The Effects of Price Transparency Regulation on Prices in the Healthcare Industry

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We provide empirical evidence on the causal effects of price transparency regulation (PTR) in the healthcare industry. Using micro data on actual healthcare purchases, and exploiting both between- and within-state variation to address endogeneity concerns, we find that PTR reduces the price charged for common, elective medical procedures by approximately 5% and increases the sensitivity of demand to a 1% change in charge prices by 0.5%. However, the effect of PTR on the actual prices paid by insured patients is limited to the relatively small fraction of patients that have the greatest incentives to directly consider the costs of care.

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I. Introduction

In 2011, healthcare expenditures in the United States were $2.7 trillion, or nearly 18 percent of GDP (CMS, 2011). The Congressional Budget Office estimates that these expenditures will grow to over 25 percent of GDP and 40 percent of total federal spending by 2037 (CBO 2012). One commonly proposed method for containing these expenditures is to mandate the ex-ante disclosure of healthcare prices (e.g., Presidential Order 13410).

On the one hand, greater price transparency has the potential to empower consumers, lower search costs, and decrease overall healthcare spending (e.g., Stigler 1961; Diamond 1971; Stahl 1989; Brown and Goolsbee 2002). On the other hand, because of the existence of differentiated pricing structures and complex multi-party payment arrangements, ex-ante price disclosures in the healthcare industry may not be directly relevant to consumers. Moreover, in the absence of other credible quality indicators, mandatory price disclosure may even create incentives to increase prices (e.g., Bagwell and Riordan 1991; Sinaiko et al. 2011). In this study, we estimate the causal effect of price transparency regulation on prices in the healthcare industry.

We focus on regulations adopted over the past decade in more than 30 states that require the disclosure of prices on publicly available state websites that allow consumers to compare the average price for common procedures across hospitals within the state (hereafter, "price transparency regulation" or "PTR"). Because charge prices are the focus of nearly all PTR regulation, we begin by investigating how PTR affects charge prices using patient-level charge price data from the Nationwide Inpatient Sample (*NIS*) database.[1]

Our main identification strategy exploits the fact that patients are likely to have the opportunity and incentive to use the PTR websites to shop only for elective, and not emergency, medical procedures. Accordingly, we base our estimates of the causal effect of PTR adoption on comparisons of price differences between shoppable and non-shoppable procedures around the staggered PTR adoption dates using state-year and procedure-year fixed effects to control for differential price trends.

We use hip replacements as our primary shoppable procedure of interest. Hip replacements are relatively common, uncomplicated, non-life-threatening, and frequently disclosed on PTR websites (Rosenthal et al. 2013). Despite the routine nature of the procedure, similar to prior studies, we document wide variation in hip replacement prices. In our sample, the charge price for a hip replacement ranges from $16,450 (1st percentile) to $94,125 (99th percentile).

We use appendectomies as our primary non-shoppable benchmark procedure. Although appendectomies exhibit similar relative price variation and are also

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1 Throughout the paper, we distinguish between the "charge price" and "total payment." We define the "charge price" as the gross, initial, non-discriminatory amounts hospitals bill for a particular procedure. Because of the presence of pre-negotiated discounts arranged by third-party payers (e.g., Medicare, Medicaid, and private insurance) and ex-post charity care discounts, patients are often not responsible for the full charge price. We define the" total payment" as the net price including all applicable discounts.

commonly offered by most hospitals and disclosed on nearly all PTR websites, unlike hip replacements, they usually require immediate medical attention.

We first separately examine the between-state variation in hip replacement and appendectomy charge prices following the adoption of PTR. We control for differences in the quantity and complexity of care associated with each procedure using a variety of patient- and hospital-level control variables. We also control for state and year fixed effects so that identification in this analysis comes from variation among states in the dates when the regulation entered into force. We document that in those states that adopted price transparency websites the price charged for a hip replacement decreased by an average of over 7.3 percent, or approximately $3,130. The point estimate for the change in charge prices for appendectomies is less than 1.0 percent and statistically indistinguishable from zero.

A potential concern with identifying the causal effect of PTR based on variation between states in implementation dates is that the regulation is not randomly assigned to states and thus additional state-level factors that also affect charge prices may influence the timing of the decision to regulate. To address this potential endogeneity concern, our second analysis exploits *within*-state price variation in hip replacements relative to appendectomies. We argue that most potential alternative state-specific explanations for our results are likely to similarly affect both elective and emergency procedures.[2]

Similar to our analysis based on variation in implementation dates, after the adoption of PTR, we document a decline in hip replacement charge costs of 5.2 percent compared to appendectomies (or 6.3 percent when we include procedure-year fixed effects). The estimated decline in charge prices is 3.1 percent when we include hospital fixed effects, which suggests that about half of the observed mean reduction in charge prices is attributable to providers reducing prices whereas the other half is attributable to patients switching to cheaper hospitals.

