A Study of Prescription Drug Spending by Medicare and Employers

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1 Introduction

Over the last ten years, the face of American health care has changed dramatically. Under the direction of two different presidents, the system has undergone a drastic transformation, complete with a number of new laws signed into legislation. These events continue to affect families in a powerful, and frequently, permanent, manner. In particular, evidence suggests that labor force status has affected many families' prescription drug expenditures and health insurance coverage.

Prescription drug expenditures are driven by a number of factors, including increased utilization of generic drugs, and continued attenuation of the number of new and innovative drugs coming to the U.S. market. Because prescription drugs encompass more than 15% of national health care costs, there is ongoing emphasis on managing prescription drug spending. In addition, out-of-pocket drug costs for patients, including those with prescription drug benefits, have continued to increase in the current decade. In health plans, hospitals, and other health care organizations, drug costs continue to be a substantial operating expense and a frequent target for cost containment. In particular, the high rate of increase in spending on specialty pharmaceuticals continues to be a focus for policymakers and administrators.

This paper explores the relationship between labor force status, health insurance coverage and expenditures, and prescription drug costs. In order to determine for which families out-of-pocket costs are rising – those with insurance, those without or both, data from the Panel Study of Income Dynamics (PSID) will be evaluated. The general outline of the paper is to review the data utilized and outline several econometric models, highlighting age as a key factor, in order to compile a spending pattern. Finally the results of the estimations are broken down with a

conclusion that forecasts the future of the industry. Ultimately, this is a study of health related spending from 1999 until 2007, where the central theme for analysis is, "Who spends what?"

2 Prescription Drugs

To estimate the effects of labor force status on coverage and drugs, I rely on data from the Panel Study of Income Dynamics (PSID), a national, longitudinal study of nearly 9,000 American families. The families are considered a fairly representative sample of the United States. PSID researchers began collecting economic and demographic data in 1968 and continue to do so today.

In 1999, PSID interviewers began to ask respondents what amount was spent on prescription drugs since their last interview (typically two years prior). Respondents also reported whether or not they were covered by health insurance, and the amount they spent on the coverage. Interviewers continued to collect this information in the 2001, 2003, 2005, and 2007 interviews. The question of how much was spent out-of-pocket on prescription drugs will serve as the primary variable of interest for analysis. The intent is to identify patterns and trends behind this data, and to measure the importance of factor variables like coverage and employment on this information.

From the 2007 wave, I consider family-level data on out-of-pocket prescription drug expenditures, the existence of health coverage, the amount spent on health coverage, marital status, labor force status, age of familial head and age of wife.

Initial Analysis

I begin by considering the drug expenditure data from 1999 until 2007. In Table 1, shown below, I performed an initial set of summary statistics on the expense data. Noteworthy from the beginning is the general increase in mean out-of-pocket prescription drug expenditures during

the five periods in which the PSID asked this question. The only period in which the mean did not increase is the last one, from 2007. As a possible explanation, 2007 records data from the calendar years 2005 and 2006, and 2006 is the first year that Medicare Part D, or the prescription drug coverage plan for Medicare users, went into effect.

Table 1-Prescription Drug Expenditures Summary Statistics

Year	Obs.	Mean	Std. Dev.	Min	Max	CPI-ALL	CPI-MED	CPI-Drugs	Quantities
1999	5741	380.03	1270.91	0	60000	162.80	241.80	258.00	1.473
2001	6088	522.80	2315.47	0	132000	172.20	260.30	284.50	1.838
2003	6451	575.58	2434.56	0	106340	179.60	284.60	316.50	1.819
2005	6636	677.89	1999.88	0	61200	188.90	309.80	337.20	2.010
2007	7002	656.43	1515.88	0	57600	201.90	336.10	364.80	1.799

Source: PSID Online

Also included is data from the Consumer Price Index (CPI), which measures the average change over time in the prices paid by urban consumers for a market basket of goods and services. When compared to the overall CPI during 1998-2006 (the average of June for each year) a change of 24% is found, the overall medical component experienced a change of 39%, and prescription drugs specifically experienced a 41.4% change. Consequently, prices of prescription drugs, according to the CPI, are inflating more rapidly than the average U.S. level of goods.

Furthermore, in the last column, I utilized the CPI-Drug data per year with the mean to determine if the quantity of out of pocket prescription drug expenditures purchased each year is increasing. Though up from 1999, the amount purchased has remained fairly stable since 2001, indicating that most of the expenditure increase has been due to price rises. Because of this, the regression results throughout this paper are meaningful in dollar terms, since it has already been determined that prices are rising.

Multiple paired t-tests were also performed to check the strength of the difference in means, i.e. to make sure that the differences between the average amount reported in each year

was not due to chance. In Table 2, the 95% confidence intervals are reported for the sequential tests, demonstrating that the differences were each statistically significant:

Table 2-Prescription Drug Expenditure Paired T Tests

Test	Obs.	Mean	Std. Error	Std. Dev.	95% Confidence Interval	
99=01	5072	-198.50	31.99	2277.99	-261.21	-135.80
01=03	5379	-138.68	34.11	2501.75	-205.55	-71.81
03=05	5543	-188.98	30.92	2301.94	-249.59	-128.37
05=07	5842	-47.49	22.01	1682.20	-90.64	-4.35

Source: PSID Online

Regression Analysis

Next, I analyze the effects that previously reported drug expenditures have on the current year of data, i.e. do the expenditures reported in 1999 affect those reported in 2001? Consider a model of the form:

$$exp\_year_i=\alpha+\beta\mathbf{x}_i+\gamma(age)+\varepsilon_i$$

where estimation of the coefficients is performed using ordinary least squares (OLS). exp_year_i is our dependent, current year of analysis, expenditure variable taking on values from the years 2001, 2003, 2005 and 2007. $\mathbf{x}_i$ is a vector containing the previously reported data, taking on values from 1999 to 2005. *age* is a variable recording the age of the family head in the year of the independent variable. The coefficients from the regression are reported in Table 3.

Table 3-OLS Results of Drug Expenditure Carry Over

Independent Variable	Dependent Variable			
	exp_2007	exp_2005	exp_2003	exp_2001
2005	0.3222984* (.0092086)			
2003		0.2707577* (.0142479)		
2001			0.5911574* (.0221368)	
1999				1.013575* (.0361305)
F-Statistic	929.38	353.42	482.12	487.06
r^2	0.2415	0.1132	0.1522	0.1612
constant	-246.1302	-496.2463	-640.2493	-389.4280
N	5840	5542	5376	5070

Source: PSID Online
Note: Standard Errors are in parenthesis.
Note: No serial correlation was present in the time-series data, allowing for the use of OLS.
**significant at the .001 level*

The model suggests a strong relationship between previously recorded expenditures and currently reported expenditures, controlling for age. The coefficients are statistically significant in each regression, and moreover, each model exhibits overall significance (see F-statistics near the bottom of the table). According to OLS, in 2007, 24.15% of the variation in the prescription drug expenditures can be explained by the regression model. The other years have smaller r^2 values, but 2001 reports the highest coefficient. Each coefficient can be interpreted as the impact of a one dollar increase in previous expenditures on the expected value of current expenditures over and above the effect that head of family age has on expenditures. For example, in 2001, $.59 for every dollar, on average, carries over to 2003.

3 Health Insurance

Let us now switch our focus to health insurance. The variable of interest is total paid for health insurance in the last two years, including amounts that were automatically deducted from pay, as well as directly paid amounts. I performed the same initial set of summary statistics on this data as I performed on the out-of-pocket drug expenditure data. The results are shown in Table 4.

Table 4-Health Insurance Cost Summary Statistics

Year	Obs.	Mean	Std. Dev.	Min	Max
1999	5269	1537.44	2461.71	0	30000
2001	5693	1823.29	2896.93	0	32000
2003	5669	2114.05	3477.93	0	70000
2005	5688	2432.40	3948.94	0	60000
2007	6279	2554.78	4258.88	0	72000

Source: PSID Online

Similar to the results found with the expenditure data, the mean amount paid in premiums has been increasing over the five periods under observation. In trying to determine if prescription drug expenditures are a function of health insurance premiums, it becomes necessary to observe the behavior of the insurance data. One of the most basic queries is which families have insurance, and how much do they spend? Focusing specifically on the data from 2007, the results are listed in Table 5, on the next page.

Age of Head is the same variable from earlier, recording the age of the familial head in 2007. *Insurance* is a binary variable generated from the question in the PSID, taking values '1' and '0' for being covered or not being covered, respectively. The table records the frequencies, for both values, as well as the average amount spent on premiums if the respondent's value was a '1.' Not surprisingly, the table demonstrates that, generally, as the age of the familial head increases, so does the frequency of insurance coverage and the average amount spent on premiums. There are a number of explanations for this trend; [1] the increasing family size with older family heads (namely, children) might necessitate greater cost, [2] the increasing likelihood of injury or illness with age, and [3] the potential increasing level of prosperity with older families. Also worth noting is that past age 65, almost all respondents are covered in some manner by insurance, most likely due to Medicare.

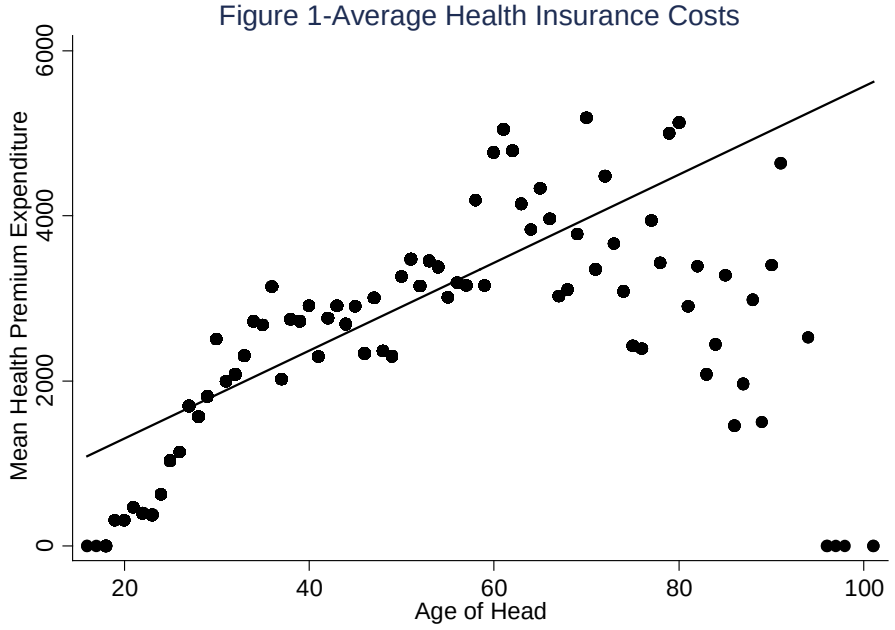
Table 5-2007 Health Insurance Expenditures (by Age)

Age of Head	Insurance Freq.	No Insurance Freq.	Insurance Mean Spent	**Age of Head**	Insurance Freq.	No Insurance Freq.	Insurance Mean Spent
16	-	2	-	**57**	101	7	3403.13
17	1	-	0.00	**58**	88	5	4451.81
18	14	1	0.00	**59**	102	11	3533.74
19	32	7	385.89	**60**	95	2	4881.21
20	51	16	432.47	**61**	60	4	5424.15
21	73	22	639.40	**62**	58	4	5155.87
22	78	24	552.40	**63**	55	3	4406.94
23	109	27	482.59	**64**	46	1	3925.76
24	149	23	748.73	**65**	43	4	4769.90
25	136	21	1224.39	**66**	47	-	3959.52
26	182	25	1313.51	**67**	38	-	3022.26
27	193	25	1961.60	**68**	35	3	3405.10
28	184	22	1769.33	**69**	45	-	3773.51
29	174	21	2059.68	**70**	35	-	5180.90
30	164	12	2725.79	**71**	28	-	3350.92
31	156	11	2158.99	**72**	34	-	4481.43
32	145	19	2390.62	**73**	27	-	3658.77
33	149	9	2477.42	**74**	40	-	3082.27
34	155	7	2854.73	**75**	33	-	2418.43
35	136	11	2914.20	**76**	19	-	2384.24
36	138	10	3395.08	**77**	25	-	3937.10
37	138	11	2200.40	**78**	32	-	3426.55
38	119	11	3020.11	**79**	28	-	5002.08
39	114	8	2936.37	**80**	27	-	5131.27
40	123	11	3186.68	**81**	23	-	2896.85
41	121	13	2572.76	**82**	22	-	3388.35
42	135	19	3202.68	**83**	19	-	2077.93
43	141	14	3214.82	**84**	15	-	2440.33
44	144	20	3109.94	**85**	18	-	3272.60
45	147	15	3238.40	**86**	7	-	1457.00
46	141	18	2671.03	**87**	12	-	1963.70
47	150	17	3378.21	**88**	8	-	2980.00
48	142	17	2696.04	**89**	4	-	1496.00
49	138	15	2573.41	**90**	6	-	3400.00
50	127	22	3931.60	**91**	3	-	4638.33
51	124	16	3960.36	**92**	1	-	-
52	130	15	3536.44	**93**	1	-	-
53	156	8	3646.42	**94**	4	1	3360.00
54	126	6	3552.20	**96**	2	-	0.00
55	112	13	3393.50	**97**	1	-	0.00
56	113	12	3586.24	**98**	1	-	0.00
				101	1	1	0.00

Source: PSID Online

In Figure 1 below, the graph of age of family head against the average amount spent is shown; and the presence of a 'Medicare Gap' becomes more visible. At age 65, the expenditures drop below the fitted regression line, indicating that the predicted values are higher than the values reported by the respondents.

