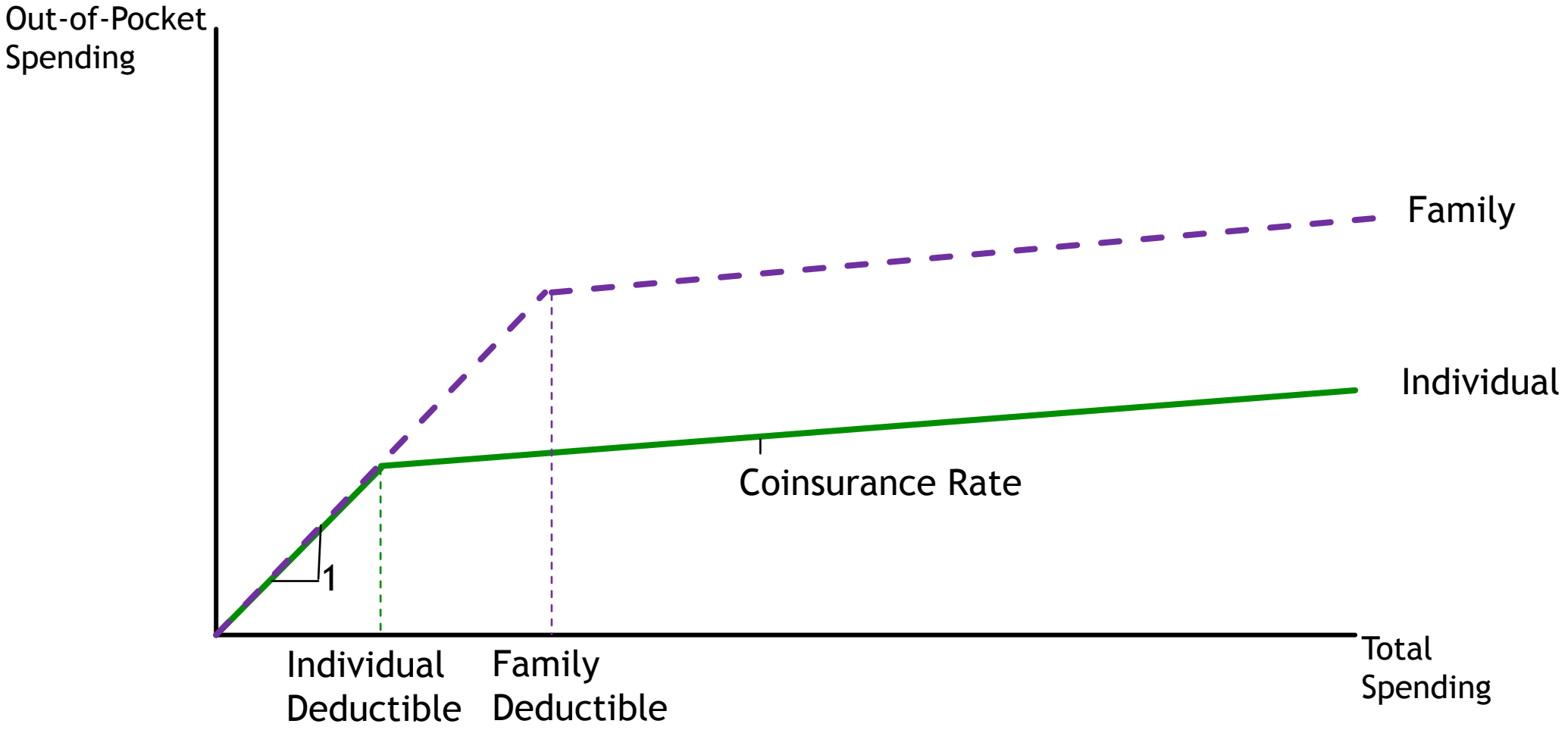
High Deductibles are Becoming Increasingly Common

- From 2010 to 2020, the number of employer-sponsored health plans with a deductible over $1,000 for singles rose from 27% to 57% and among those with a deductible the average rose from $917 to $1,644
  - Kaiser Family Foundation, 2020

- Little is known about how individuals respond to non-linear health insurance contracts across years in modern private health insurance plans

Non-Linear Health Insurance Contracts

- Deductible – responsible for full cost of medical care (100% coinsurance)
- Coinsurance – pay a certain percentage of medical care costs (ex. 20%)
- Stoploss/Out-of-pocket maximum – no longer pay for medical care



Research Questions

- How does meeting deductible in one year affect spending in the following year?
- Do individuals that do not reach their deductible in every year:
  - increase their healthcare consumption in the year they meet their deductible?
  - decrease healthcare consumption in the year after they meet their deductible?

- Estimates of saving from high-deductible insurance plans that use only a single year could be overstating savings due to consumers substituting across years to lower prices for non-urgent care.

