

DO MEDICARE ADVANTAGE PLANS STILL PAY HOSPITALS PRICES CLOSE TO TRADITIONAL MEDICARE'S?

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Abstract

The prices that Medicare Advantage (MA) plans pay for hospital services have historically hewed closely to what traditional Medicare (TM) pays for the same services, but the studies that first established this fact relied on claims data from an era when MA was far smaller. This paper uses 2025 hospital price transparency (HPT) data to study whether and how the relationship between MA and TM prices may have changed. We find that the prices that MA plans pay for both inpatient and outpatient services are still close to TM's, on average, consistent with the findings of two other recent studies using HPT data. We also find little evidence that MA-to-TM price ratios vary with MA penetration. We discuss whether these patterns are likely to persist, tentatively concluding that while there are plausible reasons that MA prices might ultimately diverge from TM's, this outcome seems unlikely in the near term and absent major changes in policy.

Introduction

The prices that Medicare Advantage (MA) plans pay for hospital services have historically hewed closely to the prices that traditional Medicare (TM) pays for the same services (Berenson et al. 2015; Maeda and Nelson 2018). This feature of MA contrasts starkly with outcomes in the commercial health insurance market, where private insurers typically pay hospitals prices that exceed TM's prices by a factor of two or more (CBO 2022).

The seminal studies measuring what MA plans pay for hospital care used claims data dating to 2013 or earlier (Baker et al. 2016b, 2016a; Maeda and Nelson 2018). But the MA market has grown dramatically since then, with the share of eligible beneficiaries choosing MA over TM rising from 29% in 2013 to 55% in 2026 (Freed et al. 2026). This raises the question of whether plan-hospital bargaining dynamics and, in turn, prices have changed as well.

In this paper, we use the hospital price transparency (HPT) data that hospitals are required to publish under federal rules to take a fresh look at how the prices that MA plans pay for inpatient and outpatient services compare to what TM would pay for the same services. Using data collected during 2025, we find that the prices MA plans pay for both categories of services remain close to TM's, at least on average, including in the areas with the highest MA penetration. Our findings are broadly consistent with those from two other recent studies that also used HPT data to examine the prices that MA plans pay for care: Xu and Polsky (2023), who used 2022 HPT data to study the prices that MA plans pay for a set of outpatient services that overlaps with the services we study here; and Mackleby et al. (2025), who used 2024 HPT data to study a subset of the inpatient services that we examine here.

In what follows, we describe how we obtain and process the HPT data, then use them to compare the prices paid by MA and TM both nationwide and in areas with different levels of MA penetration. We close by considering why the prices paid by MA plans seem to be so well anchored to TM's and whether this is likely to remain the case going forward.

Data and measures

We constructed our hospital sample using the Centers for Medicare and Medicaid Services (CMS) Provider of Services file. Similar to prior work (Xu and Polsky 2023; Mackleby et al. 2025), we limited our sample to short-term hospitals (other than critical access hospitals) that are located in the 50 states or the District of Columbia, excluding Maryland. This procedure resulted in a base sample of 3,020 hospitals, as reported in Table 1.

Table 1: Sample hospital and entry counts

Sample	Inpatient		Outpatient	
	Hospitals	Entries	Hospitals	Entries
Base hospital sample	3,020	N/A	3,020	N/A
...limited to hospitals with usable HPT files	2,870	N/A	2,870	N/A
...limited to entries for relevant services	2,404	757,466	2,277	818,262
...limited to entries with valid dollar prices	1,842	652,429	1,862	479,765
...limited to entries with plausible price ratios	1,784	639,610	1,851	415,181

We obtained price information from the HPT files that U.S. hospitals (with narrow exceptions) are required to publish under federal rules. For each hospital, we manually identified the web address where it published its most recent HPT file; files were located during September-November 2025 and downloaded during October-December 2025. We were able to locate a usable HPT file for 2,870 hospitals (95% of the hospitals in our base sample).¹

The HPT files are required to include service-level pricing information for each commercial, MA, or Medicaid managed care plan with which the hospital has a contract. The files do not include a plan-type indicator, so we developed an algorithm to identify MA plans based on the presence or absence of various key words in the plain-text payer and plan descriptions that appear on each entry.² To assess the performance of this algorithm, we manually reviewed 200 hospital-plan combinations classified as MA and 200 hospital-plan combinations classified as non-MA. In each case, the error rate was 3% or less.

We limited our analysis to 20 inpatient and 20 outpatient services that account for substantial Medicare spending. For our inpatient analysis, we selected the 20 Diagnosis-Related Groups (DRGs) that accounted for the most spending under TM's Inpatient Prospective Payment System (IPPS) during calendar year 2024, as reported in CMS' inpatient utilization public use files. For our outpatient analysis, we selected 20 Healthcare Common Procedure Coding System (HCPCS) codes likely to have high spending using the "cost statistics" files that CMS published with the 2025 Outpatient Prospective Payment System (OPPS) final rule.³ Appendix A provides the full list of DRGs and HCPCS codes.

Table 1 reports the number of hospital-plan-service entries in the HPT files corresponding to one of these services, as well as the number of hospitals with at least one such entry. When a hospital's file includes at least one relevant entry, it typically (although not always) has reasonably broad coverage of the services of interest across the set of MA plans present in the file. For inpatient services, the median hospital with at least one relevant entry had entries for 90% of potential plan-service combinations and 18 unique services from our list. For outpatient services, the median hospital with at least one relevant entry had entries for 78% of potential plan-service combinations and 17 unique services from our list.

¹ There were 51 hospitals for which we could not locate an HPT file, and another 99 hospitals whose files had formatting or other problems that made them unusable. Some hospitals without usable files appeared to have recently closed or to be exempt from HPT reporting (e.g., because they are Indian Health Service facilities), so lacking a usable HPT file does not necessarily indicate non-compliance with HPT rules.

