

## Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to: Zhang Y, Donohue JM, Lave JR, O'Donnell G, Newhouse JP. The effect of Medicare Part D on drug and medical spending. *N Engl J Med* 2009;361:52-61.

## Appendix Tables

### Coefficients and Confidence Intervals Used to Calculate Impact of Part D on Total Monthly Pharmacy Spending, Lipid Lowering and Anti-Diabetic Medication Use, and Non-Drug Medical Spending

Table A1: The impact of Part D on overall pharmacy spending

Comparing No Coverage and No Cap Groups	No Cap			No Coverage			No Coverage vs No Cap		
	No Cap	95% CI	172.0	Coverage	95% CI	49.4	No Cap	95% CI	172.0
Estimated expenditure level in Jan 04	165.3	158.6	172.0	46.3	43.2	49.4	-119.1	-115.5	-122.7
Estimated rate of change in expenditures during 2004-2005	0.4	0.3	0.5	0.4	0.3	0.5	0.0	0.0	0.0
Estimated expenditure level in Dec 05	174.9	165.1	184.7	55.8	49.7	62.0	-119.1	-115.5	-122.7
Estimated change in expenditures between Dec 05 and Jan 06				17.0	8.8	25.2	17.0	8.8	25.2
Estimated rate of change in expenditures during 2006	0.4	0.3	0.5	2.2	1.1	3.2	1.8	0.8	2.7
Estimated rate of change in expenditures during 2007	0.4	0.3	0.5	0.7	-1.9	3.2	0.3	-2.2	2.7
Estimated expenditure level in Dec 07	184.5	171.6	197.3	101.7	45.4	158.1	-82.7	-126.2	-39.2
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	4.8	3.2	6.3	42.9	22.2	63.6	38.1	19.0	57.3
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	4.8	3.2	6.3	7.8	-23.2	38.8	3.0	-26.4	32.5
Difference between two groups in spending changes pre- and post- Part D							<b>41.1</b>	<b>32.7</b>	<b>49.6</b>

Comparing \$150 and No Cap Groups	No Cap			\$150 Cap			\$150 vs No Cap		
	No Cap	95% CI	175.0	Cap	95% CI	94.2	Cap	95% CI	175.0
Estimated expenditure level in Jan 04	169.5	163.9	175.0	91.6	89.0	94.2	-77.8	-74.8	-80.8
Estimated rate of change in expenditures during 2004-2005	0.4	0.3	0.5	0.4	0.3	0.5	0.0	0.0	0.0
Estimated expenditure level in Dec 05	178.8	170.6	186.9	100.9	95.8	106.1	-77.8	-74.8	-80.8
Estimated change in expenditures between Dec 05 and Jan 06				7.7	0.7	14.6	7.7	0.7	14.6
Estimated rate of change in expenditures during 2006	0.4	0.3	0.5	2.0	1.1	2.8	1.6	0.8	2.3
Estimated rate of change in expenditures during 2007	0.4	0.3	0.5	0.4	-1.7	2.6	0.1	-2.0	2.1
Estimated expenditure level in Dec 07	188.1	177.4	198.8	132.8	85.2	180.4	-55.3	-92.1	-18.4
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	4.7	3.4	5.9	31.1	13.6	48.6	26.5	10.3	42.7
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	4.7	3.4	5.9	5.4	-20.8	31.6	0.7	-24.2	25.6
Difference between two groups in spending changes pre- and post- Part D							<b>27.2</b>	<b>20.1</b>	<b>34.3</b>

Comparing \$350 and No Cap Groups	No Cap			\$350 Cap			\$350 vs No Cap		
	No Cap	95% CI	177.5	Cap	95% CI	112.6	Cap	95% CI	177.5
Estimated expenditure level in Jan 04	170.5	163.6	177.5	109.4	106.1	112.6	-61.2	-57.5	-64.9
Estimated rate of change in expenditures during 2004-2005	0.4	0.2	0.5	0.4	0.2	0.5	0.0	0.0	0.0
Estimated expenditure level in Dec 05	179.1	169.0	189.3	117.9	111.5	124.4	-61.2	-57.5	-64.9
Estimated change in expenditures between Dec 05 and Jan 06				10.34	1.66	19.03	10.34	1.66	19.03
Estimated rate of change in expenditures during 2006	0.4	0.2	0.5	0.71	-0.39	1.80	0.35	-0.61	1.31
Estimated rate of change in expenditures during 2007	0.4	0.2	0.5	0.21	-2.51	2.94	-0.14	-2.73	2.44
Estimated expenditure level in Dec 07	187.7	174.4	201.0	135.0	75.7	194.3	-52.7	-98.7	-6.7
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	4.3	2.7	5.9	18.8	-3.0	40.6	14.5	7.6	21.4
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	4.3	2.7	5.9	2.6	-30.1	35.2	-1.7	-3.4	-0.1
Difference between two groups in spending changes pre- and post- Part D							<b>12.8</b>	<b>3.87</b>	<b>21.69</b>

We tested for and found first-order serial correlation in the three comparisons: No Coverage:  $\rho = 0.34$  (p-value=0.03); \$150 cap:  $\rho = -0.41$  (p-value=0.006); \$350 cap:  $\rho = -0.50$  (p-value=0.005).