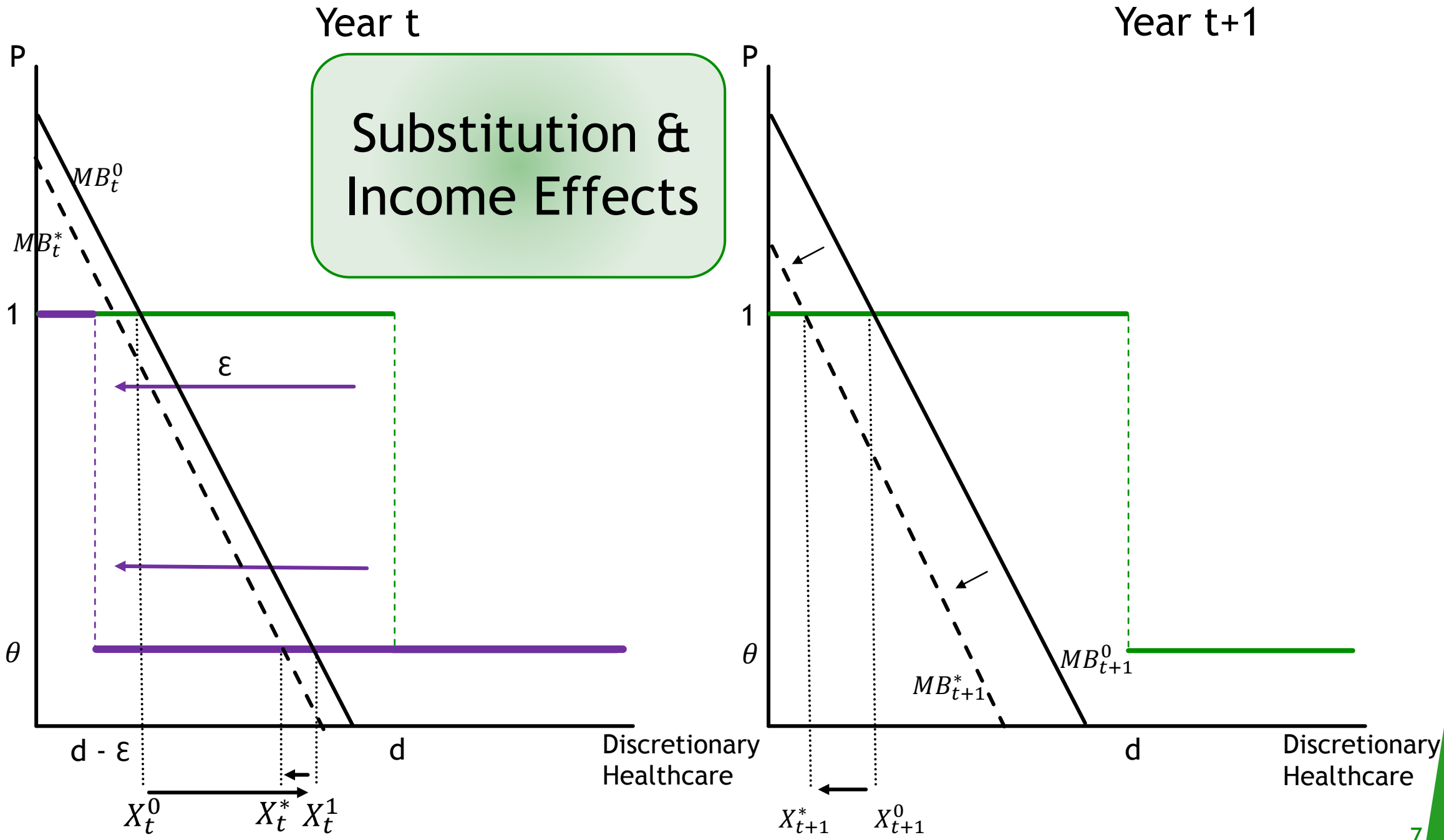
Fuzzy Regression Discontinuity Design

- Compare the healthcare spending and consumption in 2012 of those with similar injuries in late 2010 and early 2011
- Sample: Privately insured with unexpected injuries
- Running Variable: date of injury
- Discontinuity: Year change when deductible resets
- First stage: Jump in probability of exceeding 2011 deductible for those with late 2010 vs early 2011 injuries
- IV Estimate (LATE): $13,263 decrease in 2012 Total Spending
- LATE Takeaway: for every $1 more spent on healthcare in the year the deductible is met, about $0.37 less is spent in the following year.

Extend Literature to Modern Private Health Insurance

- Dynamic incentives, spot prices, and future prices matter within a plan year for healthcare consumption choices
  - Aron-Dine et al., 2015; Brot-Goldberg, 2017; Dalton et al., 2019; Guo & Zhang, 2019; Kowalski, 2016
- Across-year intertemporal substitution has been shown for dental insurance, Medicare Part D, and RAND Health Insurance Experiment
  - Cabral, 2016; Einav et al., 2015; Lin & Sacks, 2019

Substitution & Income Effects



2010-2012 IBM MarketScan Commercial Database

- Follows privately insured individuals and their dependents through the healthcare system
- Identifies procedures, diagnoses, prescription drug usage, and limited demographic information
- For each claim the total pay, deductible, coinsurance, copay
  - Must back out deductible using plan identifier and when deductible spending ceases
  - Assume family deductible is twice individual
- Sample restrictions: not observed all 3 years, under 18, deductible ≤$100, without identifying injury

Injuries in Sample

- From Kowalski (2016)
- Individuals that have the injury in their families do not spend more on their own medical care before the injuries occur.
- When in the year the injury occurs determines how long the individual can benefit from reaching the coinsurance arm of their plan.

Injuries from Kowalski (2016)	Total Injuries (Percent)
Entire Sample	254,902 (100)
Fractures	23,847 (9.4)
Dislocation	24,742 (9.7)
Sprains & Strains of Joints & Adjacent Muscles	87,431 (34.3)
Intracranial Injuries, Excluding Skull Fractures	4,334 (1.7)
Open Wounds	25,453 (10.0)
Injury to Blood Vessels	267 (0.1)
Late Effects of Injuries, Poisonings, Toxic	1,018 (0.4)
Superficial Injuries	13,535 (5.3)
Contusion with Intact Skin Surface	23,908 (9.4)
Crushing Injuries	675 (0.3)
Foreign Body Injuries	5,031 (2.0)
Burns	2,346 (0.9)
Injuries to Nerves and Spinal Cord	1,165 (0.5)
Complications of Trauma	32,188 (12.6)
Poisoning by Drugs, Medicinal and Biological	2,254 (0.9)
Toxic Effects of Substances Nonmedicinal	17,729 (7.0)
Complications of Surgical and Medical Care	16,789 (6.6)

Balanced on Observables Across Discontinuity

	Overall (%)	Late 2010 Injury	Early 2011 Injury
2011 Deductible ($)			
Mean	**607.9**	**606.8**	**609.1**
101-199	6.9	6.7	7.0
200-299	18.6	18.8	18.3
300-399	20.0	20.2	19.9
400-499	6.6	6.5	6.7
500-749	22.0	22.1	21.8
750-999	5.3	5.2	5.4
1000-1249	9.7	9.5	9.9
1250-1499	3.3	3.1	3.5
1500-1749	4.3	4.3	4.2
1750-1999	0.4	0.5	0.4
2000-2499	1.2	1.2	1.1
2500-2999	0.6	0.6	0.6
3000-4999	1.1	1.2	1.1
≥ 5000	0.0	0.0	0.0

	Overall (%)	Late 2010 Injury	Early 2011 Injury
Sex			
Male	42.0	42.3	41.7
Female	58.0	57.7	58.3
Age (in 2010)			
18-34	24.7	24.4	25.0
35-44	24.6	24.5	24.8
45-54	33.0	33.3	32.6
55-64	17.7	17.9	17.6
# of Family Members Enrolled			
1	20.0	19.5	20.6
2	23.6	24.0	23.3
3	18.1	18.2	18.0
4	22.7	22.8	22.7
5-6	13.4	13.4	13.4
7-8	1.7	1.7	1.7
≥ 9	0.4	0.4	0.4

Outcomes: Spending

- Total Spending: total dollars spent by the insurance company and individual out of pocket on all healthcare claims (outpatient, inpatient, and pharmaceutical).

- Out of Pocket Spending: total dollars paid out of pocket on healthcare (outpatient, inpatient, and pharmaceutical). Sum of all payments towards the deductible, coinsurance, or copayments.