Several additional analyses further support a causal interpretation of the effect of PTR on charge prices. First, the effect of PTR is concentrated around the date on which charge prices became available online, as opposed to the date when state legislators passed the regulations, suggesting that the observed decrease is directly attributable to the website disclosures. Second, consistent with competition among hospitals playing an important role, the negative association between PTR and charge prices is strongest in urban areas. Third, the documented decrease in charge prices is most pronounced among those hospitals with a pre-PTR price level above the 50th percentile. Those hospitals below the 50th percentile experience no significant price changes.

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[2] For example, PTR could also potentially lower prices by increasing public scrutiny of hospitals' prices. Reports in the popular press of extreme hospital prices can create significant backlash from both consumers and politicians, potentially increasing the pressure on hospitals to avoid being perceived as overcharging for services (e.g., Neal 2003). Price disclosures could also serve as a useful source of information for regulators seeking to lower costs by limiting payment differentials (Mechanic et al. 2012).

In order to more directly assess the relevance of charge price disclosures via the PTR websites, we next examine the sensitivity of procedure demand to changes in charge prices. We find that, within a given state and year, the price a hospital charges has a modest association with the quantity demanded – a 1 percent higher charge price is associated with a -0.591 percent lower quantity of hip replacements. Consistent with an increase in consumer search, we find that on average the charge price sensitivity of demand for hip replacements increases by -0.464 percent relative to appendectomies following the adoption of PTR. This increase is primarily driven by the subset of patients most likely to be under- or uninsured and with enough personal assets not to qualify for charity care or bankruptcy (i.e., those living in middle income zip codes), suggesting that patient incentives are an important determinant of this relationship.[3]

Next, we examine the effect of PTR on actual patient payments. The fact that many patients are not responsible for paying the full charge price means that the observed decrease in charge prices does not necessarily imply a reduction in all patients' actual expenditures. To more directly address this issue, we use a separate sample of claim reimbursement data for patients with employer-

[3] We define 'underinsured' patients as patients who, although they have some insurance coverage, are also responsible for directly paying for a relatively substantial portion of their own costs of care, for example, through high deductibles, high coinsurance and/or limitations on the total insurance benefit within a year.

sponsored health insurance from the *Truven Health Analytics Marketscan Commercial Claims* database ("*Marketscan*").[4]

When we repeat our analyses using actual payment data from *Marketscan*, we find that, on average, PTR had no effect on the actual payments made by insured patients. Our results allow us to reject with 95 percent confidence that, on average, PTR decreases payments for patients with employer-provided insurance by more than 1.8 percent.

The relatively high cost of hip replacements coupled with the cap on patients' marginal costs at their annual out-of-pocket maximum is one potential explanation for the lack of an effect of PTR on actual insured-patient payments. To address this possibility, we next examine the effect of PTR on the actual price paid for a less expensive shoppable procedure – a routine, uncomplicated, Caesarean section scheduled because the patient has previously given birth by Caesarean section (hereafter, "a C-section").[5]

Despite the lower total costs, we find limited evidence that PTR had a significant effect on the average C-section coinsurance payment. Relative to appendectomies, PTR decreases C-section costs by less than 2 percent. However, among a relatively small subsample of patients whose income levels and

[4] One important caveat to this data is that consumers with employer-provided insurance may directly pay for very little of their medical care and thus may be relatively less price sensitive compared with patients who directly purchase their own insurance or uninsured patients. That we can estimate the effect of PTR on actual payments only for patients with employer-provided insurance, and not the uninsured or patients who directly purchase their own insurance, is a limitation of our findings.

[5] For patients who previously gave birth via C-section, for subsequent pregnancies, C-sections are commonly medically recommended and scheduled in advance (Cunningham et al. 2010).

insurance contracts likely provide the greatest incentives to consider costs we find that PTR does have a substantial impact on actual patient payments – average C-section coinsurance payments decrease by approximately 13.3%, or $217.

