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The Private Health Insurance Underwriting Cycle, Economic Profits and Their Determinants

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Abstract

The underwriting cycle in private health insurance refers to fluctuations in profit margin over time. This research, a novel effort, aims to understand the peak-to-trough magnitudes and determinants of the industry-wide underwriting cycle. Historical industry-wide profits and losses have not been previously estimated, making this study a significant contribution to the field. Based on the reports of the Centers for Medicare and Medicaid Services (national health expenditures reports), this study begins by constructing the underwriting cycle of private health insurance performance over the last six decades, from which profit margins can be estimated. Expressing the net cost of private health insurance and personal health expenditures as a fraction of the premium facilitates the analysis, which employs standard methods. The results show, over a 62-year period from 1960 through 2022, that there are 12 underwriting cycles. The capacity to generate profits is influenced by the cost of personal healthcare expenditures, competition for enrollment, and the availability of substitutes. Evidence of reduced capacity for profitability is a finding that additional enrollment does not contribute to profits and that private health insurance enrollment is generally declining. Cumulative profits due to the sales of private health insurance only over the 62 years assessed are negative.

Keywords

Underwriting Cycle, Profit, Loss, Private Health Insurance, Medicaid, Medicare, Price Elasticity of Demand

1. Introduction

Private health insurance (PHI) profits are controversial on both practical and political grounds. The practical grounds include the millions of uninsured and the finding that health insurance is unaffordable for those with income less than 400 percent of poverty and those that hover near that boundary. The political basis surrounds resolving an acceptable policy approach for solving the unaffordability and consequent inequity of coverage that continues to be a feature of the healthcare system. In public financial reporting, frequently underwriting gains and losses (profit or loss due to the sales of private health insurance) are entangled in the revenue and expense categories of private health insurers that also sell life insurance, pharmacy benefit management, other services, and sometimes assets. In 2009, leading up to the passage of the Affordable Care Act, record insurer profits were widely reported [1-3]. WellPoint, Inc. reported a net income of $ 4.75 billion for 2009. However, when the sales of the WellPoint, Inc. Pharmacy Benefits Management business ($ 3.792billion) and investment income ($ 857.4 million) are excluded, the net income drops to $ 96.2 million, and when "other" revenue is

considered, they incurred an underwriting loss [4]. Humana reported [5] a net income of $ 614 million in 2016; without income from investments and services of $ 1.36 billion, Humana would have experienced a loss. The Congressional Research Service noted in 2010 [6] that health insurance profits may reflect the type of health insurance provided. Milliman [7] reports similar conclusions for a later period, where the individual market shows a negative underwriting margin for each year (-0.3% to -9.6%) while the small group market (1.1% to 3.2%) and the large group market (1.5% to 2.3%) show positive underwriting margins each year. Short-run errors for actuarial projections are reported in the 0.6% to 1.6% [8, 9] range. A competitive market for enrollees and the motivation to achieve a profit pushes the health plans in two directions, likely resulting in market "churn" [10-12]. Churning, loosely defined as changes in insurance coverage over time, is thought to be the primary determinant of the underwriting cycle as those with PHI search for alternatives due to rising personal healthcare expenditures. The left panel of Figure 1 shows the rapid increase in nominal personal health care costs for the privately insured, rising from $4.87 billion in 1960 to $1.16 trillion in 2022, an increase of 2,245%

after adjusting for inflation [13]. The nominal net cost of health insurance rose from $761 million in 1960 to $131.31 billion in 2022, a real increase of 1,603%. The left panel shows fluctuations that are not organized as regular or cyclical. The right panel of Figure 1, expressed as a fraction of the health insurance premium, shows that the net cost of private health insurance (solid line) provides a glimpse of the cyclical nature of the underwriting or profit cycle [14]. Note that in 1984 (first vertical dashed reference line), the net cost of private health insurance (also known as administrative costs) reached a peak of 14.1% of premium, and three years later, in 1987 (the second vertical dashed reference line) costs reached a trough, at 8.4% of premium. The converse description is that in 1987, personal healthcare spending unexpectedly rose to a peak at 91.6% of premium, requiring spending money budgeted for administrative costs on healthcare, causing a financial loss to insurers. The dashed horizontal line in the right panel represents average total costs (ATC). These cyclical fluctuations in administrative costs represent profits when they are above the ATC and losses when below the ATC. There has been reduced industry emphasis on the underwriting cycle in recent years [15].

