
Technological Change and Risk Adjustment: Benefit Design Incentives in Medicare Part D Online Appendix

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Appendix

A Subsidization Scheme for Medicare Part D Plans

A Part D plan i who enrolls beneficiary j will receive four types of payments for that beneficiary:

$$\text{Payments}_{ij} = \underbrace{(DP_{ij} + GP_{ij} - \text{prem}_i)}_{\text{Direct Subsidy}} + \text{prem}_i + RI_{ij}$$

where DP_j is the diagnosis-specific risk adjustment for beneficiary j in plan i
 GP_{ij} is the demographic-specific risk adjustment for beneficiary j in plan i
 prem_i is chosen plan i 's premium paid by each beneficiary
 RI_{ij} is the government reinsurance payment for beneficiary j in chosen plan i

The Direct Subsidy contains the risk adjustment that the plan receives for beneficiary j . The diagnosis-specific portion is the sum of risk adjustment over the individual's diagnoses, scaled up or down by the plan's bid.

$$DP_{ij} = \frac{\text{bid}_i}{NAB} \sum_x W_x D_{jx}$$

W_x are the risk adjustment amounts (in dollars) described in Section II.1¹ and D_{jx} is 1 if beneficiary j has diagnosis x . These weights are inflated by the ratio of the plan's bid to the national average bid for the year. Demographic-specific risk adjustment GP_{ij} are computed in the same way for the demographic categories described in Section II.1.

Insurance plans also receive premiums and reinsurance payments. Plan i 's premium prem_i is subtracted from the Direct Subsidy and then collected directly from beneficiaries. Reinsurance payments reimburse plans directly for 80% of plan liabilities in the catastrophic zone. The government makes two other payments to plans that I ignore in my empirical strategy. Firstly, because low-income beneficiaries pay reduced copays, the Low-Income Cost-Sharing Subsidy reimburses plans directly for the difference between the reduced copay and the plan's stated copay. I can ignore this payment because plan expenditure is the same regardless of a beneficiary's low-income status. Secondly, a Risk Corridor payment partially offsets the losses of any plan whose total expenditure exceeds its total receipts by five percent. If instead an plan's total receipts exceed its expenditure by 5%, the insurer remits part of its profits to the government under the rules of the Risk Corridor. Since risk corridor payments apply at the plan level rather than the beneficiary level, I cannot incorporate them into my adjustments.

B Adjustments to Raw Plan Expenditure

In the Medicare prescription drug claims, I observe the plan's raw expenditure on each beneficiary. I make four modifications to this expenditure in order to isolate the portion of expenditure that corresponds to diagnosis-specific risk adjustment.

¹To reiterate, W_x in this paper are the weights in Robst et al. (2007) times the 2009 national average bid and divided by the 2009 upcoding normalization factor.

1. I subtract reinsurance payments. Reinsurance payments are simply calculated as 80% of the plan's expenditure above the catastrophic threshold.
2. I subtract demographic risk adjustment.
3. I subtract supplemental premiums collected by plans offering enhanced benefits. The supplemental premium is paid by beneficiaries but not subtracted from the Direct Subsidy, therefore it does not drop out of total payments.
4. Finally, I divide by $\frac{bid_i}{NAB}$. This rescales plan expenditure by overall plan generosity to make expenditure incurred by plans of varying generosity comparable.

Modified expenditure \widetilde{E}_j is the dependent variable in Equation 2.

C Use of Datasources Over Time

The table below describes the timeline of data used to for risk adjustment and this paper's measurement and estimation. The first column shows that the Part D risk adjustment calibration data comes from 2000 (disabled Medicaid beneficiaries used to represent disabled Medicare beneficiaries) and 2002 (Federal retirees used to represent elderly Medicare beneficiaries). I collect the cumulative technological change (entrants and new generics) between 2003 and 2008, inclusive. Medical and prescription drug claims for a 5% sample of Medicare beneficiaries are used to link drugs to diagnoses (Section V.3). Risk adjustment payments are based on diagnoses from the previous calendar year, so in estimation of Equation 2, I use diagnoses from 2008 and modified expenditure from 2009. We call the resulting coefficient *treatment costs* for 2009. The difference between risk adjustment in 2009 and treatment costs in 2009 is *profitability* for 2009, which is the independent variable in the estimation of Equation 4. I use 2009 profitability to explain benefit design outcomes in 2010; finally, this equation is weighted by expenditure on drugs in Medicare Advantage in 2009.