² Code for the algorithm is available upon request.

³ In detail, for each HCPCS code reported in the cost statistics file, we computed the product of the number of times that code appeared in the claims sample that CMS used to generate the cost statistics file and the payment rate of the ambulatory payment classification (APC) to which that HCPCS code was assigned. We then selected the 20 HCPCS codes for which this product was largest, except that we excluded hospital outpatient clinic visits (HCPCS code G0463) and services with Restructured BETOS codes indicating that they were injections or infusions because those services may be subject to special payment rules.

Not all HPT file entries report a valid dollar price, so we limited our analysis to entries that did.⁴ This restriction excludes 14% of inpatient entries and 41% of outpatient entries.

For each entry with a dollar price, we calculated the ratio of the price to TM's allowed amount for that service at that hospital (the "MA-to-TM price ratio"). For inpatient services, we used the total IPPS payment amount (for a stay with no outlier payments), less any operating indirect medical education payment and any pass-through payments, similar to Maeda and Nelson (2018) and Mackleby et al. (2025).⁵ We calculated this amount using CMS' IPPS Pricer. For outpatient services, we used the total OPPOS payment amount with no adjustments, and we calculated this amount using CMS' OPPOS Pricer. For both inpatient and outpatient services, we used the last-updated date reported on the HPT file as the date that the service was delivered.⁶ We did not reduce TM allowed amounts to reflect sequestration.

Some prices reported in the HPT files were implausibly high or low, a feature of these data that has also been noted in prior work (Lo et al. 2023; Xu and Polsky 2023; Mackleby et al. 2025). To prevent data errors from distorting our results, we excluded entries where the MA-to-TM ratio was above 10 or below 0.25; Xu and Polsky (2023) and Mackleby et al. (2025) each applied a similar trimming procedure in their analyses of HPT data. Our trimming step excluded an additional 2% of inpatient prices and 13% of outpatient prices.⁷

For each hospital, we created a hospital-level MA-to-TM price ratio that summarizes how each hospital's reported MA prices compare to TM's, one for inpatient services and one for outpatient services. To do so, we first calculated the mean MA-to-TM ratio for each hospital-service pair, weighting these calculations so that each payer present in the data for that hospital-service pair received the same weight (regardless of how many of the payer's plans were present in the data). Our final hospital-level MA-to-TM price ratio was then the simple unweighted mean of these hospital-service means.⁸ This aggregation procedure is similar to the procedures used by Xu and Polsky (2023) and Mackleby et al. (2025).

⁴ In doing so, we excluded a small number of entries that were marked as per diem rates, as those amounts may reflect the payment per day of care rather than the full payment for the service. Additionally, some entries that did not include dollar amounts either: (a) were marked as being covered by percentage of billed charges contracts and reported both the applicable percentage and a typical gross charge, meaning that it would be possible to calculate a typical payment amount; or (b) reported an "estimated amount" intended to reflect the amount typically paid under the hospital's contract with the plan. We did not use these amounts in our analyses because their reliability was less clear. When we experimented with including these entries, our findings were qualitatively similar, although for outpatient services we observed more price dispersion, and the relationship between prices and MA penetration was less precisely estimated.

⁵ For new hospitals, IPPS capital payments are made on a pass-through basis. For the small number of new hospitals in our sample, we substituted the ordinary IPPS capital payment.

⁶ This date was in calendar year 2025 for 64% of hospitals and calendar year 2024 for 36% of hospitals, with a negligible share in other years; it was in fiscal year 2025 for 93% of hospitals, with small shares in other years.

⁷ A negligible number of additional entries were excluded because the IPPS Pricer did not return a TM price.

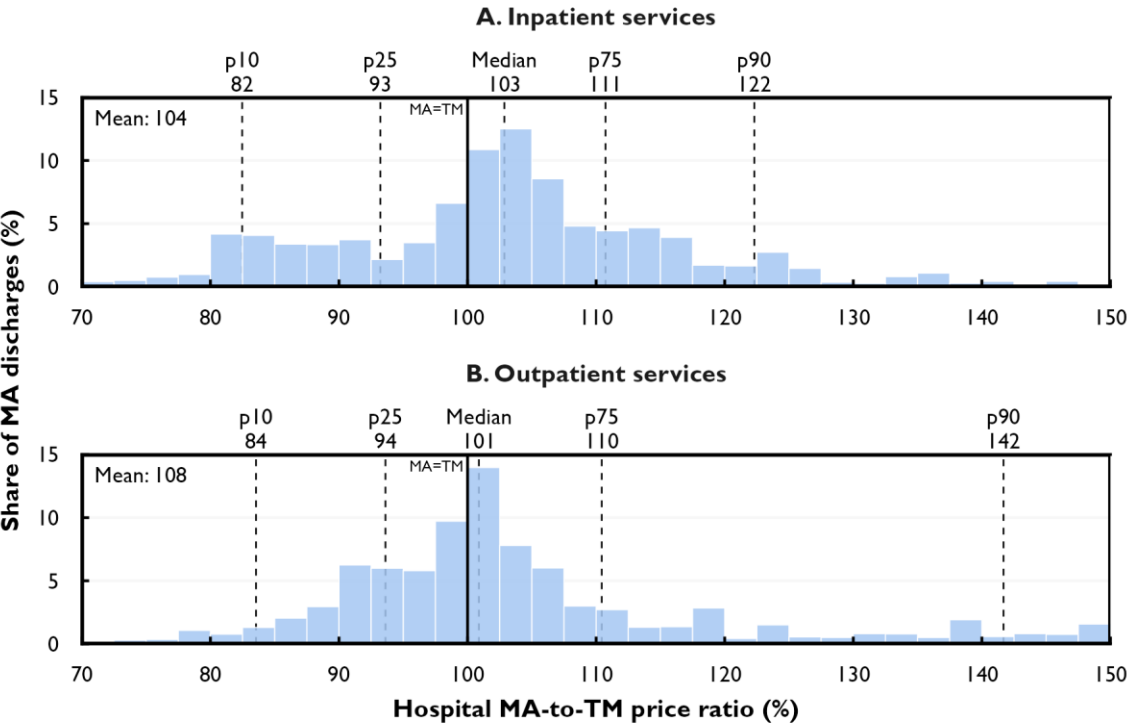
⁸ As noted above, not all services were observed for all hospitals, so we computed these means across the hospital-service pairs that were observed. Observing different services for different hospitals could, in principle, distort our hospital-level MA-to-TM price ratios. To assess this concern, we experimented with an imputation procedure in which we: regressed the observed hospital-service MA-to-TM ratios on hospital

