Comparison of Commercial & Medicare Professional Service Prices

Methodology Document

Introduction

This project studies how the prices paid by commercial insurers for professional (clinician) services differ from Medicare rates at a local level across the country. We measure commercial prices using Health Care Cost Institute (HCCI) commercial claims data. We measure Medicare prices using a combination of Medicare Physician Fee Schedule (PFS) and Medicare Fee-for-Service (FFS) claims. This allows us to see how different methods of computing Medicare prices impacts our analysis. We compare the prices paid for the same services at both the core-based statistical area (CBSA) and state level. We do so both across and within the same types of providers (PCPs, Non-PCPs).

This document describes how we use HCCI, Medicare FFS, and Medicare PFS data to compare commercial and Medicare prices. From HCCI data, we construct a sample containing the health care claims for individuals receiving commercial health insurance through their employer in 2017 residing in one of our 271 sample metro areas across 48 states and Washington, DC. These data contain more than 210 million claims in 2017 from over 25 million member years. Using our analytic sample of claims, we construct measures of average commercial professional service prices, and average Medicare professional service prices. We use a standardized market basket of common services observed in our sample of commercial claims. We subsequently compare the ratio of the average commercial to Medicare professional service price both across provider types and within provider types at the metro area and state level.

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1. Constructing an Analytic Sample of Commercial Claims

1. 1. Defining a Sample Population of Members

Using monthly enrollment data, we constructed a sample of member month observations. For a member month to be included in the sample population, the member needed to be under the age of 65 and have an identifiable age and gender in the data. We also limited our sample of member months to individuals with an identifiable five-digit ZIP code.

Additionally, we restricted our analysis to member months for individuals with coverage through an employer-sponsored insurance (ESI) plan. Specifically, we limited our sample to individuals with either small or large group commercial insurance coverage with one of the following plan types: Health Maintenance Organization, Preferred Provider Organization, Point of Service Plan, or Exclusive Provider Organization.

1. 2. Assigning Member Months to Core-Based Statistical Areas

Our geographic unit of analysis is the CBSA. Using monthly enrollment data, we crosswalk the five-digit ZIP code associated with each member month to a CBSA. To construct our geographic crosswalk, we use a five-digit ZIP code to CBSA crosswalk constructed by the United States Department of Housing and Urban Development (HUD).[1] In cases where a ZIP code is assigned to multiple CBSAs, we assign ZIP codes to the CBSA with the greatest "Total Ratio" followed by the greatest "Residential Ratio". We also cross walked five-digit ZIP codes to states using the National Bureau of Economic Research's SSA to FIPS State and County Crosswalk."[2]

Member months associated with ZIP codes that do not match either a CBSA or state from the crosswalk were omitted. Member months whose ZIP codes matched a state but not a CBSA were assigned to the CBSA "Rest of State – [State Abbreviation]". For the state-level analysis, we assign each five-digit ZIP code to a single state based on the state with the largest share of member months observed in our sample within each ZIP code.

1. 3. Aggregating Claim Lines to Claim Level

Prior to aggregating claim lines, we link enrollment information such that we include only claims associated with our sample population, so each line includes needed member information, such as ZIP code. We merge the enrollment information with claim lines based on the month associated with each claim line. We excluded all claim lines associated with member months that were not part of our sample population. Using both the member and provider ZIP code within each claim line, we assign the member[3] and provider to the CBSA and state associated with the five-digit ZIP code, respectively.

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[1] Specifically, we use the crosswalk titled "ZIP-CBSA" from the 4th quarter of 2013. Available online from the HUD website: https://www.huduser.gov/portal/datasets/usps_crosswalk.html. We use the 2013 data to maintain consistency between this work and the Healthy Marketplace Index report: https://healthcostinstitute.org/research/hmi

[2] We used the 2013"SSA to FIPS State and County Crosswalk" available online from the NBER website: https://data.nber.org/data/ssa-fips-state-county-crosswalk.html

[3] Member locality is used to ensure we meet our masking rule criteria.

We define a service claim as all claim lines for an individual with common dates and service codes.[4] For this project, we limited our analysis to only professional claims.

When aggregating claim lines to the service claim level, we summed all allowed amounts (the actual amount paid to for the claim) from each claim line associated with a particular service claim. Allowed amounts comprise both the insurer's payment to a provider as well as any out-of-pocket spending (copayments, coinsurance, or deductibles) by the patient. We define the sum of the these allowed amounts as the total spending on a service claim.

1. 4. Cleaning Sample Claims and Omitting Outliers

We applied additional cleaning procedures to our sample of professional service claims to remove outlier claims. Our unit of analysis for professional claims was the visit or procedure level defined by the combination of year, patient, visit dates, current procedural terminology (CPT) code, CPT modifier code level.

Assigning Each Claim to Providers

We identified the provider associated with each claim by encrypted National Plan and Provider Enumeration System Identifiers (NPI). Each claim was assigned a single NPI based off the most common non-missing NPI value among the visit claim lines. In cases where the most common NPI value for a claim was the same for two or more non-missing NPIs, we assigned to the claim the NPI associated with a greater allowed amount, out-of-pocket payment, or charges (in that order). If a claim contained all missing NPI values, we assigned it an NPI of "blank". We subsequently dropped all claims with "blank" NPIs.

