Regional Price Level Estimates for Medical Services in the United States *

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3/6/25

Abstract

This paper estimates regional price levels for medical services in the United States using two of the largest available sources of commercial health claims. I provide estimates for inpatient, outpatient, and professional services, as well as aggregate expenditure-weighted estimates. By using two independent data sources, this paper addresses representativeness concerns and sheds light on the interchangeability of two widely used commercial claims databases. I utilize the estimated price indices to examine the relationship between medical prices and total health care spending per beneficiary, and also provide a novel state-level comparison of medical and non-medical price levels. I find that, Alaska, Wisconsin, Wyoming, Oregon, and California tend to have the highest health care prices, while Alabama, Arkansas, Kentucky, Michigan, and Louisiana have the lowest, although there is considerable heterogeneity across service categories. Medical prices are significantly more disperse than non-medical prices, and the correlation between the two is weak across states. I find that variation in the medical price level explains about one-half of the variation in health care spending per person.

1 Introduction

Commercial health care prices vary substantially across geographic areas in the United States [1, 2, 3]. Cooper et al. (2019) report that lower-limb MRI prices vary by a factor of 2.9 between hospitals in the 90th and 10th percentiles, respectively, and vary almost twelvefold between the most-expensive and least-expensive providers [1]. Compared to Medicare fee for service (FFS) rates, commercial prices are both higher and more variable [2, 3, 4, 5, 6, 7]. On average, commercial insurers pay more than 200% of Medicare rates for inpatient and outpatient services, and this price premium ranges across states from below 150% to well over 300% [2, 3, 4]. Importantly, the variation in commercial prices is a significant driver of geographic variation in spending among the privately insured [8, 1].

There are numerous factors that contribute to geographic variation in commercial health care prices. Commercial prices are generally the product of negotiations between individual insurers and providers. As a result, factors that influence the costs and relative bargaining power of each party may affect contracted prices. On the provider side, greater market concentration has been shown to be correlated with higher

*I thank Abe Dunn, Justine Mallatt, Eric Figueroa, and Kyle Hood for helpful comments. I also thank Peter Shieh for outstanding research assistance. The author(s) acknowledge the assistance of the Health Care Cost Institute (HCCI) and its data contributors in providing the claims data analyzed in this study. The views expressed in this article are solely my own and do not necessarily reflect the views of the Bureau of Economic Analysis, Merative, or the HCCI.

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prices [9, 10, 1, 4]. Similarly, vertical integration between hospitals and physician practices is strongly associated with higher prices [11, 12, 13, 14, 4]. On the insurer side, higher concentration tends to result in lower negotiated prices [15, 16]. More-traditional explanations for price dispersion, such as variation in input costs or quality, may also play a role, although the evidence on these is somewhat weaker [4].[1]

The consequences of the level, growth, and dispersion of commercial medical prices are substantial. Recent research has shown that increases in commercial prices are associated with higher premiums, higher out-of-pocket costs, and an increase in the use of high-deductible health plans [17, 4, 18]. Additionally, the evidence suggests that commercial price growth puts downward pressure on wages and upward pressure on unemployment [17, 18]. On the public side, higher commercial prices lead to larger federal subsidies for health care via tax exclusions, deductions, and credits [4]. Finally, increases in commercial prices, relative to Medicare and Medicaid rates, raise the opportunity cost of treating publicly-insured patients, which has implications for quality of care [19].

While there are a number of existing studies that document health care price variation, this paper makes a number of important new contributions. Most prominently, this is the first study to use both the Merative™ MarketScan® Commercial Database and the Health Care Cost Institute (HCCI) database to measure price variation. The value of utilizing both databases is that they originate from different sources—with MarketScan being collected primarily from large employers and HCCI being sourced primarily from large national carriers. This paper provides the first aggregation of these two sources as well as the first explicit comparison of the two in terms of measuring geographic variation. I exploit the richness of this data to construct a novel state-level regional price index for medical services the United States.

In contrast to prior studies, the goal of this paper is to construct the most comprehensive, accurate, and recent, price level estimates for a suite of service categories and in aggregate. These estimates are valuable both as descriptive evidence of price variation and as implicit regional price deflators. Researchers and policymakers can use these estimates to accurately compare health care utilization across geographic areas by deflating spending differences.

Two of the most closely related studies to this paper are Cooper et al. (2019) and Chernew et al. (2020) [1, 2]. Cooper et al. (2019) use HCCI data from 2007–2011 to measure prices for inpatient stays and several procedures at the hospital level, and aggregate these price measures to the hospital referral region (HRR) level. Chernew et al. (2020) use MarketScan data from 2017 to compute state-level commercial-to-Medicare price ratios for inpatient, outpatient, and professional service. In contrast to each of these studies, this paper uses more recent data, covering 2018–2022, from both MarketScan and HCCI. Additionally, this study includes both a larger sample of procedures and analyses of finer procedure categories such as imaging and tests. I utilize this large sample to examine the extent to which price levels are correlated across procedure categories.

Many existing studies of health care price variation, including Chernew et al. (2020), Whaley et al.

[1] In this paper, I do not attempt to adjust price-level estimates for quality differences across geographic areas. While the existing evidence suggests that the role of quality variation is limited, further research is needed to asses its impact more concretely [1, 4].

(2020), and others, examine commercial prices relative to Medicare, because Medicare fees are adjusted for regional differences in input costs.[2] In contrast, this paper compares health care price variation to price variation for other goods and services using price parity estimates from the Bureau of Economic Analysis (BEA), which currently exclude medical care. In doing so, this work greatly improves the comprehensiveness of national price level estimates, and sheds light on the relationship between health care price variation and price variation for non-medical goods and services. These insights are relevant for businesses, policymakers, and researchers given the current level of health care spending nationally.

2 Data and Methods

2.1 Data

I use data from two of the largest and most prominent sources of commercial health claims in the U.S.: the Health Care Cost Institute (HCCI) database and the Merative MarketScan database. Each of these two data sources has been used in similar work measuring geographic variation in commercial prices [1, 2]. This is the first study to use data from both sources. I construct aggregate price level estimates using both data sources and provide a comparison of the estimates derived separately from each source.

The HCCI database contains commercial claims covering about one-third of the employer-sponsored insurance population in the United States. The database includes over 1 billion claims per year, sourced from Aetna, Humana, and Blue Health Intelligence, and cover around 50 million unique individuals annually. The data include records from all 50 states and the District of Columbia, from both fully insured and self-insured products, and covering small, medium, and large employers. Claims are organized into inpatient, outpatient, and professional datasets. The most important limitation of the HCCI data is that the current database no longer includes claims from United HealthCare. The HCCI data are used in the landmark study of Cooper et al. documenting regional price variation.

The Merative MarketScan database contains commercial claims covering around 20 million unique patients annually. The data are sourced from over 350 employers and 40 health plans, and contain claims for inpatient, outpatient, and professional services. The primary limitation of the MarketScan database is that the majority of the claims are sourced from large employers, and so may underrepresent small group and individual plans. The MarketScan data are used in the related study of Chernew et al., who calculate commercial-to-Medicare price ratios by state.

For both the HCCI and MarketScan data, I analyze non-capitated commercial claims over the period 2018–2022. I restrict attention to claims associated with enrollees under age 65 with employer-sponsored health insurance who are enrolled in an HMO, PPO, POS, or EPO type of plan.[3] I drop claims that report zero or negative total payments as well as those where payments are in the top 1% of the distribution for the given procedure code (for outpatient and professional) or DRG (for inpatient). My final sample

[2] Additional studies in this spirit include Ginsburg (2010), Trish et al., (2017), Bai and Anderson (2018), Seldon (2020), Pelech (2020), and CBO (2022) [20, 5, 7, 6, 4].

[3] This includes high-deductible-type plans.

consists of over 5 billion claims across the two databases and three service categories, with details given in Appendix Table A5.

To compare geographic variation in health care prices to variation in the prices of other goods and services, I use 2022 regional price parity (RPP) estimates produced by the Bureau of Economic Analysis. The BEA RPP estimates capture regional price variation for a large array of goods and services, including housing [21, 22].[4] Importantly, the current RPPs do not currently include medical services due to data challenges. As a result, the BEA RPPs provide an excellent point of comparison for variation in medical service price.

2.2 Methods

To estimate state price levels, I adopt the general hedonic approach of regressing service-level payments on a vector of control variables and state-level fixed effects. A similar approach is used by Cooper et al. (2019) to measure price variation across hospitals and regions, and this methodology mirrors that used by BEA to produce the RPPs [1, 23, 21]. The regressions take the following general form:

$$log(p_{i,j,r,s,t}) = \beta X_{i,j} + \lambda_r + \lambda_t + \delta_s + \epsilon_{s,g,t} \tag{1}$$

where $p_{i,j,r,s,t}$ denotes the total payments associated with medical service r rendered to patient i by provider j in state s in year t. In this equation, $X_{i,j}$ reflects control variables associated with the patient and provider, λ_r denotes service-level fixed effects (captured by a procedure or diagnosis code), and λ_t denotes time fixed effects. The primary coefficient of interest in this regression is the vector of state-level fixed effects (δ_s), which capture variation in prices across states, adjusted for differences in the composition of services and for patient and provider characteristics. I estimate separate models for inpatient, outpatient, and professional services, modifying the service-line definition and controls in each case.

For inpatient services, the unit of observation is an inpatient stay. The total price of a stay is defined as the sum of all payments associated with the stay. I define service fixed effects at the DRG level, and I include controls for age, sex, admission type, discharge status, and length of stay. I estimate the inpatient regressions using all stays from 2018–2022.

For outpatient and professional claims, service fixed effects are defined at the procedure code level, which is most commonly a CPT/HCPCS code, but is sometimes and ICD10 code. I also include procedure modifier codes and controls for place of service, provider type, and whether the claim was paid as in-network. Because the data files for outpatient and professional services prohibitively large at the claim-line level, I collapse observations based on all unique combinations of procedure codes and controls, computing the average price in each cell. I then estimate regressions at this level of observation, using weights for cell volume. Notably, the coefficient estimates from these weighted regressions at the collapsed level are

[4] See https://www.bea.gov/data/prices-inflation/regional-price-parities-state-and-metro-area for the current estimates and details on data and methodology.

equivalent to estimates from regressions at the claim-line level because the controls are all factors.[5]

I use the estimated coefficients $\hat{\delta_s}$ to construct a price index measuring relative price levels across states. To compute the price level in each state, I apply the transformation:

$$PL_s = \frac{\exp(\hat{\delta_s})}{\frac{1}{N_s}\sum_{s' \in S} \exp(\hat{\delta_{s'}})} \tag{2}$$

The interpretation of $\hat{PL_s}$ is the price level in state s relative to the average price level across all states S. For instance, a price level estimate of 1.25 for a particular state indicates that prices are about 25% higher in that state than the national average. I cluster standard errors at the state level and use the delta method to compute standard errors for the estimated PLs. I estimate state price levels separately for each of the three major service categories and each of the two databases. I then compute aggregate price level estimates for both the MarketScan database and HCCI database by computing the expenditure-weighted average of PLs across the three service categories. I calculate expenditure weights using MarketScan data from 2018.[6]

3 Results

3.1 Aggregate Results

Figure 1 plots the aggregate price level estimates, averaged across the MarketScan-based and HCCI-based results. Overall, states in the west, especially the Pacific west, Montana, and Wyoming have the highest health care prices. Conversely, states in the South, especially in the east-south-central and west-south-central regions, have the lowest prices. Specifically, Alaska has the highest price level (1.65), followed by Wyoming (1.36), Wisconsin (1.30), Oregon (1.23), and Minnesota (1.20). Alabama has the lowest price level (0.66), with Arkansas (0.73), Kentucky (0.75), Michigan (0.77), and Louisiana (0.78) also being in the bottom five. Michigan is a significant outlier in terms of having a much lower price level than the surrounding states. West Virginia, on the other hand, has a much higher price level than bordering states.

Figure 2 plots the MarketScan-based and HCCI-based price level estimates separately, ordered by aggregate price level, and including the inpatient, outpatient, and professional component estimates. Overall, the estimates derived from each of the two databases are remarkably similar. In terms of aggregate price level, four of the top five most expensive states are the same, and the bottom six states are identical. Across all states, the correlation between the MarketScan-based and HCCI-based aggregate price level estimates is 0.95, as Appendix Figure A1 illustrates. The inpatient, outpatient, and professional price level estimates are similarly correlated between the two sets of estimates, as A2 depicts. This is

[5] I also compute price level estimates for outpatient and professional services using the full claim-line-level MarketScan data from 2018. These estimates, which are presented in the Appendix, do not differ much from the baseline estimates based on the collapsed data.

[6] The expenditure weights calculated using the HCCI data are very similar.

an important finding for researchers who are using, or planning to use, either the MarketScan or HCCI database to study health care prices.

3.2 Results by Service Category

In addition to plotting aggregate price level estimates associated with each database, Figure 2 plots the price level estimates separately for inpatient, outpatient, and physician services. Additionally, Tables A1 and A2 present the precise numerical estimates for each service group and database, while Table A3 presents the average price levels across the two databases. While the estimates are correlated across the three service categories, there is heterogeneity in both the absolute and relative measures. For example, Illinois is in the top quintile for inpatient prices, the bottom quintile for outpatient prices, and the third quintile for physician prices. Similarly, Mississippi is in the bottom quintile for inpatient and outpatient prices and yet occupies the fourth quintile for physician services.

For inpatient services, California, Oregon, Washington, Alaska, and New York represent the most expensive states, while Alabama, Mississippi, Arkansas, Iowa, and Kentucky are among least expensive. For outpatient services, Wyoming, West Virginia, and Wisconsin are among the most expensive areas, while Arkansas, Rhode Island, and Mississippi are among the least expensive. For physician services, states with the highest price level include Alaska, North Dakota, Wisconsin, and Minnesota, and states with the lowest price level include Arizona, Kentucky, and Indiana are among the least expensive.