Outcomes: Care Dates

- Examine Care Dates
  - to better understand where spending changes
  - to address possible relationship between propensity to consume more care and more expensive care

- **Total Care Dates:** count of days with outpatient or inpatient services
- **Outpatient Care Dates:** count of days with outpatient services
- **Inpatient Care Dates:** count of days with inpatient services

- Total Care Dates = Outpatient Care Dates + Inpatient Care Dates

Outcomes: Care Dates

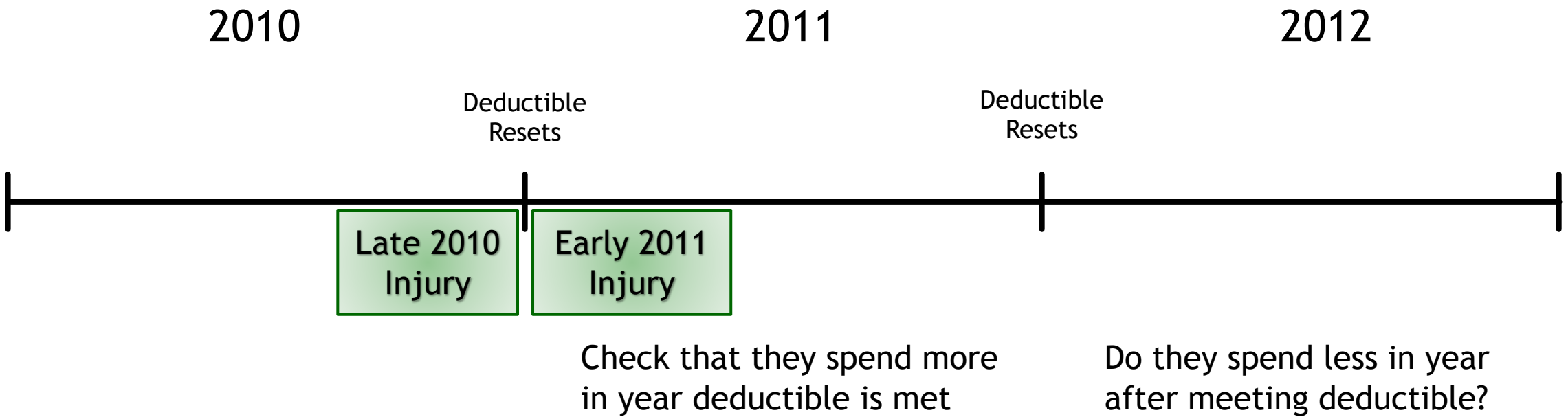
- **Elective services.** Defined using the BETOS codes from Clemens and Gottlieb (2014) also used by Guo and Zhang (2019).
  - Examples: hip replacement, knee replacement, cataract removal/lens insertion, minor skin procedures, colonoscopy, bronchoscopy, cardiac catheter
- **Preventive services.** Based on the CMS list of preventive services.
  - Examples: Annual Wellness Visit, Cervical Cancer Screening, Depression Screening, Diabetes Screening, Diabetes Self-Management Training, Flu Shot, Glaucoma Screening, Hepatitis B Screening, HIV screening, Initial Preventive Physical Exam, Lung Cancer Screening

2012 Outcome Summary Statistics

	Mean	SD	P1	P25	P50	P75	P99
Total Spending	11,631	32,495	52	1,368	3,867	10,403	125,763
Out of Pocket	1,468	1,900	0	383	958	2,038	7,121
Care Dates	16.17	19.43	0	5	10	21	88
Outpatient	15.75	18.39	0	5	10	20	83
Inpatient	0.53	3.64	0	0	0	0	11
Elective	0.54	1.47	0	0	0	1	5
Preventive	1.08	1.31	0	0	1	2	5
1(Inpatient>0)	0.09	0.28	0	0	0	0	1
1(Elective>0)	0.31	0.46	0	0	0	1	1
1(Preventive>0)	0.60	0.49	0	0	1	1	1

Fuzzy Regression Discontinuity

- Compare the healthcare spending & consumption in 2012 of those with similar injuries in Late 2010 and Early 2011
  - Those with injury in late 2010 will be less likely to respond to meeting deductible before it resets



Specification: Fuzzy Regression Discontinuity as 2SLS

- First Stage:

$$w_{it} = \gamma_0 + \gamma_1 Injury_{it} + \gamma_2 Injury_{it-1} \times Date_{it-1} + \gamma_3 Injury_{it} \times Date_{it} + \boldsymbol{\gamma_4 X'_{it}} + \upsilon_{it}$$

- Reduced Form:

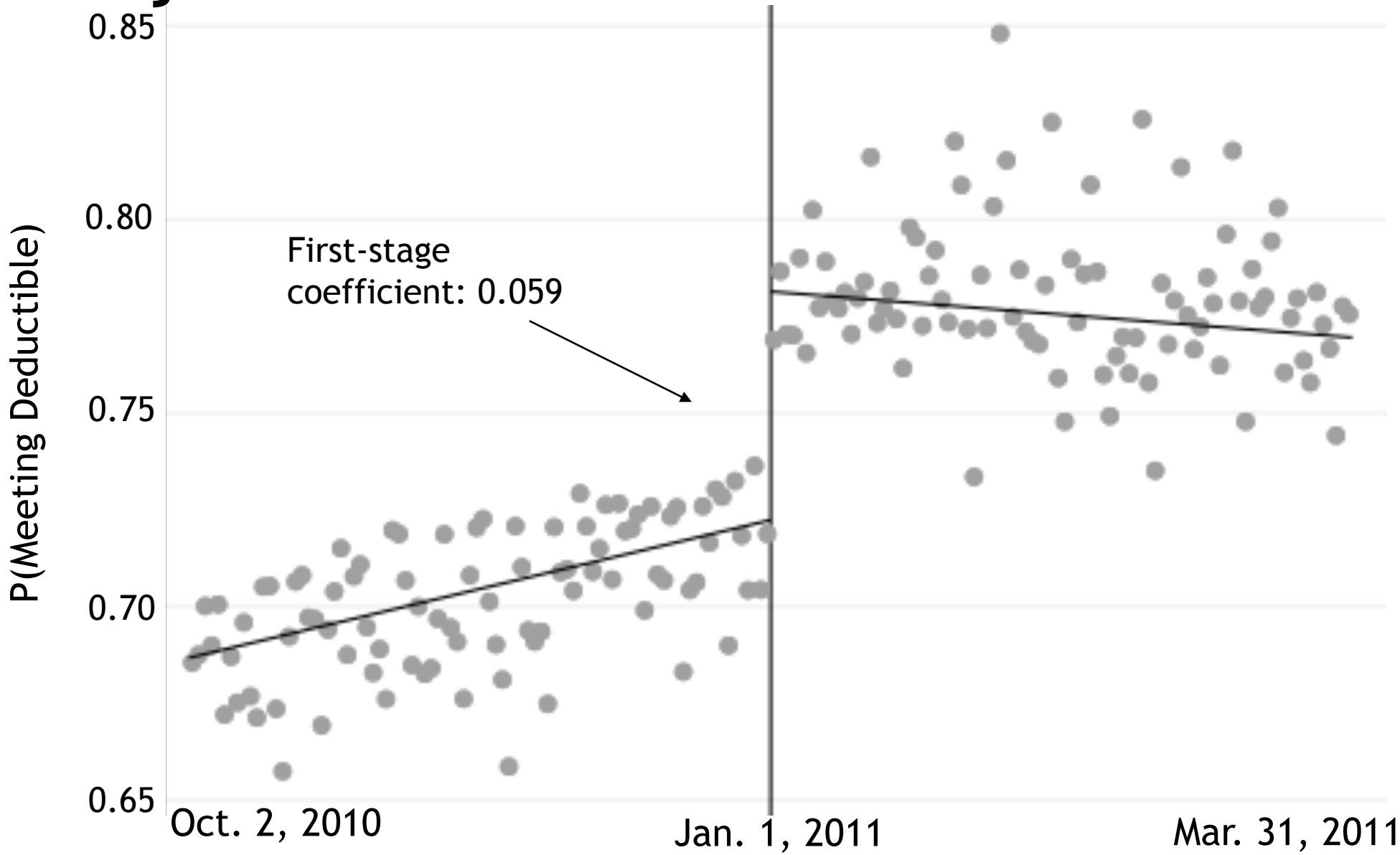
$$y_{it+1} = \beta_0 + \beta_1 w_{it} + \beta_2 Injury_{it-1} \times Date_{it-1} + \beta_3 Injury_{it} \times Date_{it} + \boldsymbol{\beta_4 X'_{it}} + \varepsilon_{it}$$