Comparison of the net cost of private health insurance and personal health care expenditures for the privately insured
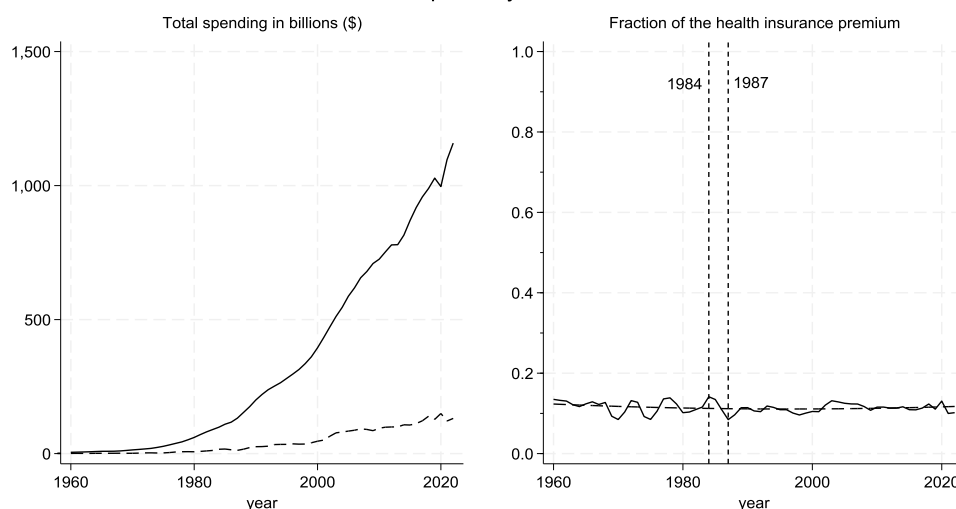

Figure 1. Left panel: The history of the net cost of health insurance (dashed) and personal health care expenditures (solid) in billions($) for those privately insured for 62 years, from 1960 through 2022. Right panel: A display of the same information expressed as a fraction of the health insurance premium over the same time with the average total cost added as the horizontal dashed line.

2. Materials and Methods

The annual Centers for Medicare and Medicaid Services (CMS) report of national health expenditures (NHE) includes private health insurance (PHI) premiums and benefit costs in the "Health Consumption Expenditures" and "Personal Health Care" accounts, respectively. The goal of the Department of Health and Human Services with the national health expendi-

tures reports is to measure "the total annual dollar amount of health care consumption in the U.S., as well as the dollar amount invested in medical sector structures, equipment, and non-commercial research to procure health services in the future." Health insurer administrative expenses are separately reported for PHI as "The Net Cost of Health Insurance Expenditures" and are the difference between premium and total PHI personal health expenditures (PHE). The net cost of health insurance includes employee compensation, capital expendi-

tures, taxes and fees, rent, advertising, commissions, changes to reserves, and underwriting gains or losses [16], also known as operating expenses or administrative costs.

Two different samples of the 1960 – 2022 NHE accounts [17] are used: 1) for the years 1960 through 2022 to identify the underwriting cycle and gains and losses and 2) 1987 through 2022 for enrollment and per enrollee expenditures by type of coverage. Two additional data sets, a BlueCross BlueShield [18] (1965-2002) and an HMO [19] (1990-2005) underwriting gain and loss series, are compared to the estimated gains and losses from the CMS-based series. Employment for the private health insurance industry (Bureau of Labor Statistics series BLS CEU5552411001) from 1990-2022 is used to test the ATC.

The three underwriting cycles, 1) NHE (developed in this paper), 2) BCBS, and 3) HMO, were compared across the years when both measures were available using Hausman for the linear model coefficients for the year and constant; fit using no constant linear regression estimates of adjusted R^2 and root-mean-squared error, and the difference between the NHE and the two reference series using the paired t-test.