Excluding Claims with Missing or Invalid Information

Each provider in our data has an attached five-digit ZIP code; we exclude from this analysis claims associated with multiple provider ZIP codes. We also omitted claims with a provider ZIP code that was not associated with one of the 50 states or Washington, DC. We excluded claims if the CPT code was missing because we could not assign it a service code. We omit all professional claims which do not have valid place-of-service (POS) codes.

Omitting Outlier Claims

We also excluded claims with charges or allowed amounts less than 1 dollar. Claims were excluded if the effective rate (allowed amount divided by charge) was less than 20%. Of the remaining claims, we omitted those with lowest 1% of allowed amounts. For claims with the highest 1% of allowed amounts, we replaced the actual allowed amount for each claim with the allowed amount of the 99th percentile within each year. We excluded claims with lengths of stay greater than one day (different first and last dates) and claims with units less than 1 and more than 5.

[4] For the remainder of this document, we use CPT code to refer to the combination of CPT code and CPT code modifier.

1. 5. Limiting Sample Based on BETOS codes

Berenson-Eggers Type of Service (BETOS) codes were developed primarily for analyzing the growth in Medicare expenditures. Each CPT code is assigned to one of about 100 BETOS codes. These codes consist of readily understood clinical categories, are stable overtime, and are relatively immune to minor changes in technology or practice patterns. All Medicare National Claims History (NCH) carrier claims are assigned to BETOS codes by the Centers for Medicare and Medicaid Services (CMS). We separately mapped the commercial claims for this study to BETOS codes using the CPT code for each claim to aid in organizing claims and service utilization patterns. Commercial claims that did not map to a BETOS code of Evaluation & Management ("M") or non-anesthesia, non-dialysis, or non-fee-schedule Procedures ("P") were excluded from this study.

1. 6. Mapping Claims to Facility Designation

Using POS codes, we designated each commercial claim as facility or non-facility. Claims with POS codes 02, 19, 21, 22, 23, 24, 26, 31, 34, 41, 42, 51, 52, 53, 56, or 61 were assigned as facility claims. Claims with POS codes 01, 03, 04, 09, 11, 12, 13, 14, 15, 16, 17, 20, 25, 32, 33, 49, 50, 54, 55, 57, 60, 62, 65, 71, 72, 81, or 99 were assigned as non-facility claims. Claims that had either POS codes from both facility and non-facility groupings or neither grouping were dropped from the analysis.

1. 7. Mapping Claims to Provider Specialties

We assigned each provider to a single specialty based on the specialty that appeared most often on their professional claims in 2017. Similar to previous work, physicians with a family practice, internal medicine, pediatrics, geriatric medicine, or gynecology specialty, as well as nurse practitioners and physician assistants were considered primary care providers.[5] We excluded providers for which at least 90% of their allowed spending occurred in an acute inpatient hospital. Providers that were not identified as primary care providers were classified as non-primary care (or "other") providers.

1.8. Mapping ZIP Codes to CMS Locale Geographic Descriptions

In the commercial claims, the ZIP code geographic information was mapped to the CMS locale for 2017. See section 2.1 for more information about CMS locales. Commercial claims with ZIP codes that did not match a CMS locale were excluded from the analysis.

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[5] See, for example:

- Reid R, Damberg C, Friedberg MW. Primary care spending in the fee-for-service Medicare population. JAMAInternMed. 2019;179(7):977-980. doi:10.1001/jamainternmed.2018.8747
- Bailit MH, Friedberg MW, Houy ML. Standardizing the Measurement of Commercial Health Plan Primary Care Spending. NewYork, NY:Milbank Memorial Fund; 2017. https://www.milbank.org/wp-content/uploads/2017/07/ MMF-Primary-Care-Spending-Report.pdf.AccessedNovember14,2019.
- Reiff J, Brennan N, Fuglesten Biniek J. Primary Care Spending in the Commercially Insured Population. JAMA 2019;322(22):2244-2245.

1. 9. Descriptive Statistics of Analytic Sample

Our analytic sample spans nearly 210 million professional claims in 2017 from nearly 25 million member years. Following our cleaning procedures, we capture over 35% of professional claims and over 45% of spending in the entire HCCI professional claims dataset in 2017.

2. Constructing Medicare Service Code Level Pricing Data Set

2. 1. Medicare PFS Data

Annually, CMS publishes a complete listing of fees which is used to pay doctors or other providers/suppliers. CMS develops fee schedules for several different services which include physicians, ambulance services, clinical laboratory services, and durable medical equipment, prosthetics, orthotics, and supplies. We focus on payment rates to physicians, specifically services classified as Evaluation & Management and Procedures.

PFS rates were acquired from the CMS 2017 publicly available data.[6] This dataset contains the Medicare rate for each CPT and modifier code for each CMS locale (i.e., each "carrier" and "locality" combination). We consolidated the fee-schedule data so that each locale, CPT code, and modifier combination in the dataset contained exactly one facility designated price and one non-facility designated price. Note that the modifiers included in the PFS are directly built into the pricing file for only one of three values: "26" for professional component, "TC" for technical component, "53" for the discontinuation of a service because of extenuating circumstances. All other modifiers are encompassed in the PFS by a "blank" modifier value; some modifiers, such as "50" for a bilateral procedure carry a 150% payment to the base rate of qualifying CPT codes. We did not make any adjustment to the base rate prices beyond what is directly available in the PFS.