There is also variation across the three main service categories in the extent of price dispersion across states. In particular, outpatient services exhibit the largest degree of price dispersion, followed by inpatient services and professional services. Table 1 presents summary dispersion measures for several categories of medical and non-medical services. Overall, outpatient services exhibit more price dispersion than inpatient and professional services. The interquartile range spans 33 percentage points for outpatient services, 25 percentage points for inpatient services, and just 21 percentage points for professional services. Similarly, the coefficient of variation for the outpatient price index (0.27) is significantly larger than for the inpatient (0.18) and professional (0.21) prices indices. The other dispersion measures presented show a similar pattern. The high degree of dispersion in outpatient prices is driven largely by outpatient tests, which are the most common outpatient procedure.

Table A4 reports the correlation matrix of price level estimates for inpatient, outpatient, and professional services, as well as the five most common subcategories of outpatient and professional services: evaluation and management (E&M), imaging, procedures, tests, and treatments. Overall, the correlations between price levels of different service categories are relatively low. The correlation between inpatient and outpatient services is 0.47, while the correlation between inpatient and professional services is 0.39. The correlation between outpatient and professional price levels is 0.41. Among the service subcategories, the correlations are much larger for professional services than for outpatient services. For professional services, the minimum correlation is 0.76 (imaging and treatments) and the maximum is 0.94 (imaging and procedures). For outpatient services, the minimum correlation is 0.36 (E&M and tests) and the maximum correlation is 0.85 (imaging and tests).

3.3 Sensitivity to Alternative Modeling Choices

I consider several alternative specifications to assess the sensitivity of the main price level estimates. First, I estimate a Poisson GLM version of equation (1) rather than the linear specification of log payments. Second, I use claim-line-level data, rather than collapsed cell values, to estimate outpatient and professional services. For this, I use the entire 2018 MarketScan sample. Third, I re-estimate outpatient and physician price levels using spending weights rather than volume weights. These results are given in Appendix Tables A6-A8. Overall, I find that price level estimates are quite similar across specifications and data sources.

3.4 Relationship to Total Health Care Spending

Health care spending per privately-insured beneficiary varies considerably across geographic areas in the U.S. [8, 1, 24]. In order to design policies aimed at containing health care expenditures, it is critical to understand the role of price variation in driving variation in total spending. In this section, I examine the relationship between the estimated medical price levels developed above and mean annual spending per beneficiary. To do so, I first calculate average annual spending per person in each state using using the MarketScan data from 2018–2022. I calculate total spending using the same inpatient, outpatient, and professional claims used to construct the price level estimates.[7]

The top panel of Figure 4 plots mean annual spending per person and the aggregate medical price level for each state. I also estimate a linear regression using these data points to estimate the slope of the best-fit line and the regression R^2. As the plot shows, the relationship between the price level and spending is strong and positive. The correlation between the two variables is .7, and the estimated slope implies that a 10 percentage point increase in the price level is associated with an additional $277 in spending per person-year. The estimated R^2 indicates that price level variation explains about half of the variation in mean annual spending. This finding is similar to that of Cooper et al. (2019), who find that price variation accounts for around half of the spending variation for inpatient DRGs across hospital referral regions.

Geographic price level estimates can be used to deflate total spending across areas so as to more closely compare quantity differences. The bottom panel of Figure 4 plots the deflated average annual spending per beneficiary for each state, sorted by increasing order. Consistent with the R^2 estimate in the top panel, there remains considerable variation in spending across states, even after deflating for price differences. While Alabama has the lowest medical price level of any state, it actually has the highest level of deflated spending per beneficiary. Other states with high deflated spending include New York, Kentucky, and New Jersey. States with low levels of deflated spending per beneficiary include states with very high price levels, including Wisconsin, California, North Dakota, and Oregon.

[7] Total annual spending calculations do not include other service categories like drugs, home health care, or dental services.

3.5 Comparison with Non-Medical Price Levels

A growing literature in economics and health services research documents the relationship between health care market structure and health care prices. However, less is known about the extent to which medical prices are correlated with the prices of non-medical goods and services. To examine this, I compare the medical price level estimates to three different price parity estimates from BEA: all items, goods, and housing. The top panel of Figure 3 plots the aggregate medical price levels on the x-axis against the all items RPP from BEA on the y-axis.[8] Overall, the relationship between the two price measures is quite weak—with a correlation of 0.27. The correlation with housing prices is even lower (0.22), while the correlation with goods is slightly higher (0.37). The Pacific west states of California, Oregon, and Washington tend to have high prices for both health care and other goods in services. Conversely, the southern states of Alabama, Arkansas, and Mississippi exhibit low prices for both medical and non-medical items.

Perhaps the most interesting points on Figure 3 represent those states with significant differences in relative price levels between medical and non-medical goods and services. The bottom panel of Figure 3 depicts the difference between each state's aggregate medical price level and the BEA all items price parity, sorted in ascending order. States in the Midwest and mountain west—especially Wyoming, Wisconsin, North Dakota, Minnesota, and Montana—exhibit the largest (positive) gap between medical and non-medical prices. Conversely, states in the South, Northeast, and Mid-Atlantic—especially Maryland, Rhode Island, and Alabama—tend to show much lower health care prices than other goods and services price.

As Figure 3 demonstrates, health care prices are significantly more disperse than non-medical goods and services prices across states. Table 1 reports several summary dispersion measures for both medical and non-medical price index estimates. The coefficient of variation for the BEA all items RPPs (0.08) is less than half the value for inpatient (0.18) and outpatient (0.27) services. One exception is housing, where the extent of price dispersion actually exceeds that of medical care.

3.6 Comparison with External Estimates

I next compare the commercial price level estimates presented in this paper to similar state-level price estimates from two previous studies: Chernew et al. (2020) and Whaley et al. (2020)[2, 3]. Chernew et al. also use commercial claims from the MarketScan database, while Whaley et al. (2020) assemble claims from a large number of self-insured health plans as well as several all-payer claims databases. A key difference between this paper and these two prior studies is that both Chernew et al. (2020) and Whaley et al. (2020) use Medicare FFS prices to calculate commercial-to-medicare price ratios. The advantage of computing commercial-to-medicare price ratios is that medicare prices are adjusted for geographic differences in input costs. Therefore, variation in commercial-to-medicare ratios better reflects variation in markups than variation in commercial price levels.

[8]Figures A5 and A6 present the analogous results for goods and housing, respectively.

To compare the price level estimates in this paper to the estimates from and Chernew et al. (2020) and Whaley et al. (2020), I normalize the estimates for each service category by the group average, and then compute the expenditure-weighted average across the three major services categories using the expenditure weights used in this paper. The top panel of Figure A7 plots the aggregate price level estimates derived from the MarketScan data against the analogous estimates from Chernew et al. (2020). Overall, the results are remarkably similar, with a correlation of 0.88. The bottom panel of Figure A7 shows the analogous comparison using the HCCI estimates, which is nearly identical. In both cases, the most expensive states remain Alaska, Wisconsin, Wyoming, and Oregon, while the least expensive states remain Alabama, Arkansas, Kentucky, Louisiana, and Michigan. Figure A8 presents the analogous plots with the estimates from Whaley et al. (2020). In this case, the correlation is 0.70 for the MarketScan estimates and 0.73 for the HCCI estimates. A likely reason why the correlations are stronger with the Chernew et al. (2020) estimates is because Chernew et al. (2020) also use the MarketScan database, whereas Whaley et al. (2020) use data from a number of different smaller sources.

The fact that the estimates presented in this paper are so similar to the estimates of Chernew et al. (2020) and Whaley et al. (2020) suggests that variation in input costs does not explain the bulk of the geographic variation in commercial prices. This finding is consistent with prior evidence on the drivers of commercial price variation, which primarily implicates features of the health care market structure.[1, 4]

4 Discussion

4.1 Limitations

This study has several notable limitations. Most prominently, my analysis does not include Medicare and Medicaid, which cover about two-thirds of the U.S. population [25]. However, because Medicare and Medicaid reimbursements are set administratively, the nature of price variation in those programs is fundamentally different. Additionally, the estimates in this paper do not cover several important service categories such as drugs, durable medical equipment, and home health care. It would be fruitful for future work to address these other categories. A third limitation is that these estimates do not cover cash prices paid by uninsured patients or prices charged by providers who do not accept commercial plans.

4.2 Conclusions

This paper provides novel price level estimates for commercial health services in the U.S. using two of the largest available claims databases. In doing so, this paper offers the most recent and comprehensive account of state-level variation in commercial health care prices. Like previous studies, I document considerable price variation across states. Overall, price levels are 40–50 percentage points higher in the most expensive states than in the least expensive states. By comparison, the gap between the most expensive and least states for non-medical goods and services is about 20 percentage points.

In addition to variation in aggregate medical RPPs across states, I also find substantial heterogeneity across service categories, as RPPs are only moderately correlated between inpatient, outpatient, and professional services. As a result, states can have relatively high prices for some services and relatively low prices for others. This heterogeneity may be driven by within-state differences in hospital and physician market structure. Indeed, a growing literature in health economics implicates factors like high market concentration and vertical integration with higher health care prices [9, 10, 1, 4, 11, 12, 13, 14]. Then, for example, a state that has a highly concentrated hospital sector, but a less-concentrated physician sector, may have high inpatient facility prices and lower professional services prices. It would be valuable for future work to precisely account for price variation by service in terms of market structure determinants.

I compare health care price variation to variation in the prices of non-medical goods and services using external price level estimates from BEA. I find that medical prices are only weakly correlated with non-medical prices. States such as Wyoming and Wisconsin have significantly higher relative medical prices than non-medical prices, while states like Maryland, Alabama, and Michigan have much lower health care prices than non-medical prices. This suggests that the market forces governing health care prices may be only weakly related to those affecting non-medical goods and services prices, including housing. This finding is highly relevant for policymakers and researchers interested in health care spending. If instead health care prices were very strongly correlated with other prices, then the scope for policies to reduce health care prices would be quite general, and may even focus on other industries. Instead, these findings indicate that effective policies in curbing health care price growth are likely to be those targeting the health care industry specifically.

Understanding both the extent of and drivers of geographic variation in commercial medical prices is critical for insurers and policymakers, as these prices affect consumer spending, federal spending, wages, and employment. This paper presents precise estimates of medical price variation, and provides suggestive evidence that it is not driven primarily by variation in input costs. Overall, these results indicate that further research into the relationship between health care market structure and health care prices would be fruitful. Motivated by the price level estimates presented here, for example, it would be illuminating to understand why health care prices are so much higher in Wisconsin than in Michigan, despite having similar price non-medical price levels based on BEA estimates.