The extent and nature of private health insurance market "churn" and profit are evaluated by estimating price and cross-price elasticity of demand using linear models and marginal effects post-estimation, where demand was expressed fractionally as enrollment/population and price/expenditures was decomposed into two components: 1) personal health care expense for private health insurance and 2) the net cost of private health insurance per enrollee, expressed as the fraction of annual median real (chained 2017 dollars) disposable personal income per capita for that year [20].

3. Results

The Spearman's rank correlation test of independence for the recession indicator and the net cost of private health insurance shows that while the coefficient (-0.1879) is low, the P-value of <0.0000 indicates we can reject the null hypothesis of independence. Recessions are related to administrative costs.
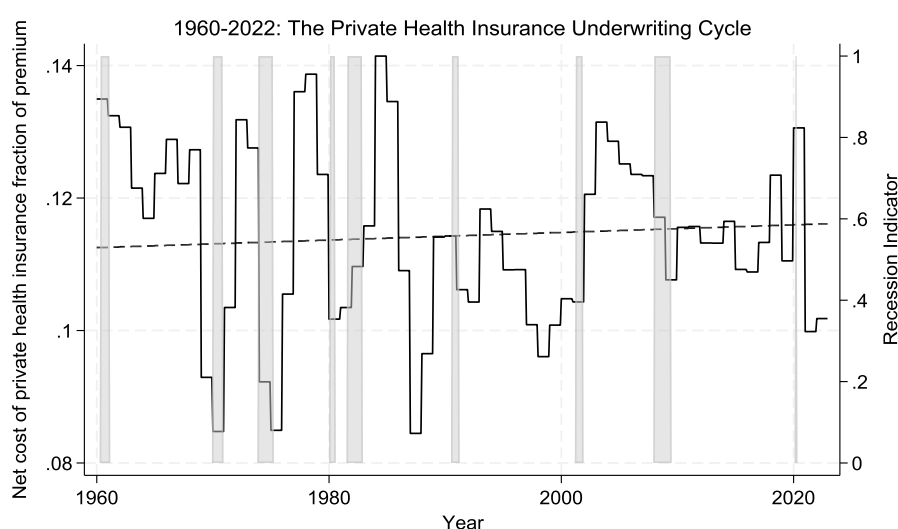

Figure 2. The underwriting cycle is defined by the net cost of private health insurance expressed as a fraction of premium revenue (solid black line) and is shown against the average total cost (dashed black line). This graph is a magnified version of the right panel of Figure 1, with National Bureau of Economic Research recessions shaded in gray and the date formatted in month and year rather than just year to match the recession indicator format.

Table 1. Underwriting (profit/loss) cycles during 1960-2022.

Year of peak	Year of trough	Number of Years peak to trough	Change in profit margin peak to trough
1960	1964	4	-1.54%
1966	1970	4	-4.20%
1972	1975	3	-4.56%
1978	1980	2	-3.63%

Year of peak	Year of trough	Number of Years peak to trough	Change in profit margin peak to trough
1984	1987	3	-5.64%
1990	1992	2	-0.98%
1993	1998	5	-2.22%
2003	2009	6	-2.49%
2010	2013	3	-0.32%
2014	2016	2	-0.84%
2018	2019	1	-1.34%
2020	2021	1	-3.12%

3.1. Average Total Cost

The net cost of PHI per enrollee is only available for 1987 through 2022; enrollment is not available for earlier years; however, the net cost of PHI is available for all years. To extend across the entire 1960-2022 series, a linear, no-constant function $bx = 0.0000574x$ is used. The linear form is chosen because of the low root mean squared error = 0.0139 and adjusted R-squared = 0.986. Models with constants were not significant, nor were quadratic or higher-order terms. The classic formula for ATC = Total Cost/Quantity expressed as a fraction of the premium by year is available for 35 of 62 years of data = 0.11434 (0.110 − 0.117) compared to 0.11431 (0.113 − 0.116) for the linear model, nearly identical to the history. Figure 2 illustrates the volatility of the net cost of private health insurance reported by CMS and expressed as a fraction of the premium. Linear regression of industry employment in 1,000s, available for 1990 -2023, versus the estimate of ATC and PHI profits, both as a fraction of the premium, shows that the ATC coefficient = 7073, t = 98.74, P <0.0005; PHI profit coefficient = -716, t = -0.81, P = 0.426; model adjusted R^2 = 0.997 and RMSE = 46.2. The ATC model illustrates the high association between industry employment and the estimated ATC, while the low significance of the PHI profit models shows that there is no relationship between PHI profits and ATC. Profit becomes = (Price (premium))-ATC) * Quantity (enrollment), a form that fits market supply in the long run with firm entry and exit [21].