A ZIP code to CMS locale crosswalk was made in order to map the Medicare PFS prices specific to each CMS payment local down to a ZIP code level. We used crosswalks provided by CMS to map ZIP codes to different CMS locales.[7] We refer to the resulting locality-mapped price file as our Medicare PFS file.

2. 2. Medicare FFS Data

We also compared the actual payment amount made by Medicare using our 100% Medicare Part B claims as part of our research re-use Data Use Agreement with CMS from the data obtained through our participation in the Qualified Entity (QE) program. For this comparison, we created a dataset using similar selection criteria as we did for the commercial claims. We then refined the data set to only include claims where the payment rule year code was 2017, where Medicare was the primary payer, where the provider agreed to the Medicare rate, and where the provider was a physician (i.e., payments made for work by a physician assistant, nurse practitioner, or midwife were excluded).

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[6] Data available at https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/PFS-Carrier-Specific-Files-Items/CY2017-CarrierFiles

[7] (A) CMS SSA to FIPS state and county crosswalk provided by the National Bureau of Economic Research: 2017 data available http://data.nber.org/data/ssa-fips-state-county-crosswalk.html. (B) CMS carrier and locality crosswalk data available at https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/Locality

The metric of interest for the Medicare FFS payment amount was the "allowed amount," which is the amount Medicare paid plus the beneficiary's deductible and coinsurance. We separately calculated certain payment adjustments that were made to the Medicare PFS rate to form the allowed amount CMS would make on a claim. Adjustments that add to the PFS rate amounts included: interest additions, positive rounding adjustment, value-based payment modifier positive payment adjustments, and positive amount for quality payment program payment adjustments. In contrast, adjustments that were subtracted from the PFS rate amount included: Gramm-Rudman reductions, negative rounding adjustments, good cause payments, PMD demonstration reductions, sequestration reduction amounts, eRX negative adjustment reduction amounts, accountable care organization (ACO) payment adjustment amount, ambulatory surgical center (ASC) quality reporting payment reduction, physician quality reporting system negative payment adjustment, value modifier payment adjustment, electronic health record negative payment adjustment, prior authorization reduction, comprehensive primary care plus payment adjustment, Maryland primary care program, and negative amount for quality payment program payment adjustments. These amounts were summed (positive and negative) and condensed into one 'adjuster value' which allowed us to begin to quantify the expected difference in the FFS data from the PFS rate. Note, while we made these adjusted calculations for the FFS data, we merely used them to directly compare the differences in price between the PFS and FFS amounts; our analysis of FFS prices to commercial prices used the actual, unadjusted payments.

There were several adjustment calculations we did not make to the FFS data. We did not calculate adjustments made for claims that had a Health Professional Shortage Area (HPSA) bonus payment, any rate reductions resulting from the Outpatient Prospective Payment System (OPPS) caps, any adjustments from modifiers that would affect the PFS payment rate (including global payment modifiers, bilateral modifiers, assisted procedure modifiers, multiple procedure modifiers, or modifiers for unusual work), and payments made to providers assisting a procedure. Finally, we do not include Method II Critical Access Hospital (CAH) payments.

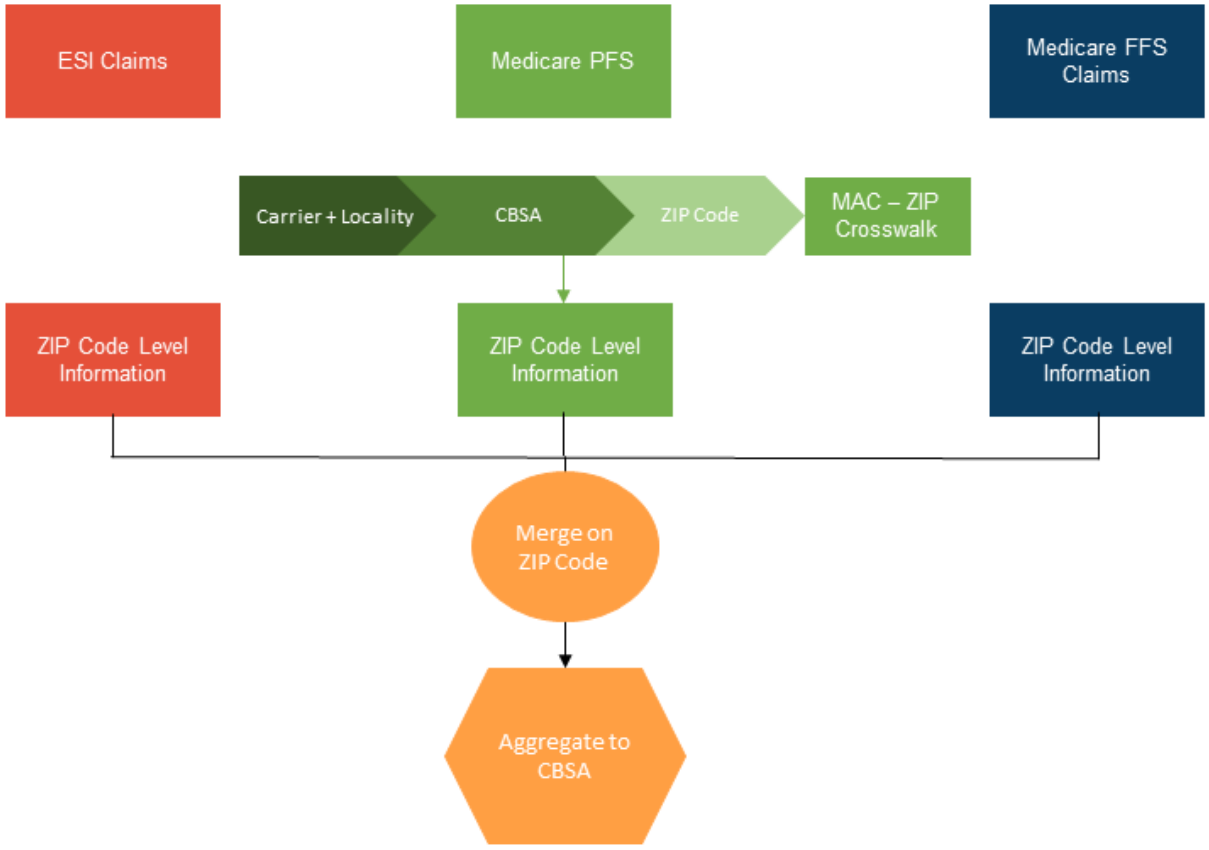
Medicare FFS dollars spent, adjusted dollars spent, and claim lines utilized were summed across each geography, CPT code, CPT modifier, facility flag combination. The resulting file is referred to as our Medicare FFS file.