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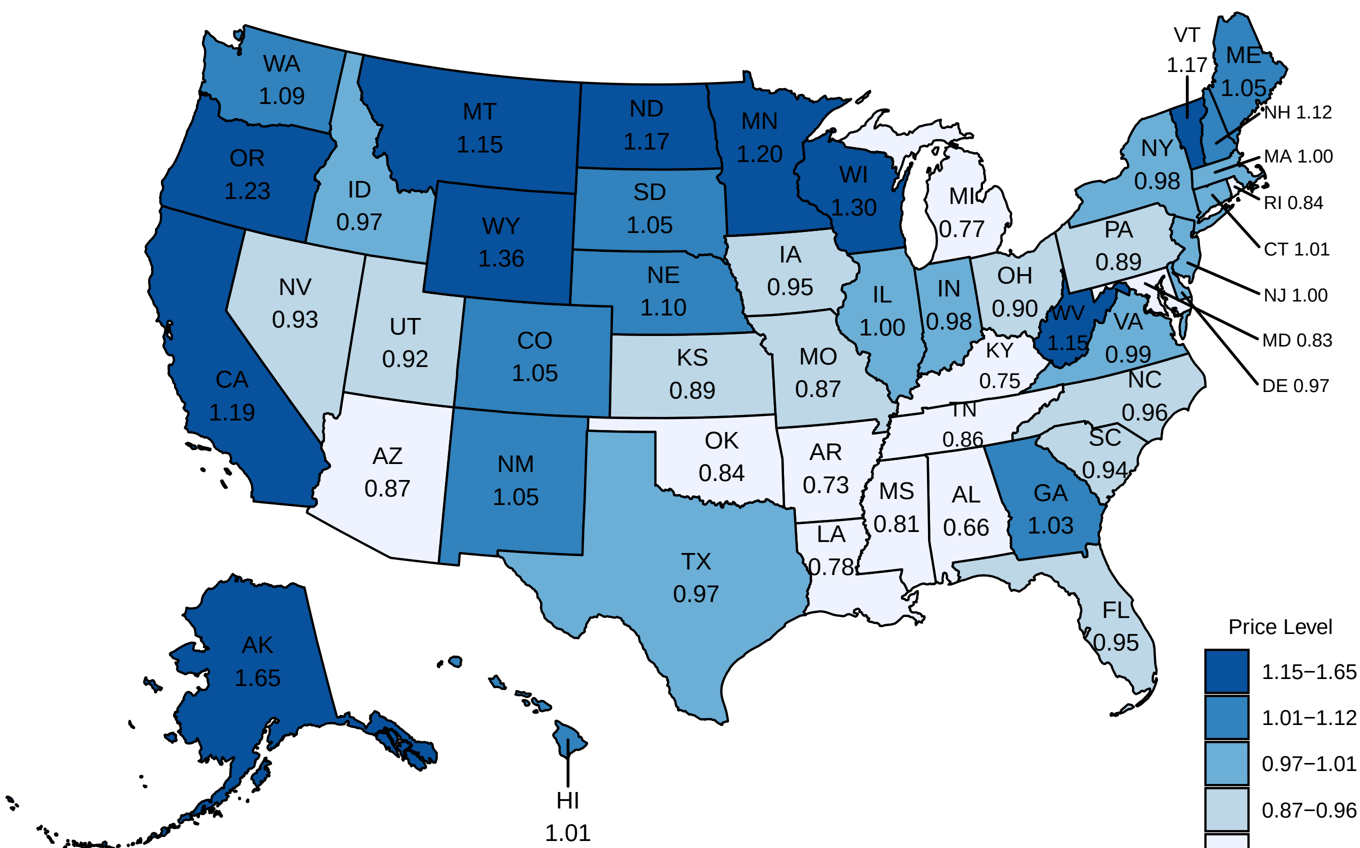
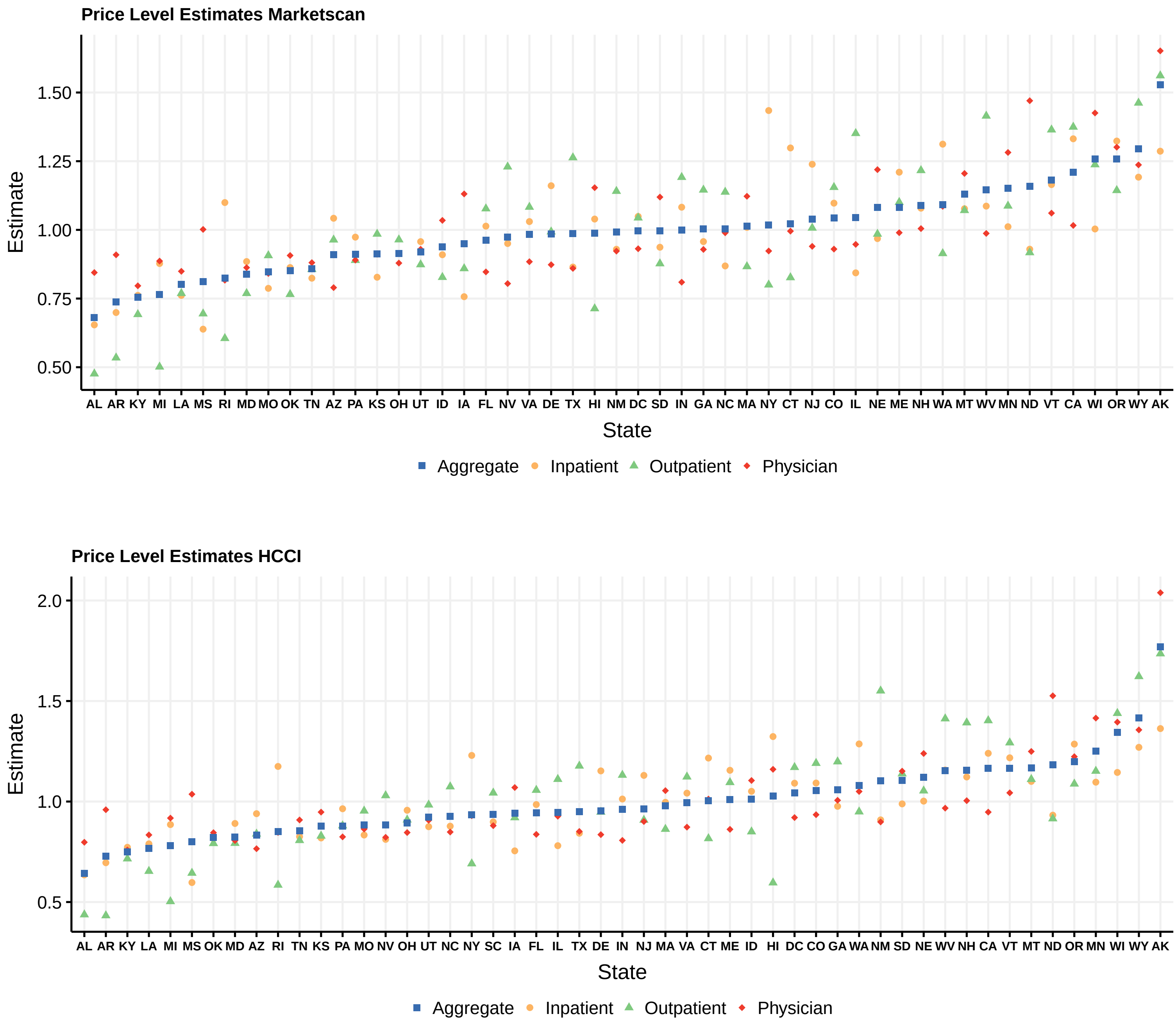
Figure 1: Aggregate Price Level Estimates Derived from MarketScan and HCCI Data



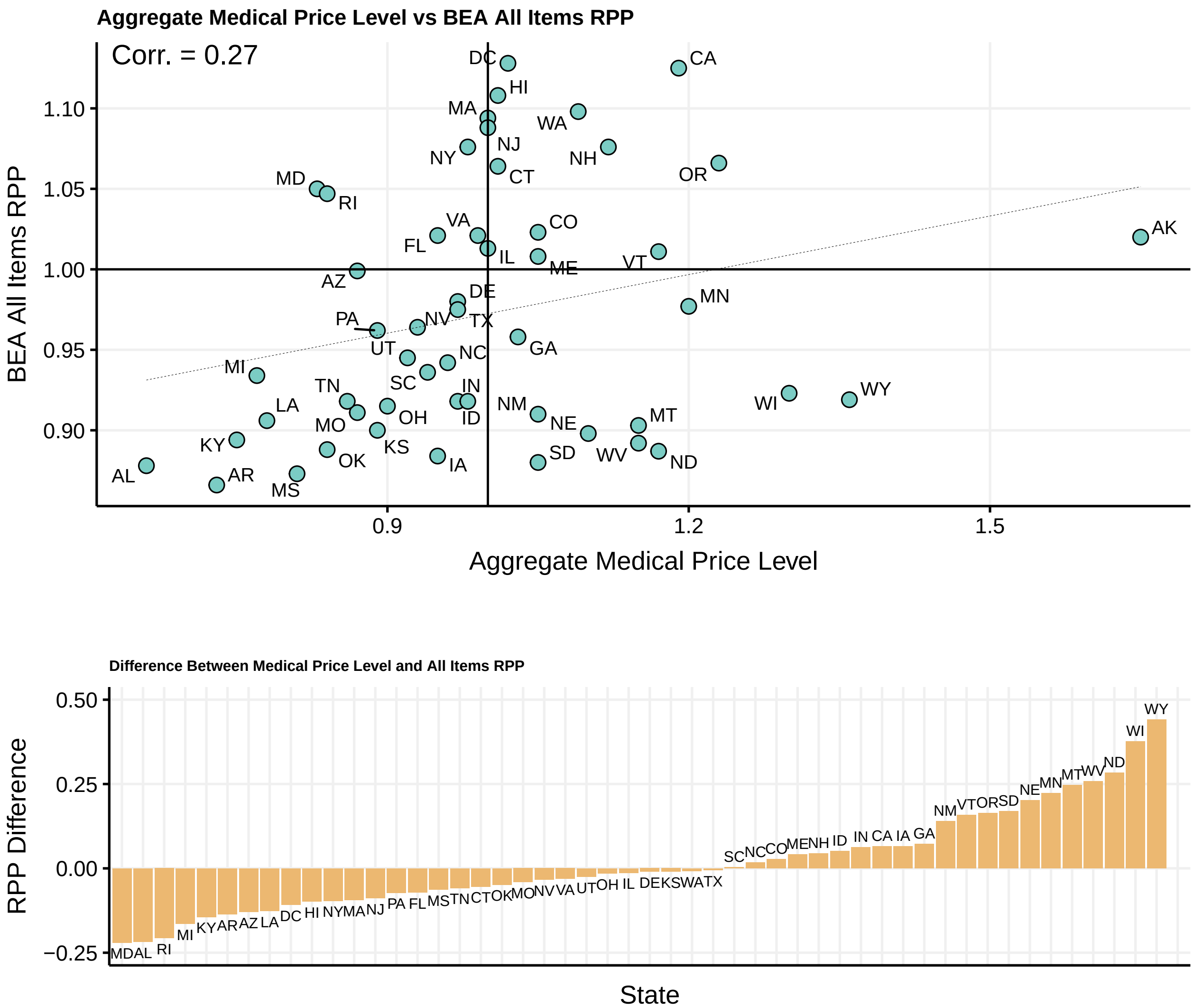
Notes: Map shows the average aggregate price level estimates for each state derived from the MarketScan and HCCI data. Price levels are estimated according to equations (1) and (2) in the text for inpatient, outpatient, and physician services. Aggregate price levels are then calculated as the expenditure-weighted average across the three major service categories. Aggregate price level estimates are computed using both the MarketScan and HCCI databases, with the average of the two presented here. Separate estimates for each service category and database are provided in the Appendix.

Figure 2: Price Level Estimates by Category for MarketScan and HCCI Data



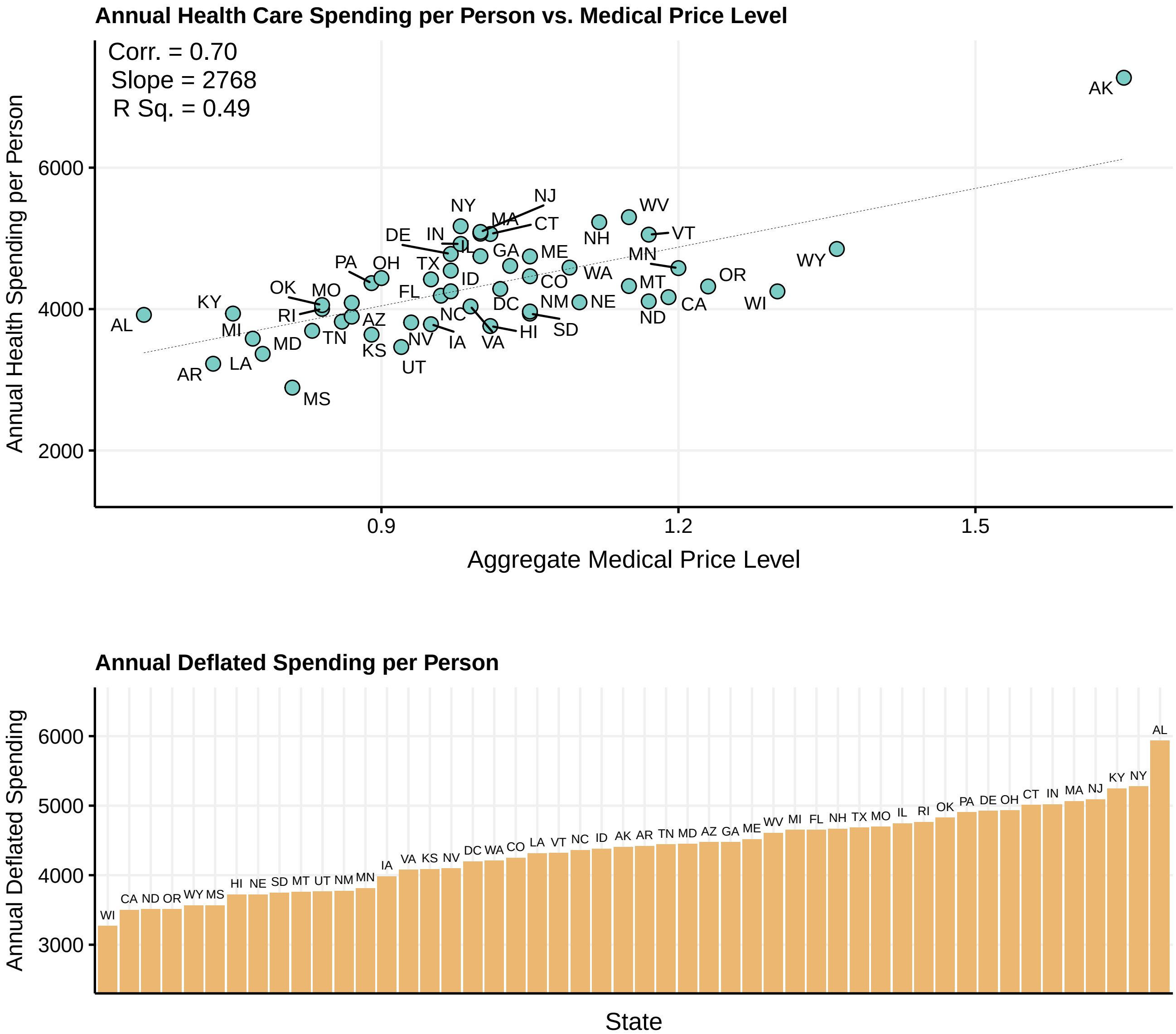
Notes: Top panel presents the aggregate, inpatient, outpatient, and physician price level estimates derived from the MarketScan database. The bottom panel presents the analogous results derived from the HCCI database. Price levels are estimated according to equations (1) and (2) in the text for inpatient, outpatient, and physicians services. Aggregate price levels are then calculated as the expenditure-weighted average across the three major service categories.

Figure 3: Medical Price Level Estimates Compared with BEA All Item Price Parity Estimates



Notes: **Top panel** plots aggregate medical price level estimates for each state on the x-axis against the BEA all items RPP estimates on the y-axis. The aggregate medical price level estimates here represent the average of the MarketScan-based and HCCI-based estimates, which are each computed as the expenditure-weighted average of inpatient, outpatient, and professional price level estimates. BEA all item RPP estimates capture regional price variation for a large array of goods and services, including housing, but excluding medical care. See https://www.bea.gov/data/prices-inflation/regional-price-parities-state-and-metro-area for the current estimates and details on data and methodology. **Bottom panel** depicts the difference between the state-level medical price levels and the BEA all item RPPs, sorted in increasing order.

Figure 4: Relationship Between Medical Price Level and Annual Spending



Notes: **Top panel** plots aggregate medical price level estimates for each state on the x-axis against the average annual spending per person. The aggregate medical price level estimates here represent the average of the MarketScan-based and HCCI-based estimates, which are each computed as the expenditure-weighted average of inpatient, outpatient, and professional price level estimates. Mean annual spending per person are calculated using the MarketScan data from 2018–2022 **Bottom panel** depicts the average annual spending per beneficiary for each state deflated by the regional price level estimates.