3.2. The Underwriting Cycle

Table 2 shows the results for the Hausman test, no constant linear regression, and paired t-test of the underwriting cycle estimated here and previously published observations of the underwriting cycles for a group of Blue Cross Blue Shield plans and a second from a group of HMOs. There is no difference between the linear regression model coefficients, as

shown by the Hausman results. The no-constant linear regression results show the fit statistics where the adjusted R^2 and root mean squared errors differ. The NHE series includes all industry-wide private health insurance results, whereas the BCBS series includes both not-for-profit and for-profit health plans, and the HMO series is for-profit only. There is no difference between the BCBS underwriting cycle and the estimated underwriting cycle based on NHE personal health care expenditures and the net cost of private health insurance. The mean underwriting margins are: 1) NHE = -0.000026, 2) BCBS = -0.0018, and 3) HMO = 0.008, showing a greater loss for the BCBS plans than the NHE-based estimate and a greater profit for the HMO plans.

Comparison of the underwriting cycles NHE, BCBS and HMO

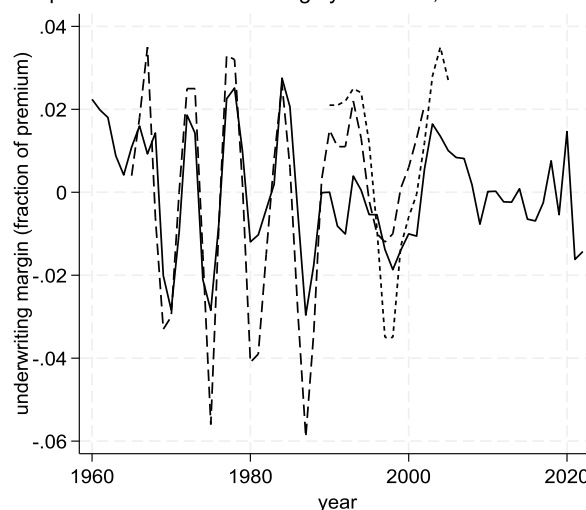*Figure 3. The underwriting cycle based on NHE reported data (solid line), estimated in this paper, the BlueCross BlueShield (medium dashed), and HMO (small dash) series, both reported by the American Hospital Association. The underwriting cycle is the underwriting profit margin time series: 1) the estimated series is reported for 1960-2022; 2) the BCBS series is reported for 1965-2002; 3) the HMO series is reported for 1990-2005.*

3.3. Underwriting Cycle Determinants

Demand is private health insurance enrollment/population for the left panel and Medicaid enrollment/population for the right panel (dashed black lines). The regression results and elasticities confirm these graphical results.

The price and cross-price elasticity of demand were tested

using linear models and the marginal effects post-estimation, where demand was expressed as enrollment/population and price was decomposed into two components: 1) personal health care expense and 2) the net cost of private health insurance per enrollee, expressed as the fraction of annual median real (chained 2017 dollars) disposable personal income per capita for that year.

Table 2. Comparison of underwriting cycles.

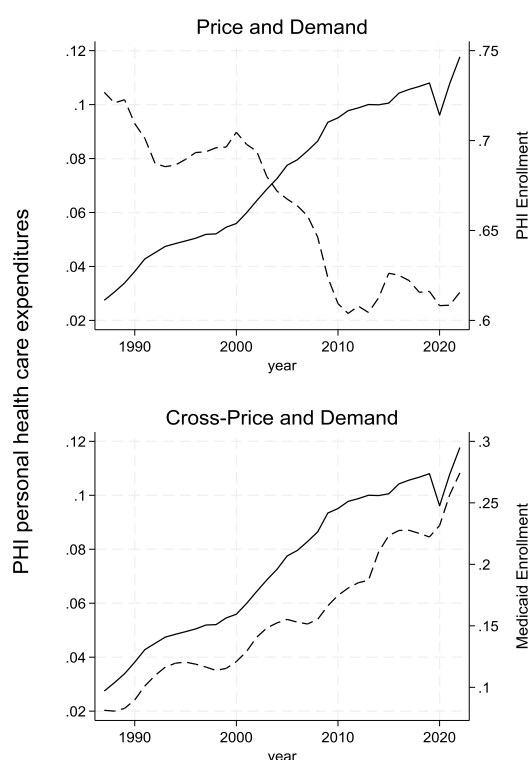| Method							
	Hausman		linear regression		Paired t-test		
Comparison	χ^2	P-value	Adjusted R^2	RMSE	t	P (|T|>|t|)	Mean difference
NHE v BCBS (n = 38)	0.58	0.448	0.59	0.0098	-0.199	0.847	-0.0005
NHE v HMO (n = 16)	0.00	0.952	0.33	0.0086	-2.86	0.012	-0.008