Table A1: Datasources Over Time

	Risk adjustment calibration data	Stock of Tech. Change from FDA	Linking Drugs to Diagnoses	Measuring Profitability	Effect of Profitability on Outcomes
2000	Medicaid				
2001					
2002	Federal Retiree				
2003		X			
2004		X			
2005		X			
2006		X			
2007		X	RHS: diagnoses LHS: drug choices		
2008		X	RHS: diagnoses LHS: drug choices	RHS: diagnoses	
2009			RHS: diagnoses LHS: drug choices	LHS: spending	RHS: profitability weights: MA spending
2010					LHS: outcomes

Table A2: Effect of Profitability on Benefit Design: Each Technological Change Instrument Singly

IV: Entrants						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
Profitability	-0.0103 (0.0179)	0.2031 (0.5599)	0.0079 (0.0315)	-0.5388 (0.9029)	0.0016 (0.0020)	0.0584 (0.0583)
Entrants	-34.12 (10.08)***	-12.96 (6.64)+	-14.58 (3.71)***	-15.61 (11.73)	-12.96 (6.64)+	-12.96 (6.64)+
F	11	4	15	2	4	4
IV: New Generics						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
Profitability	0.0102 (0.0330)	-0.4471 (0.3302)	-0.0808 (0.0173)***	0.1404 (0.6581)	-0.0034 (0.0007)***	-0.077 (0.0179)***
New Generics	4.91 (0.81)***	9.45 (1.41)***	6.74 (0.83)***	11.59 (2.47)***	9.45 (1.41)***	9.45 (1.41)***
F	36	45	66	22	45	45
IV: Expenditure on Entrants						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
Profitability	0.2179 (0.0768)**	-3.7528 (19.1437)	-0.1765 (0.1445)	10.1602 (34.9727)	0.0116 (0.1023)	-0.6785 (3.5075)
\$ on Entrants	0.16 (0.17)	0.01 (0.10)	-0.09 (0.06)	0.04 (0.18)	0.01 (0.10)	0.01 (0.10)
F	1	0	2	0	0	0
IV: Takers of New Generics						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
Profitability	0.0371 (0.0216)+	-0.5379 (0.2854)+	-0.0624 (0.0123)***	-0.2528 (0.5790)	-0.0028 (0.0005)***	-0.0679 (0.0143)***
Takers of New Generics	13.71 (3.31)***	20.8 (2.58)***	15.43 (1.59)***	24.83 (3.95)***	20.8 (2.58)***	20.8 (2.58)***
F	17	65	94	40	65	65
Sample	all	covered	covered & OOP is copay	covered & OOP is coins?	covered	covered

This table reports the results of estimation of Equation 4 on each of 3611 drugs in 1550 Part D plans in 2010. Each panel uses a different instrument in 2SLS estimation. Analyses are weighted by the expenditure on the drug in Medicare Advantage. Plan dummies are always included. When the outcome is coverage, controls for therapeutic class are included. Standard errors (in parentheses) are clustered on drugs. †, *, **, and *** represent significance at 10, 5, 1, and 0.1 percent.