3. Mapping Medicare Data onto Commercial Claims

Three files were fit together: the commercial claims file described in Section 1.9, the Medicare PFS file from Section 2.1, and the Medicare FFS file from Section 2.2. We used four components to map Medicare data to commercial claims: 1) geographic, 2) CPT, 3) CPT modifier, and 4) facility flag derived from the POS. **Figure M1** illustrates how we addressed mapping geographies. In order to aggregate across the three data sets, we had to condense to the smallest geographic area to allow for like-like comparison. Both the Medicare FFS claims and ESI claims had the provider ZIP code level of information. The Medicare PFS is based on the geographic jurisdiction of the Medicare Administrative Contractor (MAC), also known as a carrier, and a specific locality (either CBSA, county, county groups, or whole states). The PFS broke locality and carrier distinctions into ZIP codes by crosswalking the MAC geographies to

CBSAs and ZIP codes (shown by the arrow diagram at the top of the figure). Once at the ZIP code level, the files were combined and then aggregated back up to CBSAs for analysis.

Figure M1. Geographic Mapping of ESI Claims, Medicare FFS Claims, and Medicare PFS



The Medicare PFS and the Medicare FFS files were mapped onto the commercial claims using the geography (CMS locale for the PFS file and ZIP code for the FFS file), CPT code, CPT modifier, facility flag combination. If the commercial claim and Medicare PFS file only matched on CMS locale, CPT code, and facility flag (i.e., the claims within both files did not contain matching CPT modifier), the commercial claim was assigned the Medicare PFS price associated with the null modifier value of that given combination. If the commercial claim and Medicare FFS file only matched on ZIP code, CPT code, and facility flag (i.e., the claims within both files did not contain matching CPT modifier), the commercial claim was assigned the payment and claim total of the corresponding FFS null modifier value.

4. Comparing Average Commercial and Medicare PFS Prices at the CBSA, CBSA-Specialty level

In order to calculate average commercial prices for each service at the CBSA and CBSA-Specialty level, we first computed total spending and total use of each service using the set of claims in our analytic sample (*C*).

4. 1. Measuring Total Commercial Spending, Use at the CBSA-Service, CBSA, National Level

Defining Commercial Spending, Use at the CBSA-Specialty-Service Level

For a given CBSA-specialty-service combination, we define total commercial spending (y_{gsi}^{ESI}) as the sum of commercial allowed amounts on all claims (defined by units) *c* for service *i* for all residents of CBSA *g* provided by a provider of specialty *s*:

$$y_{gsi}^{ESI} = Allowed\ Amt_{gsi}^{ESI} = \sum_{c \in C_{gsi}} Allowed\ Amt_{gsic}^{ESI}$$

For a given CBSA-specialty-service combination, we define use as the number of units for service *i* in for a resident of CBSA *g*:

$$u_{gsi}^{ESI} = \sum_{c \in C_{gsi}} units_{gsic}\ ;\ u_{gsi}^{ESI} \geq 0$$

Aggregating Total Spending, Use (Across Services) Across Services, Specialties

We compute total spending and use at the CBSA-service level by summing across specialties *s*:

$$y_{gi}^{ESI} = \sum_{s \in S} y_{gsi}^{ESI}\ ;\ u_{gi}^{ESI} = \sum_{s \in S} u_{gsi}^{ESI}$$

We can similarly compute total spending and use at the CBSA-specialty level by summing across services:

$$y_{gs}^{ESI} = \sum_{i \in I_{gs}} y_{gsi}^{ESI}\ ;\ u_{gs}^{ESI} = \sum_{i \in I_{gs}} u_{gsi}^{ESI}$$