Figure 4. 1987-2022: Graphic analysis of the price (upper panel) and cross-price (lower panel) relation with demand. The price and cross-price are personal health expenditures per enrollee/real personal income per capita for that year on the left vertical axis for both upper and lower panels (solid black lines). Demand is private health insurance enrollment/population for the upper panel and Medicaid enrollment/population for the lower panel (dashed black lines). The regression results and elasticities confirm these graphical observations.

Table 3 shows the linear model coefficients upon which the price elasticity calculations are based. Elasticities can only be calculated in continuous covariates for which the log value can be obtained, while the linear coefficients are the derivative. The price elasticity of demand for private health insurance enrollment is -0.192 (t = -3.85, P = 0.001), confirming that enrollment decreases by 0.192% as personal health expenditures increase by 1.0%. The cross-price elasticity of demand for Medicare is -0.182% (t = -1.96, P = 0.059) as the price of PHI increases by 1.0%, a marginal complement effect. In contrast, the cross-price elasticity of demand for Medicaid is 0.546 (t = 4.14, P = 0.000), a substitution effect. As PHI health expenditures rise, three identified changes in coverage may occur: 1) a reduction in private health insurance coverage, 2) a complementary reduction in Medicare coverage, and 3) an increase in the substitution of Medicaid coverage for PHI. An additional feature of the left panel of Figure 4 is the remarkable decline in PHI enrollment, measured as a fraction of the population, from 72.6% in 1987 to 61.6% in 2022—a decrease in PHI coverage of 0.3% of the population per year.

Elasticities for the regression results in Table 4 cannot be calculated due to negative results from the model's prediction function and the inability to take the log of a negative. Private health insurance profits are 1) negatively associated with Medicare enrollment, 2) marginally and positively associated with Medicaid enrollment, 3) not associated with PHI enrollment, 4) significantly and negatively associated with increases in personal health care expenditures, and 5) positively associated with increases in the net cost of private health insurance.

4. Discussion

Private health insurance includes administration by third-party administrators, who may only provide claim payment and bear no risk for cost management of personal health expenses, to those who also manage provider networks, have medical management systems, and bear some cost risk. Health insurance may be self-funded by an employer or fully insured by a private health insurance company that accepts a premium that includes a predetermined payment for the net cost of providing insurance and personal health care expenditures. Health insurance coverage may be purchased through an employer or insurance company. Coverage may also be purchased through the Affordable Care Act marketplace. Types of coverage may include Medicare supplement or Medigap insurance to reduce the personal health care expenditure coverage risk to Medicare enrollees, for example. The PHI market system includes Agents/Brokers and consultants. Large and small employers have differing regulations regarding how health benefits can be offered. The benefits designs have a wide range of the portion of the premium paid by the employer and the size of point-of-service payments. These options incentivize employers, employees, and individuals to consider costs.

Underwriting cycles, profits, and losses will likely vary with benefits designs, product types, and insurance providers. This paper only seeks to identify the aggregate or industry-wide underwriting cycle, profits, and losses due to health insurance sales. It cannot identify which insurers are profitable and which are not, including which forms of insurance provision are profitable and which are not. However, at the end of the firm entry and exit process, the remaining firms are thought to make zero economic profits, where ATC = Price (here, the net cost of private health insurance, exclusive of personal health care).

Table 3. Coefficients from the linear models of the price/enrollment relationship.