To create our final analytic dataset, we obtained the MA penetration rate in each hospital’s county as of January 2024 from CMS’ MA penetration files. Similarly, we obtained each hospital’s TM discharge volume in calendar year 2024 from CMS’ inpatient utilization public use files. We then estimated each hospital’s MA discharge volume in calendar year 2024 by multiplying its TM discharge volume by the ratio of the MA penetration rate to the TM enrollment share (that is, one minus the MA penetration rate) in the hospital’s county.⁹

Overall distribution of MA prices relative to TM

We begin by examining the overall distribution of the prices that hospitals receive from MA plans relative to those they receive from TM. To that end, Figure 1 presents histograms of the hospital-level MA-to-TM price ratios described above, separately for inpatient and outpatient services; we weight each hospital by its MA discharge volume, so each bar represents the share of MA discharges occurring at hospitals with price ratios in the specified range. The figure also reports the means and various percentiles of these weighted distributions.

Figure 1. Distribution of Hospital MA-to-TM Price Ratios by Service Type



Note: Bar height shows the share of MA discharges that occur at hospitals with a price ratio in the depicted range. Bin width is 2.5%. Percentiles and means are weighted by MA discharges. Some hospitals fall outside the plotted range.

and service fixed effects; used the fitted model to impute a complete set of service-level predicted MA-to-TM ratios for each hospital; and then calculated the mean of the imputed values. The resulting hospital-level MA-to-TM price ratios were very similar to those calculated using the method described in the main text. The mean absolute difference between the two measures was 0.001 for inpatient services and 0.028 for outpatient services. In both cases, the correlation between the two measures exceeded 0.996.

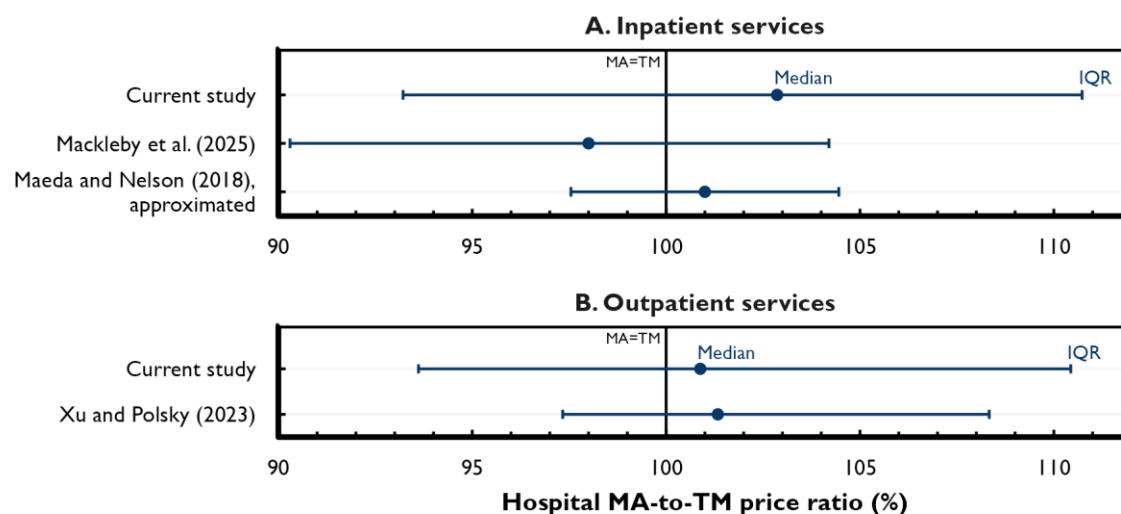
⁹ A small number of hospitals (four in the final inpatient sample and seven in the final outpatient sample) lacked TM discharge counts, which meant that we could not estimate MA discharge volume using this method. We assigned these hospitals the median MA discharge volume in the analyses that follow.

Figure 1 shows that the typical MA discharge occurs at a hospital with an MA-to-TM price ratio slightly above 100%. There is, however, meaningful dispersion; for inpatient services, the interquartile range (IQR) for the MA-to-TM price ratio—that is, the interval bounded by the 25th and 75th percentiles—spans a distance of approximately 18 percentage points (p.p.). For outpatient services, the IQR spans a distance of approximately 16 p.p.

Figure 2 compares our estimates to those from prior studies, focusing on the median and IQR of MA-to-TM price ratios. Our estimates are similar to those from prior studies using HPT data (Xu and Polsky 2023; Mackleby et al. 2025). Like the prior studies, we find that median MA-to-TM price ratios are close to 100%. We do find more dispersion in MA-to-TM price ratios than the prior studies using HPT data, likely partly due to differences in the methods we use to exclude extreme values, as well as the fact that we weight our results by discharge volume, while these other studies do not. Appendix Figure C1 shows that the estimated amount of price dispersion is somewhat sensitive to these choices.