  - w_{it}, reaching coinsurance arm (meeting deductible) in 2011
  - Where $\boldsymbol{X'_{it}}$ includes:
    - 2011 Deductible
    - Number of Family Members Enrolled
    - Sex
    - Age

Fuzzy Regression Discontinuity Specification Details

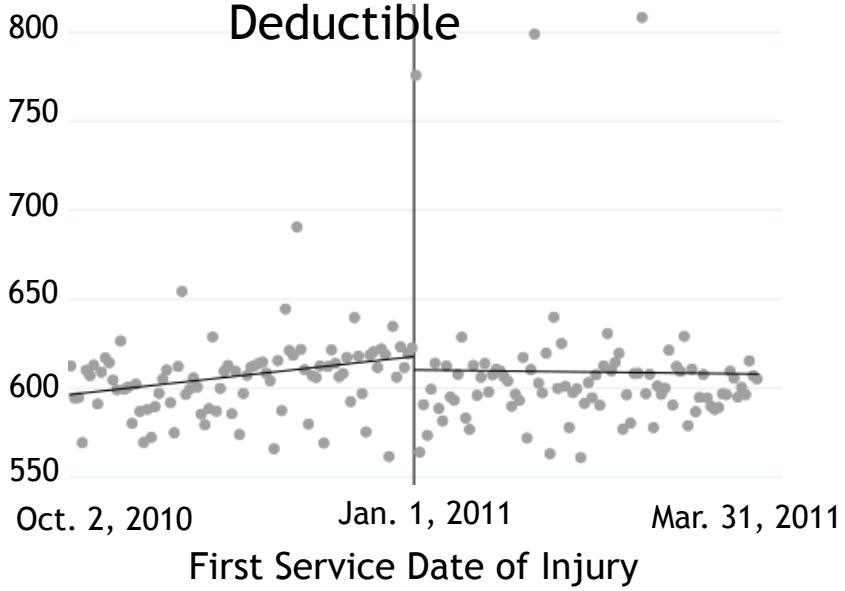
- Local linear regression
- 90 Day Bandwidth
  - Selected using Calonico, Cattenao, and Titiunik (2014)
- Uniform kernel
- N = 254,902
- First stage F-statistic of 297
- Robust standard errors clustered at injury date level