Here I_{gt} is the subset of services *I* provided by specialty *s* observed in CBSA *g*:

$$I_{gs} = \{i \mid u_{gsi} > 0\}$$

We define total spending and use by a CBSA as the sum of spending and use (respectively) on each service *i* provided across specialties *s* for all residents of CBSA g:

$$y_g^{ESI} = \sum_{i \in I_{gs}} \sum_{s \in S} y_{gsi}^{ESI} \; ; \; u_g^{ESI} = \sum_{i \in I_g} \sum_{s \in S} u_{gsi}^{ESI}$$

4. 2. Constructing a Market Basket of Common Professional Services

Identifying a Set of Common Claims to Construct a Consistent Service Basket

In order to benchmark health care spending, prices, and utilization, we identify a consistent set of services for which to compare these metrics across areas. These services were the 500 most commonly observed service codes among the commercial portion of our analytic data set. These groups of service codes will be referred to as our set of common services and set of common services within specialty.

Constructing a Market Basket of Health Care Services from our Set of Common Services

Using our set of common services, we constructed a basket of health care services by assigning a weight to each service. We used these weights to compute a weighted-average price across services. This enables us to compare prices for the same market basket of services across geographies.

We assign weights to each service in our set of common services $\tilde{S}$ based on the share of commercial claims they account for within our analytic sample. More formally, we the weight for service *s* is assigned to be its share of all services used *nationally* (across CBSAs g) among our sample services $\tilde{S}$:

$$w_i = \frac{u_{gi}^{ESI}}{u^{ESI}} = \frac{\sum_{g \in G} u_{gi}^{ESI}}{\sum_{i \in \tilde{I}} \sum_{g \in G} u_{gi}^{ESI}}$$

Here, u_{gi}^{com} is defined as in Section 4.1. Note that the weights in our market basket are assigned regardless of specialty. This allows us to compare the average price paid for the same market basket across specialties.

4. 3. Measuring Professional Prices at the CBSA-Specialty, CBSA Level by Payer Type

Defining Average Commercial Price at the CBSA-Specialty-Service Level

Given these definitions of spending and use, we can re-write spending on service *i* observed in CBSA *g* provided by specialty *s* as the product of spending per claim (average price) and the number of claims:

$$y_{gsi}^{ESI} = \left(\frac{y_{gsi}^{ESI}}{u_{gsi}^{ESI}}\right) u_{gsi}^{ESI} = \bar{p}_{gsi}^{ESI} u_{gsi}^{ESI}$$

This allows us to define the average price of a service *i* observed in CBSA *g* provided by specialty *s* as total spending on that service-specialty combination divided by the number of claims:

$$\bar{p}_{gsi}^{ESI} = \frac{y_{gsi}^{ESI}}{u_{gsi}^{ESI}}$$

We analogously compute average prices at the CBSA-service level regardless of specialty:

$$\bar{p}_{gi}^{ESI} = \frac{y_{gi}^{ESI}}{u_{gi}^{ESI}}$$

Defining Medicare PFS Price at the CBSA-Specialty-Service, CBSA-Service Level

We map a Medicare service price from the Medicare PFS onto each claim *c* as described above. We measure what spending would have been if our sample of claims had been paid at the associated fee from the Medicare PFS rather than at the negotiated commercial price. We call this measure "implied Medicare spending." Note that this measure does not take into account a number of adjustments that in reality affect how Medicare reimburses individual claims.

We define implied Medicare spending at the CBSA-Specialty-Service level based on the PFS price:

$$y_{gsi}^{PFS} = Allowed\ Amt_{gsi}^{PFS} = \sum_{c \in C_{gsi}} Allowed\ Amt_{gsic}^{PFS}$$

We compute implied total spending at the CBSA-service level by summing across specialties *s*:

$$y_{gi}^{PFS} = \sum_{s \in S} y_{gsi}^{PFS}$$

Similar to computing our average commercial service price, we compute the average Medicare PFS price as the implied total spending divided by the number of claims at the CBSA-Specialty, and CBSA Level:

$$\bar{p}_{gsi}^{PFS} = \frac{y_{gsi}^{PFS}}{u_{gsi}^{ESI}}$$

$$\bar{p}_{gi}^{PFS} = \frac{y_{gi}^{PFS}}{u_{gi}^{ESI}}$$

Defining Average Medicare FFS Prices at the CBSA-Specialty-Service, CBSA-Service Level

We compute average Medicare FFS service prices for each CBSA-Specialty-Service and CBSA-Service combination separately from our commercial claims data. In the Medicare FFS data, we compute the total allowed spending and total number of claims (defined by units) at the ZIP code (*m)*-CBSA-Specialty-Service Level:

$$y_{mgsi}^{FFS}\ ,\ u_{mgsi}^{FFS}$$

We sum each of these measures across ZIP codes within each CBSA-Specialty-Service combination:

$$y_{gsi}^{FFS} = \sum_{m \in M_g} y_{mgsi}^{FFS}$$

$$u_{gsi}^{FFS} = \sum_{m \in M_g} u_{mgsi}^{FFS}$$

Then, analogously to computing average commercial service prices, we compute average Medicare FFS service prices as the ratio of spending per service at the CBSA-Specialty-Service and CBSA-Service level:

$$\bar{p}_{gsi}^{FFS} = \frac{y_{gsi}^{FFS}}{u_{gsi}^{FFS}}$$

$$\bar{p}_{gi}^{FFS} = \frac{y_{gi}^{FFS}}{u_{gi}^{FFS}}$$

Imputing Average Commercial Prices at the CBSA-Service Level for Missing Observations