Table 1: Summary Dispersion Measures for Different Price Level Categories

Service Category	Coefficient of Variation	Interquartile Range	90th-10th Percentile	Min	Max
Main Service Categories					
Aggregate Medical	0.17	0.18	0.38	0.66	1.65
IP	0.18	0.25	0.48	0.62	1.33
OP	0.27	0.33	0.67	0.46	1.65
Prof.	0.21	0.21	0.43	0.78	1.85
Outpatient Subcategories					
OP E&M	0.21	0.20	0.48	0.28	1.52
OP Imag.	0.29	0.30	0.78	0.42	1.66
OP Proc.	0.23	0.34	0.66	0.55	1.55
OP Test	0.31	0.46	0.74	0.37	1.59
OP Treat.	0.27	0.32	0.70	0.52	1.93
Professional Subcategories					
Prof. E&M	0.21	0.26	0.49	0.72	1.77
Prof. Imag.	0.28	0.20	0.38	0.71	2.31
Prof. Proc	0.28	0.32	0.54	0.69	2.35
Prof. Test	0.26	0.20	0.62	0.72	1.81
Prof. Treat.	0.21	0.23	0.42	0.69	1.92
BEA RPPs					
All Items	0.08	0.11	0.20	0.87	1.13
Goods	0.05	0.07	0.13	0.92	1.13
Housing	0.28	0.39	0.66	0.54	1.77

Notes: Table shows summary dispersion measures for price level estimates for major medical categories, outpatient and professional subcategories, and three BEA non-medical categories. Medical price levels reflect the average of MarketScan and HCCI estimates. BEA RPP estimates capture regional price variation for a large array of goods and services, including housing, but excluding medical care. See https://www.bea.gov/data/prices-inflation/regional-price-parities-state-and-metro-area for the current estimates and details on data and methodology.

Appendix A: Additional Tables and Figures

5 Additional Details on Data Preparation and Analysis

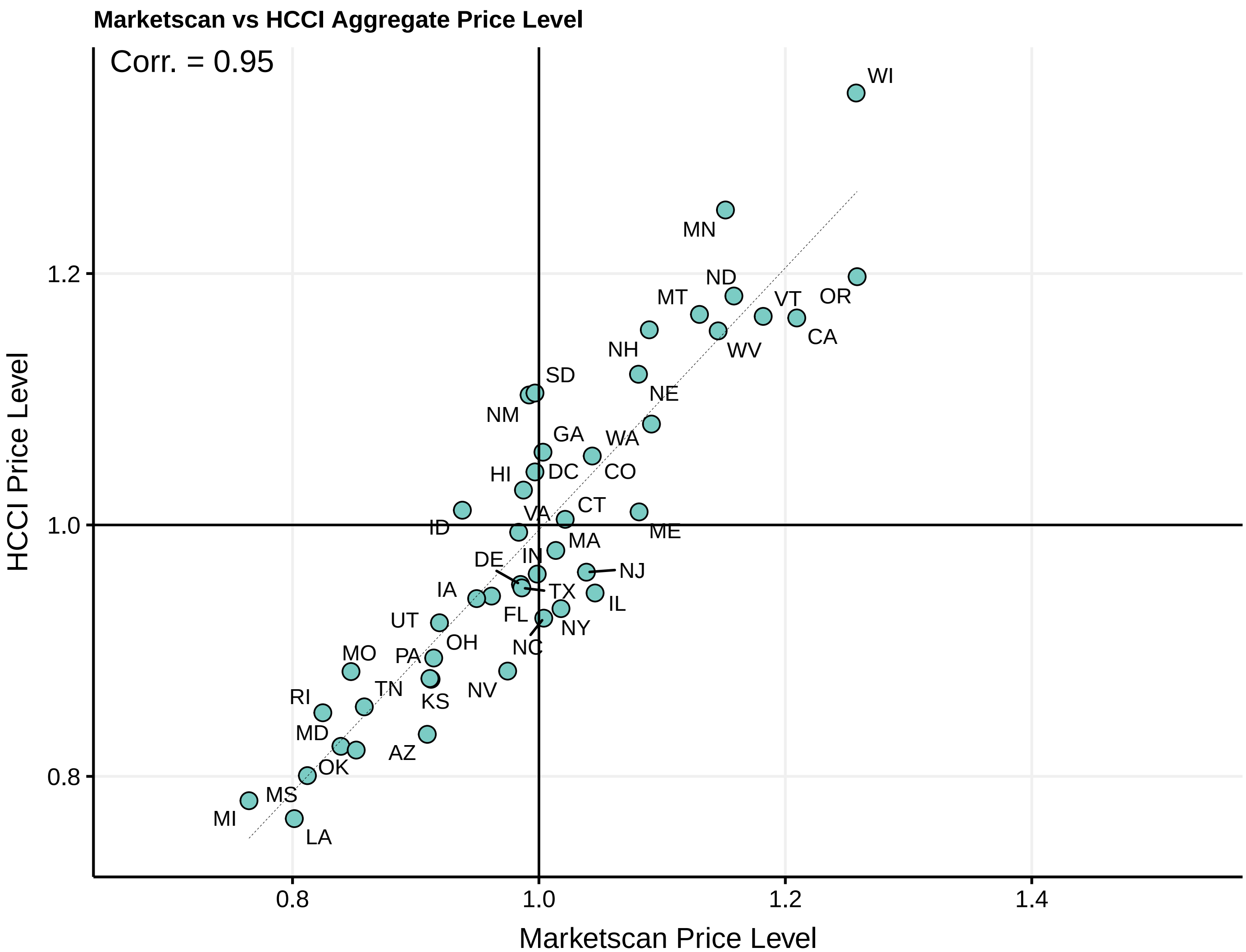
The data used in this paper come from two of the largest sources of commercial health claims in the United States: the Health Care Cost Institute (HCCI) database and the Merative MarketScan database. The HCCI database encompasses over 1 billion commercial claims annually from Aetna, Humana, and Blue Health Intelligence, representing approximately one-third of the employer-sponsored insurance population in the United States and covering around 50 million unique individuals. The database's comprehensive coverage spans all 50 states and the District of Columbia, including both fully insured and self-insured products across small, medium, and large employers. The Merative MarketScan database includes commercial claims for approximately 20 million unique patients annually, drawing from over 350 employers and 40 health plans. Given the size of each database, it is likely that some claims are repeated across the two sources. Moreover, I am unable to link the two databases so as to identify repeated claims. However, given the substantive differences in the underlying source data for each database, I argue that the value of using both databases, both as a means of comparison and in aggregation, is extremely high.

For each database, I prepare three distinct data files based on claim type: inpatient, outpatient, and professional. The inpatient and outpatient data files are comprised of facility claims while the professional file is comprised of professional claims. For inpatient services, the unit of observation is an inpatient stay and the primary code is a diagnosis related group (DRG) code. The total price of an inpatient stay is defined as the sum of all payments made to the associated hospital for the stay. For outpatient and professional services, the unit of observation is an individual claim, and the defining code is a procedure code. Most procedure codes are CPT/HCPCS codes, but a small fraction are ICD-10 codes. The total price of an outpatient or professional service is the total negotiated payment made to the provider by the insurer for the claim.

I apply the same filtering operations to both databases to obtain final analysis samples. Specifically, I identify all non-capitated claims associated with individuals under age 65 who are enrolled in employer sponsored health insurance over the period 2018–2022. I further refine to claims associated with individuals who are enrolled in an HMO, PPO, POS, EPO, or high-deductible-type plan. I remove claims with missing, zero, or negative payment amounts, as well as those where total payments fall in the top 1% of the distribution for the given procedure code (for outpatient and professional services) or DRG code (for inpatient services).

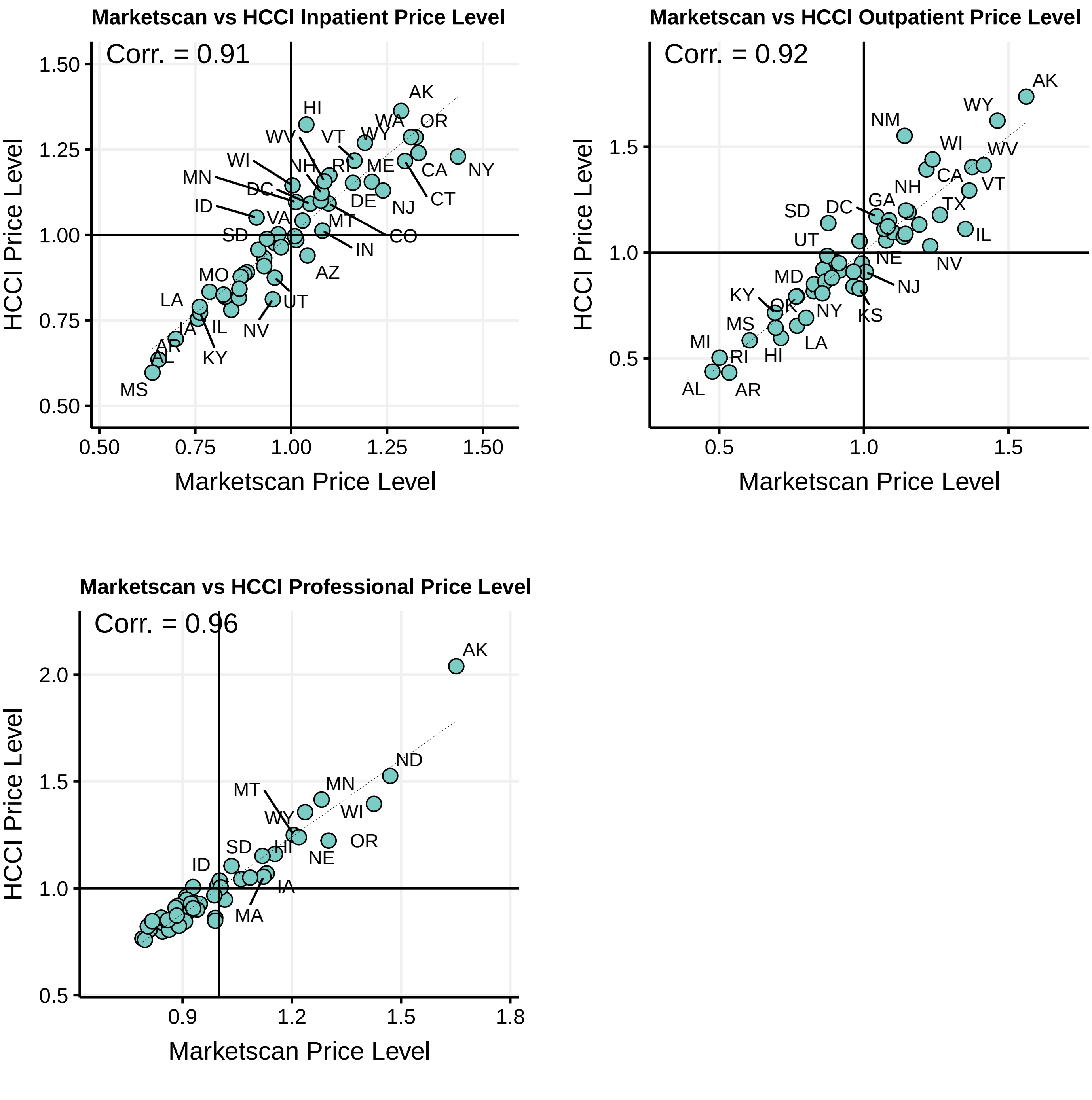
I estimate regressions for inpatient services at the stay level. For outpatient and professional claims, I collapse the claim-line-level data to the state-procedure-year-place of service-provider type-in/out of network level, taking the mean of log payments and the total volume. I then estimate volume-weighted regressions using the collapsed data. Note that this produces identical coefficient estimates as using the claim-line-level data, although the standard errors differ. Importantly, the standard errors are sufficiently small in all cases that they do not meaningfully affect the interpretation of the price level estimates.

Figure A1: Comparison of Estimates Between MarketScan and HCCI Databases



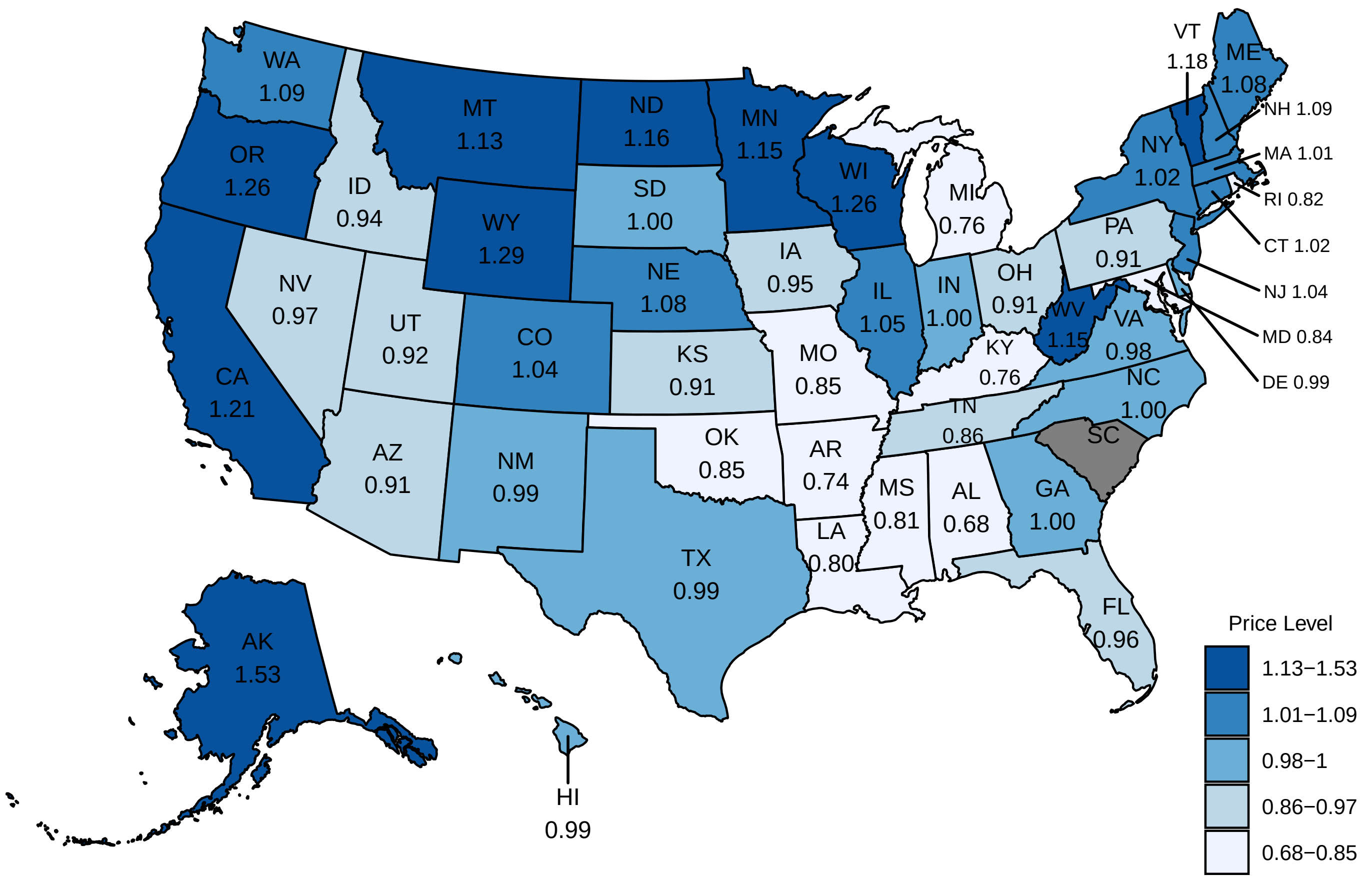
Notes: Plot shows the aggregate state price level estimates from the MarketScan database on the x-axis and estimates from the HCCI database on the y-axis. Aggregate price levels are then calculated as the expenditure-weighted average across the three major service categories. The estimate for South Carolina is omitted due to the data-use agreement with the provider.