Sharp Increase in Probability of Meeting Deductible for those Injured in 2011

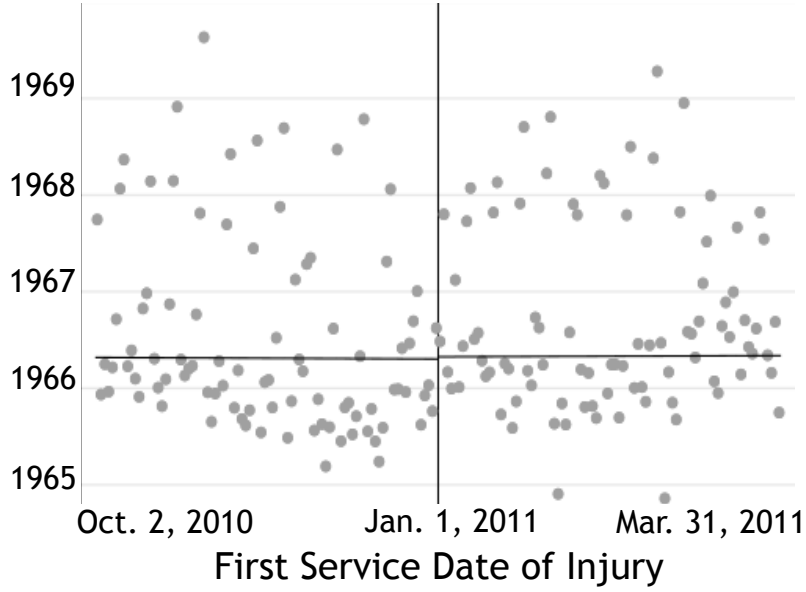


Balance Checks

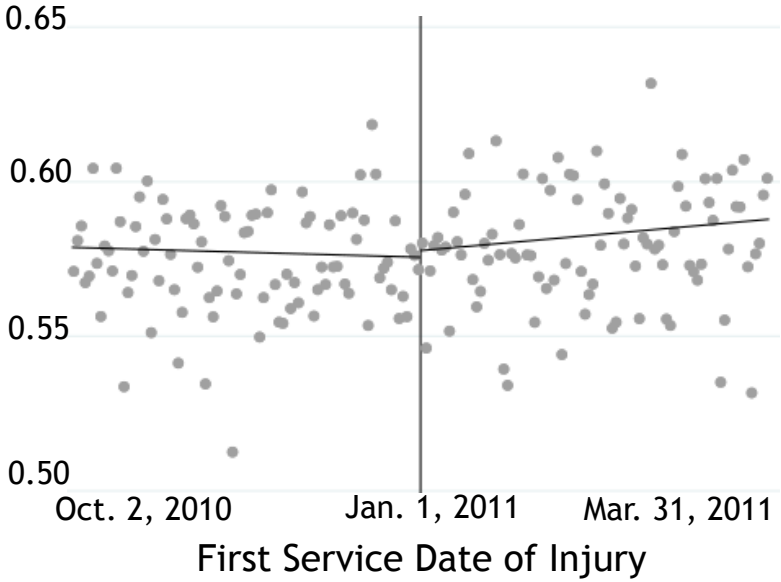
A. 2011 Deductible



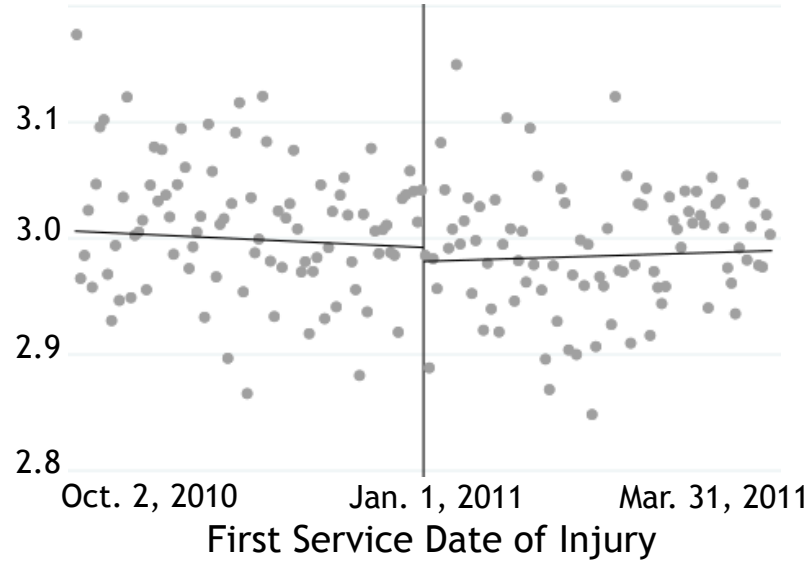
B. Birth Year



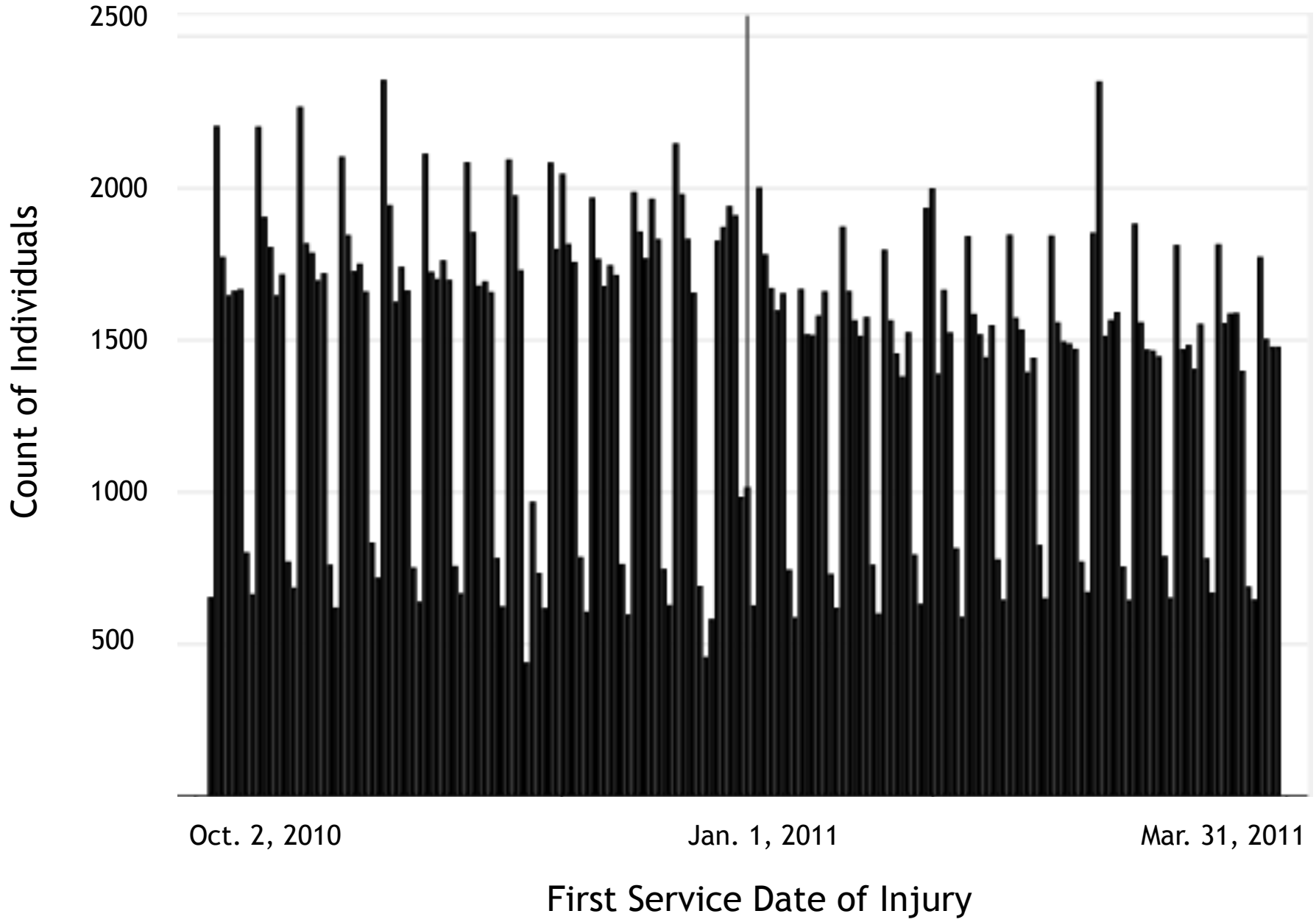
C. Sex



D. Number of Family Members Observed on Plan



Density Plot



Effects of Meeting Deductible in 2011 on 2011 Healthcare Consumption Relative to 2010

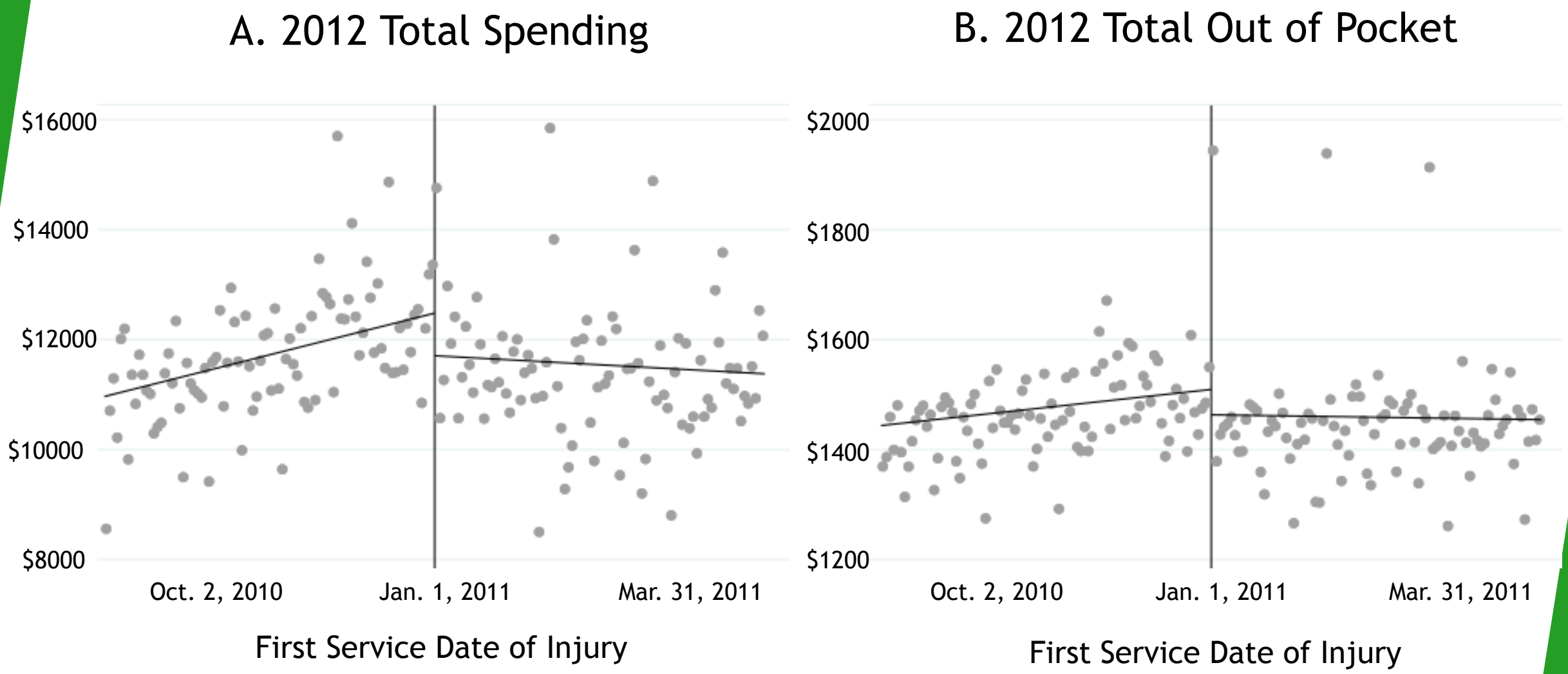
Outcome Form	Total Spending	Total Out of Pocket	Total Care Dates	Outpatient Care Dates	Inpatient Care Dates	Elective Care Dates	Preventive Care Dates
y	36,706***	3,288***	23.09***	21.46***	2.16***	1.96***	0.12
	(5,938)	(263.5)	(3.84)	(3.65)	(0.69)	(0.28)	(0.22)
ln(1+y)	4.896***	4.423***					
	(0.344)	(0.212)					
y on Injury	12.818**						
	(5,297)						
y Not on Injury	23,887***						
	(1,918)						