If there are no observations for service *s* in CBSA *g* for a specialty *p* among our analytic sample of commercial claims, we first attempt to impute the price as the price of the other specialty for that same service *s* in CBSA *g* within each payer type (ESI, PFS, FFS). If there were no observations for service *s* in CBSA *g* for both specialties, we impute both specialty prices as the national average price for that service within each payer type (ESI, PFS, FFS). In particular, for each payer type *f,* we impute this price of that service $\hat{p}_{gsi}^{f}$ as the national average price for that service. Note, here the national average service price for each payer type is computed as the ratio of total national spending and total national use on service *i* provided by specialty *s* for payer type *f*. If both specialty prices were missing for a given service in a given CBSA, then, by sample construction, the CBSA-service price would be missing as well. In that case, we analogously impute prices at the CBSA-Service level (regardless of specialty) for each payer type (i.e., assign the national average, payer-specific price).

4. 4. Constructing a Weighted Average Price Ratio of Commercial, Medicare Prices

Using our average CBSA-Specialty-Service and CBSA-Service prices, we construct two separate comparisons between commercial and Medicare professional service prices.

Comparing Commercial Prices to Medicare Prices Implied by Medicare PFS

For each CBSA-Specialty-Service and CBSA-Service combination we compute the ratio of the average prices paid by commercial payers in our analytic sample and the price implied by the Medicare PFS:

$$\tilde{p}_{gsi}^{ESI,PFS} = \frac{\tilde{p}_{gsi}^{ESI}}{\tilde{p}_{gsi}^{PFS}}$$

$$\tilde{p}_{gi}^{ESI,PFS} = \frac{\tilde{p}_{gi}^{ESI}}{\tilde{p}_{gi}^{PFS}}$$

We then construct a weighted geometric average across services using our service weights defined above:

$$\tilde{p}_{gs}^{ESI,PFS} = \prod_{i \in \tilde{I}} \left(\tilde{p}_{gsi}^{ESI,PFS}\right)^{w_i} = \prod_{i \in \tilde{I}} \left(\frac{\tilde{p}_{gsi}^{ESI}}{\tilde{p}_{gsi}^{PFS}}\right)^{w_i}$$

$$\tilde{p}_{g}^{ESI,PFS} = \prod_{i \in \tilde{I}} \left(\tilde{p}_{gi}^{ESI,FFS}\right)^{w_i} = \prod_{i \in \tilde{I}} \left(\frac{\tilde{p}_{gi}^{ESI}}{\tilde{p}_{gi}^{PFS}}\right)^{w_i}$$

Comparing Commercial Prices to Medicare FFS Prices

For each CBSA-Specialty-Service and CBSA-Service combination, we compute the ratio of the average prices paid by commercial payers in our analytic sample and the price paid for Medicare FFS beneficiaries:

$$\tilde{p}_{gsi}^{ESI,FFS} = \frac{\tilde{p}_{gsi}^{ESI}}{\tilde{p}_{gsi}^{FFS}}$$

$$\tilde{p}_{gi}^{ESI,FFS} = \frac{\tilde{p}_{gi}^{ESI}}{\tilde{p}_{gi}^{FFS}}$$

We then construct a weighted geometric average across services using our service weights defined above:

$$\tilde{p}_{gs}^{ESI,FFS} = \prod_{i \in \tilde{I}} \left(\tilde{p}_{gsi}^{ESI,FFS}\right)^{w_i} = \prod_{i \in \tilde{I}} \left(\frac{\tilde{p}_{gsi}^{ESI}}{\tilde{p}_{gsi}^{FFS}}\right)^{w_i}$$

$$\tilde{p}_{g}^{ESI,FFS} = \prod_{i \in \tilde{I}} \left(\tilde{p}_{gi}^{ESI,FFS}\right)^{w_i} = \prod_{i \in \tilde{I}} \left(\frac{\tilde{p}_{gsi}^{ESI}}{\tilde{p}_{gi}^{FFS}}\right)^{w_i}$$

We report each of these metrics as percentage differences from the relevant Medicare price. We analogously calculate each metric at the state, rather than CBSA, level.

5. Methodology Robustness

5. 1. Robustness of Our Sample Market Basket

We limit our analysis to a subset of common services – specifically the 500 most common professional services among our commercial analytic sample. This allows us to construct a standardized market basket for comparing the average prices paid by commercial insurers relative to Medicare across geographic areas. This procedure ensures that any comparison across areas is not biased by differences in which services are used or the mix of services used in different regions.

One potential concern with this approach, though, is that limiting to a set of common procedures may not capture a sufficient picture of the health care services used by the commercially insured population. Additionally, another potential concern is that our sample set of services may not capture a large portion of services provided by a specialty subset of providers. However, as seen in **Table M2** below, our sample set of services captures the majority of both claims and total spending among our analytic sample of commercial insurance claims. This is true across specialties. In other words, while we limit our analysis to a set of common services, the claims for these services still comprise the majority of claims and spending by our sample.