Figure 1-Average Health Insurance Costs



Regression Analysis

To confirm these results, a series of regressions was performed on the health insurance expenditure data from 2007 by splitting the age variable in three different categories:

Table 6-Age Categories

Category	Description
I	Ages 16-34
II	Ages 35-64
III	Ages 65+

Each category is a binary variable, which takes on a value of '1' if the respondents' data fulfill the criterion indicated above, and a '0' if not. Using OLS, and with III as our base category, the average amount spent for each age split is determined in Table 7.

Table 7-OLS Results of Average Health Insurance Costs in 2007 (by Age)

Category	Coefficient/Constant	**Mean Spent**	Std. Error	t	P>t	99.9% Confidence Interval	
I	-1222.083	**1497.234**	152.499	-8.01	0	-1724.121	-720.0442
II	551.4237	**3270.7407**	145.4179	3.79	0	72.69667	1030.151
III (const)	2719.317	**2719.317**	123.3402	22.05	0	2313.272	3125.363
N	6279						
F-Statistic	113.61						
r^2	0.0349						

Source: PSID Online

Each coefficient is significantly different from zero at the .001 level. The null hypothesis that the difference in expenditures is zero between category III and category I, and between category III and category II is rejected. However, it is also necessary to determine if mean expenditures differ between category II and category I. I use a paired t-test of the model:

$$H_0: \beta_1-\beta_2=0$$
$$H_1: \beta_1-\beta_2\neq 0$$

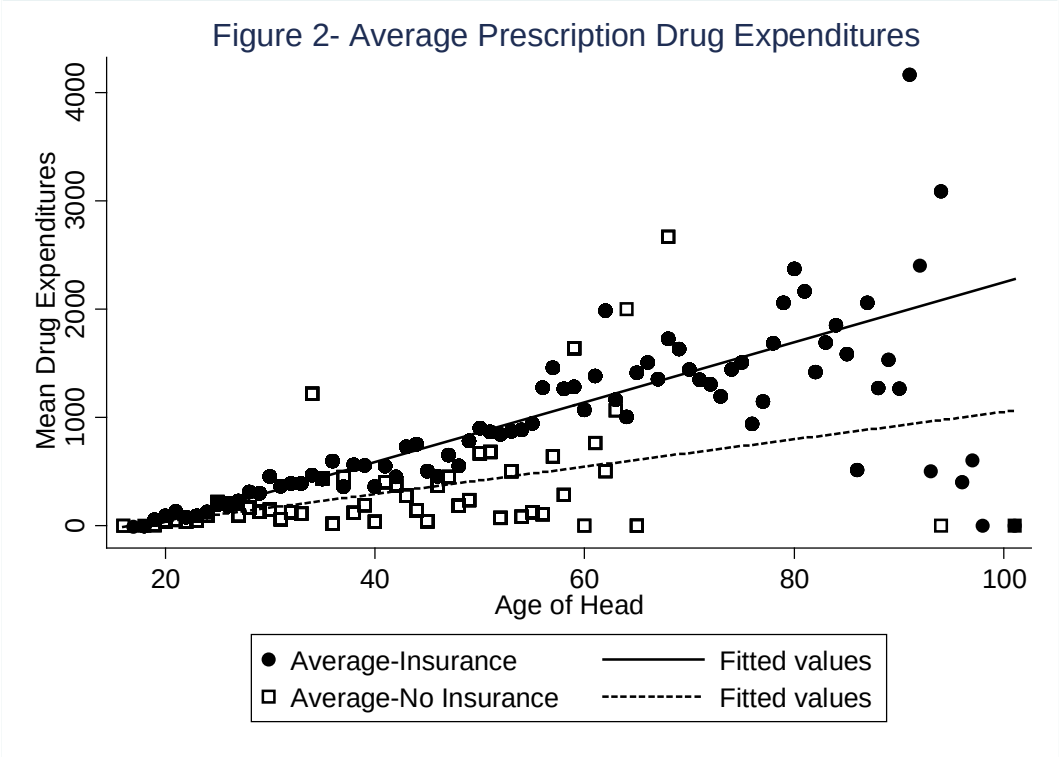
to obtain a T-statistic of -15.001, this is significant at the .001 level. It can then be reasonably concluded that the difference in coefficients is not merely due to chance. Moreover, according to OLS, the findings point towards the existence of a Medicare gap, as the average amount spent on health insurance for families aged 65+ is recorded at $2719.317, while for families aged 35-64 it is $3270.7407 and families aged 16-34 record spending $1497.234. Costs are increasing with age until Medicare becomes a factor, and then a drop occurs. How, then, can conclusions be drawn about the trend of prescription drug expenditures with respect to the increasing cost of insurance premiums? The data in Table 8 on the next page shows the mean of 2007 prescription drug expenditures, sorted by age of familial head, and factored by whether or not the family reported having health insurance.

Table 8-2007 Mean Prescription Drug Expenditures (by Age)

Age of Head	Insurance	No Insurance	Age of Head	Insurance	No Insurance
16	0.00	0.00	**57**	1460.59	640.71
17	0.00	0.00	**58**	1266.05	281.00
18	4.29	0.00	**59**	1284.64	1636.00
19	61.50	4.29	**60**	1067.55	0.00
20	97.51	41.25	**61**	1381.05	762.50
21	139.77	50.50	**62**	1985.74	500.50
22	90.36	37.50	**63**	1167.67	1066.67
23	97.07	45.37	**64**	1002.17	2000.00
24	137.24	93.91	**65**	1415.54	0.00
25	197.61	215.71	**66**	1510.70	-
26	190.51	203.60	**67**	1354.37	-
27	236.62	94.00	**68**	1726.77	2666.67
28	318.62	166.82	**69**	1631.78	-
29	308.65	128.57	**70**	1444.74	-
30	461.50	150.00	**71**	1350.93	-
31	371.28	60.45	**72**	1308.44	-
32	392.55	126.05	**73**	1196.30	-
33	395.44	111.11	**74**	1442.93	-
34	474.09	1220.00	**75**	1505.70	-
35	438.01	438.18	**76**	937.95	-
36	601.23	15.00	**77**	1146.12	-
37	365.01	448.18	**78**	1683.56	-
38	569.48	115.45	**79**	2059.14	-
39	559.09	185.63	**80**	2369.59	-
40	364.10	35.45	**81**	2166.22	-
41	552.82	404.23	**82**	1420.55	-
42	454.36	372.63	**83**	1694.26	-
43	731.20	276.79	**84**	1850.87	-
44	757.51	142.00	**85**	1587.56	-
45	508.28	40.67	**86**	511.57	-
46	461.71	366.94	**87**	2059.83	-
47	658.13	449.41	**88**	1270.00	-
48	556.65	182.06	**89**	1530.00	-
49	784.67	236.00	**90**	1266.67	-
50	904.94	665.45	**91**	4166.67	-
51	866.90	678.13	**92**	2400.00	-
52	847.91	72.67	**93**	500.00	0.00
53	872.12	504.38	**94**	3090.00	-
54	888.76	83.33	**96**	400.00	-
55	946.21	120.77	**97**	600.00	-
56	1277.58	107.50	**98**	0.00	-
			101	0.00	0.00

Below, in Figure 2, the same data are graphed. It is easily observed that families that reported having health insurance spent more on prescription drugs in 2007. This is an interesting, and perhaps unexpected causality – those expecting to need drugs may get insurance to cover their possible expenditures.

Figure 2- Average Prescription Drug Expenditures



There are a number of different and equally viable explanations for this phenomenon, but the most likely is the lack of data reporting for families without health insurance. However, it is also possible that a family with health insurance is far more likely to visit make doctor visits, and then receive medical information that may require out-of-pocket drug spending. Without insurance, the visit is never made, and thus drugs are not purchased. Nevertheless, in both cases, out-of-pocket prescription drug expenditures are increasing with age. So a different model is considered:

$$exp07=\alpha_0+ \alpha_1\boldsymbol{(age)}+\beta\boldsymbol{(HE07)}+\gamma\boldsymbol{(age\_HE)}+u$$

where *exp07* is the dependent variable: prescription drug expenditures in 2007. *age* is a binary variable, which takes the value of '1' if the head of the family records age at less than, or equal to, 64 and '0' otherwise. *HE07* records the cost of health insurance premiums in 2007, and *age_HE* means '*age*HE07,*' which records the different returns to prescription drug costs for increased health insurance premiums that each age group experiences. The results from OLS are listed in Table 9:

Table 9-OLS Results of Average Prescription Drug Costs in 2007 (by Age)

Variable	Coef.	Std. Error	t	P>t	99% Confidence Interval	
age	-706.69	75.12008	-9.41	0	-953.991	-459.3891
HE07	0.141618	0.0115166	12.3	0	0.103704	0.1795312
age_HE	-0.0458	0.0124159	-3.69	0	-0.08668	-0.004928
_cons	1038.569	71.72648	14.48	0	802.4397	1274.698
N	6279					
F-Statistic	275.46					
r^2	0.1164					

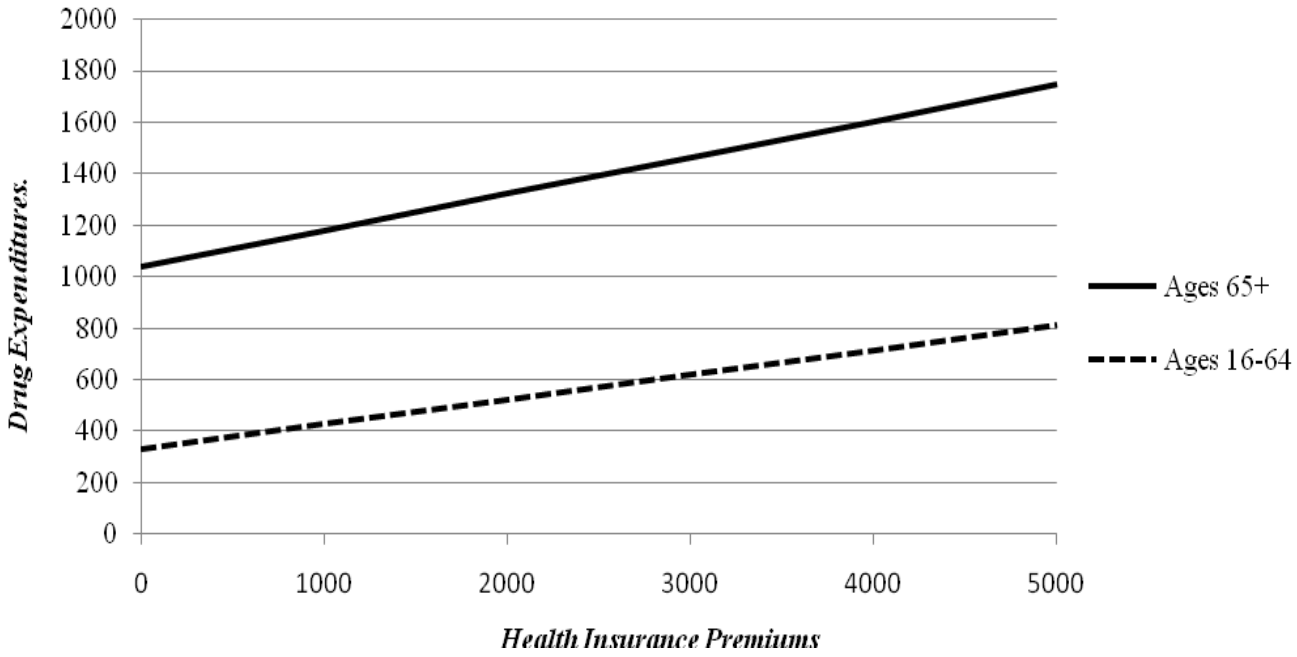
Source: PSID Online
Note: Age categories I and II were combined for this regression.

The new variable, *age_HE,* affects our interpretation of the regression coefficients. The mean expenditures of the first age group (ages less than or equal to 64) are $\alpha_0+\alpha_1+(\beta+\gamma)$***HE07***, while those affected by Medicare (ages 65+) have mean expenditures of α_0+ ***β(HE07)***. Using the data above, the effects are pictured in Figure 3.