These estimates contain the initial injury for those with an initial injury date after Dec. 31, 2010.

Effects of Meeting Deductible in 2011 on 2012 Healthcare Consumption Relative to 2010

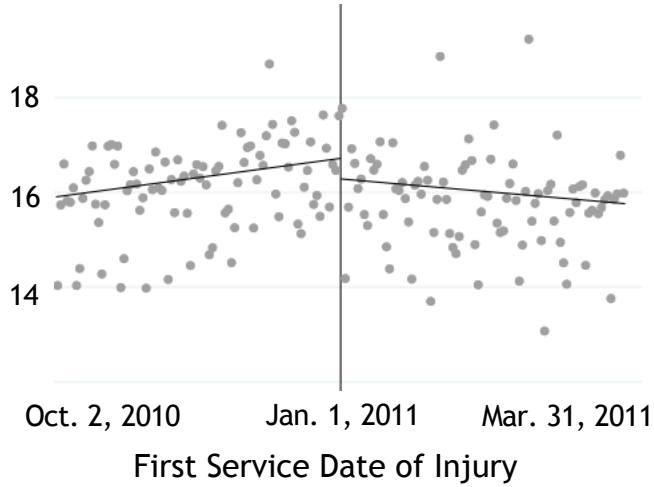
Outcome Form	Total Spending	Total Out of Pocket	Total Care Dates	Outpatient Care Dates	Inpatient Care Dates	Elective Care Dates	Preventive Care Dates
y	-13,263***	-788**	-7.39**	-6.19*	-1.56***	-0.36*	-0.20
	(5,005)	(367.5)	(3.50)	(3.29)	(0.59)	(0.19)	(0.18)
ln(1+y)	-0.503*	-0.559**					
	(0.276)	(0.235)					
1(y> 0)					-0.086**	-0.123*	-0.067
					(0.042)	(0.064)	(0.059)
Mean	11,631	1,468	16.17	15.75	0.53	0.54	1.08
SD	32,495	1,900	19.43	18.39	3.64	1.47	1.31