A related concern is that while our set of common services may capture most service use by the commercially insured population, these services may not be commonly used by the Medicare population. In this case, comparing the prices paid for services commonly used among the ESI population to the prices of the same services by Medicare may misrepresent the true difference in the cost of care paid by each payer type. For example, if Medicare used different, more expensive services on average for similar types of care, comparing the prices of commonly used ESI services to what Medicare would have paid would overstate the true difference between the average prices paid by commercial insurers in Medicare. As with the commercially insured population, our set of common services account for the majority of claims observed in our sample of claims for Medicare beneficiaries (**Table M2**).

An additional concern is that while use of our sample set of common services – as a whole – comprises a consistently large share of claims and spending among our sample of commercially insured and Medicare beneficiaries, commercially insured and Medicare beneficiaries may use or receive services in different proportions. Recall that we compute a weighted average of the ratio of prices paid by ESI and Medicare across services. We weighted service level observations according to how frequently they are performed in the ESI population. If ESI and Medicare populations used different mixes of the same set of services, our methodology may overweight services commonly used among the ESI population which are not common among Medicare beneficiaries. Take, for example, CPT 99472 (Neonatal and Pediatric Critical Care Services), for which commercial claims far outnumber Medicare claims. This may cause the weighted average price ratio we compute to misstate the difference between the prices commercial and Medicare are paying if Medicare disproportionately uses certain services less frequently, as in our example.

Table M2: Share of Commercial, Medicare Analytic Sample Claims and Spending Comprised by Set of Common Services

Specialty	Payer Type	Share of Respective Sample: Total Claims	Share of Respective Sample: Total Spending (Allowed Amounts)
Any	ESI	69.0%	67.6%
Any	Medicare FFS	74.2%	61.4%
Primary Care	ESI	73.5%	69.9%
Specialist	ESI	66.8%	66.6%

To see whether this was the case, we looked at the share of claims and spending accounted for by each service within our set of common services among both our commercial and Medicare samples. We then looked at the correlation between these shares for each population across services. As seen in **Table M3**, which reports the correlation coefficients, the share of claims and spending made up by each service were highly correlated across commercial and Medicare populations. This alleviates concerns that our common set of services are used in drastically different proportions across our populations.

Table M3: Correlation Coefficients for Share of Claims and Share of Spending by Service Across Commercially Insured, Medicare Populations

Type of Provider	Share of Claims	Share of Spending
Any	0.5978	0.5998
Primary Care Physician	0.7091	0.7230
Specialist	0.5935	0.5560

5. 2. Evaluation of Our Sample Set of Services

One final concern is that our sample set of common services may be disproportionally made up by Evaluation & Management ("M") or Procedure ("P") BETOS codes. Evaluation & Management codes can be thought of as cognitive work on the part of the provider and encompass activities that include things like office or hospital visits. Procedure codes encompass specific surgical, medical, or diagnostic interventions. Procedure codes include a wider number and variety of different types of services than Evaluation & Management codes. Typically, more work done by a provider for Evaluation & Management services results in a different, higher paying code being used. For example, an established patient visit requiring 25 minutes of face-to-face time would use CPT 99214 while a similar visit requiring 40 minutes of face-to-face time would use CPT 99215. However, more work required for procedures sometimes takes the form of the use of modifiers on a CPT code. For example a total knee replacement (CPT 27447) on one knee would typically carry a different, lower price than a procedure on both knees; the same CPT code is used for both the single and bilateral procedure, but the CPT modifier for bilateral procedures ("50") would be used and carry a 150% payment in Medicare FFS. As discussed in Section 2.1, our PFS methodology did not account for these types of price adjustments.

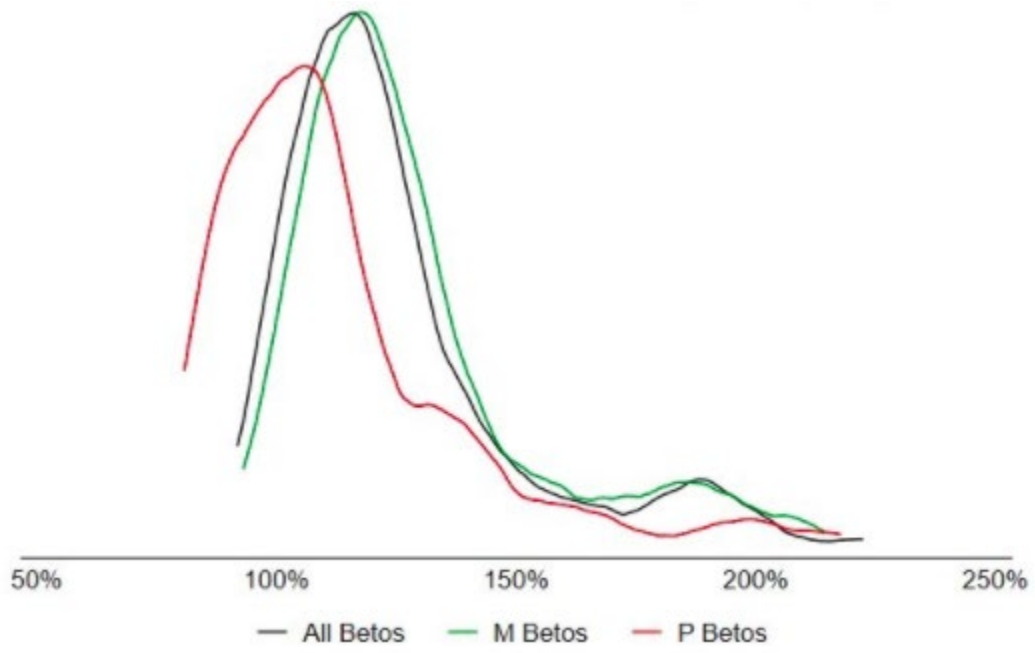
In order to determine how the differences in payment practices between Evaluation & Management and Procedures may have impacted our findings, we first examined the share of services broken down by BETOS code, see **Table M4**.