Given these results we used the SAS software to adjust for this serial correlation and used the resulting “model-based” standard errors.

Table A2: The impact of Part D on counts of monthly lipid-lowering medications

Comparing No Coverage and No Cap Groups	No Cap			No Coverage			No Coverage vs No Cap		
	No Cap	95% CI	0.00	Coverage	95% CI	0.00	No Cap	95% CI	0.00
Estimated expenditure level in Jan 04	0.00	0.00	0.00	0.50	0.00	0.00	0.50	0.00	0.00
Estimated rate of change in expenditures during 2004-2005	0.00	0.00	0.00	0.00	-0.06	0.06	0.00	-0.05	0.06
Estimated expenditure level in Dec 05	-0.03	-0.05	-0.01	0.47	-1.36	1.40	0.50	-1.31	1.41
Estimated change in expenditures between Dec 05 and Jan 06				0.00	-0.06	0.06	0.00	-0.06	0.06
Estimated rate of change in expenditures during 2006	0.00	0.00	0.00	0.01	-0.05	0.08	0.01	-0.05	0.08
Estimated rate of change in expenditures during 2007	0.00	0.00	0.00	0.00	-0.07	0.08	0.00	-0.07	0.08
Estimated expenditure level in Dec 07	-0.06	-0.11	-0.02	0.66	-2.18	2.66	0.73	-2.07	2.67
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	-0.02	-0.03	0.00	0.15	-0.66	1.00	0.16	-0.63	1.00
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	-0.02	-0.03	0.00	0.03	-0.84	0.96	0.05	-0.82	0.96
Difference between two groups in spending changes pre- and post- Part D							<b>0.21</b>	<b>0.15</b>	<b>0.27</b>

Comparing \$150 and No Cap Groups	No Cap			\$150 Cap			\$150 vs No Cap		
	No Cap	95% CI	0.90	Coverage	95% CI	0.62	No Cap	95% CI	0.00
Estimated expenditure level in Jan 04	0.86	0.82	0.90	0.60	0.59	0.62	-0.25	-0.23	-0.27
Estimated rate of change in expenditures during 2004-2005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Estimated expenditure level in Dec 05	0.83	0.77	0.89	0.58	0.54	0.61	-0.25	-0.23	-0.27
Estimated change in expenditures between Dec 05 and Jan 06				0.03	-0.01	0.08	0.03	-0.01	0.08
Estimated rate of change in expenditures during 2006	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01
Estimated rate of change in expenditures during 2007	0.00	0.00	0.00	0.00	-0.01	0.02	0.00	-0.01	0.02
Estimated expenditure level in Dec 07	0.80	0.73	0.88	0.74	0.41	1.07	-0.06	-0.32	0.20
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	-0.01	-0.02	0.00	0.11	-0.01	0.23	0.12	0.01	0.24
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	-0.01	-0.02	0.00	0.04	-0.14	0.22	0.06	-0.12	0.23
Difference between two groups in spending changes pre- and post- Part D							<b>0.18</b>	<b>0.13</b>	<b>0.23</b>

Comparing \$350 and No Cap Groups	No Cap			\$350 Cap			\$350 vs No Cap		
	No Cap	95% CI	0.90	Coverage	95% CI	0.68	No Cap	95% CI	0.00
Estimated expenditure level in Jan 04	0.86	0.81	0.90	0.66	0.63	0.68	-0.20	-0.17	-0.23
Estimated rate of change in expenditures during 2004-2005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Estimated expenditure level in Dec 05	0.83	0.76	0.90	0.63	0.59	0.68	-0.20	-0.17	-0.23
Estimated change in expenditures between Dec 05 and Jan 06				0.03	-0.03	0.09	0.03	-0.03	0.09
Estimated rate of change in expenditures during 2006	0.00	0.00	0.00	0.00	-0.01	0.01	0.00	0.00	0.01
Estimated rate of change in expenditures during 2007	0.00	0.00	0.00	0.00	-0.02	0.02	0.00	-0.01	0.02
Estimated expenditure level in Dec 07	0.81	0.71	0.90	0.73	0.31	1.15	-0.08	-0.40	0.25
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	-0.01	-0.02	0.00	0.06	-0.09	0.21	0.07	0.00	0.00
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	-0.01	-0.02	0.00	0.03	-0.20	0.26	0.04	0.00	0.00
Difference between two groups in spending changes pre- and post- Part D							<b>0.11</b>	<b>0.05</b>	<b>0.17</b>