Since the coefficient on *age_HE* is significantly different than zero, the null hypothesis that the returns on health insurance premiums are the same for those who receive Medicare and for those who do not is rejected. In fact, as Figure 3 demonstrates, with respect to health insurance premiums, out-of-pocket prescription drug expenditures for ages 65+ are not only, on

average, higher, but also a more rapidly increasing function. For those aged 16-64, we see that the expenditures start lower, and level off more quickly.

Figure 3-Drug Costs as a Function of Health Costs



Medicare and Prescription Drugs

In order to receive prescription drug coverage, while under Medicare, individuals must sign up separately under Part D if they are entitled to benefits under Part A or have enrolled in Part B. In 2007, the standard benefit required payment of a $265 deductible, with an initial coverage limit of $2,400. In this initial coverage phase, the beneficiary pays 25% out-of-pocket, while Medicare accrues 75% of the costs (Hoadley, Hargrave, Cubanski, & Neuman, 2008). Once this initial coverage limit is reached, the beneficiary must pay the full cost of his/her prescription drugs up until the total out-of-pocket costs exceed $3,850. Once out-of-pocket costs exceed $3,850, the beneficiary enters catastrophic coverage (in 2007 the level was $5,451.25). This coverage gap existing between the initial coverage limit and the catastrophic coverage limit is referred to more commonly as the “Donut Hole.” Once the beneficiary attains the catastrophic coverage limit, he

or she pays the greater of 5% coinsurance, or $2.15 for generics and $5.35 for other drugs (i.e. Medicare is responsible for 95% of the costs). The catastrophic coverage amount is calculated on a yearly basis, and a beneficiary who reaches catastrophic coverage by December 31 of one year will start his or her deductible anew on January 1 (Hoadley, et al., 2008)

Part D is a recently created section of Medicare, through the *Medicare Prescription Drug, Improvement and Modernization Act* (*Medicare Modernization Act*), passed in 2003. Key to the formulation of this legislation is that the federal government is prohibited from negotiating discounts with drug companies. Seniors represent the largest section of purchasing power for prescription drugs in the United States and as a result, the drug industry argued that a government program representing seniors would not negotiate prices, it would set them. Theory implies that if government price controls were effective, they could significantly lower drug-company profits and discourage medical innovation. If price controls were not effective, they could drive prices higher. For example, if companies were required to sell to Medicare at 15 percent off the average wholesale price, they might just raise the wholesale price. To put it another way, at the extreme, if everyone receives a discount, then no one does.

During the voting and approval phase of the bill, proponents of the program said that as it would operate, Medicare Part D avoids the issues described above by relying on dozens of private insurers which bid to offer coverage to Medicare recipients. Some would offer low premiums and lots of generic drugs, while others would have high premiums but offer brand-name drugs and full donut-hole coverage. Medicare would average the bids and would set a per-person subsidy. Pressure then would fall on the insurers to negotiate the best drug prices. Recent polls indicate that more than 80 percent of enrollees remain satisfied with their coverage (Montgomery & Lee, 2006).

Yet these polls are not necessarily a true gauge of success. Most enrollees are not sick, and the only way to know if a senior is satisfied with his or her coverage is to ask that question when the coverage becomes a necessity. Furthermore, according to a projection of spending for Medicare Part D, prepared by the Congressional Budget Office (CBO) in February 2005, between 2004 and 2013, Medicare Part D estimated outlays are at approximately $557.5 billion. This consists of $771 billion in payments for benefits and mandatory administrative costs, offset by $219 billion in premiums paid by beneficiaries and payments by states (Office, 2005).

Moreover, between 2007 and 2017, the dollar value of the coverage gap is projected to double from $3,051 to $6,241, exposing some beneficiaries to potentially high out-of-pocket costs and increasing the risk of cost-related non-compliance (Hoadley, et al., 2008). In fact, out-of-pocket spending increased substantially when enrollees reached the coverage gap in 2007, bringing to light the possible issue of enrollees making changes to their drug regimen, including stopping their medications altogether. Physicians can play an important role in helping beneficiaries who reach the coverage gap identify opportunities to switch to lower-cost alternatives, but in order to do so, physicians and patients need to talk with each other about drug costs.

Though the standard benefit is not the most common benefit offered by Part D plans, the "Donut Hole" coverage gap is still very common. In 2007, only 8 percent of Prescription Drug Plans (PDP) enrollees and 33 percent of Medicare Advantage Prescription Drug (MA-PD) plan enrollees had any gap coverage. PDPs supplement fee-for-service Medicare, while MA-PD plans, such as Health Maintenance Organizations (HMOs) or Preferred Provider Organizations (PPOs), cover drugs and other Medicare benefits. Among plans that offer gap coverage, it is mostly limited to generic rather than brand named drugs, especially among PDPs. The only out-

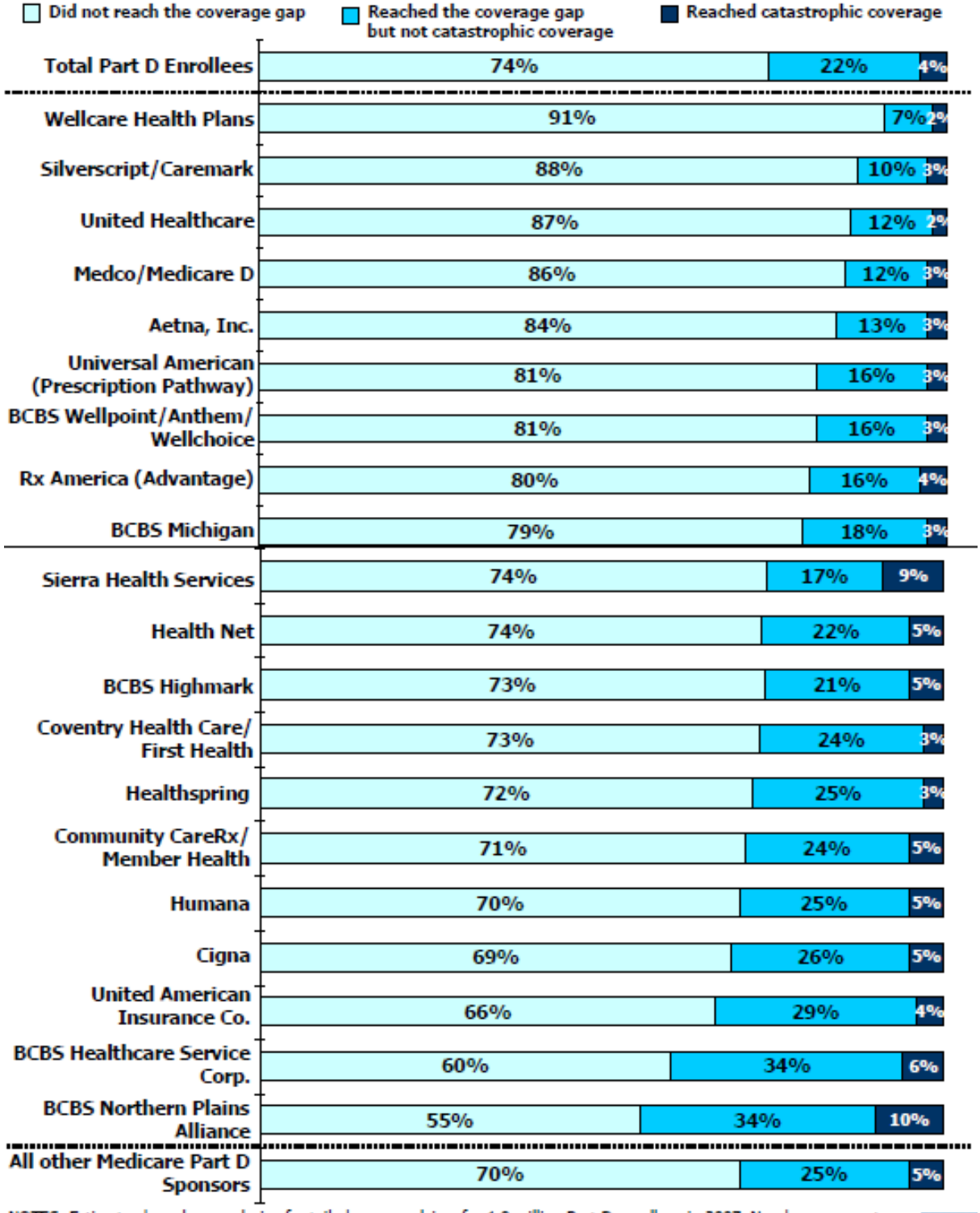
of-pocket costs that count toward getting out of the coverage gap and into catastrophic coverage are True Out-Of-Pocket (TrOOP) expenditures. TrOOP expenditures accrue only when drugs on plan's formulary are purchased in accordance with the restrictions on those drugs. Monthly premium payments do not count towards TrOOP (Hoadley, et al., 2008). In Exhibit 5 on the next page, the share of enrollees who reached the coverage gap in 2007 by drug sponsor is shown.

In comparison, most standard prescription insurance plans do not set a maximum annual coverage amount that is significant to anyone. Generally, a member will have coverage in a structure that sets either a defined dollar amount (co-pay) per prescription or a defined percentage (co-pay) per prescription. The co-pays, either dollar amount or percentage, are usually higher for brand name prescriptions and lower for generic prescriptions, thereby creating incentives for users to choose generic products. Currently Medicare Part D charges less for generics than name brands, and in 2011, will be introducing a discount for enrollees in the coverage gap that choose generics over name brands.

Exhibit 5

Share of Part D Enrollees Who Reached the Coverage Gap in 2007, By Medicare Drug Plan Sponsor

Excludes Part D Enrollees Who Receive Low-Income Subsidies and Non-Users



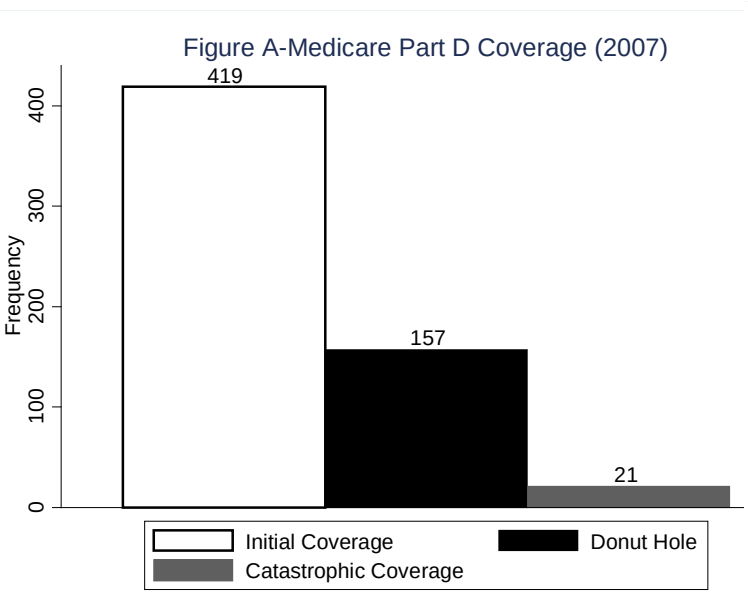
NOTES: Estimates based on analysis of retail pharmacy claims for 1.9 million Part D enrollees in 2007. Numbers may not sum to 100% due to rounding.

SOURCE: Georgetown University/NORC/Kaiser Family Foundation analysis of IMS Health LRx database, 2007.

According to a study published by the Kaiser Foundation, "The Medicare Part Coverage Gap: Costs and Consequences in 2007" among Medicare Part D enrollees in 2007 who were not eligible for low-income subsidies (non-LIS), 26% had spending high enough to reach the coverage gap. Fifteen percent of those reaching the coverage gap (4% overall) had spending high enough to reach the catastrophic coverage level. Applying this estimate to the entire population of Part D enrollees, the analysis suggest that about 3.4 million beneficiaries (14 percent of all Part D enrollees) reached the coverage gap and faced the full cost of their prescriptions in 2007.

With this in mind, the trend of increasing out-of-pocket drug expenditures with increasing insurance expenditures (Figure 3) for those eligible for Medicare is logical. Enrolling and spending more for Part D of Medicare indicates a necessity for prescription drug coverage. However, due to the presence of the coverage gap many beneficiaries may end up stuck in the "Donut Hole" (of their respective plan) and responsible for 100% of their prescription drug costs. Our data only records out of pocket costs, and not total prescription drug costs, but by utilizing the out of pocket cost checkpoints[1] a general derivation of the frequency of "Donut Hole" occurrences can be determined in Figures A and B on the next page.