Independent variables	Dependent variables (enrollments)		
Coefficient label	PHI	Medicare	Medicaid
PHI enrollment		-0.130†	0.232†
Medicare enrollment*	-0.958†		1.54††††
Medicaid enrollment*	0.558†	0.503†††	
PHCE.**	-1.725†††	-0.371	1.16†††
Cost of PHI**	-1.460	-1.04	0.66
Intercept	0.858†††	0.194†††	19.70

* All enrollment is expressed as a fraction of the median U.S. population for that year. **All expenditure or cost figures are a fraction of that year's median real personal income per capita. † P<0.05; ††P<0.01; †††P<0.001. PHCE = personal healthcare expenditures.

Table 4. Private health insurance profit (dependent variable) linear model.

Independent variables	Coef.	t	p-value
Medicare enrollment*	-0.304	-2.03	0.051
Medicaid enrollment*	0.149	1.74	0.092
PHI enrollment*	0.010	0.19	0.850
Personal healthcare exp.†	-1.280	-7.66	0.000
Cost of PHI†	9.908	13.81	0.000
Intercept	0.013	0.27	-0.792

* All enrollment is expressed as a fraction of the median U.S. population for that year. †All expenditure cost and profit figures are expressed as a fraction of that year's median real personal income per capita.
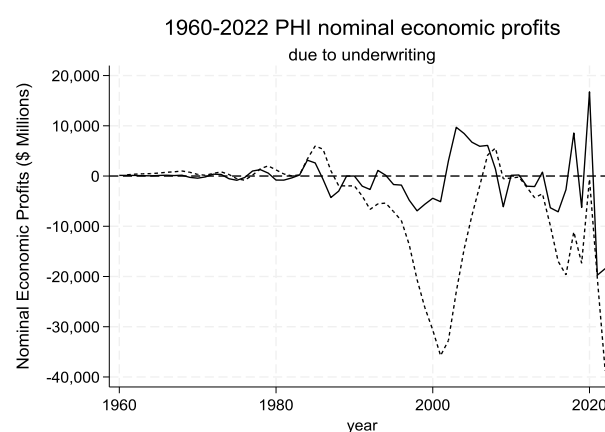

Figure 5. The history of industry-wide PHI economic profits reflects that profitability is unlikely. Neither profits by year (solid) nor cumulative profits (short dash) due to underwriting alone are persistent.

5. Conclusions

National Health Expenditures data provided by the Centers for Medicare and Medicaid Services are an excellent source of information for aggregate healthcare spending by use and source of funds. The ability to analyze financial performance by payer type while comparing well to similar data produced in an entirely different manner may help plan the innovation or successor approaches for PHI. The additional contribution of this study that highlights the determinants of market churn and profits provides insight that may be essential.

Milliman [22] has identified different underwriting cycles for Blue Cross Blue Shield plans and Commercial insurance and suggests that the underwriting cycle can vary across health insurers based on plan type, carrier size, and whether the insurer is an HMO. The reference series in this analysis represents two lines of business at their outset: traditional coverage and HMO. The BCBS series began in 1965 when hospitalization-only and physician-service coverage plans

were available and ended in 2003. In 2003, the BCBS group of insurers covered a range of popular plans, including traditional, PPO, HMO, and point-of-service, all with and without prescription drug coverage. The estimated underwriting cycle and derivatives are based on the National Health Expenditures, which includes all private coverage types and is the sum of all PHI underwriting cycles.

PHI Personal healthcare expenditures are the most significant predictor of PHI enrollment and one of two significant predictors for Medicaid enrollment; the other predictor is Medicare enrollment. The determinants of PHI market churn include increases in personal healthcare expenditures and consequent shifts in enrollment away from PHI and Medicare towards Medicaid. On average, PHI enrollment does not contribute to PHI profits, while Medicaid enrollment does. Medicaid's function as a high-risk pool [23] provides a destination for those with high healthcare costs who can no longer afford the PHI premium, removing high-risk, high-cost, privately insured enrollees and marginally boosting PHI profits. There are just two predictors of increased PHI profits: the marginally insignificant offloading of enrollees to Medicaid and raising the price of administrative services.