Figure A2: Comparison of Estimates Between MarketScan and HCCI Databases by Service Category



Notes: Plot shows price level estimates derived from the MarketScan database against the estimated derived from the HCCI database for inpatient, outpatient, and physician services. Price levels are estimated according to equations (1) and (2) in the text.

Figure A3: Aggregate Price Level Estimates Derived from MarketScan Data



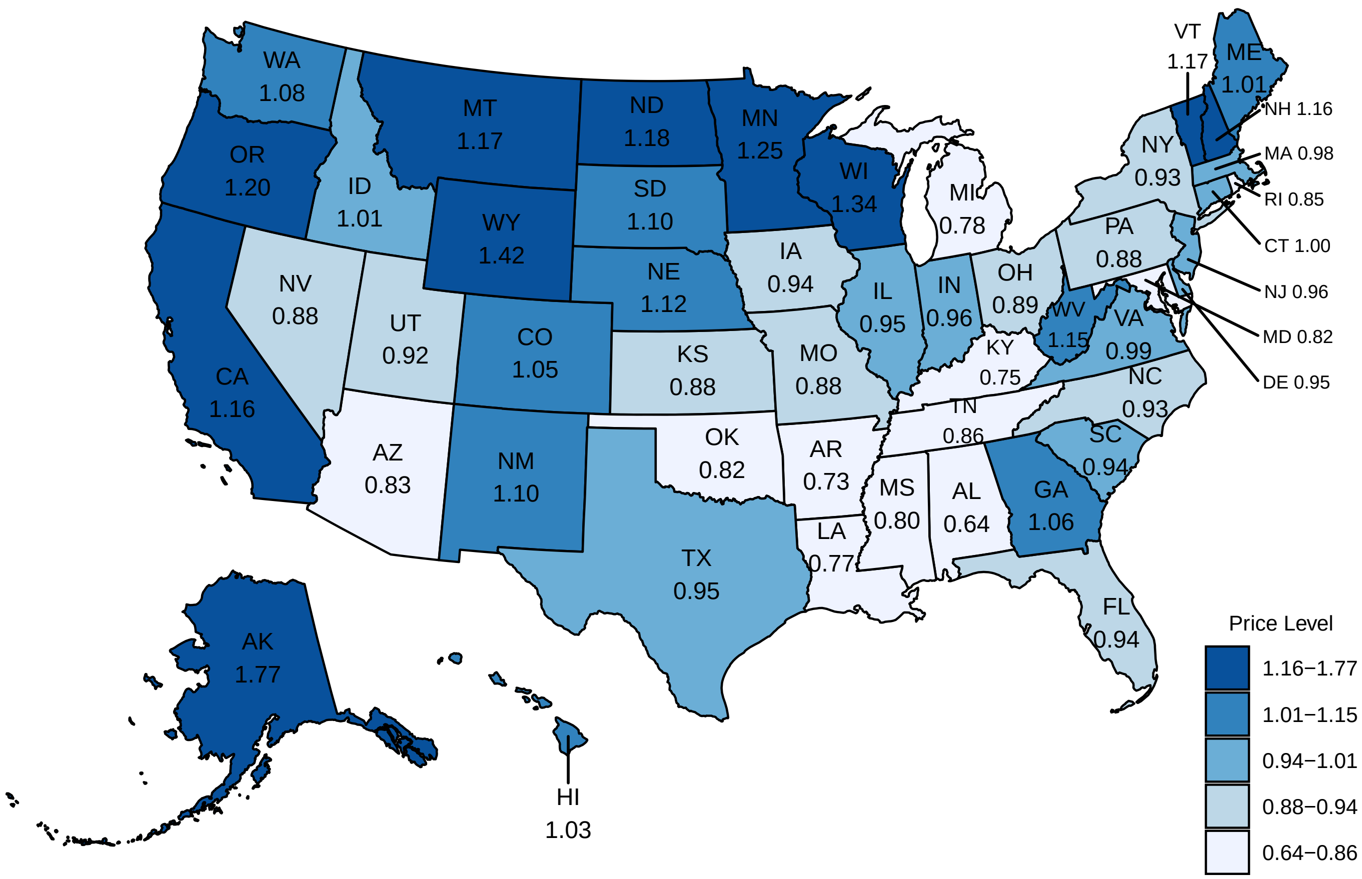
Notes: Map shows aggregate price level estimates for each state derived from the MarketScan data. Price levels are estimated according to equations (1) and (2) in the text for inpatient, outpatient, and physicians services. Aggregate price levels are then calculated as the expenditure-weighted average across the three major service categories. The estimate for South Carolina is omitted due to the data-use agreement with the provider.

Table A1: RPP Estimates for MarketScan Data

	Inpatient				Outpatient				Physician			
State	Coefficient	SE	Price Parity	Quintile	Coefficient	SE	Price Parity	Quintile	Coefficient	SE	Price Parity	Quintile
AK	0.169	0.009	1.29	5	0.099	0.009	1.56	5	0.515	0.007	1.65	5
AL	-0.507	0.003	0.65	1	-1.089	0.007	0.48	1	-0.156	0.003	0.84	1
AR	-0.441	0.004	0.70	1	-0.974	0.005	0.53	1	-0.082	0.004	0.91	2
AZ	-0.041	0.008	1.04	4	-0.384	0.009	0.96	3	-0.223	0.005	0.79	1
CA	0.204	0.004	1.33	5	-0.029	0.009	1.37	5	0.029	0.007	1.02	4
CO	0.010	0.007	1.10	4	-0.203	0.011	1.16	4	-0.060	0.003	0.93	3
CT	0.177	0.004	1.30	5	-0.538	0.008	0.83	2	0.008	0.003	1.00	4
DC	-0.035	0.006	1.05	4	-0.304	0.013	1.04	3	-0.058	0.008	0.93	3
DE	0.066	0.006	1.16	4	-0.354	0.007	0.99	3	-0.123	0.005	0.87	2
FL	-0.070	0.005	1.01	3	-0.273	0.011	1.08	3	-0.153	0.006	0.85	1
GA	-0.127	0.002	0.96	3	-0.211	0.012	1.15	4	-0.061	0.008	0.93	3
HI	-0.044	0.004	1.04	4	-0.685	0.014	0.71	1	0.156	0.007	1.15	5
IA	-0.361	0.007	0.76	1	-0.499	0.008	0.86	2	0.136	0.003	1.13	5
ID	-0.178	0.007	0.91	2	-0.536	0.009	0.83	2	0.047	0.003	1.03	4
IL	-0.253	0.006	0.84	1	-0.046	0.008	1.35	5	-0.041	0.006	0.95	3
IN	-0.005	0.005	1.08	4	-0.172	0.007	1.19	4	-0.198	0.002	0.81	1
KS	-0.272	0.008	0.83	1	-0.362	0.008	0.98	3	-0.080	0.003	0.91	2
KY	-0.354	0.005	0.76	1	-0.715	0.007	0.69	1	-0.215	0.003	0.80	1
LA	-0.355	0.003	0.76	1	-0.610	0.007	0.77	1	-0.151	0.004	0.85	1
MA	-0.073	0.007	1.01	3	-0.490	0.012	0.87	2	0.128	0.004	1.12	4
MD	-0.205	0.005	0.88	2	-0.610	0.008	0.77	1	-0.135	0.005	0.86	1
ME	0.108	0.004	1.21	5	-0.251	0.007	1.10	4	0.003	0.004	0.99	4
MI	-0.214	0.007	0.88	2	-1.038	0.011	0.50	1	-0.108	0.003	0.89	2
MN	-0.071	0.008	1.01	3	-0.263	0.011	1.09	4	0.261	0.006	1.28	5
MO	-0.322	0.005	0.79	1	-0.445	0.008	0.91	2	-0.160	0.003	0.84	1
MS	-0.532	0.003	0.64	1	-0.711	0.005	0.69	1	0.015	0.004	1.00	4
MT	-0.009	0.007	1.08	4	-0.278	0.007	1.07	3	0.200	0.004	1.21	5
NC	-0.224	0.006	0.87	2	-0.218	0.006	1.14	4	0.002	0.003	0.99	3
ND	-0.156	0.009	0.93	2	-0.433	0.013	0.92	3	0.398	0.008	1.47	5
NE	-0.117	0.008	0.97	3	-0.362	0.008	0.98	3	0.211	0.004	1.22	5
NH	-0.007	0.004	1.08	4	-0.151	0.009	1.22	4	0.018	0.003	1.00	4
NJ	0.132	0.006	1.24	5	-0.340	0.013	1.01	3	-0.049	0.009	0.94	3
NM	-0.156	0.005	0.93	2	-0.215	0.012	1.14	4	-0.067	0.004	0.92	2
NV	-0.132	0.006	0.95	2	-0.140	0.006	1.23	5	-0.205	0.006	0.80	1
NY	0.278	0.003	1.43	5	-0.570	0.009	0.80	1	-0.067	0.007	0.92	3
OH	-0.173	0.006	0.91	2	-0.383	0.009	0.96	3	-0.116	0.003	0.88	2
OK	-0.229	0.003	0.86	1	-0.614	0.007	0.77	1	-0.085	0.003	0.91	2
OR	0.198	0.010	1.32	5	-0.213	0.009	1.14	4	0.276	0.004	1.30	5
PA	-0.110	0.006	0.97	3	-0.464	0.009	0.89	2	-0.104	0.004	0.89	2
RI	0.012	0.005	1.10	4	-0.849	0.009	0.61	1	-0.190	0.005	0.82	1
SD	-0.148	0.007	0.94	2	-0.478	0.023	0.88	2	0.126	0.005	1.12	4
TN	-0.277	0.001	0.82	1	-0.502	0.011	0.86	2	-0.114	0.003	0.88	2
TX	-0.228	0.006	0.86	2	-0.113	0.011	1.26	5	-0.138	0.006	0.86	1
UT	-0.127	0.009	0.96	3	-0.482	0.006	0.87	2	-0.060	0.002	0.93	3
VA	-0.054	0.003	1.03	3	-0.267	0.008	1.08	4	-0.110	0.003	0.88	2
VT	0.070	0.004	1.16	5	-0.036	0.006	1.36	5	0.072	0.003	1.06	4
WA	0.189	0.007	1.31	5	-0.437	0.007	0.91	2	0.095	0.004	1.09	4
WI	-0.080	0.008	1.00	3	-0.134	0.009	1.24	5	0.367	0.005	1.43	5
WY	0.093	0.008	1.19	5	0.033	0.004	1.46	5	0.225	0.004	1.24	5
WV	NA	0.000	1.09	4	NA	0.000	1.41	5	NA	0.000	0.99	3

Notes: Table reports coefficient estimates and transformed price level estimates for inpatient, outpatient, and physician services derived from the MarketScan database. Coefficient estimates are based on equation (1) in the text and price level estimates are based on the transformation described by equation (2). The estimates for South Carolina is omitted due to the data-use agreement with the provider. Standard errors are clustered at the state level.

Figure A4: Aggregate RPP Estimates Derived from HCCI Data



Notes: Map shows aggregate price level estimates for each state derived from the HCCI data. Price levels are estimated according to equations (1) and (2) in the text for inpatient, outpatient, and physicians services. Aggregate price levels are then calculated as the expenditure-weighted average across the three major service categories.