[1] See http://www.q1medicare.com/PartD-The-2010-Medicare-Part-D-Outlook.php



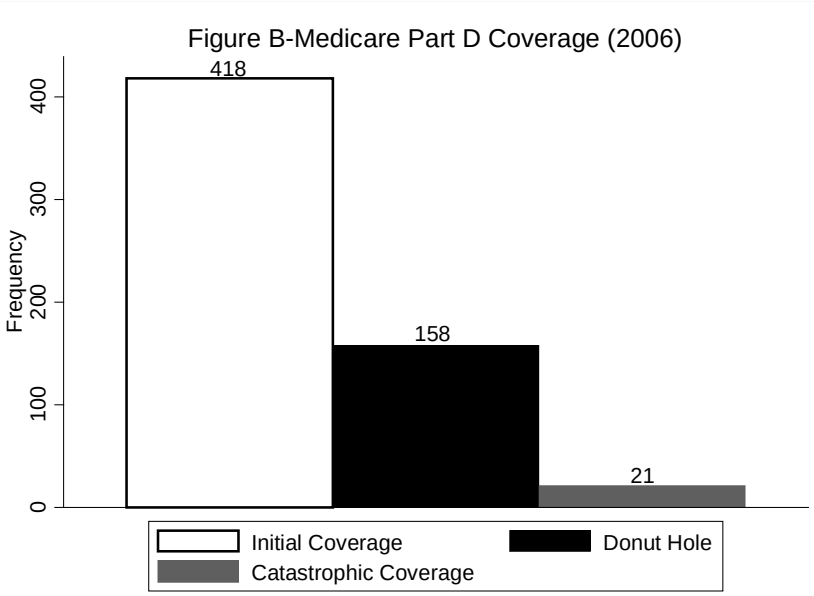


Figure A displays the 2007 expenditure data with the 2007 Medicare Part D checkpoints. Because 2007 is the first year in which most beneficiaries were enrolled for 12 months, it represents the first time they faced the full impact of the gap. However, since the 2007 PSID data records combined values for the years 2005 and 2006, with the interview occurring in mid-2007, I also checked the 2007 data against the 2006 Medicare checkpoints. There was only one value change.

It is worth nothing that most of the respondent answers will be based on 2006 values since the tendency is to lose the economic numbers going back to 2005[2]. Furthermore, since Medicare Part D only went into effect in 2006, the economic numbers from 2005 might not reflect valid out of pocket expenditures for this analysis (respondents might have paid more or less without the effects of Medicare Part D in 2005). This analysis also assumes that all over sixty-five participants in the PSID utilize both Medicare and Medicare Part D, an assumption that cannot be confirmed. That being said, for the purpose of comparison, in Table 10 below, I

[2] To see the strengths and weaknesses of data collected in 2 year increments: Frank P. Stafford and W. Jean Yeung, "Assessing the Quality of Income Data Collected on A Two-Year Periodicity: Experience from the Panel Study of Income Dynamics," Manuscript prepared for the 2008 International Conference on Survey Research Methodology, September 11-12, Center for Survey Research, RCHSS, Academia Sinica, Taiwan. Survey Research—Method and Application, Vol. 23, p. 33-80.

contrast the percentage of families in each category, and evaluate these values with those found by the Kaiser Foundation.

Table 10-Share of the Over 65 in the Coverage Gap

Category	Kaiser Study	Figure A	Figure B
Initial Coverage	74.00%	70.18%	70.02%
Donut Hole	22.00%	26.30%	26.47%
Catastrophic Coverage	4.00%	3.52%	3.52%
Catastrophic as % of Total Gap	15.00%	11.80%	11.73%

Source: The Medicare Part D Coverage Gap: Costs and Consequences in 2007

The Kaiser Foundation Study utilized calendar year 2007 data from IMS Health's Longitudinal Prescription Drug Database (LRx), which includes retail transaction data aggregated to the person level for 50 percent of all retail prescriptions filled in the United States and over 150 million unique de-identified patients. Operating under the assumptions outlined above, the percentages found in the PSID data are very similar to those found by the LRx data.

The Kaiser Study utilized eight different drug classes for their analysis – Proton Pump Inhibitors, Antidepressants, Oral Anti-Diabetics, Osteoporosis Treatments, ACE Inhibitors, Statins, Angiotensin Receptor Blockers and Alzheimer's Treatments Most concerning is that the report found that averaged across Part D enrollees using drugs in one or more of eight drug classes, 20% of enrollees who reached the coverage gap in 2007 either stopped taking a medication in that drug class, reduced their medication use (e.g. skipped doses), or switched to a different medication in that class when they reached the gap. Among the small share of Part D enrollees using drugs in the eight classes who stopped taking their medication during the coverage gap and then qualified for catastrophic coverage, 57 percent remained off that medication. Ultimately, both stopping and switching medications could result in higher costs for other parts of the Medicare program if beneficiaries have health issues that are not being

controlled by medication, or if they simply require more physician visits to prescribe and monitor changes in medications.

Table 11-Average Out-of-Pocket Spending Comparison

				By Benefit Class-Monthly Spending		
Study	Total Out-of-Pocket	Annual	Monthly	Initial	Gap	Catastrophic
Kaiser Study	739.00	739.00	62.00	16.93	196.00	285.00
PSID	1572.60	786.30	65.53	26.00	137.44	491.71

Note: Using the 2006 checkpoints

Moreover, as would be expected, average monthly out-of-pocket spending on prescription drugs more than doubled once they reached the coverage gap. Note the similarities in the non-LIS, non-classified, annual and monthly out-of-pocket spending amounts between the PSID and the Kaiser Study. By coverage status, the results vary a bit, but this is probably due to sample size differences, as the Kaiser Study has significantly more values from which to draw. The values are somewhat comparable, except in the case of monthly catastrophic payments. The relatively high out of pocket monthly spending that the PSID values record can be to due to several factors including: [1] Some Part D enrollees who reached catastrophic coverage might have experience a change in health that required higher total AND out-of-pocket costs, [2] Some beneficiaries may be paying for drugs not covered by their plan and [3] Potential misclassification of gap status.

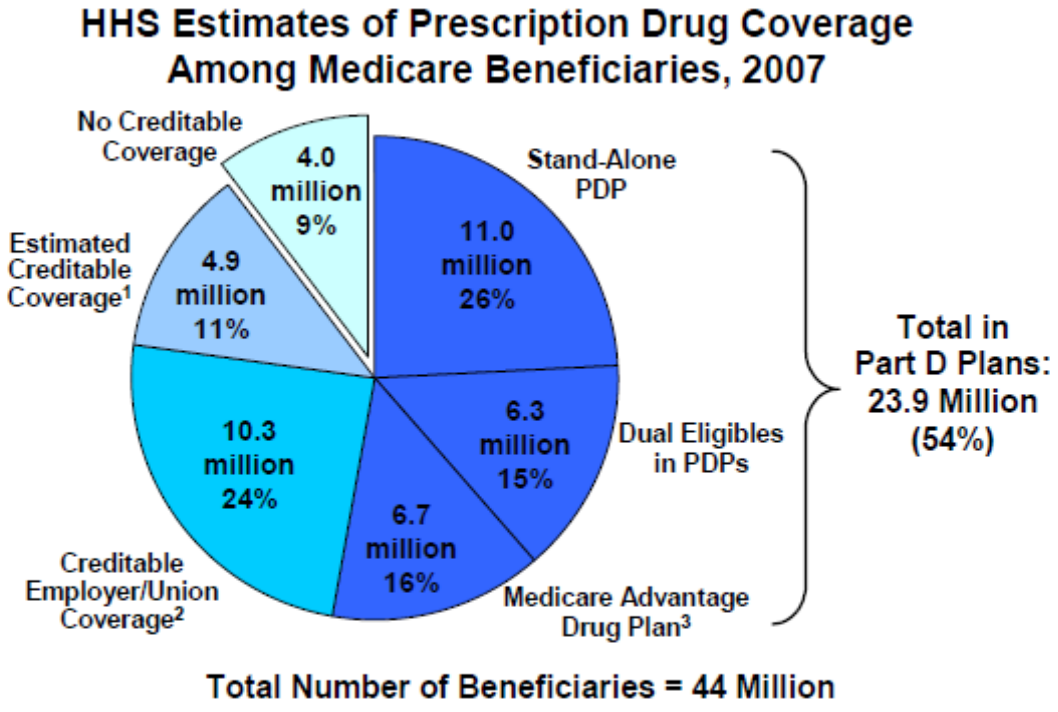
With respect to situation [2] above, different Part D plans do and do not cover certain drugs, so this may also be a factor in increasing out-of-pocket prescription drug costs. Without a doubt, there are more and more prescription drugs available every year to treat a variety of conditions. But updating the health care plans of Americans is not necessarily as rapid as the research and development of new pharmaceuticals. Without knowledge on what Part D plans (whether PDPs or MA-PDs) each over age sixty-five participant in the PSID uses, it is

impossible to determine the likelihood of this phenomenon. In general, Medicare Part D does not cover the following drug types:

- Drugs used for anorexia, weight loss, or weight gain
- Drugs used to promote fertility
- Drugs used for erectile dysfunction
- Drugs used for cosmetic purposes (hair growth, etc.)
- Drugs used for the symptomatic relief of cough and colds
- Barbiturates
- Benzodiazepines
- Prescription vitamins and mineral products, except prenatal vitamins and fluoride preparations
- Drugs where the manufacturer requires as a condition of sale any associated tests or monitoring services to be purchased exclusively from that manufacturer or its designee

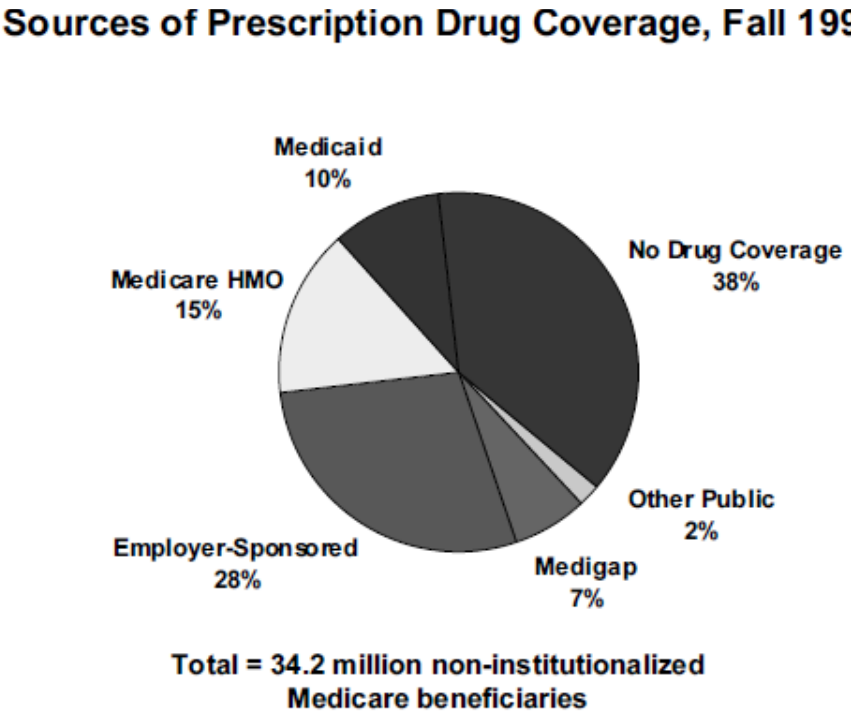
It is noteworthy, however, that in contrast, prior to the implementation of the Medicare Part D Prescription Drug Benefit, almost 38% of Medicare enrollees had no prescription drug coverage, according to a Kaiser Foundation Study from the fall of 1999 ("Medicare and Prescription Drugs: Fact Sheet," 2003). In June of 2007, Kaiser pegged that value at only 9% ("The Medicare Prescription Drug Benefit," 2007). Furthermore, in each of the years leading up to the passing of the Medicare Modernization Act, out of pocket prescription drug expenditures increased (Figures C-F). Both the 2007 Kaiser Medicare Study and the PSID data found average out of pocket costs to be less than $800, while in 2003, before the passing of the Medicare Modernization Act, that value was $1,147.

Figure C



Note: Estimates do not sum to 100% due to rounding. [1] Includes Veterans Administration, Indian Health Service, employer plans without retiree subsidies, employer plans for active workers, and state pharmaceutical assistance programs. [2] Includes employer/union, FEHB, and TRICARE coverage. [3] Approximately 0.5 million dual eligibles are enrolled in Medicare Advantage drug plans and are reported in this category. SOURCE: HHS, January 30, 2007. Data as of January 16, 2007.