Table M4: Share of Sample Services by BETOS Code Grouping

BETOS Code Grouping	Number of Distinct Sample Services	Proportion of ESI Claims among Sample Services
Evaluation & Management	201	79.8%
Procedure	299	20.2%
All Codes	500	100.0%

Since 60% of our sample of common services were Procedures (N=299), there exists the possibility that our basket of common services could potentially be overly influenced by Procedures; however, the share of Procedure ESI claims that make up our analytic sample represented only 20% of claims. Further investigation looking at the distribution of commercial to PFS price ratios across CBSAs with service baskets made up by groupings of specific BETOS codes, we confirm that P BETOS code services did not substantially impact the overall professional service price ratio more than expected (**Figure M5**).

Figure M5: Distribution of ESI to PFS Price Ratio by BETOS Grouping across Sample CBSAs



5.3 Utilizing PFS Prices Versus Utilizing FFS Payments to Compare Commercial Prices

Finally, we more closely examined the difference between using the Medicare PFS price versus the Medicare FFS paid amounts to compare to our commercial prices in order to evaluate our assumptions about the differences in how Evaluation & Management and Procedures are paid were effecting the caparisons in price between our two methodologies (commercial-PFS comparison vs commercial-FFS comparison). Generally, we found the same distributions and relationships between the PFS-commercial comparison as we did the FFS-commercial comparison. **Figure M6** shows the sample CBSA weighted basket prices for FFS and PFS among the Evaluation & Management services. As we expected, the differences in average prices between the FFS data and the PFS data are very similar, as we were able to closely match the FFS payments to the PFS prices at the line level. **Figure M7** shows the sample CBSA weighted basket prices for FFS and PFS among the procedure codes. We expected a larger difference in the basket prices between the FFS data and the PFS data since procedures are more likely to have modifiers that would affect the PFS price (e.g. bilateral procedure modifier). However, our assumption that the surgical procedures that fall into the "procedures" category would weigh the distributions to be higher in price was incorrect, and further investigation showed that the physical and occupational therapies make up a substantial portion of services in the Medicare data, outweighing more expensive surgical procedures.

Figure M6: Distribution of BETOS "M" FFS and PFS Basket Prices across Sample CBSAs

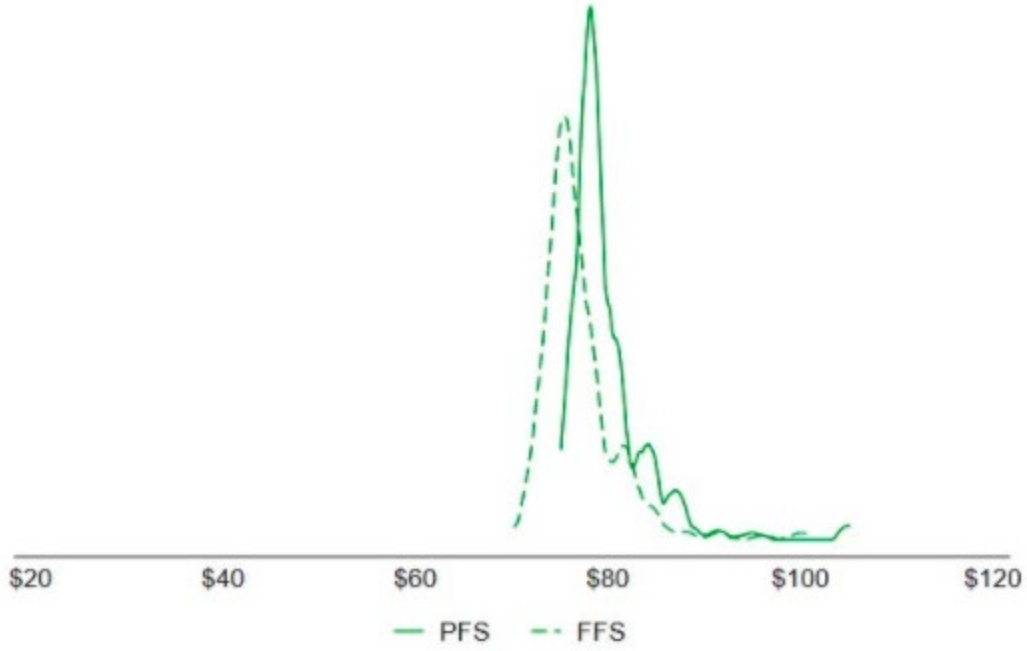


Figure M7: Distribution of BETOS "P" FFS and PFS Basket Prices across Sample CBSAs