Table A3: "Reduced Form" of IV: Direct Regression of Technological Change Instruments on Benefit Design

	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coinsurance? (p.p.)
Entrants	0.3607 (0.7096)	4.4930 (7.7405)	0.9523 (0.3939)*	7.7807 (16.3698)	0.0333 (0.0200)+	0.3975 (0.6208)
New Generics	-0.0057 (0.1877)	-4.8078 (3.6456)	-0.6654 (0.1044)***	0.5273 (8.3765)	-0.0362 (0.0063)***	-0.7792 (0.1777)***
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coinsurance? (p.p.)
\$ on Entrants	0.0348 (0.0111)**	0.0500 (0.1380)	0.0254 (0.0079)**	0.5101 (0.3613)	0.0006 (0.0003)+	0.0039 (0.0084)
Takers of New Generics	0.0664 (0.3018)	-11.60 (6.7929)+	-1.1655 (0.1771)***	-11.029 (16.4003)	-0.0641 (0.0105)***	-1.4449 (0.2976)***
N	5,597,050	3,812,124	2,950,041	862,083	3,812,124	3,812,124
Sample	all	covered	covered & OOP is copay	covered & OOP is coins.	covered	covered

This table uses the same empirical model as Table 5 but reports the reduced form of instruments on the benefit design outcomes directly. Analyses are weighted by the expenditure on the drug in Medicare Advantage. Plan dummies are always included. When the outcome is coverage, controls for therapeutic class are included. Standard errors (in parentheses) are clustered on drugs. †, *, **, and *** represent significance at 10, 5, 1, and 0.1 percent.

Table A4: First Stage for Table 6

First Stage for Brands						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
IV: Entrants and New Generics						
Entrants	-85.38 (40.59)*	-4.48 (15.42)	-28.58 (8.18)***	4.93 (17.03)	-4.48 (15.42)	-4.48 (15.42)
New Generics	19.2 (6.56)**	10.63 (1.76)***	8.85 (1.27)***	14.61 (3.15)***	10.63 (1.76)***	10.63 (1.76)***
F	14	21	25	12	21	21
IV: Expenditure on Entrants and Takers of New Generics						
\$ on Entrants	1.64 (0.92)+	0.23 (0.27)	-0.21 (0.13)	0.35 (0.29)	0.23 (0.27)	0.23 (0.27)
Takers of New Generics	-12.04 (11.85)	18.87 (3.70)***	13.29 (2.07)***	26.14 (5.76)***	18.87 (3.70)***	18.87 (3.70)***
F	22	34	35	16	34	34
First Stage for Generics						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
IV: Entrants and New Generics						
Entrants	-89.65 (16.73)***	-30.02 (8.78)***	-31.72 (8.48)***	-23.69 (10.89)*	-30.02 (8.78)***	-30.02 (8.78)***
New Generics	17.18 (2.62)***	8.76 (1.17)***	8.96 (1.17)***	7.54 (1.44)***	8.76 (1.17)***	8.76 (1.17)***
F	27	33	37	17	33	33
IV: Expenditure on Entrants and Takers of New Generics						
\$ on Entrants	-0.12 (0.38)	-0.18 (0.07)*	-0.18 (0.07)**	-0.19 (0.09)*	-0.18 (0.07)*	-0.18 (0.07)*
Takers of New Generics	11.41 (2.79)***	12.85 (1.92)***	12.75 (1.72)***	13.46 (2.43)***	12.85 (1.92)***	12.85 (1.92)***
F	17	22	28	15	22	22
First Stage for Protected						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
IV: Entrants and New Generics						
Entrants	-30.51 (7.55)***	-51.81 (9.14)***	-26.32 (5.54)***	-76.15 (13.34)***	-51.81 (9.14)***	-51.81 (9.14)***
New Generics	20.58 (7.12)**	57.51 (12.58)***	29.56 (7.31)***	73.29 (17.29)***	57.51 (12.58)***	57.51 (12.58)***
F	18	19	12	23	19	19
IV: Expenditure on Entrants and Takers of New Generics						
\$ on Entrants	0.24 (0.29)	-0.71 (0.27)**	-0.35 (0.17)*	-1.05 (0.49)*	-0.71 (0.27)**	-0.71 (0.27)**
Takers of New Generics	-51.92 (28.85)+	103.48 (28.91)***	82.86 (16.70)***	38.71 (-49.85)	103.48 (28.91)***	103.48 (28.91)***
F	2	11	12	3	11	11
Sample	all	covered	covered & OOP is copay	covered & OOP is coins.	covered	covered

This table reports the first stages that correspond to the IV analyses in Table 6. †, *, **, and *** represent significance at 10, 5, 1, and 0.1 percent.