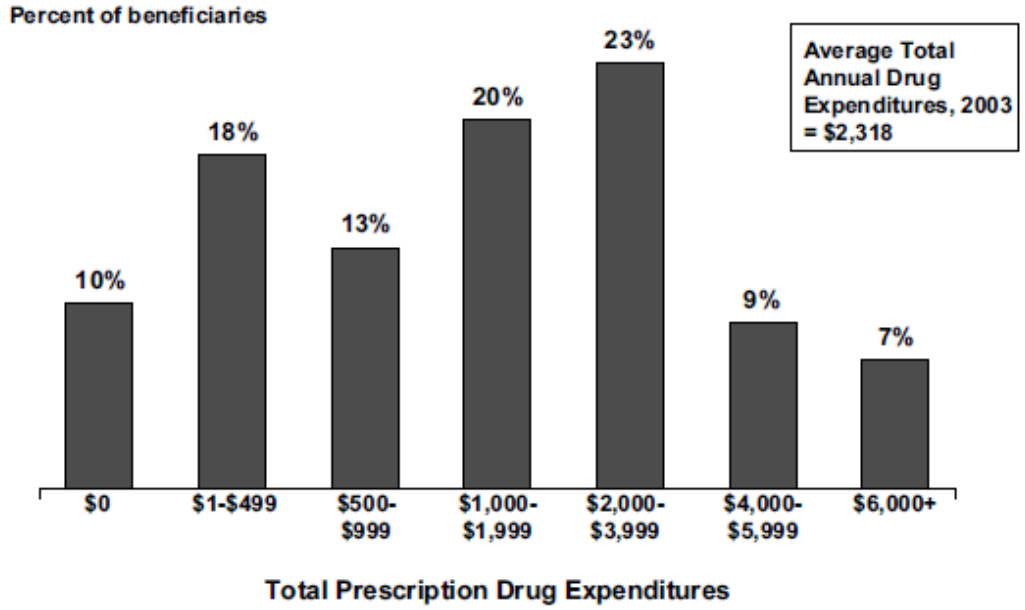
Figure D



Note: Analysis of non-institutionalized beneficiaries enrolled in Medicare for a full year and with classifiable drug coverage status.
SOURCE: Laschober, et al., *Health Affairs*, February 2002.

Figure E

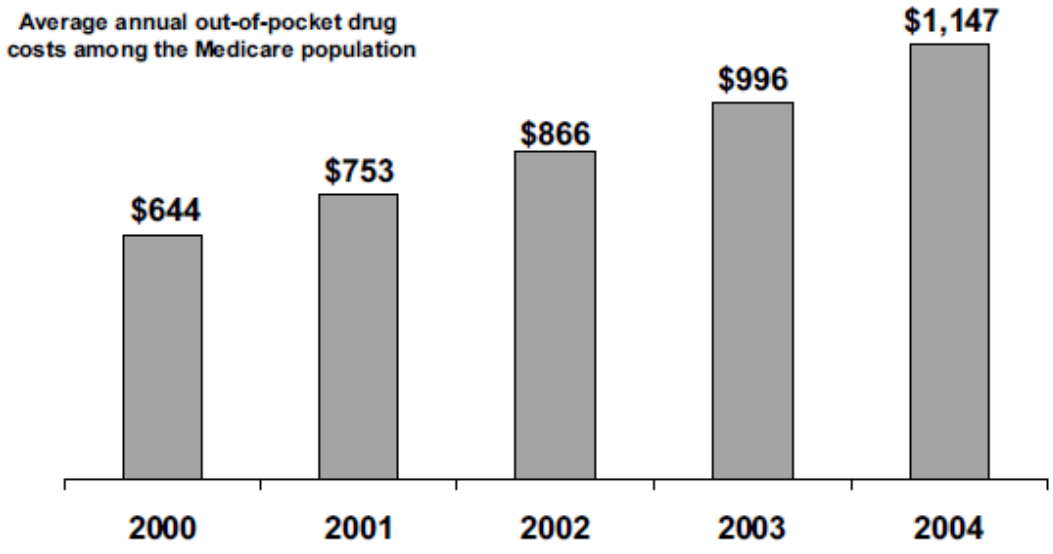
Distribution of Medicare Beneficiaries, by Total Prescription Drug Expenditures, 2003



SOURCE: CBO, 2003.

Figure F

Growth in Medicare Beneficiaries' Out-of-Pocket Prescription Drug Expenditures, 2000-2004



SOURCE: Actuarial Research Corporation analysis for The Kaiser Family Foundation (using CBO's 2003 estimates of prescription drug spending, which reflect adjustments in historical spending and lower expected economic growth in the near term).

Although the cost of closing the "Donut Hole" may present a serious challenge to policymakers in the current fiscal climate, raising awareness among Part D enrollees and their physicians about the coverage gap and improving enrollees' ability to monitor their total drug spending in relation to the gap could minimize the risk that enrollees who reach the gap will incur high out-of-pocket costs or experience preventable adverse outcomes from medication non-adherence. Careful attention is needed to ensure that gains to Medicare beneficiaries from the addition of the Part D drug benefit are not undermined by the coverage gap – especially for those enrollees who are highly dependent on medications to manage ongoing chronic conditions.

The Theory of Insurance: A Short Synopsis

In the case of health insurance there are three players; the physician, the patient and the insurance company. What is desired (as is the case with any form of insurance) is that the event against which insurance is taken be out of control of the patient. But, moral hazard plays an increasingly significant role in development of health insurance policies. For example, the physician presumably has a better idea of what the patient needs than the insurance company, and by certifying the necessity of a given treatment or drug, the physician acts as a controlling agent on the behalf of the insurance company. But it is not a perfect check; the physician might have his or her own reasons for prescribing more expensive and frequent treatments and so insurance companies have high premiums to protect themselves. More simply, insurance removes the incentive on the part of both patients and physicians to find better prices for medical care. Ideally, those with higher incidences of illness should pay higher premiums (Arrow, 1963).

Furthermore, because medical knowledge is complicated, the information possessed by the physician is much greater than that possessed by the patient. Yet, general practice has created a situation in which the physician has a social obligation to the patient; i.e., the patient replaces direct observation with a generalized belief in the ability of the doctor. A consequence of this is

that the physician cannot appear to act in a profit-maximizing manner, as it promotes distrust is the relationship. The patient is buying what the physician is selling (a belief in the medical best practice), so the physician must always "act" as thoroughly on behalf of the patient as possible (Arrow, 1963).

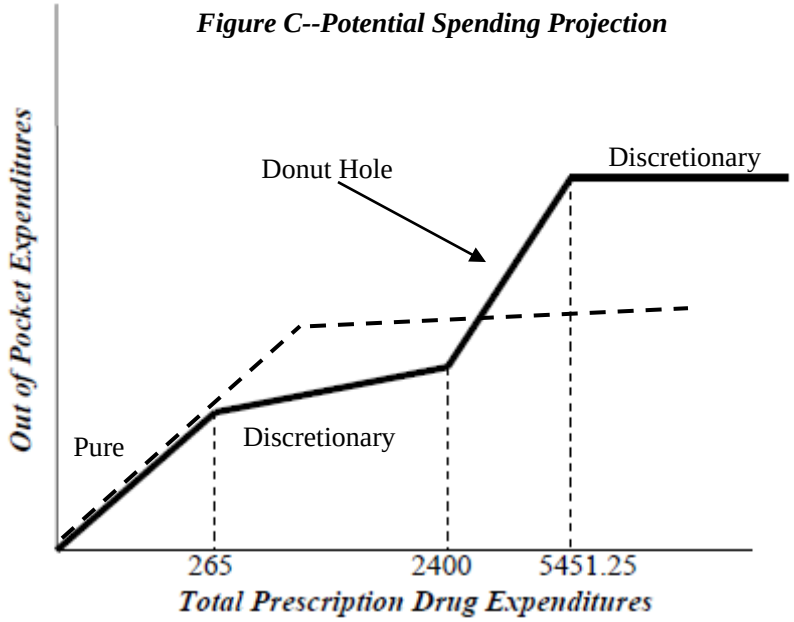
According to Kenneth Arrow, in his paper "Uncertainty and the Welfare Economics of Medical Care" the optimal contract for insurance is one in which, "the patient would actually have no concern with the informational inequality between himself and the physician, since he would only be paying by results anyway, his utility position would in fact be thoroughly guaranteed" (Arrow, 1963, p. 147). This implies that a patient would not feel concern about his or her lack of medical knowledge, because he or she would only pay the physician when a health improvement is achieved, i.e. with diagnosis or cure. But in the absence of this contract, the medical industry develops standards to compensate for the market failures. The "best" course of action is always prescribed, without regard to cost, in order to avoid failing the social bond. The general principle is that with barriers to information flow, and a lack of a comprehensive market to insure all the above risks, interactions take place through convergent expectations, assisted by signals, which may force non-optimal patterns of behavior. It follows that the government should undertake insurance in those cases where the market, for whatever reason, has failed to emerge. Consequently, direct institutional control becomes more and more the norm (Arrow, 1963).

The Medicare analysis, supplemented by data from the Kaiser Family Foundation, demonstrate that on average more people received prescription drug coverage with the passage of the Medicare Part D, as a part of the *Medicare Modernization Act* in 2003. But, as the dollar gap expands each year, there is an incentive to carry over and hold off on purchasing prescription drugs in order to receive a large sum and become a part of the catastrophic coverage zone. For

example, individuals will have new information about their needed prescriptions from the previous year, and will also be aware of checkpoints in advance, making it easy to hold off on purchasing drugs until total out of pocket expenditures exceed the catastrophic limit. It is a case of adverse selection, and brings the point made by Kenneth Arrow into a modern light, given the conditions of today's insurance market.

If this is the case, then out of pocket expenditures should increase rapidly as a function of total prescription drug expenditures in the coverage gap, in order to break the past the lower bound of catastrophic coverage. Once within catastrophic coverage, the function should be relatively flat to reflect the low out of pocket expenditures that are recorded within this benefit class. In effect, the graph should look something like that pictured below:

Figure C--Potential Spending Projection



In a subsequent paper titled, "Optimal Insurance and Generalized Deductibles" Arrow expands upon his point and concludes that the optimal contract for insurance (when there are management costs or a loading factor) is one with a deductible and then full coverage beyond the deductible (Arrow, 1973). The dashed line represents this theoretical coverage stucture. Using the theory of co-payments described earlier, it becomes apparent

that Medicare Part D is a combination of pure insurance, and partially discretionary co-payments. Utlizing either of these main economic arguments as a payment structure makes sense, except for the "Donut Hole."

4 Labor Force

Having thoroughly analyzed the data on those over the age of 65, I now turn my attention to those still in the labor force, or for the purpose of this study, families aged 16-64. Initially, I wish to determine if coverage is a function of labor force status, and then whether or not each of these variables factors into out-of-pocket prescription drug costs.

To complete this analysis, a new age variable, *familiesUnder65*, was generated, which recorded the data for married couples where each partner is under the age of 68 (to eliminate the Medicare factor). Other data sets utilized correspond to the employment status of the head of the family, and in which labor sector the head of the family was employed. *Union* is a binary referring to membership in a labor union, *Govt.* records values for those employed at the federal, state and local levels of government, *Business* indicates both employment by an unincorporated business or a corporation, and *Other* is self-employed, or employed for someone else, or both. In the following pages, the results of health insurance coverage analysis can be found. In Table 12, the frequency of insurance coverage is listed. In Table 13, the results of average health insurance costs can be found. Figures 4 and 5 show the same results, respectively. In the frequency results, there seems to be a large and significant gap between those who reported *Other* and those who reported *Union*, *Govt.*, or *Business*. This can potentially be explained by the increased sample size in *Other*, as its criteria cover more of the population. In the average expenditure results, we can see that generally *Union* seems to spend less, while *Business* spends more.