Figure 2 also displays a median and IQR derived from estimates that Maeda and Nelson (2018) produced using claims data from 2013.¹⁰ (Maeda and Nelson do not report these precise quantities, so we approximate them using the methods described in Appendix B.) Our estimate of the median MA-to-TM price ratio aligns closely with Maeda and Nelson's.¹¹ However, both our study and the other studies using HPT data find much more dispersion in price ratios than Maeda and Nelson. This could reflect changes in market conditions since 2013 or differences between the overall market and the three large insurers represented in the claims data used by Maeda and Nelson. An alternative—and perhaps more likely—explanation is that the HPT data contain errors

Figure 2. Comparison of Estimates of Hospital MA-to-TM Price Ratios



Note: The amounts shown for Maeda and Nelson (2018) are approximations of the desired quantities derived as described in Appendix B. The median and IQR shown for Xu and Polsky (2023) are the means of the corresponding quantities across the three categories of outpatient services the authors examine. IQR = interquartile range.

¹⁰ We do not include estimates from Baker et al. (2016b) in Figure 2, as they compute TM rates somewhat differently (as discussed in detail by Baker et al. (2016a) and Maeda and Nelson (2018)) and do not report comparable information on dispersion in MA-to-TM price ratios.

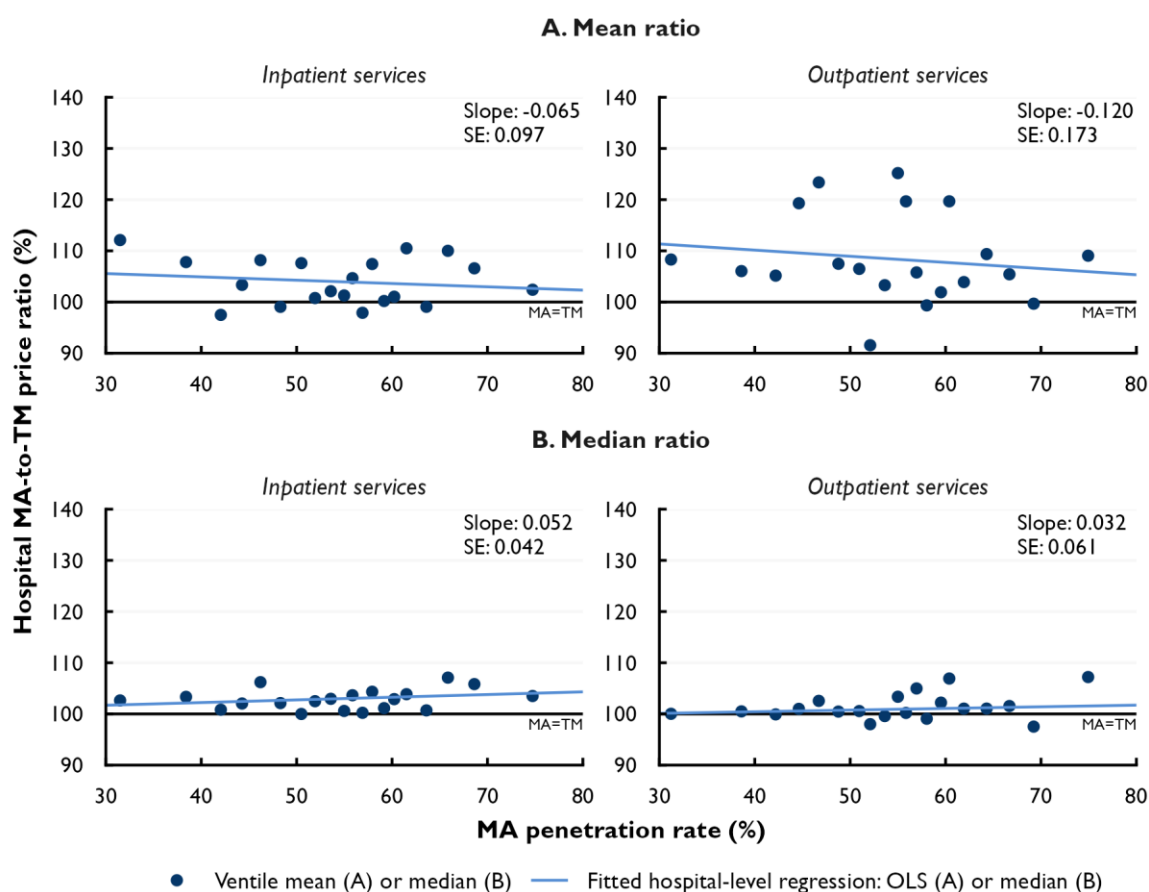
¹¹ A caveat is that Maeda and Nelson (2018) adjust the relevant TM rates for sequestration, which we do not. Without this difference in methods, the gap between our estimates and theirs would be slightly larger.

that are not fully screened out by our (and others') data-cleaning efforts and that inflate the prevalence of extreme price ratios.

Differences between areas with high and low MA penetration

We next examine how the relationship between MA and TM prices varies with MA penetration rates. As a first step, we analyze the relationship between mean hospital MA-to-TM price ratios and MA penetration. Concretely, we run an ordinary least squares regression of the hospital-level MA-to-TM price ratio on MA penetration in the hospital's county, weighting each hospital by its MA discharges; we calculate standard errors clustered at the county level. To obtain a less parametric representation of this relationship, we also report a binscatter; that is, we rank hospitals by MA penetration, group them into 20 bins (ventiles) defined to have an equal share of MA discharges, and then calculate the weighted mean MA-to-TM price ratio and MA penetration rate within each ventile. We report the results in Panel A of Figure 3.