Table A2: Price Level Estimates for HCCI Data

	Inpatient				Outpatient				Physician			
State	Coefficient	SE	Price Parity	Quintile	Coefficient	SE	Price Parity	Quintile	Coefficient	SE	Price Parity	Quintile
AK	0.164	0.014	1.36	5	0.206	0.031	1.74	5	0.746	0.012	2.04	5
AL	-0.6	0.004	0.64	1	-1.173	0.031	0.44	1	-0.193	0.007	0.80	1
AR	-0.509	0.012	0.70	1	-1.183	0.027	0.43	1	-0.008	0.007	0.96	3
AZ	-0.208	0.012	0.94	2	-0.521	0.013	0.84	2	-0.234	0.005	0.77	1
CA	0.07	0.007	1.24	5	-0.007	0.032	1.40	5	-0.021	0.007	0.95	3
CO	-0.057	0.014	1.09	4	-0.171	0.016	1.19	5	-0.034	0.006	0.93	3
CT	0.05	0.019	1.22	5	-0.548	0.012	0.82	2	0.045	0.005	1.01	4
DC	-0.058	0.011	1.09	4	-0.188	0.032	1.17	4	-0.05	0.013	0.92	3
DE	-0.004	0.010	1.15	4	-0.399	0.008	0.95	3	-0.147	0.009	0.84	1
FL	-0.161	0.010	0.98	3	-0.29	0.027	1.06	3	-0.145	0.006	0.84	1
GA	-0.17	0.007	0.98	3	-0.164	0.019	1.20	5	0.039	0.005	1.01	4
HI	0.135	0.021	1.32	5	-0.863	0.033	0.60	1	0.182	0.006	1.16	5
IA	-0.427	0.007	0.75	1	-0.428	0.015	0.92	3	0.101	0.007	1.07	4
ID	-0.096	0.010	1.05	3	-0.508	0.010	0.85	2	0.133	0.007	1.10	4
IL	-0.394	0.008	0.78	1	-0.24	0.022	1.11	4	-0.042	0.007	0.93	3
IN	-0.133	0.007	1.01	3	-0.222	0.013	1.13	4	-0.181	0.006	0.81	1
KS	-0.345	0.006	0.82	1	-0.533	0.009	0.83	2	-0.021	0.005	0.95	3
KY	-0.404	0.007	0.77	1	-0.68	0.010	0.72	1	-0.242	0.007	0.76	1
LA	-0.382	0.003	0.79	1	-0.771	0.031	0.65	1	-0.148	0.005	0.83	1
MA	-0.149	0.012	1.00	3	-0.493	0.023	0.86	2	0.086	0.007	1.05	4
MD	-0.261	0.004	0.89	2	-0.578	0.042	0.79	1	-0.182	0.010	0.81	1
ME	-0.001	0.013	1.16	4	-0.254	0.009	1.10	4	-0.115	0.008	0.86	2
MI	-0.267	0.007	0.89	2	-1.033	0.011	0.50	1	-0.053	0.008	0.92	3
MN	-0.054	0.007	1.10	4	-0.204	0.010	1.15	4	0.381	0.007	1.42	5
MO	-0.328	0.005	0.83	2	-0.393	0.011	0.95	3	-0.114	0.007	0.86	2
MS	-0.661	0.003	0.60	1	-0.785	0.018	0.64	1	0.069	0.006	1.04	4
MT	-0.05	0.009	1.10	4	-0.24	0.029	1.11	4	0.256	0.011	1.25	5
NC	-0.276	0.008	0.88	2	-0.274	0.010	1.07	3	-0.131	0.011	0.85	2
ND	-0.216	0.008	0.93	2	-0.434	0.013	0.91	2	0.456	0.015	1.53	5
NE	-0.143	0.013	1.00	3	-0.293	0.009	1.05	3	0.248	0.009	1.24	5
NH	-0.03	0.008	1.12	4	-0.014	0.010	1.39	5	0.038	0.009	1.00	4
NJ	-0.023	0.021	1.13	4	-0.442	0.017	0.91	2	-0.071	0.009	0.90	2
NM	-0.241	0.010	0.91	2	0.094	0.028	1.55	5	-0.074	0.013	0.90	2
NV	-0.354	0.020	0.81	1	-0.316	0.009	1.03	3	-0.163	0.006	0.82	1
NY	0.061	0.008	1.23	5	-0.715	0.029	0.69	1	-0.04	0.009	0.93	3
OH	-0.19	0.007	0.96	3	-0.441	0.011	0.91	2	-0.134	0.005	0.85	2
OK	-0.349	0.007	0.82	1	-0.579	0.031	0.79	1	-0.135	0.008	0.85	1
OR	0.106	0.010	1.29	5	-0.261	0.015	1.09	4	0.235	0.006	1.22	5
PA	-0.182	0.006	0.96	3	-0.473	0.010	0.88	2	-0.16	0.007	0.82	1
RI	0.015	0.009	1.17	5	-0.882	0.011	0.58	1	-0.133	0.008	0.85	2
SC	-0.253	0.007	0.90	2	-0.303	0.101	1.04	3	-0.094	0.006	0.88	2
SD	-0.157	0.006	0.99	3	-0.215	0.019	1.14	4	0.174	0.009	1.15	5
TN	-0.337	0.003	0.83	1	-0.56	0.008	0.81	2	-0.063	0.005	0.91	3
TX	-0.317	0.009	0.84	2	-0.182	0.027	1.18	4	-0.128	0.008	0.85	2
UT	-0.279	0.009	0.87	2	-0.362	0.019	0.98	3	-0.065	0.008	0.91	3
VA	-0.105	0.013	1.04	3	-0.229	0.011	1.12	4	-0.103	0.008	0.87	2
VT	0.051	0.008	1.22	5	-0.088	0.006	1.29	5	0.076	0.013	1.04	4
WA	0.106	0.010	1.29	5	-0.397	0.034	0.95	3	0.082	0.008	1.05	4
WI	-0.01	0.008	1.14	4	0.019	0.014	1.44	5	0.366	0.006	1.40	5
WY	0.093	0.009	1.27	5	0.139	0.013	1.62	5	0.338	0.015	1.36	5
WV		0.000	1.16	4		0.000	1.41	5		0.000	0.97	4

Notes: Table reports coefficient estimates and transformed price level estimates for inpatient, outpatient, and physician services derived from the HCCI database. Coefficient estimates are based on equation (1) in the text and price level estimates are based on the transformation described by equation (2). Standard errors are clustered at the state level.

Table A3: Average Price Level Estimates for MarketScan and HCCI Data

	Inpatient		Outpatient		Physician	
State	Coefficient	SE	Price Parity	Quintile	Coefficient	SE
AK	1.32	5	1.65	5	1.85	5
AL	0.64	1	0.46	1	0.82	1
AR	0.70	1	0.48	1	0.93	3
AZ	0.99	3	0.90	2	0.78	1
CA	1.29	5	1.39	5	0.98	4
CO	1.09	4	1.17	4	0.93	3
CT	1.26	5	0.82	2	1.00	4
DC	1.07	4	1.11	4	0.93	3
DE	1.16	4	0.97	3	0.85	1
FL	1.00	3	1.07	3	0.84	1
GA	0.97	3	1.17	4	0.97	3
HI	1.18	4	0.65	1	1.16	5
IA	0.76	1	0.89	2	1.10	4
ID	0.98	3	0.84	2	1.07	4
IL	0.81	1	1.23	5	0.94	3
IN	1.05	3	1.16	4	0.81	1
KS	0.82	1	0.91	2	0.93	3
KY	0.77	1	0.70	1	0.78	1
LA	0.78	1	0.71	1	0.84	1
MA	1.00	3	0.86	2	1.09	4
MD	0.89	2	0.78	1	0.83	1
ME	1.18	5	1.10	3	0.93	3
MI	0.88	2	0.50	1	0.90	2
MN	1.05	4	1.12	4	1.35	5
MO	0.81	1	0.93	3	0.85	1
MS	0.62	1	0.67	1	1.02	4
MT	1.09	4	1.09	3	1.23	5
NC	0.87	2	1.11	4	0.92	3
ND	0.93	2	0.92	2	1.50	5
NE	0.99	3	1.02	3	1.23	5
NH	1.10	4	1.30	5	1.00	4
NJ	1.18	5	0.96	3	0.92	3
NM	0.92	2	1.35	5	0.91	2
NV	0.88	2	1.13	4	0.81	1
NY	1.33	5	0.75	1	0.93	3
OH	0.94	2	0.94	3	0.86	2
OK	0.84	1	0.78	1	0.88	2
OR	1.30	5	1.12	4	1.26	5
PA	0.97	3	0.88	2	0.86	2
RI	1.14	4	0.59	1	0.83	1
SC	0.94	2	1.18	4	0.90	2
SD	0.96	3	1.01	3	1.14	5
TN	0.82	1	0.83	2	0.89	2
TX	0.85	2	1.22	5	0.86	2
UT	0.92	2	0.93	2	0.92	2
VA	1.04	3	1.10	4	0.88	2
VT	1.19	5	1.33	5	1.05	4
WA	1.30	5	0.93	3	1.07	4
WI	1.07	4	1.34	5	1.41	5
WV	1.12	4	1.41	5	0.98	4
WY	1.23	5	1.54	5	1.30	5

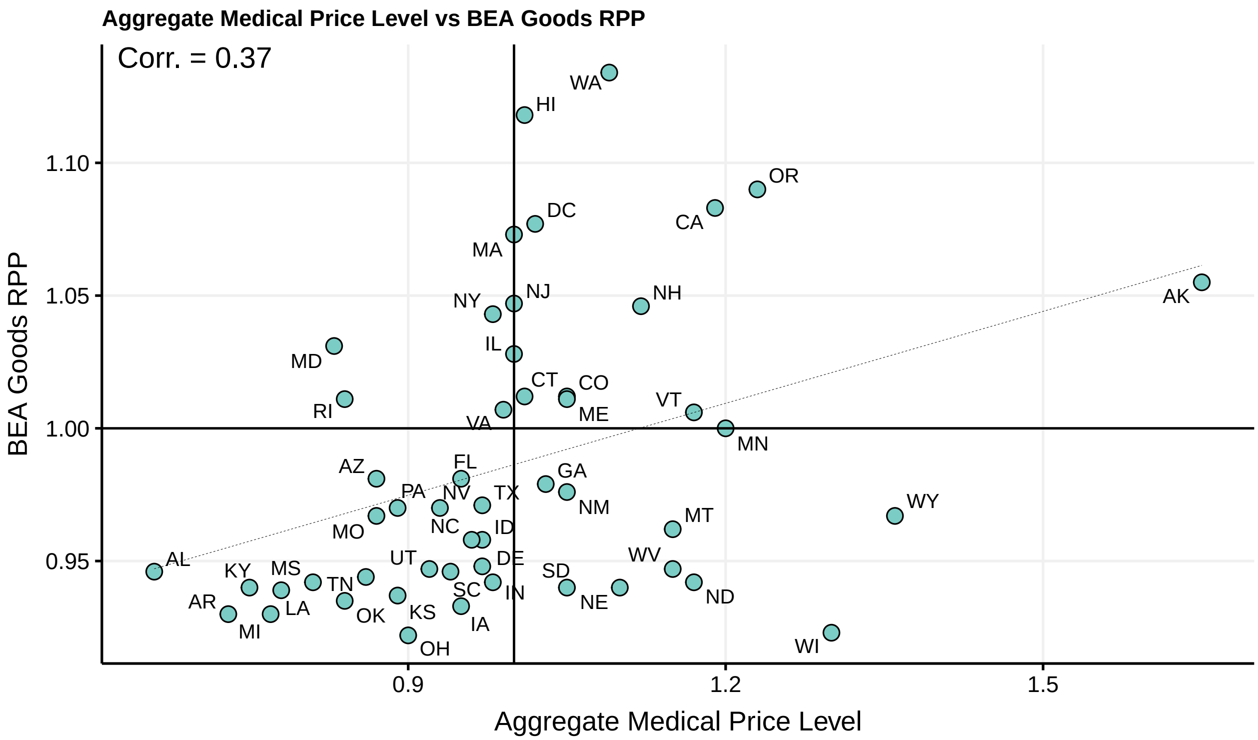
Notes: Table reports price level estimates for inpatient, outpatient, and physician services, averaged across the MarketScan-based and HCCI-based estimates. Coefficient estimates are based on equation (1) in the text and RPP estimates are based on the transformation described by equation (2).

Table A4: Correlation Across Service Types

	IP	OP	Phys.	Phys. E&M	Phys. Imag.	Phys. Proc	Phys. Test	Phys. Treat.	OP E&M	OP Imag.	OP Proc.	OP Test	OP Treat.
IP	1.00	0.47	0.39	0.45	0.42	0.38	0.37	0.23	0.74	0.53	0.62	0.34	0.45
OP	0.47	1.00	0.41	0.44	0.57	0.47	0.37	0.34	0.49	0.92	0.70	0.95	0.85
Phys.	0.39	0.41	1.00	0.94	0.88	0.92	0.92	0.91	0.15	0.27	0.45	0.37	0.50
Phys. E&M	0.45	0.44	0.94	1.00	0.83	0.90	0.77	0.79	0.26	0.32	0.55	0.40	0.48
Phys. Imag.	0.42	0.57	0.88	0.83	1.00	0.94	0.80	0.76	0.23	0.44	0.52	0.51	0.63
Phys. Proc	0.38	0.47	0.92	0.90	0.94	1.00	0.80	0.82	0.22	0.37	0.54	0.42	0.52
Phys. Test	0.37	0.37	0.92	0.77	0.80	0.80	1.00	0.81	0.10	0.23	0.31	0.33	0.42
Phys. Treat.	0.23	0.34	0.91	0.79	0.76	0.82	0.81	1.00	-0.01	0.21	0.35	0.27	0.50
OP E&M	0.74	0.49	0.15	0.26	0.23	0.22	0.10	-0.01	1.00	0.56	0.56	0.36	0.39
OP Imag.	0.53	0.92	0.27	0.32	0.44	0.37	0.23	0.21	0.56	1.00	0.69	0.85	0.72
OP Proc.	0.62	0.70	0.45	0.55	0.52	0.54	0.31	0.35	0.56	0.69	1.00	0.62	0.60
OP Test	0.34	0.95	0.37	0.40	0.51	0.42	0.33	0.27	0.36	0.85	0.62	1.00	0.70
OP Treat.	0.45	0.85	0.50	0.48	0.63	0.52	0.42	0.50	0.39	0.72	0.60	0.70	1.00