Table 12-Familial Health Insurance Coverage Frequency in 2007 (by Labor Sector)

Age of Head	Total	Union	Govt.	Business	Other
19	8	-	5	-	11
20	6	3	-	2	11
21	17	-	6	2	19
22	61	11	13	7	69
23	75	-	11	6	80
24	102	13	27	11	112
25	124	14	25	2	129
26	215	20	20	14	232
27	239	20	42	21	243
28	213	10	26	14	226
29	304	32	43	22	313
30	341	27	39	35	352
31	353	35	72	37	370
32	313	5	31	46	336
33	345	60	78	26	348
34	382	44	76	52	400
35	382	49	49	68	385
36	323	51	62	20	338
37	370	57	64	59	381
38	374	32	55	35	370
39	353	53	60	59	368
40	313	47	43	45	331
41	297	51	55	46	312
42	309	24	32	45	326
43	353	43	51	67	372
44	299	56	50	55	300
45	372	52	102	49	374
46	373	84	67	54	415
47	393	70	68	72	411
48	315	42	26	44	338
49	362	73	37	50	353
50	365	82	68	61	378
51	301	26	42	43	283
52	299	37	54	51	296
53	307	81	60	59	321
54	315	45	66	37	314
55	245	29	32	36	240
56	262	35	53	38	264
57	156	23	25	38	158
58	257	42	51	73	260
59	186	57	42	28	194
60	160	12	21	35	155
61	100	13	19	29	104
62	102	8	14	29	92
63	99	-	18	19	97
64	59	9	12	18	54

Source: PSID Online

Table 13-Familial Health Insurance Expenditures in 2007 (by Labor Sector)

Age of Head	Total Expenditures	Union	Govt.	Business	Other
19	300.00	-	0.00	-	200.00
20	0.00	0.00	-	0.00	0.00
21	1099.08	-	584.00	0.00	952.53
22	861.84	117.82	682.91	0.00	742.97
23	750.89	-	0.00	0.00	695.68
24	910.45	685.71	600.00	258.18	963.94
25	1579.21	1820.18	888.00	1975.00	1484.06
26	2006.03	0.00	1256.00	1414.29	1856.02
27	2788.50	1146.25	2410.80	2687.63	2731.72
28	3281.07	288.00	2330.77	1828.57	3078.92
29	2986.79	1795.85	3753.21	3820.00	2924.07
30	3484.86	1986.07	4112.80	2676.53	3273.56
31	2523.98	202.73	1736.81	1932.94	2283.95
32	3676.60	2400.00	3402.31	3214.50	3345.97
33	3109.04	2064.58	1720.07	5216.00	3075.84
34	3909.86	3109.51	2495.62	4316.60	3826.18
35	3754.57	2200.63	3364.41	2569.25	3654.56
36	4687.68	1627.72	3369.65	11940.00	4368.92
37	3764.10	1859.93	2031.50	7079.93	3643.03
38	4047.02	648.00	4290.64	1756.36	4047.60
39	3747.76	502.24	1357.11	5935.69	3540.72
40	3934.65	3371.95	5039.49	9486.32	3677.47
41	4495.65	1625.10	2345.11	7540.65	4239.25
42	4374.01	2882.10	3205.46	8400.49	4241.81
43	4141.80	2278.95	2848.24	8251.79	3905.48
44	4518.66	2841.85	4244.30	5018.05	4416.85
45	4649.17	6082.88	4857.67	5604.09	4562.00
46	4637.82	3000.46	2991.56	8289.50	4067.49
47	3930.39	2042.63	2830.44	9996.47	4011.87
48	3981.80	1048.21	4792.38	10000.00	3723.78
49	2854.36	1825.71	2304.12	3499.57	2694.34
50	4843.50	3397.46	3046.68	7032.22	4448.77
51	4346.07	655.38	2513.68	7301.47	4453.67
52	3735.86	2952.34	2780.41	7147.33	3748.12
53	4769.80	2012.33	4214.04	5990.81	4533.79
54	5577.04	2658.92	3507.06	10804.00	5388.57
55	4365.02	3501.25	3787.40	8250.00	4358.52
56	4635.75	1890.92	2207.49	7426.26	4523.97
57	5427.38	1743.74	1902.80	9180.21	5002.74
58	4488.34	3157.56	4643.84	5364.24	4449.14
59	3805.70	3175.10	2836.75	4908.24	3688.55
60	5619.86	1093.33	4055.16	8075.43	4989.93
61	6596.93	4950.00	3067.58	10353.85	5869.79
62	6902.05	4080.00	4332.00	7789.86	6404.66
63	6119.28	-	1812.31	10301.05	6199.37
64	4254.00	2037.33	2865.60	5704.14	4073.21

Source: PSID Online

Figure 4-Health Insurance Frequency (by Labor Sector)

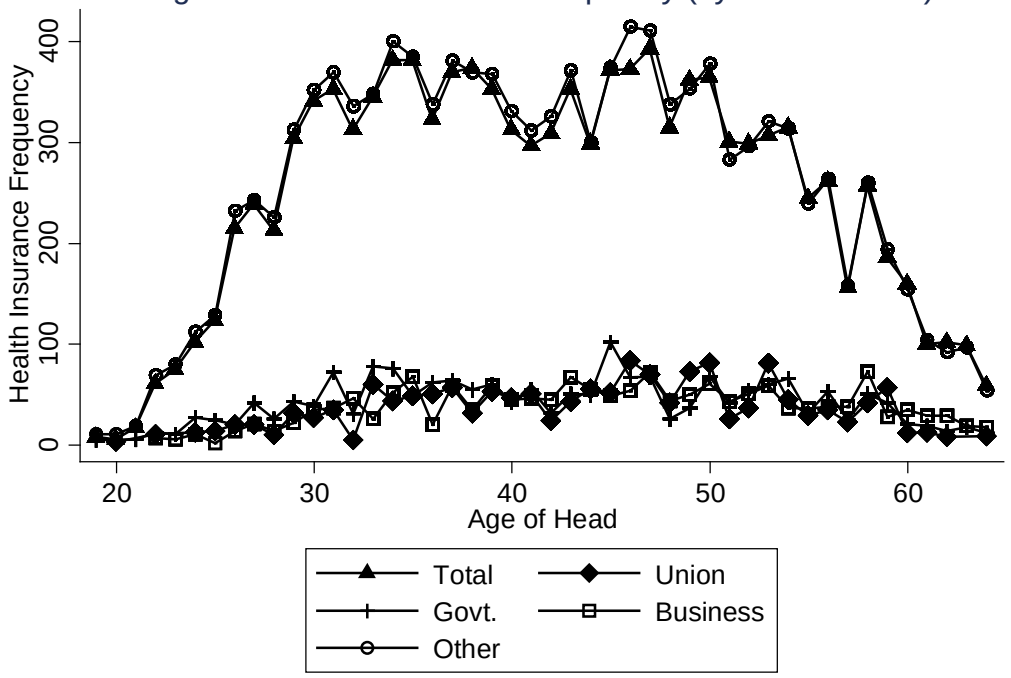
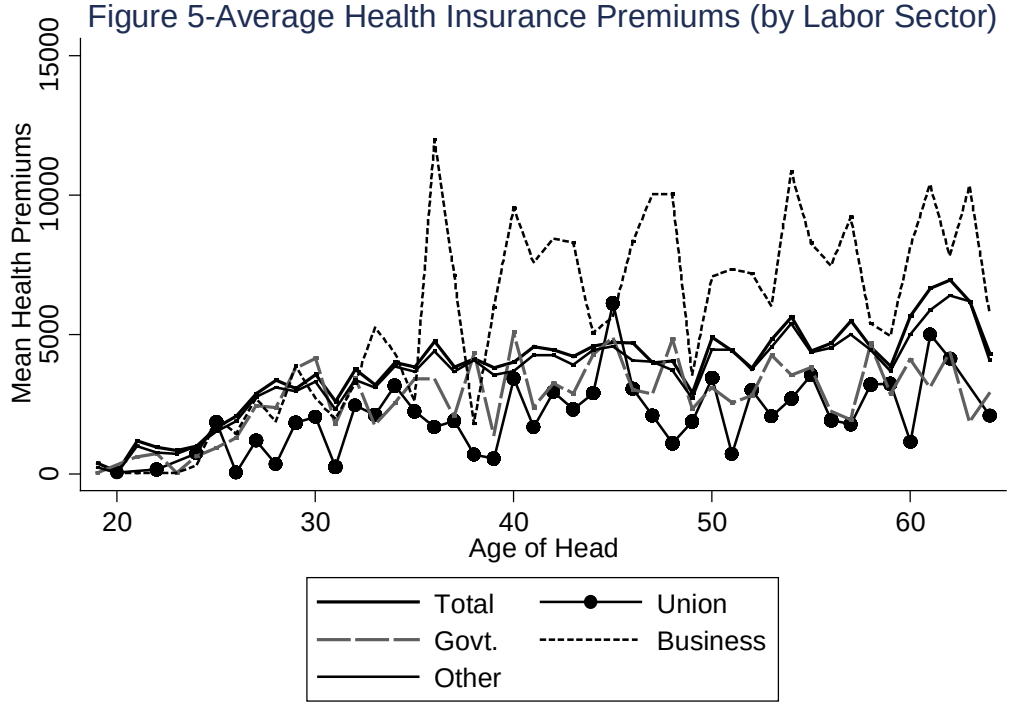


Figure 5-Average Health Insurance Premiums (by Labor Sector)



Regression Analysis: Probit Model

In order to determine what industries have the highest probability of having health insurance coverage for families under the age of sixty five, I utilized a probit model. A probit model corrects the errors that may occur when utilizing OLS as a linear probability model with a binary response variable. The model takes the form:

$$Pr\ (y_i = 1|x_i) = \Phi(x'_i\beta)$$

where y_i is a binary dependent variable and x_i is a vector of independent variables. In the case of the PSID data, y_i is health insurance (yes or no) and x_i is a categorical variable taking on values 1-19 for different labor industries. The predicted probability results of the margin test, after estimating the probit model, are shown in Table 14.

Table 14-Health Insurance Probability by Industry

Industry	Percent
Agriculture, Forestry, Fishing, Hunting	0.8952
Mining	0.9722
Utilities	0.9818
Construction	0.8917
Manufacturing	0.9560
Wholesale Trade	0.9486
Retail Trade	0.9351
Transportation and Warehousing	0.9328
Information	0.9684
Finance and Insurance	0.9787
Real Estate and Rental and Leasing	0.9275
Professional, Scientific and Technical Services	0.9854
Management, Administrative and Support and Waste Management	0.9150
Educational Services	0.9888
Health Care and Social Assistance	0.9368
Arts, Entertainment and Recreation	0.9444
Accommodations and Food Services	0.8725
Other Services (Except Public Administration)	0.9212
Public Administration and Active Military Duty	0.9895

Source: PSID Online

Regression Analysis-OLS Model

To further analyze the results found from the expenditure tables and figures, a model of the form below is utilized:

$$HE07=\alpha_0+ \alpha_1(\textbf{Union})+ \alpha_2(\textbf{Govt.})+ \alpha_3(\textbf{Business})+u$$

where the variable of interest, *HE07*, is 2007 Health Insurance Expenditures. The independent variables are the binary variables described above. Using OLS, and with *Other* as the base category, the results are listed in Table 15:

Table 15-OLS Results of Average Health Insurance Costs in 2007 (by Labor Sector)

Variable	Coefficient	**Mean Spent**	Std. Err.	t	P>t	99% Confidence Interval	
Union	-1131.48	**2362.571**	147.8948	-7.65	0	-1618.27	-644.6976
Business	2930.742	**6424.793**	139.1087	21.07	0	2472.877	3388.607
Govt.	-142.335	**3351.716**	133.947	-1.06	0.288	-583.21	298.5407
Other(const)	3494.051	**3494.051**	57.10368	61.19	0	3306.099	3682.003
N	10923						
F-Statistic	196.57						
r^2	0.0512						

Source: PSID Online

Each of the coefficients, except for *Govt.*, is statistically significantly different from zero at the .001 level, indicating that the null hypothesis can be rejected that the difference in mean expenditures is zero between *Other* and *Union*, or *Business*. In the case of *Govt*., the probability of a difference in mean expenditures between *Govt.* and *Other* at least as far away from zero as the OLS estimate is 28.8%. The difference in mean health insurance expenditures between those that record self-employment and employment by the government is not statistically significant.

In order to test the differences between the additional categories, several paired T tests of the model below were performed:

$$H_0: \alpha_1-\alpha_2=0$$
$$H_1: \alpha_1-\alpha_2\neq 0$$

Table 16-T Statistics

		α_2		
	Variable	Union	Government	Business
α_1	**Union**	-	-4.45	-21.18
	Govt.	-	-	17.13
	Business	-	-	-

Each T statistic is significant at the .001 level, indicating that the difference in means between these categories is not merely due to chance.

The results from OLS confirm the initial hypothesis – that married couples under the age of 65, where the head of the family is employed by a labor union, spent less on health insurance in 2007. Approximately, the average is calculated at $2362.57. Following this, the results point to either married couples employed by the government or self-employed (as the difference was computed to be not statistically significant) and then those employed by an unincorporated business or corporation at $6424.79.