Figure 3. Hospital MA-to-TM Price Ratios by MA Penetration



Note: Each point corresponds to a ventile defined by ranking hospitals by MA penetration and grouping them into 20 bins containing an equal number of MA discharges; the x-coordinate is the mean MA penetration rate in the ventile, while the y-coordinate is either the mean MA-to-TM price ratio (Panel A) or the median ratio (Panel B), weighted by MA discharges. The plotted lines and the reported coefficients reflect the results of a hospital-level regression of MA-to-TM price ratios on county MA penetration rates, weighted by MA discharges; this regression is either an ordinary least squares regression (Panel A) or a median regression (Panel B). Standard errors are clustered at the county level.

The results offer little evidence that MA-to-TM price ratios are associated with local MA penetration. The estimated slope coefficients are moderately negative, with a 10 p.p. increase in MA penetration being associated with a 0.6 p.p. decline in mean MA-to-TM price ratios for inpatient services and a 1.2 p.p. decline for outpatient services. However, both point estimates are smaller than their associated standard errors in absolute value, so we cannot rule out the hypothesis that there is no association (or even a meaningful positive association) between penetration and prices at conventional confidence levels.

We next examine how *median* MA-to-TM price ratios vary across areas with different MA penetration rates. We examine medians for two reasons: first, the experience of the typical hospital may be of independent interest; and second, median price ratios may be less likely to be distorted by data errors than mean price ratios. To do so, we use the same approach as above, except that we run median regressions (with bootstrapped cluster-robust standard errors) in place of ordinary least squares regressions and calculate the median (rather than mean) MA-to-TM price ratio for each ventile. We report the results in Panel B of Figure 3.

These results similarly offer little evidence that MA-to-TM price ratios are associated with local MA penetration. The two slope coefficients are now positive but remain statistically indistinguishable from zero, with the ventile estimates almost all falling in a narrow range centered just over 100%. Notably, the median regression coefficients are much more precisely estimated than their least squares counterparts. As such, we can put much tighter bounds on the association between MA penetration and median MA-to-TM price ratios; a 95% confidence interval for the effect of a 10 p.p. increase in MA penetration extends from -0.3 to 1.3 p.p. for inpatient services and from -0.9 to 1.5 p.p. for outpatient services.

Our finding that there is no clear difference in MA-to-TM price ratios between areas with higher and lower MA penetration broadly aligns with prior work. Mackleby et al. (2025) report a small and, in most specifications, statistically insignificant negative association between MA penetration and MA-to-TM price ratios in their analysis of inpatient prices using HPT data.¹² Similarly, Maeda and Nelson (2018) report a small, statistically insignificant positive association between MA penetration and MA-to-TM price ratios in their analysis of inpatient claims data.

Discussion

This paper uses HPT data to examine how the prices that MA plans pay for a set of high-volume inpatient and outpatient hospital services compare to TM's prices. We find that the prices that MA plans pay are close to TM's on average, although the data show meaningful dispersion in

¹² In some specifications, Mackleby et al. do find a statistically significant negative association between MA penetration and MA-to-TM price ratios even though their point estimates are uniformly smaller in magnitude than ours, reflecting the fact that their standard errors are much smaller. One reason for this difference is that Mackleby et al. run their regressions at the hospital-plan level (rather than the hospital level) and cluster their standard errors at the hospital-insurer level (rather than the county level). If there is correlation in price ratios across insurers within a hospital or across hospitals within a county, standard errors computed this way would tend to be biased downward, perhaps substantially. Indeed, when we experimented with regressions run at the hospital-plan level, we found that standard errors were markedly lower when clustering at the hospital-insurer level rather than the county level. The fact that Mackleby et al. use a more aggressive method for trimming extreme values, plus the fact that they do not weight hospitals by discharge volume, likely also play a role. In our data, both choices tend to result in lower standard errors.

prices across hospitals. We find little evidence that the gap between MA and TM prices differs between areas with higher and lower MA penetration, especially when we focus on median (rather than mean) price ratios. These findings broadly align with those of prior studies using HPT data (Xu and Polsky 2023; Mackleby et al. 2025).

Our findings are, however, subject to some important caveats. First, the HPT files are an incomplete source of price information. As depicted in Table 1, some hospitals have not published usable HPT files, some hospitals with usable HPT files do not have entries for the services of interest, and some entries for the relevant services are unusable either because they do not report valid dollar prices or report implausible values. These gaps could have various causes, including features of plan-hospital contracts that make it difficult for hospitals to report prices in this format and hospital errors when preparing their files.

In any event, the fact that some prices are missing raises the possibility that the missing prices differ systematically from the prices we do observe. We cannot exclude this possibility. Indeed, prices are not missing completely at random; in supplemental analyses reported in Appendix D, we find that local MA penetration, hospital size, and a hospital's market share are all at least somewhat predictive of various forms of missingness.

Second, even where prices are available from the HPT files, they are clearly sometimes inaccurate, as demonstrated by the fact that some entries report highly implausible prices. While we do “trim” some extreme entries from our sample, it is very likely that many data errors remain. As discussed above, these errors may lead us to overstate the amount of dispersion in MA-to-TM price ratios. Indeed, we suspect that this limitation of the HPT data is a major reason that both our analysis and prior analyses using HPT data (Xu and Polsky 2023; Mackleby et al. 2025) find much more dispersion in MA-to-TM price ratios than earlier work using claims data (Maeda and Nelson 2018).

Third, because the HPT data report prices at the service level, they will generally miss payments that MA plans make to hospitals via non-fee-for-service mechanisms, which are in widespread use in MA (HCPLAN 2026). The magnitude of any resulting bias is not clear, as we are unaware of good information on the size of plans' non-fee-for-service payments.