Table A3: The impact of Part D on counts of monthly anti-diabetic medications

Comparing No Coverage and No Cap Groups	No Cap			No Coverage			No Coverage vs No Cap		
	No Cap	95% CI	95% CI	No Coverage	95% CI	95% CI	No Coverage vs No Cap	95% CI	95% CI
Estimated expenditure level in Jan 04	0.00	0.00	0.00	0.68	0.00	0.00	0.68	0.00	0.00
Estimated rate of change in expenditures during 2004-2005	0.00	0.00	0.00	0.00	0.06	0.22	0.00	0.07	0.22
Estimated expenditure level in Dec 05	-0.07	-0.10	-0.04	0.62	1.51	5.35	0.68	1.61	5.38
Estimated change in expenditures between Dec 05 and Jan 06				0.14	0.06	0.22	0.14	0.06	0.22
Estimated rate of change in expenditures during 2006	0.00	0.00	0.00	0.01	0.06	0.24	0.01	0.07	0.24
Estimated rate of change in expenditures during 2007	0.00	0.00	0.00	0.00	0.04	0.25	0.00	0.04	0.25
Estimated expenditure level in Dec 07	-0.13	-0.19	-0.07	0.85	2.06	8.77	0.98	2.25	8.83
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	-0.03	-0.05	-0.02	0.23	0.83	3.12	0.26	0.88	3.14
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	-0.03	-0.05	-0.02	-0.03	0.47	2.97	0.01	0.52	2.99
Difference between two groups in spending changes pre- and post- Part D							<b>0.27</b>	<b>0.19</b>	<b>0.35</b>

  

Comparing \$150 and No Cap Groups	No Cap			\$150 Cap			\$150 vs No Cap		
	No Cap	95% CI	95% CI	\$150 Cap	95% CI	95% CI	\$150 vs No Cap	95% CI	95% CI
Estimated expenditure level in Jan 04	1.1	1.09	1.20	0.92	0.89	0.95	-0.22	-0.19	-0.26
Estimated rate of change in expenditures during 2004-2005	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Estimated expenditure level in Dec 05	1.09	1.00	1.18	0.87	0.81	0.92	-0.22	-0.19	-0.26
Estimated change in expenditures between Dec 05 and Jan 06				0.14	0.07	0.22	0.14	0.07	0.22
Estimated rate of change in expenditures during 2006	0.0	0.00	0.00	0.00	-0.01	0.01	0.00	-0.01	0.01
Estimated rate of change in expenditures during 2007	0.0	0.00	0.00	0.00	-0.03	0.02	0.00	-0.02	0.02
Estimated expenditure level in Dec 07	1.0	0.92	1.15	0.95	0.44	1.46	-0.09	-0.48	0.31
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	0.0	-0.04	-0.01	0.09	-0.09	0.28	0.12	-0.05	0.29
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	0.0	-0.04	-0.01	-0.04	-0.31	0.24	-0.01	-0.27	0.26
Difference between two groups in spending changes pre- and post- Part D							<b>0.11</b>	<b>0.03</b>	<b>0.19</b>

  

Comparing \$350 and No Cap Groups	No Cap			\$350 Cap			\$350 vs No Cap		
	No Cap	95% CI	95% CI	\$350 Cap	95% CI	95% CI	\$350 vs No Cap	95% CI	95% CI
Estimated expenditure level in Jan 04	1.16	1.10	1.21	0.95	0.92	0.97	-0.21	-0.18	-0.24
Estimated rate of change in expenditures during 2004-2005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Estimated expenditure level in Dec 05	1.09	1.01	1.18	0.88	0.83	0.94	-0.21	-0.18	-0.24
Estimated change in expenditures between Dec 05 and Jan 06				0.13	0.05	0.20	0.13	0.05	0.20
Estimated rate of change in expenditures during 2006	0.00	0.00	0.00	-0.01	-0.02	0.00	-0.01	-0.01	0.00
Estimated rate of change in expenditures during 2007	0.00	0.00	0.00	-0.01	-0.03	0.02	0.00	-0.03	0.02
Estimated expenditure level in Dec 07	1.03	0.92	1.14	0.85	0.35	1.36	-0.18	-0.57	0.21
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	-0.03	-0.04	-0.02	0.02	-0.16	0.21	0.05	0.00	0.00
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	-0.03	-0.04	-0.02	-0.08	-0.36	0.19	-0.05	0.00	0.00
Difference between two groups in spending changes pre- and post- Part D							<b>0.00</b>	<b>-0.07</b>	<b>0.08</b>