The financial success of PHI is likely a function of managing short-term profits and accumulating invested reserves. Although there are recent signs of short-term stability, decreasing PHI enrollment, expressed as a fraction of the population, while Medicare and Medicaid enrollment continues to increase, highlights a further profit challenge. Absent the option to explore additional private market aggregation, market reform will need to focus on cost containment in some form for the private market to continue. Lastly, the underwriting cycle is still present, influenced by the same dynamics. The reduced industry emphasis remains, perhaps due to the unwillingness to discuss the implications for cost containment and associated benefits structures in the board room and media.

Abbreviations

ATC	Average Total Cost
BCBS	Blue Cross Blue Shield
CMS	Center for Medicare and Medicaid Services
HMO	Health Maintenance Organization
NHE	National Health Expenditures
PHI	Private Health Insurance
PHE	Personal Healthcare Expenditures

Author Contributions

William Thomas Cecil is the sole author. The author read and approved the final manuscript.

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Data Availability Statement

The data that support the findings of this study can be found at 1) National Health Expenditure Data | CMS and 2) AHA: TrendWatch Chartbook 2003: TOC (aonl.org).

Conflicts of Interest

The author declares no conflicts of interest.

Appendix

The appendix contains PHI profits and ATC by year in nominal dollars.

	Nominal Dollars in Millions	
Year	PHI profits	Average Total Cost
1960	$ 126	$ 635
1961	$ 124	$ 707
1962	$ 126	$ 784
1963	$ 68	$ 870
1964	$ 37	$ 991
1965	$ 107	$ 1,102
1966	$ 159	$ 1,127
1967	$ 94	$ 1,144
1968	$ 164	$ 1,295
1969	$ (261)	$ 1,468
1970	$ (427)	$ 1,705
1971	$ (168)	$ 1,960
1972	$ 372	$ 2,268
1973	$ 318	$ 2,522
1974	$ (534)	$ 2,873
1975	$ (846)	$ 3,371
1976	$ (289)	$ 4,120
1977	$ 996	$ 5,014
1978	$ 1,274	$ 5,758
1979	$ 586	$ 6,695
1980	$ (802)	$ 7,628
1981	$ (814)	$ 9,012
1982	$ (377)	$ 10,370
1983	$ 197	$ 11,562
1984	$ 3,154	$ 13,056
1985	$ 2,607	$ 14,429
1986	$ (656)	$ 15,005
1987	$ (4,280)	$ 16,488
1988	$ (2,999)	$ 19,412
1989	$ (18)	$ 22,598
1990	$ 4	$ 25,813
1991	$ (2,011)	$ 28,218
1992	$ (2,679)	$ 30,427
1993	$ 1,118	$ 32,662
1994	$ 143	$ 34,210
1995	$ (1,694)	$ 36,084
1996	$ (1,802)	$ 38,187
1997	$ (4,813)	$ 40,047

Nominal Dollars in Millions		
Year	PHI profits	Average Total Cost
1998	$ (6,929)	$ 42,599
1999	$ (5,604)	$ 46,087
2000	$ (4,423)	$ 50,641
2001	$ (5,109)	$ 55,536
2002	$ 3,021	$ 61,787
2003	$ 9,701	$ 67,766
2004	$ 8,463	$ 72,038
2005	$ 6,735	$ 77,256
2006	$ 5,922	$ 81,277
2007	$ 6,095	$ 86,259
2008	$ 1,394	$ 88,741
2009	$ (6,116)	$ 91,674
2010	$ 143	$ 94,650
2011	$ 206	$ 98,257
2012	$ (2,022)	$ 101,436
2013	$ (2,095)	$ 101,608
2014	$ 782	$ 106,680
2015	$ (6,318)	$ 112,974
2016	$ (7,120)	$ 119,234
2017	$ (2,711)	$ 125,093
2018	$ 8,563	$ 130,735
2019	$ (6,244)	$ 133,974
2020	$ 16,751	$ 132,930
2021	$ (19,731)	$ 141,364
2022	$ (18,429)	$ 149,739

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Biography

William Thomas Cecil is an Independent Consultant. He completed his MBA in Finance at the University of Missouri at Kansas City in 1989. He studied economics at the University of Tennessee at Knoxville. He was the Director of Health Policy Research at BlueCross BlueShield of Tennessee from 2001-2009.

Research Field

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