Fourth, while we find no statistically significant association between hospital MA-to-TM price ratios and local MA penetration, we cannot rule out associations of an economically meaningful magnitude. As noted above, our 95% confidence intervals admit increases in the median ratio as large as 1.3 p.p. per 10 p.p. increase in MA penetration for inpatient services and 1.5 p.p. per 10 p.p. increase in MA penetration for outpatient services. Our estimates for mean ratios are less precise and thus compatible with even stronger associations.

Fifth, even if there is no association between local MA penetration and MA-to-TM price ratios, that does not necessarily answer the *causal questions* of ultimate interest, such as how a payment change that increased MA penetration would affect what MA plans pay hospitals. For example, if MA plans are more successful in areas where features of the hospital market allow them to negotiate lower prices with hospitals, the association we estimate would tend to be biased downward relative to the underlying causal effect of interest.

Notwithstanding these caveats, we believe that the most likely explanation for our results is: (1) MA plans pay hospitals prices close to TM's, on average; and (2) environmental or policy changes

that cause more beneficiaries to prefer MA over TM currently have little downstream causal effect on the relationship between MA and TM prices. If these claims are indeed true, it is natural to ask why they are true and whether they will remain true in the future.

One widely cited explanation for this pattern is that the amounts that hospitals can collect for out-of-network care in MA are capped at what TM would pay for the same care (e.g., Berenson et al. 2015; Trish et al. 2017; Maeda and Nelson 2018); the logic of this argument is that if MA plans know they can pay TM rates absent a network agreement, then they have little reason to sign an agreement that would require them to pay higher prices. This theory can account for the observed results, and it suggests that the prices MA plans pay are likely to remain close to TM's indefinitely, irrespective of how the MA market evolves.

However, some prior work has argued that there are limits on the ability of an out-of-network cap to discipline in-network prices (Fiedler 2020; Fiedler and Ly 2023); in particular, because hospitals are not required to accept out-of-network patients (outside of emergency situations), MA plans may opt to pay in-network prices above TM's to ensure that their patients can access a hospital's services. Accordingly, this work has suggested that competitive pressure from TM may play the key role in keeping the prices negotiated by MA plans moored to TM's, with the out-of-network cap playing only a supporting role. Under this theory, if TM became a weak enough competitor for MA plans, then the prices that MA plans pay might begin to rise above TM levels—and toward the higher prices in commercial plans.

The fact that this does not seem to have happened so far, including in areas with MA penetration well above the national average, does not mean that it never will. It is possible that no market has yet reached the “tipping point” at which TM becomes too weak a competitor to anchor MA plans' prices to TM levels. Or it may require time and, perhaps, a critical mass of hospitals operating in environments where TM is a very weak competitor before these effects emerge. Indeed, even when TM is weak, limiting the leverage that MA plans can derive from the out-of-network cap still requires hospitals to: (a) be willing to turn away out-of-network patients; (b) have the policies and procedures needed to follow through on doing so; and (c) make this threat credible to plans in contract negotiations. Learning how to do these things may not be easy. Nevertheless, in our view, the results of our study and others' studies suggest that—at least in the near term and absent major changes in policy—the prices that MA plans pay hospitals are likely to remain close to TM's.

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Appendix A: List of included codes

Table A1: List of included DRGs

DRG	Description
003	ECMO or tracheostomy with mv >96 hours or principal diagnosis except face, mouth and neck with major O.R. procedures
064	Intracranial hemorrhage or cerebral infarction with MCC
177	Respiratory infections and inflammations with MCC
189	Pulmonary edema and respiratory failure
193	Simple pneumonia and pleurisy with MCC
219	Cardiac valve and other major cardiothoracic procedures without cardiac catheterization with MCC
266	Endovascular cardiac valve replacement and supplement procedures with MCC
267	Endovascular cardiac valve replacement and supplement procedures without MCC
274	Percutaneous and other intracardiac procedures without MCC
280	Acute myocardial infarction, discharged alive with MCC
291	Heart failure and shock with MCC
329	Major small and large bowel procedures with MCC
470	Major hip and knee joint replacement or reattachment of lower extremity without MCC
481	Hip and femur procedures except major joint with CC
682	Renal failure with MCC
698	Other kidney and urinary tract diagnoses with MCC
853	Infectious and parasitic diseases with O.R. procedures with MCC
870	Septicemia or severe sepsis with mv >96 hours
871	Septicemia or severe sepsis without mv >96 hours with MCC
872	Septicemia or severe sepsis without mv >96 hours without MCC

Table A2: List of included HCPCS codes

HCPCS	Description
23472	Reconstruct shoulder joint
27130	Total hip arthroplasty
27447	Total knee arthroplasty
33249	Insj/rplcmt defib w/lead(s)
45380	Colonoscopy and biopsy
45385	Colonoscopy w/lesion removal
66984	Xcapsl ctrc rmvl w/o ecp
74177	Ct abd & pelvis w/contrast
77386	Ntsty modul rad tx dlvr cplx
78452	Ht muscle image spect mult
78815	Pet image w/ct skull-thigh
93005	Electrocardiogram tracing
93306	Tte w/doppler complete
93458	L hrt artery/ventricle angio
93653	Compre ep eval tx svt
93656	Compre ep eval abltj atr fib
99283	Emergency dept visit low mdm
99284	Emergency dept visit mod mdm

99285	Emergency dept visit hi mdm
C9600	Perc drug-el cor stent sing

Appendix B: Deriving approximations from Maeda and Nelson (2018)

Figure 2 in the main text presents estimates from several prior studies, including Maeda and Nelson (2018), of selected percentiles of the distribution of MA-to-TM price ratios across hospitals. Maeda and Nelson do not directly report the relevant amounts, so we use information they do report to approximate what these amounts would have been in their data. This appendix describes how we construct these approximations.