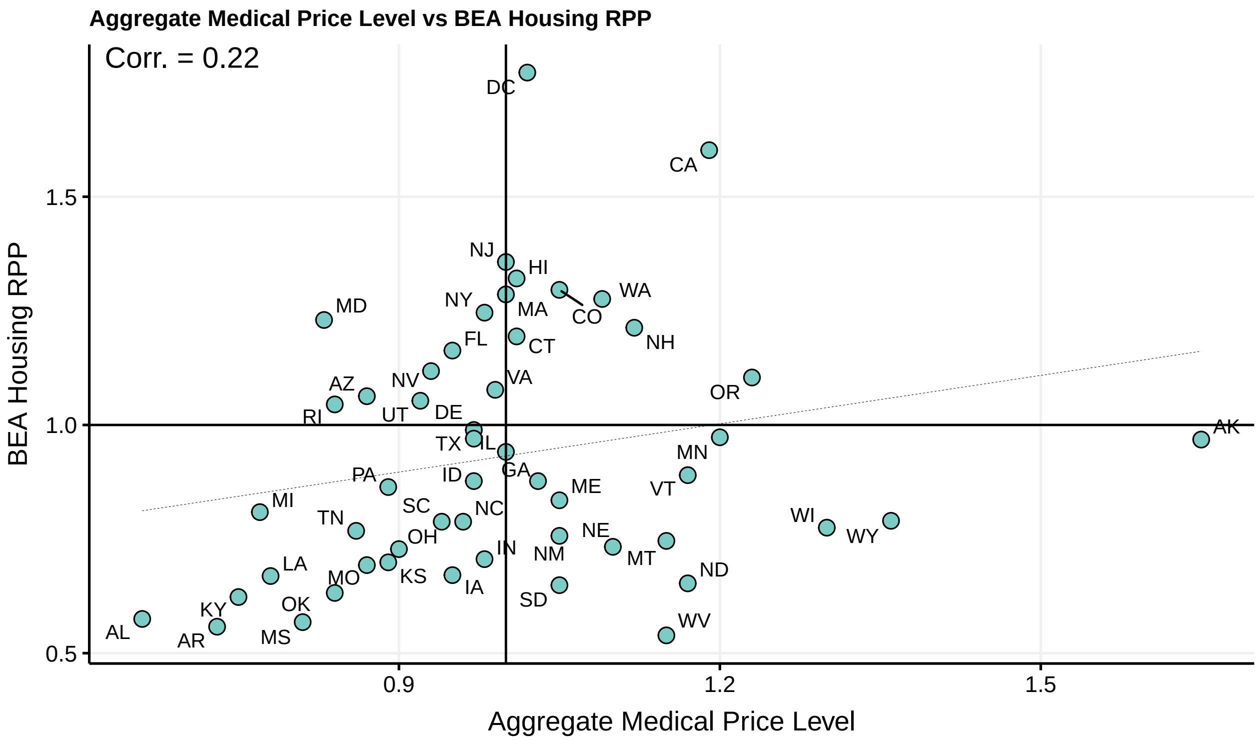
Notes: Table reports the correlation matrix of price level estimates for the five most common subcategories of outpatient and physician services: E&M, imaging, procedures, tests, and treatments. Price level estimates are computed separately for each sub-category and outpatient/physician designation and the correlation is computed for the state-level estimates. Service sub-categories are identified using the Restructured BETOS Classification System (RBCS), released by CMS.

Figure A5: Comparison of Medical Price Levels with BEA Goods RPPs



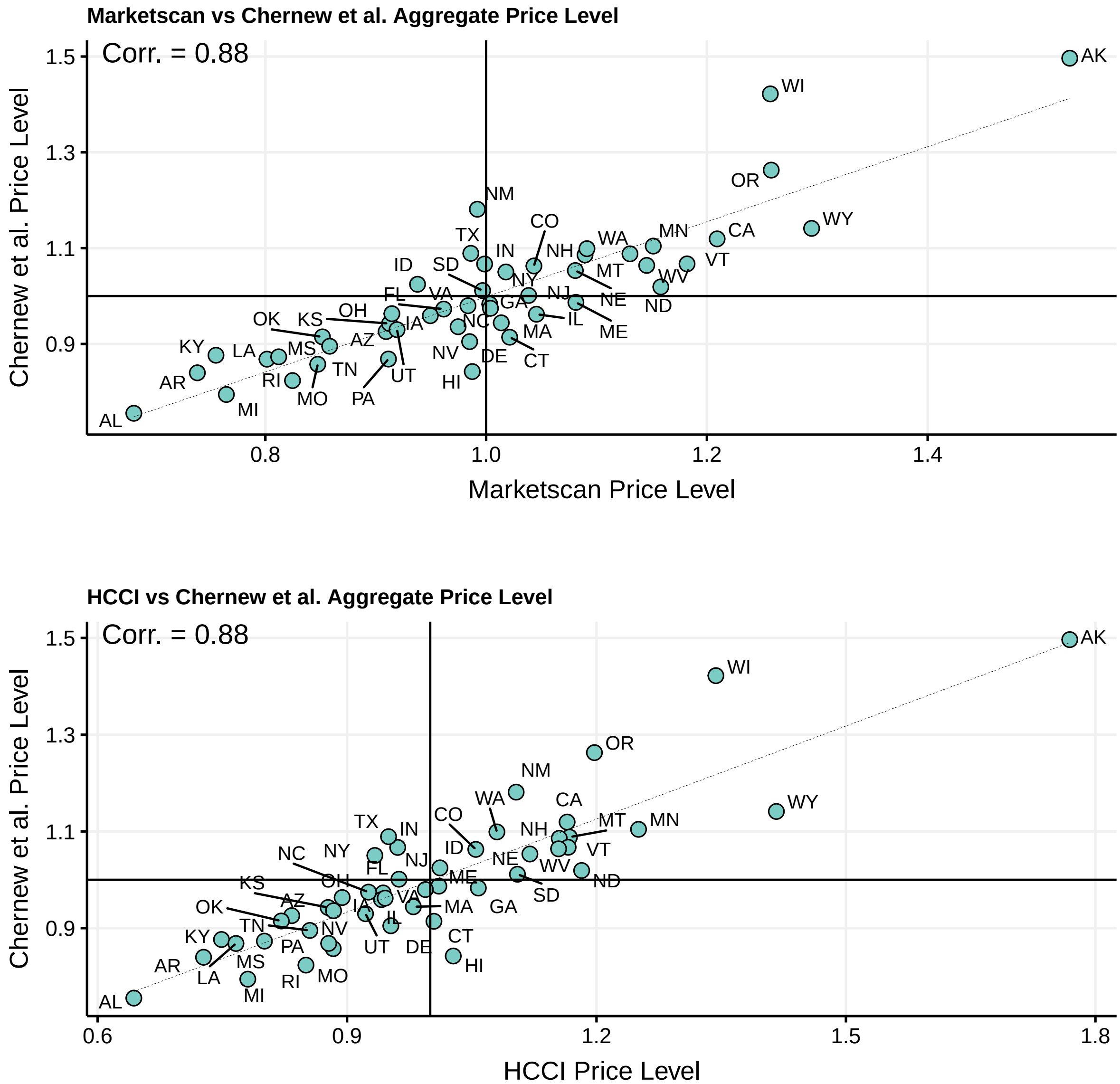
Notes: Figure plots aggregate medical price level estimates for each state on the x-axis against the BEA all goods RPP estimates on the y-axis. The aggregate medical price level estimates here represent the average of the MarketScan-based and HCCI-based estimates, which are each computed as the expenditure-weighted average of inpatient, outpatient, and professional price level estimates. See https://www.bea.gov/data/prices-inflation/regional-price-parities-state-and-metro-area for the current estimates and details on data and methodology.

Figure A6: Comparison of Medical Price Levels with BEA Housing RPPs



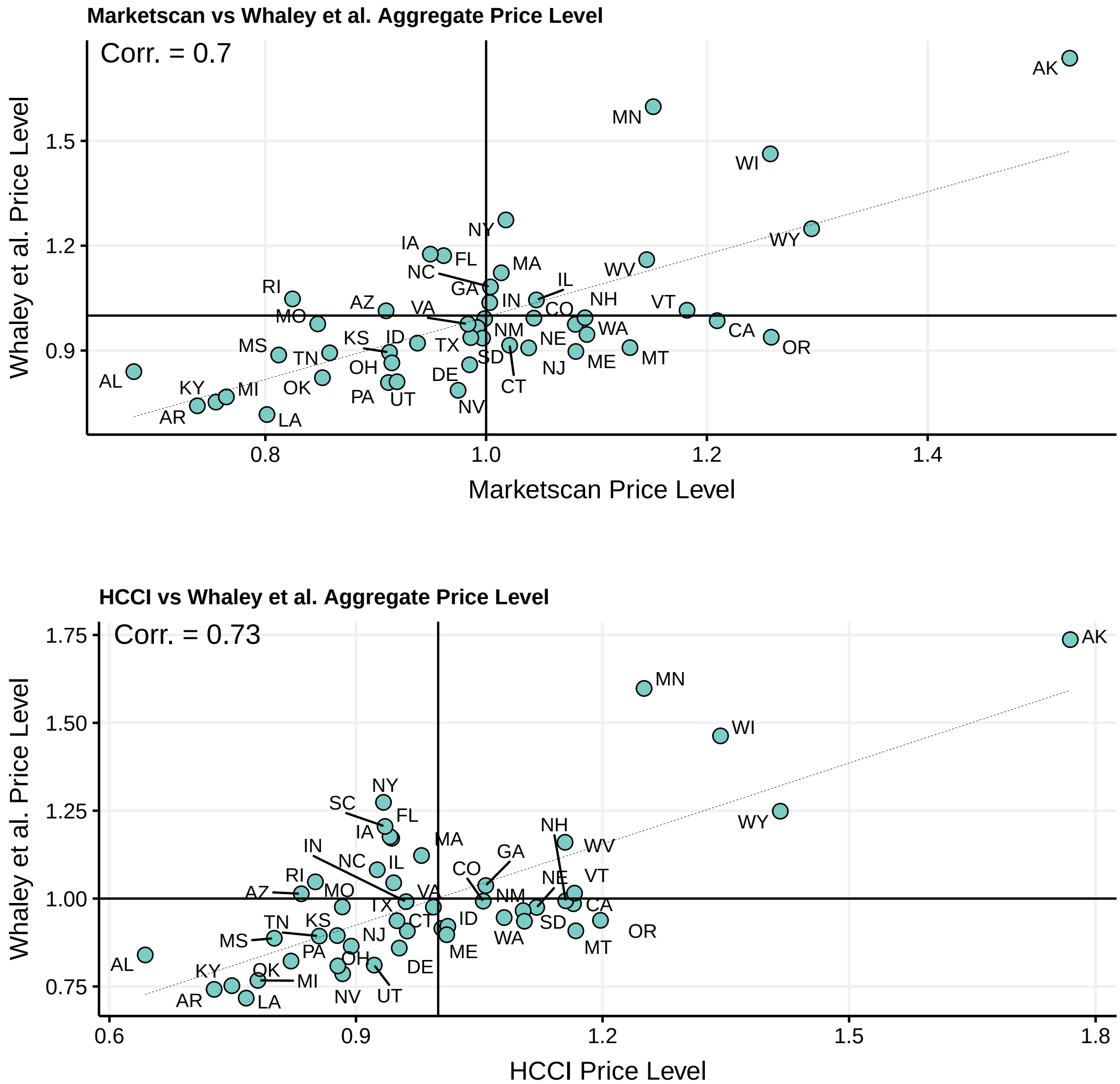
Notes: Figure plots aggregate medical price level estimates for each state on the x-axis against the BEA housing RPP estimates on the y-axis. The aggregate medical price level estimates here represent the average of the MarketScan-based and HCCI-based estimates, which are each computed as the expenditure-weighted average of inpatient, outpatient, and professional price level estimates. See https://www.bea.gov/data/prices-inflation/regional-price-parities-state-and-metro-area for the current estimates and details on data and methodology.

Figure A7: Comparison of MarketScan and HCCI Estimates to Chernew et al. (2020) Estimates



Notes: Top panel presents the aggregate price level estimates derived from the MarketScan data on the x-axis and the transformed estimates from Chernew et al. (2020). The Chernew et al. (2020) estimates for inpatient, outpatient, and physician services are normalized by their respective group means and the averaged using the expenditure weights used in this paper to generate a comparable set of estimates. The bottom panel depicts the analogous plot for the price level estimates derived from the HCCI database.

Figure A8: Comparison of MarketScan and HCCI Estimates to Whaley et al. (2020) Estimates



Notes: Top panel presents the aggregate price level estimates derived from the MarketScan data on the x-axis and the transformed estimates from Whaley et al. (2020). The Whaley et al. (2020) estimates for inpatient, outpatient, and physician services are normalized by their respective group means and the averaged using the expenditure weights used in this paper to generate a comparable set of estimates. The bottom panel depicts the analogous plot for the price level estimates derived from the HCCI database.

Table A5: Summary Statistics of Sample

Data Set	Mean Price	Total Volume	Unique Procedures
Marketscan Inpatient	22525.44	3,465,043	771
Marketscan Outpatient	367.71	264,026,812	5,327
Marketscan Professional	100.27	1,284,266,816	7,304
HCCI Inpatient	22695.79	8,246,022	787
HCCI Outpatient	297.63	683,931,464	4,691
HCCI Professional	91.80	3,081,153,190	6,485

Notes: Table shows summary statistics for both the MarketScan-based and HCCI-based samples used for all analyses in this paper.