Reduced Form: 2012 Spending

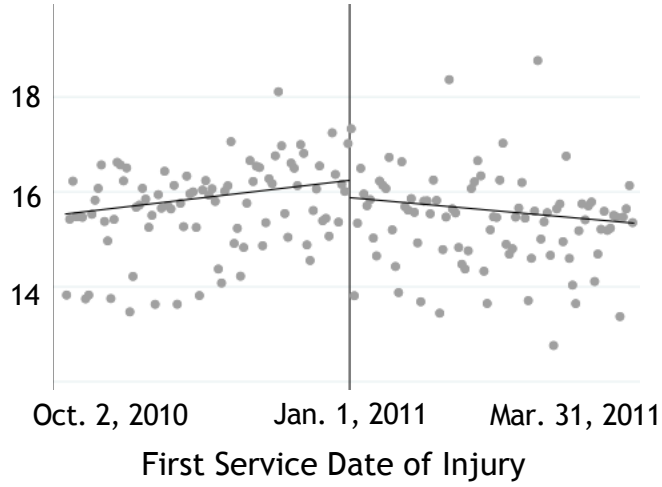


Reduced Form: 2012 Care Dates

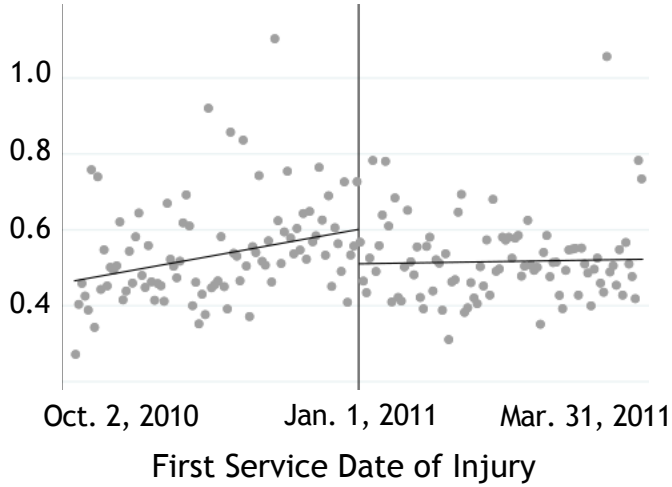
A. 2012 Total Care Dates



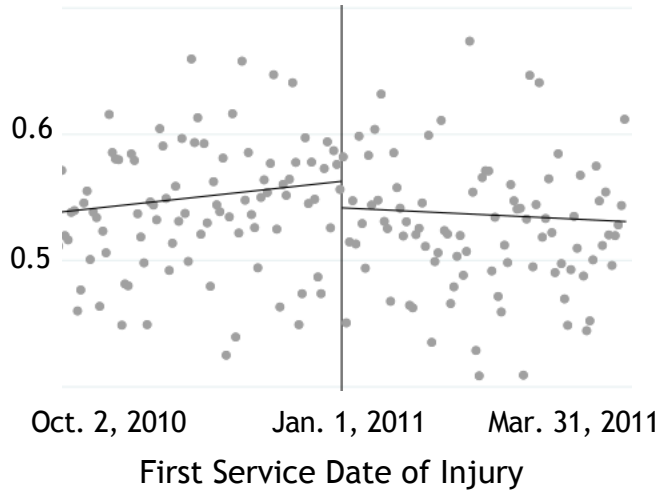
B. 2012 Total Outpatient Dates



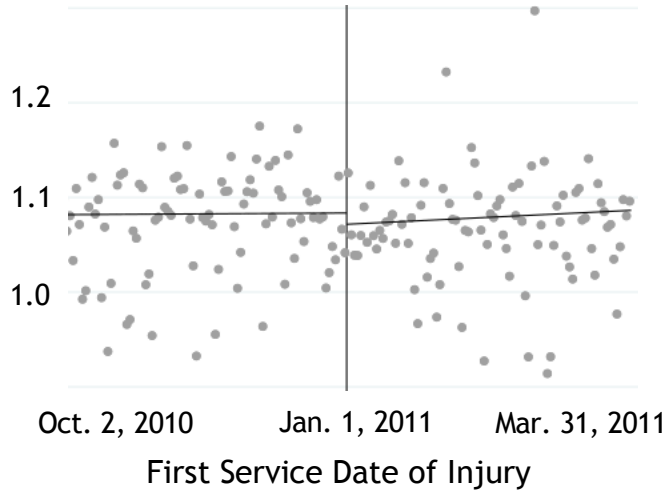
C. 2012 Total Inpatient Dates



D. 2012 Total Elective Dates



E. 2012 Total Preventive Dates

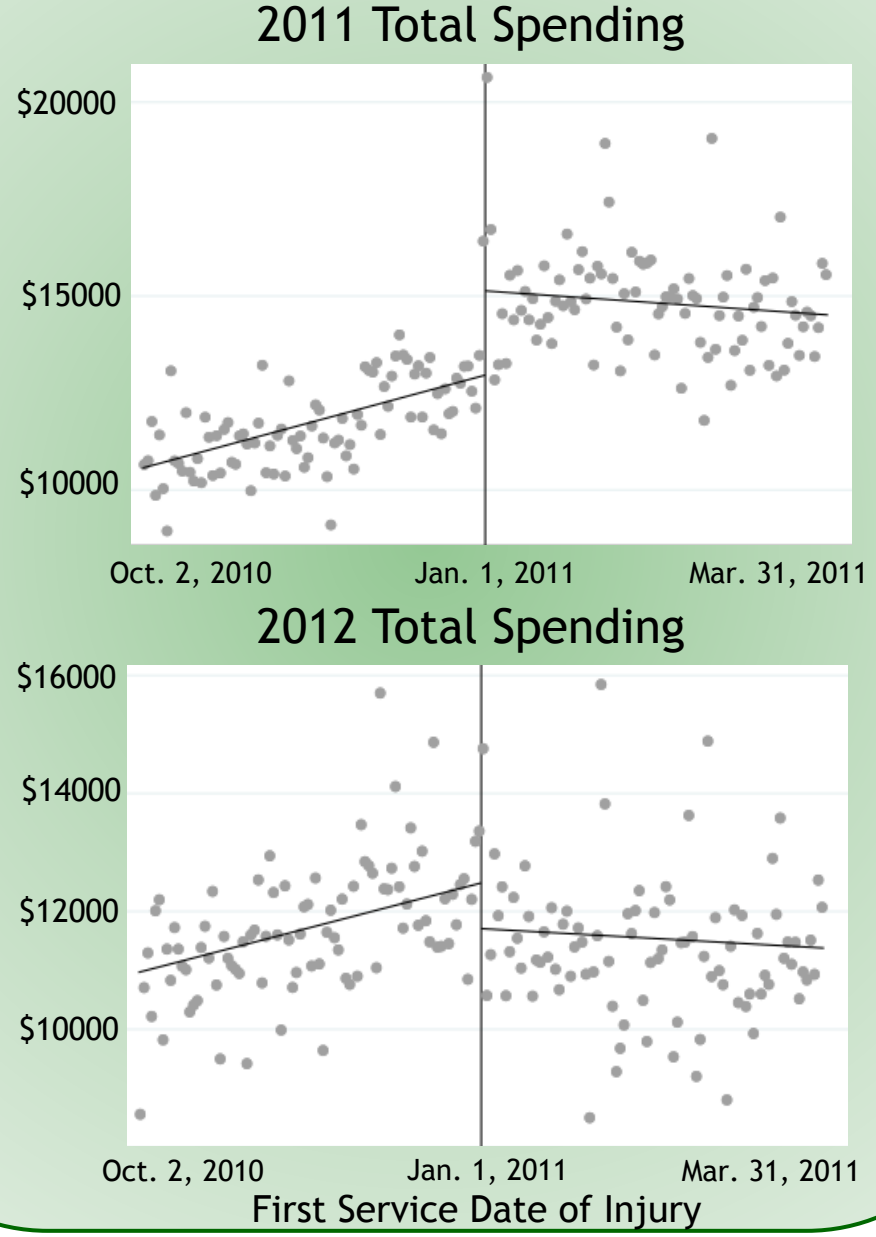


Results

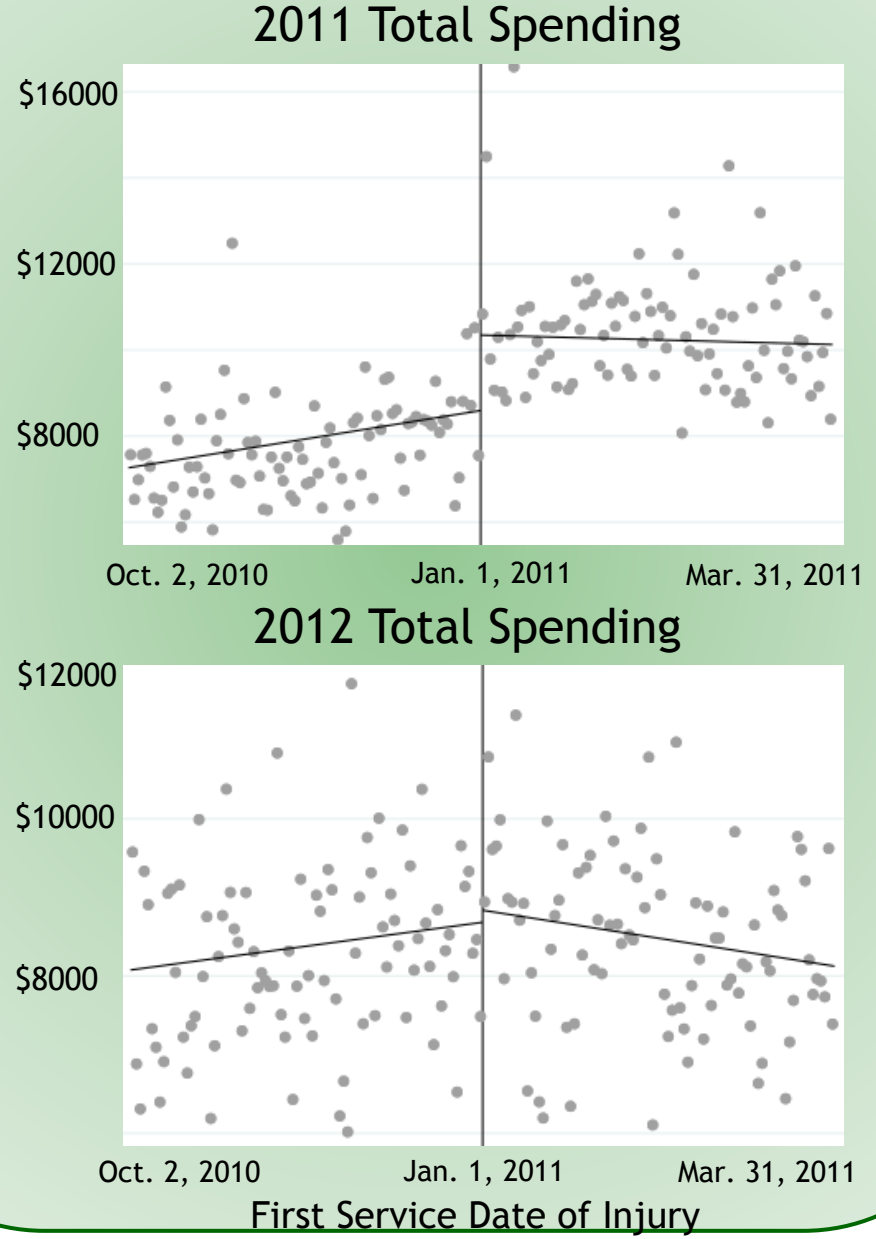
- Total Spending
  - 2011: ↑ $36,706
  - 2012: ↓ $13,263
- Out of Pocket
  - 2011: ↑ $3,288
  - 2012: ↓ $788
- Total Care Dates
  - 2011: ↑ 23
  - 2012: ↓ 7
- Outpatient Care Dates
  - 2011: ↑ 21
  - 2012: ↓ 6
- Any Inpatient Care Dates
  - 2011: ↑ 44.4 pp.
  - 2012: ↓ 8.6 pp.
- Elective Care Dates
  - 2011: ↑ 2.0
  - 2012: ↓ 0.4