To approximate the median of the hospital-level distribution, we use the median of the metropolitan-statistical-area-level (MSA-level) distribution of mean MA-to-TM price ratios presented in Table 3: 101%. This approximation relies on several assumptions: (1) mean and median MA-to-TM ratios are similar within an MSA; (2) MA-to-TM price ratios do not vary too strongly with the number of hospitals in an MSA; and (3) the number of (IPPS) hospitals located outside MSAs is not too large, or their MA-to-TM price ratios are not that different.

These conditions are reasonable. Maeda and Nelson’s results show directly that there is only modest dispersion in MA-to-TM price ratios either within or across MSAs, which supports the first two conditions. Additionally, hospitals located in MSAs accounted for nearly three-quarters of IPPS hospitals at that time, which supports the third condition (CMS 2012).

To approximate the IQR of the hospital-level distribution, we rely on the authors’ estimates of how MA-to-TM price ratios vary across and within MSAs. To formalize our method, we let R be the MA-to-TM price ratio for a randomly drawn hospital, and we let M be that hospital’s MSA. We can then decompose R as follows:

$$R = \mathbb{E}[R] + \underbrace{\mathbb{E}[R|M] - \mathbb{E}[R]}_{\text{cross-MSA deviation}} + \underbrace{R - \mathbb{E}[R|M]}_{\text{within-MSA deviation}}. \quad (\text{B1})$$

With the aid of some distributional assumptions, we can use information reported by Maeda and Nelson to estimate the amount of variation contributed by each of the two bracketed terms in equation (B1) and, thus, the total amount of variation in R .¹³

We start with the second term in equation (B1), which reflects variation in MA-to-TM price ratios *across* MSAs. To make progress, we assume that $\mathbb{E}[R|M]$ follows a normal distribution. For any normally distributed random variable X , the following identity holds:

$$V[X] = \left[\frac{F^{-1}(1 - \alpha) - F^{-1}(\alpha)}{\Phi^{-1}(1 - \alpha) - \Phi^{-1}(\alpha)} \right]^2, \quad (\text{B2})$$

where F is the c.d.f. of X and Φ is the standard normal c.d.f. Maeda and Nelson’s Table 3 reports the 10th and 90th percentiles of the distribution of $\mathbb{E}[R|M]$. By plugging these percentiles into equation (B2), we can recover an estimate of $V[\mathbb{E}(R | M)]$.

We turn next to the third term in equation (B1), which reflects variation in MA-to-TM price ratios *within* MSAs. We assume that, conditional on M , the deviation $R - \mathbb{E}[R|M]$ follows a normal distribution with variance $V[R|M]$. Table 12 of the working paper version of the paper (Maeda and Nelson 2017) reports the 10th and 90th percentiles of the distribution of the MA-to-TM ratio

¹³ In what follows, we again implicitly rely on the assumption that the distribution of MA-to-TM price ratios does not depend on the number of hospitals in an MSA.

across hospitals within the top 10 largest MSAs for two high-volume DRGs: 392 and 470.¹⁴ Focusing on DRG 392, we use equation (B2) to derive an estimate of $\mathbb{V}[R|M]$ for each of the 10 MSAs. We then approximate the distribution of $\mathbb{V}[R|M]$ using this empirical distribution.¹⁵

Under the additional assumption that $\mathbb{E}[R|M]$ and $\mathbb{V}[R|M]$ are independent, we can then draw repeatedly from the distribution of $R - \mathbb{E}[R]$. To generate each draw, we: (1) use our estimate of $\mathbb{V}[E(R | M)]$ to generate a random draw from the distribution of $\mathbb{E}[R|M] - \mathbb{E}[R]$; (2) draw a value of $\mathbb{V}[R|M]$ from the empirical distribution described above and use this variance to generate a random draw from the distribution of $R - \mathbb{E}[R|M]$; and (3) sum these amounts to generate the desired draw from the distribution of $R - \mathbb{E}[R]$. We then calculate the IQR of the simulated distribution of $R - \mathbb{E}[R]$, and, under the assumption that R has a symmetric distribution, add back our estimate of the median of the distribution of R to recover the IQR of the distribution of R itself.

Table B1 summarizes the width of the approximated IQRs obtained using this method. The table also shows that our approximated IQRs would be modestly smaller if we estimated: (1) the amount of cross-MSA variation using Maeda and Nelson's estimates of the 25th and 75th percentiles of MSA-level distribution (instead of the 10th and 90th percentiles); or (2) the amount of within-MSA variation using Maeda and Nelson's estimates for DRG 470 (rather than DRG 392).

Table B1: Approximated IQR widths based on Maeda and Nelson (2018)