Married Couple Effects

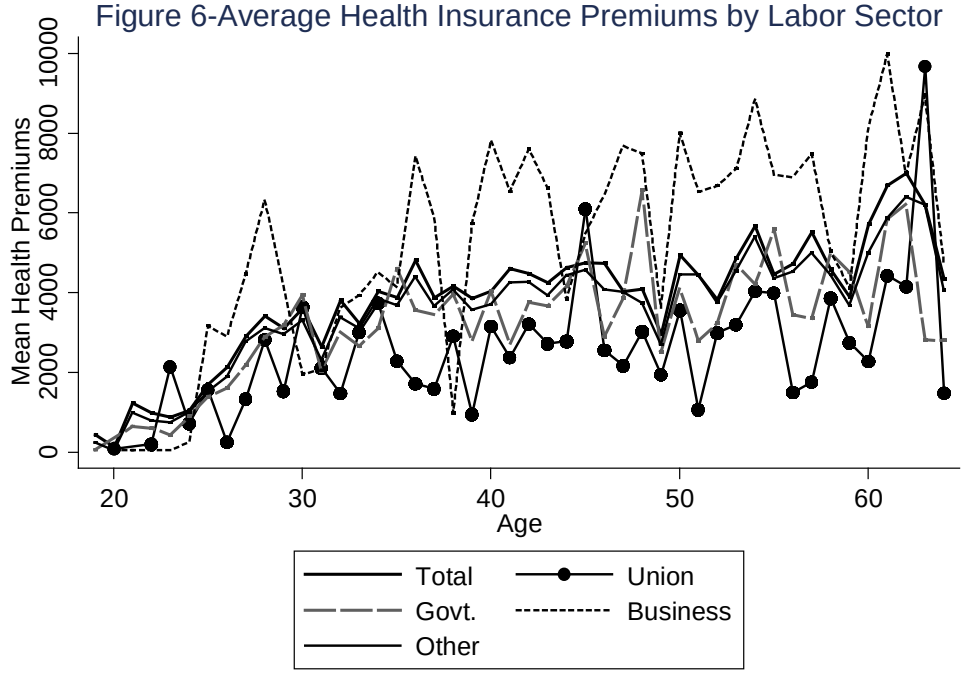
However, this model fails to take into account the effect of either member of the married couple being employed for a labor union, government, etc. The model above only looks at results for when the head of the family's labor status is considered, and to be completely thorough the results for either adult member of the family must be analyzed. In Table 17 and Figure 6 on the next pages, the results of the same average health insurance cost analysis performed earlier is shown, but using binary labor sector variables that take into account both members of the married couple.

Table 17-Married Familial Health Insurance Expenditures in 2007 (by Labor Sector)

Age	Union	Govt.	Business	Other
19	-	0.00	-	200.00
20	0.00	-	0.00	0.00
21	-	584.00	0.00	952.53
22	117.82	536.57	0.00	742.97
23	2064.00	369.23	0.00	695.68
24	644.44	835.71	202.86	963.94
25	1481.47	1323.03	3114.00	1484.06
26	171.43	1540.00	2844.35	1856.02
27	1257.00	2120.88	4424.40	2731.72
28	2730.00	2830.49	6280.00	3078.92
29	1449.68	3111.19	4124.44	2924.07
30	3564.42	3882.00	1912.83	3273.56
31	2035.00	1968.89	2008.08	2283.95
32	1390.48	2952.00	3564.56	3345.97
33	2934.71	2600.28	3878.97	3075.84
34	3645.48	3046.48	4455.93	3826.18
35	2193.64	4537.73	4089.17	3654.56
36	1627.73	3498.99	7374.54	4368.92
37	1514.51	3396.39	5817.33	3643.03
38	2834.63	3895.42	928.51	4047.60
39	872.94	2721.29	5688.87	3540.72
40	3070.33	3980.00	7776.57	3677.47
41	2299.95	2646.08	6484.96	4239.25
42	3130.43	3704.88	7550.50	4241.81
43	2646.43	3607.77	6570.06	3905.48
44	2707.33	4102.26	3787.11	4416.85
45	6020.06	5186.97	5438.03	4562.00
46	2474.31	2847.38	6399.27	4067.49
47	2088.46	3804.39	7631.83	4011.87
48	2945.26	6514.60	7443.81	3723.78
49	1866.64	2460.79	3564.00	2694.34
50	3480.28	4048.19	7949.57	4448.77
51	986.42	2738.82	6473.80	4453.67
52	2914.08	3180.39	6629.96	3748.12
53	3124.37	4653.55	7062.72	4533.79
54	3964.42	4159.78	8809.73	5388.57
55	3908.22	5542.15	6898.97	4358.52
56	1418.31	3387.94	6848.28	4523.97
57	1677.35	3304.14	7433.84	5002.74
58	3787.15	4948.06	4995.71	4449.14
59	2674.32	4460.90	4069.16	3688.55
60	2205.00	3103.91	8082.22	4989.93
61	4357.50	5789.32	9933.33	5869.79
62	4080.00	6170.00	6915.76	6404.66
63	9600.00	2768.80	8906.25	6199.37
64	1410.46	2744.38	4708.48	4073.21

Source: PSID Online

Figure 6-Average Health Insurance Premiums by Labor Sector



In comparison to Figure 5, the results demonstrate a stronger positive relationship between age and average health premiums, factored for labor sector. This is consistent with a rather stable percent of medical costs paid, but more total dollars spent as the family ages. Each sector is experiencing increasing costs with age; however, both the *Business* and *Union* sectors show a lot of variability. In Table 18, we see the results of the same OLS regression.

Table 18-OLS Results of Average Married Familial Health Insurance Costs in 2007 (by Labor Sector)

Variable	Coefficient	**Mean Spent**	Std. Err.	t	P>t	99% Confidence Interval	
Union	-1091.91	**2273.855**	128.6561	-8.49	0	-1515.37	-668.4479
Govt.	306.4716	**3672.2356**	109.2209	2.81	0.005	-53.0202	665.9634
Business	2388.032	**5753.796**	119.2986	20.02	0	1995.371	2780.694
Other(const)	3365.764	**3365.764**	63.42995	53.06	0	3156.989	3574.538
N	10923						
F-Statistic	171.66						
r^2	0.045						

Source: PSID Online

Initially, it is apparent that when taking into account each member of the married couple, the average amount spent on health insurance decreases for each section of the labor force. These results are both logical and obvious – before, the values of some couples were being left out of the analysis because only "head" of family was being analyzed. When the secondary partner is included, more couples become members of the each labor sector, decreasing the calculated averages. Furthermore, the difference between *Govt.* and *Other* becomes significant at the .001 level, whereas in the first regression it was not significant at all.

Prescription Drugs

Continuing to use the married couple model generated above, I next look at the effects that labor force has on out-of-pocket prescription drug expenditures. In Figures 7 and 8, on the next page, the graphs of labor force average drug expenditures with insurance, or without insurance, respectively, are shown. Except in the case of business, the results show that each labor force sector spends more, out-of-pocket, on prescription drugs with insurance. One possible explanation is the absence of data for families without insurance. In Table 19, the results of Figure 7 are displayed using age as an additional factor.

Figure 7-Average Drug Costs (With Insurance)

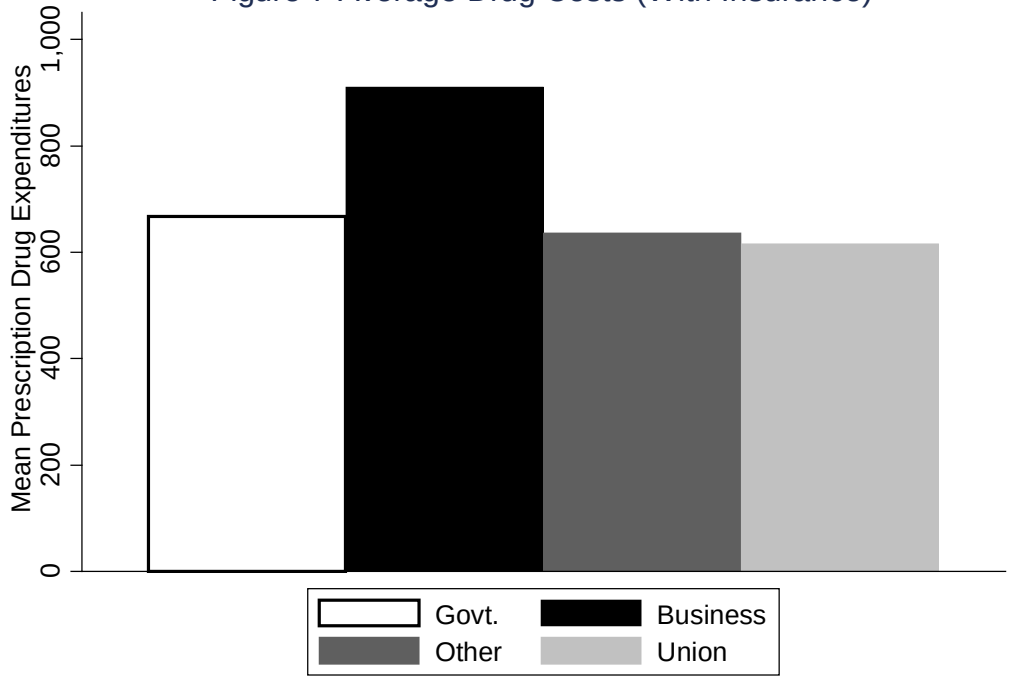


Figure 8-Average Drug Costs (no Insurance)

Table 19-Mean Prescription Drug Expenditures(with Insurance)

Age of Head	Total Spent	Union	Business	Govt.	Other
19	25.00	-	-		
20	0.00	0.00	0.00	40.00	29.09
21	71.76	-	-	16.67	0.00
22	185.84	0.00	114.29	65.38	71.76
23	99.85	30.00	66.67	115.38	182.84
24	217.96	245.67	266.43	326.67	99.85
25	274.38	448.89	150.00	291.11	205.50
26	267.32	167.27	555.56	140.26	268.85
27	333.65	739.00	120.07	340.98	266.03
28	519.14	336.67	687.50	147.64	329.14
29	423.65	330.22	287.50	353.69	350.02
30	636.99	532.65	687.62	346.48	424.18
31	430.88	347.83	314.00	753.89	628.78
32	594.87	166.67	634.09	642.78	436.08
33	467.95	567.89	290.22	447.43	588.31
34	677.52	1251.70	625.67	829.81	467.95
35	449.45	433.65	345.12	711.67	667.09
36	733.70	1154.71	710.00	403.79	453.68
37	409.13	248.18	400.30	412.16	681.98
38	781.61	199.25	383.33	309.71	409.13
39	499.83	429.17	365.49	389.91	777.01
40	668.08	267.06	803.57	445.51	507.84
41	803.32	588.47	1051.08	417.67	690.65
42	662.90	1301.43	1151.22	392.76	803.32
43	938.91	639.23	1680.56	483.97	663.91
44	904.91	643.43	1083.91	1020.92	965.80
45	702.59	676.99	594.74	592.95	936.15
46	706.13	390.85	1021.60	552.45	717.28
47	745.59	365.51	938.70	663.67	675.51
48	789.78	665.91	1073.91	852.94	716.34
49	876.87	737.54	545.82	963.93	624.12
50	892.61	748.17	1655.73	753.70	821.75
51	1102.62	717.65	1675.80	1035.56	890.92
52	818.44	705.31	676.85	1002.00	1100.46
53	1172.06	707.03	1115.22	815.27	783.38
54	866.19	1169.38	633.44	1003.72	1150.40
55	1173.01	795.80	1623.17	1245.56	864.27
56	1525.80	1616.48	1487.02	1615.50	1159.96
57	1597.37	920.00	1478.83	1710.97	1437.13
58	1450.72	782.40	1713.80	1433.08	1888.43
59	1397.12	1451.25	1102.70	1331.41	1464.38
60	1292.55	1794.74	1471.23	794.64	1407.02
61	1542.38	473.00	2028.57	1349.74	1259.54
62	1160.67	609.00	1083.30	1345.74	1586.12
63	1141.40	2320.00	1745.38	1071.50	1109.71
64	1616.49	872.00	1870.37	1106.96	1011.43

Source: PSID Online

The line graphs (factored by labor sector) that include age only show an upward trend of drug expenditures for insurance. Figure 9, with insurance, and Figure 10, without insurance, demonstrate this:

Figure 9-Drug Costs (with Insurance) by Labor Sector

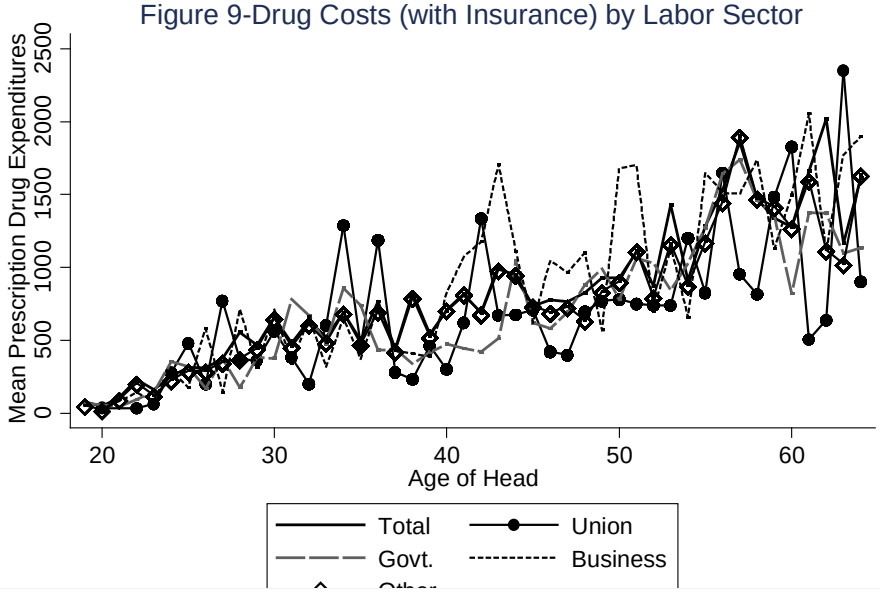
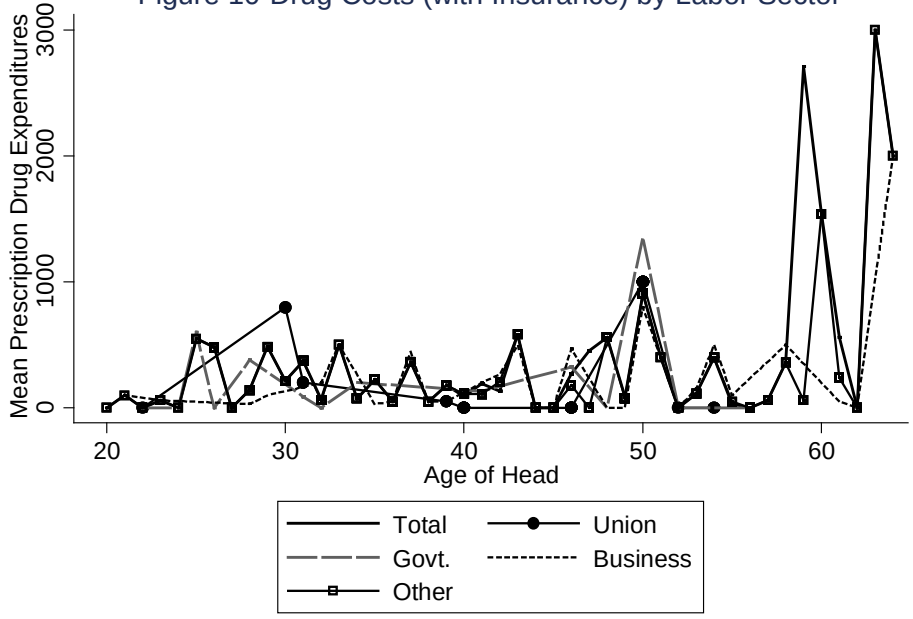


Figure 10-Drug Costs (with Insurance) by Labor Sector



In order to predict and analyze the difference in out-of-pocket prescription drug expenditures for each sector of the labor force, we utilize a model of the form:

$$Exp07=\alpha_0+ \alpha_1(\textbf{Union})+ \alpha_2(\textbf{Govt.})+ \alpha_3(\textbf{Business})+ HE07 + union\_HE07+ govt\_HE07+business\_HE07+u$$

Exp07 is the dependent variable of interest – out-of-pocket prescription drug expenditures in 2007. *Union, Govt.,* and *Business* are the new binary variables from earlier that take into account both members of a couple. *HE07* is the cost of health insurance. Because it has already been established that each sector of the labor force experiences different statistically significant average health insurance costs, the new variables account for this. *union_HE07*, *govt_HE07,* and *business_HE07* record the different returns to prescription drug expenditures from health insurance costs for each labor sector. In Table 21, with *Other* as the base category, the results from OLS are listed:

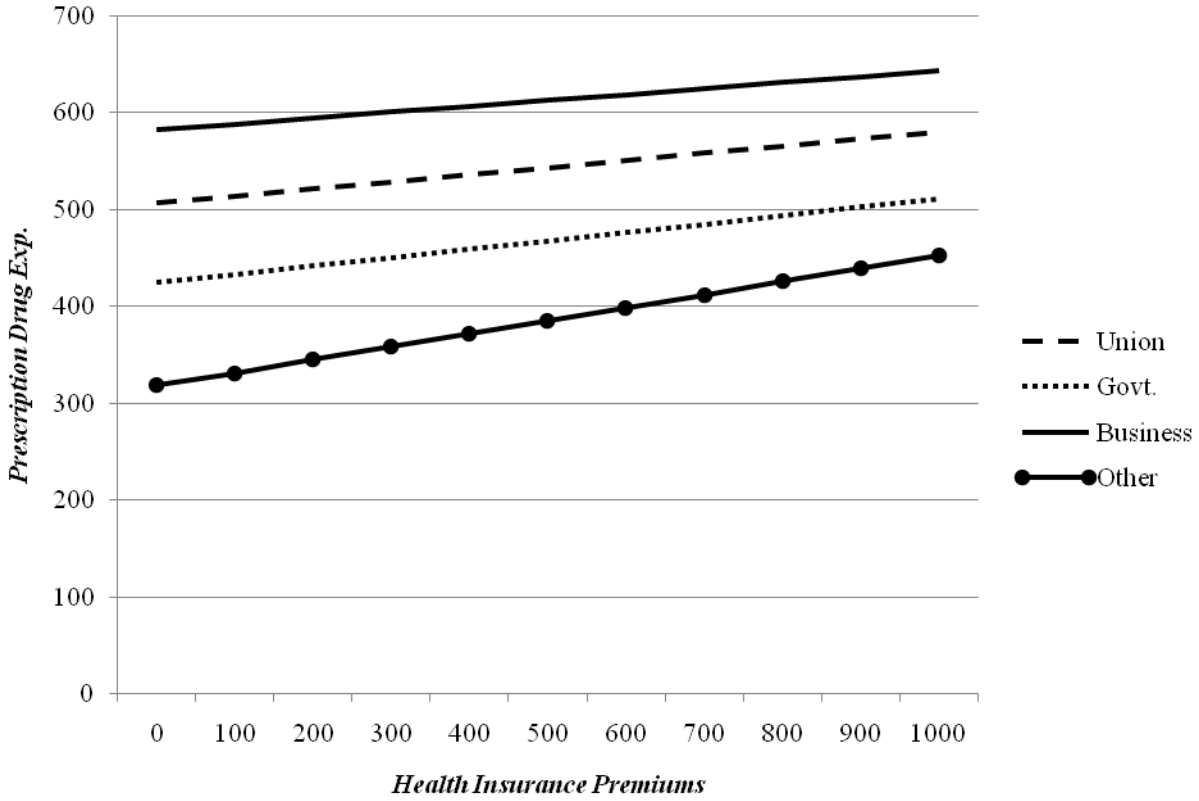
Table 21-OLS Results of Average Drug Costs by Labor Sector

Variable	Coefficient	**Mean Spent**	Std. Err.	t	P>t	99% Confidence Interval	
Union	188.269	**506.445+.074(x)**	48.127	3.91	0	29.86037	346.6771
Govt.	106.071	**424.247+.087(x)**	42.860	2.47*	0.013	-35.0005	247.1419
Business	264.025	**582.201+.061(x)**	46.009	5.74	0	112.5891	415.4613
HE07	0.135	-	0.004	31.44	0	0.120915	0.1491977
union_HE07	-0.061	-	0.010	-6.00	0	-0.09447	-0.0275484
govt_HE07	-0.048	-	0.008	-6.28	0	-0.0727	-0.0226877
business_HE07	-0.074	-	0.006	-12.54	0	-0.09374	-0.0547673
Other(const)	318.176	**318.176+.135(x)**	24.164	13.17	0	238.6408	397.7119
N	10505						
F-Statistic	169.53						
r^2	0.101						

Source: PSID Online
** significant at the .01 level*

Each of the intercepts is significantly different from zero at the .001 level, except for *Govt.* However, *Govt.* is still significantly different at the .01 level, which is strong enough for the analysis. These results indicate that the difference in intercepts between *Other* and each of the additional categories is not due to chance. Furthermore, each of the slope coefficients is also significantly different than zero, which can be interpreted in a similar fashion. Utilizing the OLS results, the effects are pictured below in Figure 11. As a function of health insurance premiums, prescription drug costs are increasing for each sector of the labor force. Moreover, while the intercept on *Business* is the highest, it also increases at the slowest rate. On the other hand, *Other* has the smallest slope, but the largest rate of increase.

Figure 11-OLS Labor Sector Drug Costs



In order to verify the results, several paired T tests of the model below were performed:

$$H_0: \alpha_1-\alpha_2=0$$
$$H_1: \alpha_1-\alpha_2\neq 0$$

Table 16-T Statistics for Intercepts

		α_2		
	Variable	Union	Government	Business
α_1	**Union**	-	1.13	-1.20
	Govt.	-	-	-2.66*
	Business	-	-	-

**significant at the .001 level*

These test the null hypothesis that the difference between the intercepts of each category is 0. The results indicate that the null hypothesis can be rejected at the .001 level of significance, for business and government, but cannot be rejected for the other pairings. Furthermore, I tested the same null hypothesis for the slop coefficients:

$$H_0: \beta_1 - \beta_2 = 0$$
$$H_1: \beta_1 - \beta_2 \neq 0$$

Table 16-T Statistics for Slope Coefficients

		β_2		
	Variable	union_HE	govt_HE	business_HE
β_1	**union_HE**	-	-.900	1.04
	govt_HE	-	-	2.59*
	business_HE	-	-	-

**significant at the .001 level*

As before, the results indicate that the null hypothesis of a difference between slope coefficients of zero can be rejected at the .001 level of significance, and the same outcome is found.

5 Conclusion

This paper analyzed and probed the theory and data behind prescription drug expenditures for different sectors of U.S. population – whether employed or on Medicare. The results were varied and significant, and further analysis would need to be accomplished in order to understand the implications.

For example, I mentioned earlier that in 2011 Medicare gap discounts will be provided to enrollees who choose generics over name brands. This is only an effective provision if drugs

have cheaper, generic counterparts. When a chemical formula is approved by the FDA, biologic manufacturers have had seventeen years of exclusivity with which to develop and test a drug utilizing this formula. Recently, with the *Patient Protection and Affordable Care Act* signed into law, the federal government has reduced this number to twelve years. On one side of the argument, many drug companies exploit the patent process, and utilize the time as a monopolistic producer to overcharge patients in desperate need of medication. The reduction in patent time will not only force drug companies to reassess their processes, but also will provide an opportunity for patients to obtain new, generic, cheaper drugs at a quicker rate. The gap discount provision might then not only be an effective method to recruit enrollees, but also lower overall out of pocket expenditures in the 'Donut Hole,' supporting the current structure of Medicare Part D.

On the other side of the discussion, it can be argued that the reduction will hurt drug companies; many use the majority of their seventeen years in clinical drug trials, and by the time the drug is officially approved by the FDA, there is hardly any time left on the patent to recoup the high cost of development. The United States is still the world leader in drug testing, and it is partially because of the money provided by the patent protection to invest in research and development. A reduction from seventeen years to twelve years is likely to diminish this available funding.

The data also demonstrated that Medicare Part D is far from perfect; applying the percentages found in Table 10 show that of the 3.4 million beneficiaries who reached the coverage gap in 2007, approximately 2.88 million remained in the coverage gap and received no additional funding for their prescriptions (by Kaiser percentages). Only 510,000 reached catastrophic coverage levels. Translated into palpable numbers, this elaborates and strengthens

the point that the current Medicare Part D structure is not above continued observation and maintenance.

Without a doubt, the Medicare drug benefit offers recipients help with out-of-pocket drug spending, which is especially important to those with low incomes, those who lacked drug coverage prior to 2006, and people with catastrophic drug expenses. Part D does bring down average out of pocket costs, as compared to coverage structures before 2006, but only for those who remain either below or above the 'Donut Hole.' As Part D continues to mature, several areas will be important to monitor, including: enrollment, plan stability, benefit design, cost sharing, and access to medications. Careful monitoring and oversight by the federal government is important to ensure that Medicare drug plans provide beneficiaries with needed protection against high and rising drug costs.

In contrast, the results differed for the sector of the population still in the labor force. Generally, for married couples under sixty-five, health insurance expenditures increase with age, on average, regardless of the sector in which the family is employed. Those with insurance also had increasing prescription drug costs, but the drug costs of those without insurance were ambiguous. Furthermore, it was shown that on average, those employed in 'business' spent the most on prescription drugs and health insurance, while those employed with employer provided coverage (i.e. 'union' or 'government') generally had lower expenditures in these areas. It remains to be seen, what happens as the different labor sectors age into Medicare. The PSID should consider an additional question to determine whether or not those over the age of sixty-five receive employer provided healthcare or rely upon Medicare for their primary coverage, as this will likely affect the results of the prescription drug analysis.

Regardless, the effects of employment on health related expenditures is not to be ignored. As one of the first regressions demonstrated, those within the labor force spend less on average on prescription drugs than those outside of it. Whether this is a function of Medicare structure or an indicator of overall health is not the subject of this analysis. Instead, the theme is as presented: when it comes to prescription drugs, Americans demonstrate varied spending patterns, affected primarily by age.

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