Table A4: The impact of Part D on non-drug medical spending

Comparing No Coverage and No Cap Groups	No Cap			No Coverage			No Coverage vs No Cap		
	No Cap	95% CI	95% CI	No Coverage	95% CI	95% CI	vs No Cap	95% CI	95% CI
Estimated expenditure level in Jan 04	380.10	364.20	396.50	380.10	364.20	396.50	0.00	0.00	0.00
Estimated rate of change in expenditures during 2004-2005	4.98	4.82	5.14	4.98	4.82	5.14	0.00	0.00	0.00
Estimated expenditure level in Dec 05	499.56	479.82	519.80	499.56	479.82	519.80	0.00	0.00	0.00
Estimated rate of change in expenditures during 2006	4.98	4.82	5.14	3.60	3.28	3.93	-1.37	-1.54	-1.21
Estimated rate of change in expenditures during 2007	4.98	4.82	5.14	3.60	3.28	3.93	-1.37	-1.54	-1.21
Estimated expenditure level in Dec 07	619.02	595.43	643.10	586.07	558.50	614.15	-32.94	-36.93	-28.96
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	59.73	57.81	61.65	43.26	39.34	47.17	-16.47	-18.47	-14.48
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	59.73	57.81	61.65	43.26	39.34	47.17	-16.47	-18.47	-14.48
Difference between two groups in spending changes pre- and post- Part D							<b>-32.94</b>	<b>-36.93</b>	<b>-28.96</b>

Comparing \$150 and No Cap Groups	No Cap			\$150 Cap			\$150 vs No Cap		
	No Cap	95% CI	95% CI	\$150 Cap	95% CI	95% CI	Cap	95% CI	95% CI
Estimated expenditure level in Jan 04	381.60	358.86	404.21	381.60	358.86	404.21	0.00	0.00	0.00
Estimated rate of change in expenditures during 2004-2005	5.05	4.78	5.33	5.05	4.78	5.33	0.00	0.00	0.00
Estimated expenditure level in Dec 05	502.89	473.57	532.08	502.89	473.57	532.08	0.00	0.00	0.00
Estimated rate of change in expenditures during 2006	5.05	4.78	5.33	3.12	2.14	4.11	-1.93	-2.64	-1.22
Estimated rate of change in expenditures during 2007	5.05	4.78	5.33	3.12	2.14	4.11	-1.93	-2.64	-1.22
Estimated expenditure level in Dec 07	624.18	588.28	659.96	577.88	524.91	630.72	-46.30	-63.37	-29.23
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	60.65	57.35	63.94	37.50	25.67	49.32	-23.15	-31.68	-14.62
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	60.65	57.35	63.94	37.50	25.67	49.32	-23.15	-31.68	-14.62
Difference between two groups in spending changes pre- and post- Part D							<b>-46.30</b>	<b>-63.37</b>	<b>-29.23</b>

Comparing \$350 and No Cap Groups	No Cap			\$350 Cap			\$350 vs No Cap		
	No Cap	95% CI	95% CI	\$350 Cap	95% CI	95% CI	Cap	95% CI	95% CI
Estimated expenditure level in Jan 04	398.92	391.76	406.08	398.92	391.76	406.08	0.00	0.00	0.00
Estimated rate of change in expenditures during 2004-2005	4.83	4.55	5.10	4.83	4.55	5.10	0.00	0.00	0.00
Estimated expenditure level in Dec 05	514.74	500.95	528.53	514.74	500.95	528.53	0.00	0.00	0.00
Estimated rate of change in expenditures during 2006	4.83	4.55	5.10	6.09	5.57	6.61	1.27	1.02	1.51
Estimated rate of change in expenditures during 2007	4.83	4.55	5.10	6.09	5.57	6.61	1.27	1.02	1.51
Estimated expenditure level in Dec 07	630.57	610.14	650.99	776.83	743.91	809.74	146.26	133.77	158.75
Comparison of annual change in expenditures between 12/05-12/06 vs 1/04-12/05	57.91	54.60	61.23	73.13	66.88	79.37	15.22	12.29	18.15
Comparison of annual change in expenditures between 12/06-12/07 vs 1/04-12/05	57.91	54.60	61.23	73.13	66.88	79.37	15.22	12.29	18.15
Difference between two groups in spending changes pre- and post- Part D							<b>30.43</b>	<b>24.57</b>	<b>36.29</b>

Note: We tested for first order serial correlation but could not reject the null hypothesis of no serial correlation. The results are for our three comparisons: No Coverage group:  $\rho = 0.0096$  (p-value=0.95); \$150 Cap group:  $\rho = -0.124$  (p-value=0.43); and \$350 Cap group:  $\rho = -0.29$  (p-value=0.067). Standard errors are empirical or robust standard errors.