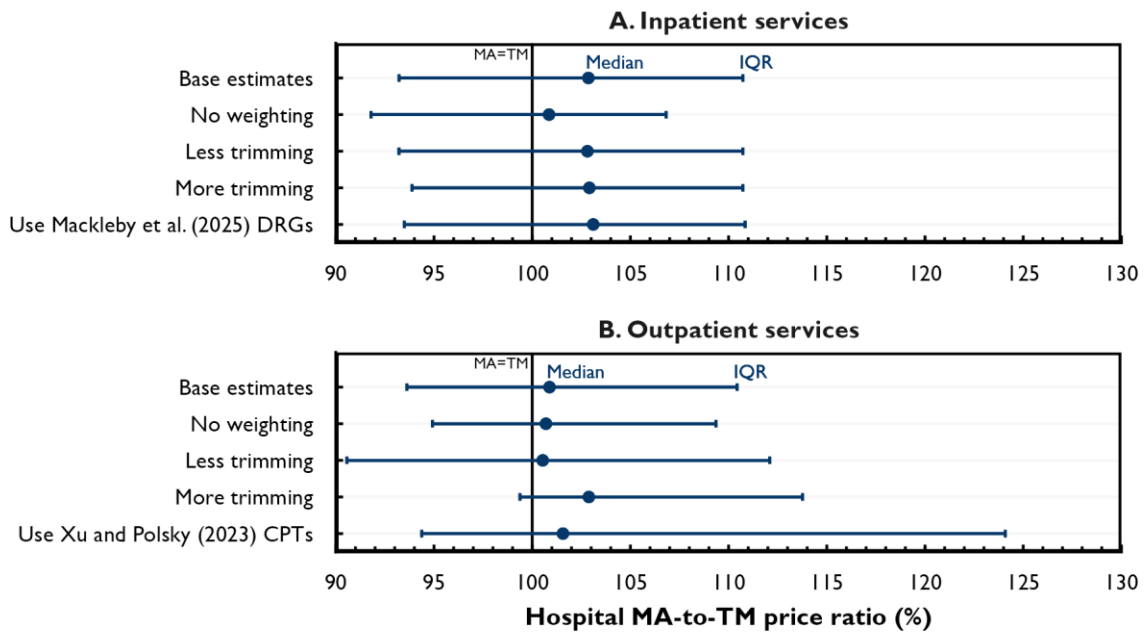
Scenario	Approximated IQR Widths (p.p.)		
	Cross- MSA	Within- MSA	Total
Base method	4.2	4.7	6.9
Use 25 th and 75 th percentiles to estimate cross-MSA variation	3.0	4.7	6.1
Use DRG 470 to estimate within-MSA variation	4.2	3.2	6.2

¹⁴ The published version of the paper reports similar estimates in graphical form in Figures 1 and 2.

¹⁵ Because MA-to-TM ratios for different DRGs may not be perfectly correlated across hospitals, this method may overstate how much an MA-to-TM ratio that encompassed more DRGs would vary within an MSA.

Appendix C: Supplemental figures

Figure C1. Estimated Distributions Under Alternative Methodologies



Note: Scenarios with less trimming exclude entries with MA-to-TM ratios above 20 or below 0.125. Scenarios with more trimming exclude entries with MA-to-TM ratios above 5 or below 0.5. IQR = interquartile range.

Appendix D: Predictors of HPT data completeness

We examined whether hospital characteristics predicted the completeness of a hospital's HPT data. We ran four sets of hospital-level bivariate least squares regressions, each of which examined a different aspect of data completeness; the outcome variables and sample definitions for each are described in Table D1. All four sets of regressions used the same predictor variables: MA penetration in the hospital's county; the natural logarithm of hospital Medicare discharges; and a hospital's Medicare market share within its county.¹⁶

Table D1: Specifications for data completeness regressions

Aspect of completeness	Outcome variable	Sample definition
Has a usable HPT file	Indicator for having a usable HPT file	All hospitals
Possible to calculate an MA-to-TM price ratio	Indicator for having a calculated MA-to-TM price ratio	Hospitals with a usable HPT file
Breadth of entries	Share of "potential" plan-service combinations present (i.e., ratio of actual number of plan-service combinations to the number of combinations if every plan had entries for all 20 relevant services)	Hospitals with a calculated MA-to-TM price ratio
Validity of entries	Share of observed entries that have valid MA-to-TM price ratios and passed data quality checks	Hospitals with a calculated MA-to-TM price ratio

Table D2 reports the slope coefficients from these regressions. At least some hospital characteristics appear to be predictive of data completeness across all four dimensions we examine, suggesting that patterns of missing data are not fully random. We caution that our finding that hospital characteristics predict the breadth of entries in a hospital's file (Panel C) may at least partly reflect the fact that some smaller hospitals do not offer all of the services we examine, rather than a higher incidence of truly missing data.

¹⁶ Each hospital's total Medicare discharges were estimated by dividing its reported TM discharges by one minus its MA penetration. Hospitals' county-level market shares were calculated using these estimated discharge amounts. Market share calculations only included hospitals within our base hospital sample and thus exclude critical access hospitals; we also omitted hospitals with missing discharge information.

Table D2: Results from data completeness regressions

	Inpatient services		Outpatient services	
	Coef. (SE)	N	Coef. (SE)	N
A. Has a usable HPT file				
County MA penetration	0.127* (0.039)	3020	0.127* (0.039)	3020
log(Medicare discharges)	0.035* (0.004)	2948	0.035* (0.004)	2948
Medicare market share	0.016 (0.011)	2948	0.016 (0.011)	2948
B. Possible to calculate an MA-to-TM price ratio				
County MA penetration	0.081 (0.090)	2870	0.181 (0.097)	2870
log(Medicare discharges)	0.037* (0.007)	2821	0.004 (0.008)	2821
Medicare market share	0.020 (0.027)	2821	-0.074* (0.029)	2821
C. Breadth of entries				
County MA penetration	0.020 (0.051)	1784	-0.108 (0.071)	1851
log(Medicare discharges)	0.043* (0.005)	1780	0.046* (0.006)	1844
Medicare market share	-0.029* (0.014)	1780	0.009 (0.021)	1844
D. Validity of entries				
County MA penetration	-0.029 (0.036)	1784	-0.112 (0.079)	1851
log(Medicare discharges)	-0.005 (0.004)	1780	-0.025* (0.006)	1844
Medicare market share	-0.006 (0.013)	1780	0.015 (0.024)	1844

Note: The table reports the slope coefficients, associated standard errors, and sample sizes from the regression specifications described in this appendix. Standard errors are clustered at the county level. An asterisk indicates that the p-value from a t-test of the hypothesis that the coefficient equals zero is less than 0.05.