Table A6: Coefficient and Price Level Estimates Based on Full MarketScan Claim-line Data for 2018

	Outpatient				Physician			
State	Coefficient	SE	Price Parity	Quintile	Coefficient	SE	Price Parity	Quintile
AK	0.123	0.008	1.59	5	0.528	0.007	1.67	5
AL	-1.074	0.006	0.48	1	-0.155	0.003	0.84	1
AR	-0.959	0.005	0.54	1	-0.079	0.004	0.91	2
AZ	-0.375	0.009	0.96	3	-0.220	0.005	0.79	1
CA	-0.022	0.008	1.37	5	0.028	0.007	1.01	4
CO	-0.200	0.010	1.15	4	-0.058	0.003	0.93	3
CT	-0.548	0.006	0.81	2	0.010	0.004	1.00	4
DC	-0.301	0.013	1.04	3	-0.062	0.008	0.93	3
DE	-0.340	0.006	1.00	3	-0.127	0.005	0.87	2
FL	-0.264	0.011	1.08	3	-0.155	0.005	0.84	1
GA	-0.208	0.011	1.14	4	-0.059	0.007	0.93	3
HI	-0.663	0.014	0.72	1	0.140	0.009	1.13	5
IA	-0.513	0.013	0.84	2	0.134	0.006	1.13	4
ID	-0.535	0.009	0.82	2	0.063	0.003	1.05	4
IL	-0.031	0.007	1.36	5	-0.037	0.006	0.95	3
IN	-0.145	0.006	1.21	4	-0.188	0.002	0.82	1
KS	-0.351	0.007	0.99	3	-0.072	0.003	0.92	2
KY	-0.679	0.007	0.71	1	-0.212	0.004	0.80	1
LA	-0.648	0.006	0.73	1	-0.158	0.004	0.84	1
MA	-0.487	0.011	0.86	2	0.124	0.003	1.12	4
MD	-0.602	0.008	0.77	1	-0.136	0.005	0.86	1
ME	-0.244	0.006	1.10	4	0.003	0.004	0.99	4
MI	-1.031	0.010	0.50	1	-0.107	0.003	0.89	2
MN	-0.240	0.010	1.10	4	0.264	0.006	1.28	5
MO	-0.449	0.008	0.90	2	-0.160	0.002	0.84	1
MS	-0.697	0.005	0.70	1	0.017	0.004	1.00	4
MT	-0.250	0.006	1.09	4	0.201	0.003	1.21	5
NC	-0.215	0.006	1.13	4	-0.003	0.003	0.98	3
ND	-0.432	0.012	0.91	3	0.397	0.006	1.47	5
NE	-0.341	0.007	1.00	3	0.216	0.004	1.22	5
NH	-0.159	0.008	1.20	4	0.027	0.003	1.01	4
NJ	-0.325	0.012	1.01	3	-0.053	0.009	0.94	3
NM	-0.179	0.010	1.17	4	-0.066	0.004	0.92	3
NV	-0.135	0.005	1.23	5	-0.203	0.006	0.81	1
NY	-0.555	0.008	0.81	1	-0.060	0.007	0.93	3
OH	-0.360	0.008	0.98	3	-0.113	0.004	0.88	2
OK	-0.574	0.007	0.79	1	-0.089	0.003	0.90	2
OR	-0.199	0.008	1.15	4	0.277	0.004	1.30	5
PA	-0.453	0.008	0.89	2	-0.103	0.004	0.89	2
RI	-0.849	0.008	0.60	1	-0.193	0.004	0.81	1
SD	-0.476	0.021	0.87	2	0.137	0.005	1.13	5
TN	-0.511	0.011	0.84	2	-0.113	0.004	0.88	2
TX	-0.105	0.010	1.26	5	-0.135	0.006	0.86	1
UT	-0.484	0.006	0.86	2	-0.061	0.002	0.93	3
VA	-0.254	0.007	1.09	3	-0.107	0.003	0.89	2
VT	-0.035	0.006	1.35	5	0.069	0.003	1.06	4
WA	-0.447	0.006	0.90	2	0.091	0.004	1.08	4
WI	-0.121	0.008	1.24	5	0.362	0.004	1.42	5
WY	0.028	0.003	1.44	5	0.227	0.004	1.24	5
WV	NA	0.000	1.40	5	NA	0.000	0.99	3

Notes: Table reports coefficient estimates and transformed price level estimates for outpatient and professional services. These estimates are based on the full claim-line-level data from MarketScan for 2018, rather than the collapsed-and-weighted sample from 2018-2022. Standard errors are clustered at the state level. The estimate for South Carolina is omitted due to the data-use agreement with the provider. Standard errors are clustered at the state level.

Table A7: Coefficient and Price Level Estimates (Poisson GLM Specification)

	Inpatient				Outpatient				Physician			
State	Coefficient	SE	Price Parity	Quintile	Coefficient	SE	Price Parity	Quintile	Coefficient	SE	Price Parity	Quintile
AK	0.240	0.017	1.37	5	0.165	0.060	1.47	5	0.617	0.034	1.71	5
AL	-0.383	0.047	0.73	1	-0.914	0.020	0.50	1	-0.155	0.023	0.79	1
AR	-0.426	0.009	0.70	1	-0.757	0.034	0.59	1	-0.062	0.018	0.87	2
AZ	-0.036	0.011	1.04	4	-0.300	0.056	0.92	2	-0.094	0.029	0.84	1
CA	0.270	0.027	1.41	5	0.066	0.045	1.33	5	0.133	0.028	1.06	4
CO	0.060	0.023	1.14	5	-0.083	0.027	1.15	4	0.057	0.020	0.98	3
CT	0.129	0.009	1.22	5	-0.184	0.021	1.04	3	0.149	0.027	1.07	4
DC	-0.055	0.010	1.02	3	-0.174	0.037	1.05	4	0.063	0.021	0.99	3
DE	0.025	0.009	1.10	4	-0.160	0.051	1.06	4	-0.059	0.020	0.87	2
FL	-0.031	0.016	1.04	4	-0.188	0.055	1.03	3	-0.047	0.035	0.88	2
GA	-0.042	0.021	1.03	3	-0.185	0.040	1.04	3	0.058	0.025	0.98	3
HI	-0.025	0.015	1.05	4	-0.347	0.062	0.88	2	0.123	0.026	1.05	4
IA	-0.412	0.014	0.71	1	-0.331	0.025	0.90	2	0.158	0.015	1.08	4
ID	-0.139	0.035	0.94	2	-0.336	0.015	0.89	2	0.074	0.022	1.00	3
IL	-0.211	0.024	0.87	2	-0.109	0.027	1.12	4	0.055	0.018	0.98	3
IN	0.009	0.013	1.09	4	-0.009	0.029	1.24	5	-0.137	0.016	0.81	1
KS	-0.190	0.029	0.89	2	-0.303	0.033	0.92	2	-0.078	0.018	0.86	1
KY	-0.293	0.007	0.80	1	-0.380	0.025	0.85	1	-0.168	0.017	0.78	1
LA	-0.330	0.012	0.77	1	-0.386	0.037	0.85	1	-0.101	0.016	0.84	1
MA	-0.073	0.020	1.00	3	-0.350	0.030	0.88	2	0.238	0.034	1.17	5
MD	-0.226	0.007	0.86	2	-0.457	0.024	0.79	1	-0.042	0.021	0.89	2
ME	0.119	0.013	1.21	5	-0.176	0.022	1.05	4	0.038	0.019	0.96	3
MI	-0.270	0.009	0.82	1	-0.523	0.018	0.74	1	-0.065	0.019	0.87	1
MN	-0.061	0.016	1.01	3	-0.232	0.017	0.99	2	0.376	0.027	1.35	5
MO	-0.237	0.021	0.85	1	-0.307	0.020	0.92	2	-0.096	0.019	0.84	1
MS	-0.460	0.022	0.68	1	-0.632	0.041	0.66	1	-0.022	0.021	0.91	2
MT	-0.011	0.013	1.06	4	-0.169	0.039	1.05	4	0.158	0.020	1.08	4
NC	-0.190	0.018	0.89	2	-0.196	0.019	1.03	3	0.114	0.022	1.04	4
ND	-0.201	0.012	0.88	2	-0.396	0.040	0.84	1	0.311	0.019	1.26	5
NE	-0.145	0.024	0.93	2	-0.219	0.032	1.00	3	0.187	0.019	1.12	5
NH	0.007	0.015	1.08	4	-0.057	0.028	1.18	5	0.174	0.023	1.10	5
NJ	0.050	0.016	1.13	4	-0.097	0.019	1.13	4	0.095	0.028	1.02	4
NM	-0.139	0.016	0.94	2	-0.181	0.030	1.04	4	0.055	0.016	0.98	3
NV	-0.055	0.028	1.02	3	-0.117	0.058	1.11	4	-0.091	0.028	0.84	1
NY	0.231	0.023	1.36	5	-0.226	0.021	1.00	3	0.094	0.028	1.02	4
OH	-0.096	0.010	0.98	3	-0.219	0.017	1.00	3	-0.074	0.014	0.86	1
OK	-0.253	0.008	0.84	1	-0.420	0.035	0.82	1	-0.090	0.020	0.85	1
OR	0.159	0.011	1.26	5	-0.041	0.032	1.20	5	0.313	0.023	1.27	5
PA	-0.108	0.008	0.97	3	-0.223	0.027	1.00	3	-0.032	0.017	0.90	2
RI	-0.063	0.006	1.01	3	-0.452	0.043	0.79	1	-0.033	0.025	0.89	2
SD	-0.236	0.015	0.85	1	-0.285	0.036	0.94	2	0.183	0.019	1.11	5
TN	-0.243	0.009	0.84	1	-0.502	0.022	0.76	1	0.010	0.026	0.93	3
TX	-0.116	0.025	0.96	2	-0.135	0.036	1.09	4	-0.010	0.030	0.92	3
UT	-0.138	0.019	0.94	2	-0.301	0.031	0.92	2	-0.011	0.019	0.92	2
VA	-0.038	0.013	1.04	4	-0.183	0.034	1.04	3	-0.021	0.015	0.91	2
VT	0.061	0.024	1.14	5	0.011	0.018	1.26	5	0.132	0.031	1.06	4
WA	0.134	0.011	1.23	5	-0.026	0.022	1.22	5	0.161	0.023	1.09	4
WI	-0.065	0.028	1.01	3	-0.071	0.018	1.16	5	0.445	0.027	1.44	5
WY	0.075	0.031	1.16	5	0.018	0.024	1.27	5	0.242	0.025	1.18	5
WV		0.000	1.08	4		0.000	1.25	5		0.000	0.93	3

Notes: Table reports coefficient estimates and transformed price level estimates for inpatient, outpatient, and professional services based on a Poisson GLM specification. The models are estimated on the MarketScan data covering 2018-2022. Standard errors are clustered at the state level. The estimates for South Carolina is omitted due to the data-use agreement with the provider. Standard errors are clustered at the state level.

Table A8: Coefficient and Price Level Estimates Based on Full MarketScan Claim-line Data for 2018

	Outpatient				Physician			
State	Coefficient	SE	Price Parity	Quintile	Coefficient	SE	Price Parity	Quintile
AK	0.279	0.009	1.67	5	0.671	0.008	1.82	5
AL	-0.938	0.010	0.50	1	-0.136	0.005	0.81	1
AR	-0.761	0.007	0.59	1	-0.049	0.003	0.89	2
AZ	-0.349	0.010	0.89	2	-0.115	0.006	0.83	1
CA	-0.037	0.007	1.22	5	0.068	0.008	1.00	4
CO	-0.106	0.008	1.14	4	0.037	0.003	0.96	3
CT	-0.208	0.008	1.03	3	0.131	0.006	1.06	4
DC	-0.119	0.012	1.12	4	0.061	0.006	0.99	4
DE	-0.144	0.008	1.10	4	-0.052	0.005	0.88	2
FL	-0.325	0.006	0.91	2	-0.086	0.004	0.85	1
GA	-0.309	0.009	0.93	2	0.010	0.005	0.94	3
HI	-0.126	0.014	1.11	4	0.183	0.006	1.12	4
IA	-0.321	0.009	0.92	2	0.163	0.003	1.09	4
ID	-0.305	0.014	0.93	3	0.084	0.004	1.01	4
IL	-0.171	0.006	1.07	4	0.033	0.004	0.96	3
IN	-0.037	0.006	1.22	5	-0.151	0.003	0.80	1
KS	-0.346	0.006	0.90	2	-0.079	0.004	0.86	1
KY	-0.432	0.007	0.82	1	-0.181	0.002	0.78	1
LA	-0.388	0.010	0.86	2	-0.115	0.002	0.83	1
MA	-0.386	0.009	0.86	2	0.219	0.004	1.16	5
MD	-0.514	0.011	0.76	1	-0.068	0.004	0.87	2
ME	-0.191	0.005	1.05	4	0.043	0.003	0.97	3
MI	-0.500	0.010	0.77	1	-0.070	0.005	0.87	2
MN	-0.233	0.009	1.00	3	0.373	0.003	1.35	5
MO	-0.397	0.005	0.85	1	-0.119	0.003	0.83	1
MS	-0.675	0.006	0.64	1	0.001	0.005	0.93	3
MT	-0.101	0.006	1.14	5	0.184	0.006	1.12	5
NC	-0.267	0.006	0.97	3	0.093	0.003	1.02	4
ND	-0.332	0.008	0.91	2	0.328	0.008	1.29	5
NE	-0.231	0.007	1.00	3	0.201	0.003	1.14	5
NH	-0.052	0.006	1.20	5	0.173	0.003	1.11	4
NJ	-0.168	0.011	1.07	4	0.051	0.012	0.98	3
NM	-0.118	0.007	1.12	4	0.060	0.004	0.99	3
NV	-0.116	0.008	1.13	4	-0.100	0.005	0.84	1
NY	-0.515	0.010	0.76	1	0.025	0.013	0.95	3
OH	-0.289	0.006	0.95	3	-0.107	0.003	0.84	1
OK	-0.420	0.012	0.83	1	-0.087	0.003	0.85	1
OR	-0.034	0.007	1.22	5	0.316	0.005	1.28	5
PA	-0.306	0.006	0.93	2	-0.070	0.004	0.87	2
RI	-0.410	0.008	0.84	1	-0.018	0.004	0.91	2
SC	-0.196	0.008	1.04	3	-0.037	0.003	0.90	2
SD	-0.204	0.011	1.03	3	0.198	0.003	1.13	5
TN	-0.580	0.007	0.71	1	-0.011	0.002	0.92	3
TX	-0.224	0.006	1.01	3	-0.064	0.005	0.87	2
UT	-0.320	0.006	0.92	2	-0.020	0.003	0.91	2
VA	-0.247	0.007	0.99	3	-0.042	0.003	0.89	2
VT	0.094	0.005	1.39	5	0.156	0.003	1.09	4
WA	-0.042	0.011	1.21	5	0.149	0.004	1.08	4
WI	-0.137	0.006	1.10	4	0.431	0.004	1.43	5
WY	0.105	0.005	1.41	5	0.282	0.005	1.23	5
WV	NA	0.000	1.27	5	NA	0.000	0.93	3

Notes: Table reports coefficient estimates and transformed price level estimates for outpatient and physician services derived from the MarketScan database. Coefficient estimates are based on equation (1) in the text and price level estimates are based on the transformation described by equation (2). In this specification, observations are weighted by share of total spending, rather than by total volume. The estimates for South Carolina is omitted due to the data-use agreement with the provider. Standard errors are clustered at the state level.