Table A5: Effect of Profitability on Benefit Design in Medicare Part D By Plan Enrollment

High Enrollment Plans						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
	OLS					
Profitability	0.0028 (0.0033)	-0.8100 (0.1631)***	-0.0254 (0.0048)***	-0.6463 (0.1893)***	-0.0017 (0.0002)***	-0.0564 (0.0067)***
	IV: Entrants and New Generics					
Profitability	-0.0048 (0.0078)	-0.3299 (0.2500)	-0.0478 (0.0082)***	-0.0747 (0.5123)	-0.0021 (0.0004)***	-0.0489 (0.0114)***
first stage F	31	85	133	51	85	85
	IV: Expenditure on Entrants and Takers of New Generics					
Profitability	0.0202 (0.0212)	-0.5795 (0.3240)+	-0.0718 (0.0105)***	-0.4637 (0.6893)	-0.0027 (0.0005)***	-0.0685 (0.0137)***
first stage F	15	116	130	70	116	116
N	588,593	440,285	346,088	94,197	440,285	440,285
Medium Enrollment Plans						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
	OLS					
Profitability	0.0039 (0.0039)	-0.7239 (0.1434)***	-0.0232 (0.0043)***	-0.5680 (0.1594)***	-0.0017 (0.0002)***	-0.0525 (0.0063)***
	IV: Entrants and New Generics					
Profitability	-0.0056 (0.0113)	-0.3048 (0.2237)	-0.0535 (0.0086)***	-0.0362 (0.4485)	-0.0023 (0.0004)***	-0.0478 (0.0111)***
first stage F	31	84	131	51	84	84
	IV: Expenditure on Entrants and Takers of New Generics					
Profitability	0.0333 (0.0217)	-0.5291 (0.2890)+	-0.0728 (0.0104)***	-0.3852 (0.6053)	-0.0029 (0.0005)***	-0.0666 (0.0132)***
first stage F	15	116	130	72	116	116
N	3,809,605	2,599,966	2,013,276	586,690	2,599,966	2,599,966
Low Enrollment Plans						
	covered (p.p)	out-of-pocket cost (\$)	copay(\$)	coins.(\$)	tier	OOP is coins? (p.p.)
	OLS					
Profitability	0.0045 (0.0046)	-0.6654 (0.1332)***	-0.0203 (0.0037)***	-0.5167 (0.1511)***	-0.0017 (0.0002)***	-0.0487 (0.0066)***
	IV: Entrants and New Generics					
Profitability	-0.0018 (0.0132)	-0.2736 (0.2071)	-0.0446 (0.0074)***	0.0021 (0.4298)	-0.0023 (0.0004)***	-0.0414 (0.0103)***
first stage F	31	82	128	49	82	82
	IV: Expenditure on Entrants and Takers of New Generics					
Profitability	0.0469 (0.0213)*	-0.4855 (0.2664)+	-0.0644 (0.0093)***	-0.3448 (0.5823)	-0.0030 (0.0005)***	-0.0599 (0.0121)***
first stage F	15	119	132	72	119	119
N	1,198,852	771,873	590,677	181,196	771,873	771,873
Sample	all	covered	covered & OOP is copay	covered & OOP is coins.	covered	covered

This table reports the results of estimation of Equations 4 across three samples of plans: 163 plans with more than 25,000 enrollees, 1055 plans with between 500 and 25,000 enrollees, and 332 plans with fewer than 500 enrollees. In each panel, the dependent variables are a binary coverage measure or, if covered, the copay or copay as a percentage of list price for each drug in 1550 Part D plans in 2010. The first results are OLS and the remaining are 2SLS with the indicated instruments. Plan dummies are always included. When the outcome is coverage, controls for therapeutic class are included. Standard errors (in parentheses) are clustered on drugs. †, *, **, and *** represent significance at 10, 5, 1, and 0.1 percent.