For those induced to consume more healthcare by meeting their deductible (LATE): for every $1 more spent on healthcare in the year the deductible is met, about $0.37 less is spent in the following year.

Deductible > $100 (Main Sample)



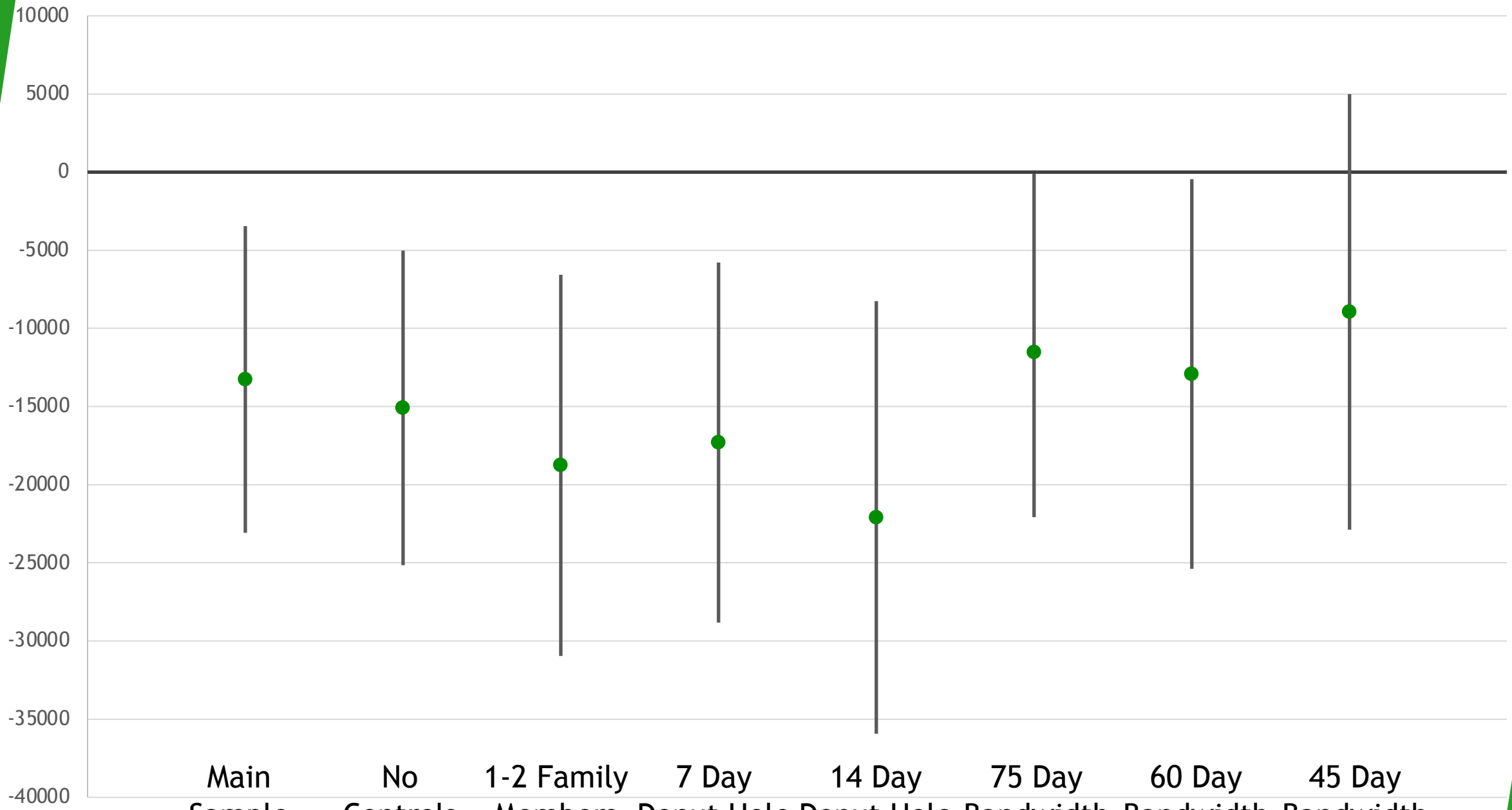
No Deductible (Placebo)



Placebo Test and Stratified By Deductible Amount

	Placebo	Deductible Amount (d)			
	0 < d ≤ 100	100 < d < 300	300 ≤ d < 500	500 ≤ d < 1000	1000 ≤ d < 10000
Total Spending	-342,356	-7,004	-18,791**	-15,106**	-9,222
	(878,255)	(9,629)	(8,970)	(7,498)	(15,000)
Sample Size	27,538	64,822	67,919	69,492	52,669
First-stage coefficient	0.004	0.048	0.058	0.073	0.054
First-stage F-statistic	0.17	43.33	93.48	91.48	50.69

2012 Total Spending Estimates are Robust



Conclusions

- For those induced to consume more healthcare by meeting their deductible (LATE): For every $1 more spent on healthcare in the year the deductible is met, about $0.37 less is spent in the following year.

- Back-of-the-envelope
- US consumers are saving at least $1.5 billion per year
- Single year estimates would overstate national savings by at least $18.3 billion

- Estimates of saving from high-deductible insurance plans that use only a single year are overstating savings due to consumers substituting across years to lower prices for non-urgent care.