These findings contribute to existing research by broadening our understanding of the effects of mandatory disclosure regulation to the healthcare market. Prior research on the effects of transparency regulation, although nuanced, largely suggests that greater transparency benefits consumers.[6] However, in the healthcare market, prices are determined through a complex interaction between hospitals, patients, employers, insurers and the government (among others), making the applicability of the results from prior research questionable. Our findings highlight how the complex pricing arrangements of the healthcare industry condition the effects of PTR and underscore the importance of consumers' incentives to directly consider costs in determining the effectiveness of charge price disclosure. Because they further elucidate the mechanisms through which price transparency regulations function in the healthcare sector and the

[6] Extant research on the effects of price transparency in the healthcare market is limited in scope and inconclusive (e.g., Tu and Lauer 2009). Studies on transparency regulation in healthcare markets have largely focused on the effect of disclosing information about quality (e.g., Culter et al. 2004; Dranove et al. 2003; Chernew et al. 2008; Dafny and Dranove 2008). The extensive literature on transparency regulation in financial markets is also mixed. Studies examining the Securities Acts of 1933 and 1934 (e.g., Stigler, 1964; Benston, 1969 and 1973; Jarrell, 1981; Mahoney and Mei, 2013) suggest that these regulations had little benefit. More recent studies on Regulation Fair Disclosure (e.g., Heflin et al. 2003; Gintschel and Markov, 2004; Francis et al. 2006) and the Sarbanes-Oxley Act (e.g., Chhaochharia and Grinstein, 2007; Zhang, 2007; Li et al. 2008) suggest the existence of both substantial costs and benefits from these regulations. Bushee and Leuz (2005) and Greenstone et al. (2006) examine extensions of U.S. securities regulation to OTC-traded firms and find that investors in this market appear to benefit from the regulations.

conditions under which charge price disclosure is likely to be effective, our findings are also relevant to policymakers considering future regulatory action.[7]

II. Effect of Price Transparency Regulation on Charge Prices

A. Data

Price Transparency Regulation.—In the healthcare market, prior to PTR, basic pricing information for even the most standardized procedures was notoriously difficult to acquire (Rosenthal et al. 2013).[8] To overcome this perceived market failure, over the past decade, more than 30 states have adopted regulation directly aimed at increasing price transparency. State legislatures have enacted three broad categories of transparency laws: (i) requirements for hospitals to disclose estimated (or average) prices upon request from patients; (ii) requirements to report average price indicators to state health departments who then summarize and publish these figures in annual reports; (iii) requirements to report charge prices to agencies that establish searchable databases and make them available on public websites.

We focus on the third solution (establishing websites that disclose charge prices) because it provides the lowest cost, most widely available, disclosure and

[7] Clearly, however, the results in this study must be traded-off against potential costs that are not addressed here, such as the costs of creating and maintaining the PTR websites.

[8] Recently firms specializing in establishing searchable databases of healthcare prices have begun to appear (e.g., Castlight and ClearHealthCosts.com) However, such services are still in their infancy and, unlike regulatory-based government organizations, cannot force providers to participate.

is thus most likely to affect prices.[9] The requirement to disclose price estimates upon request still entails significant search costs because patients have to identify and contact potential providers. Similarly, the annual reports produced by some states do not allow patients to search for the prices of specific procedures and therefore, at best, provide a noisy signal of the general cost-level.

We obtain the date of the first charge price website disclosure for each state (as of July 2013) by contacting, either by phone or email, the health department, hospital association, and/or the webmaster in each state. In the first column of Table 1, we report the relevant disclosure date for each state. There are 34 (16) states that (did not) report charge prices on publicly available websites prior to July 2013. Pennsylvania was the first state to disclose charge prices (in December 2002) and Wyoming was the last (in February 2011). Across years, the distribution of first time disclosures of charge prices is fairly well-dispersed.

Charge Prices.—We obtain charge price data from the *Nationwide Inpatient Sample* (*NIS*) provided by the *Healthcare Cost and Utilization Project* (*HCUP*) database. The *NIS* includes a representative sample of patient-level data on inpatient stays from hospitals around the country.[10] A limitation of this database

[9] In Internet Appendix Section IA1, we discuss several arguments for why, despite the ubiquitous nature of discounting, charge prices are economically relevant.

[10] HCUP selects the *NIS* hospitals from the State Inpatient Database (SID). In order to ensure the *NIS* is a representative sample of U.S. hospitals, HCUP chooses its sample from the state databases using a sampling technique where hospitals are first grouped into five strata based on: (1) geographic location; (2) teaching status; (3) ownership; (4) bed size; and (5) urban versus rural. HCUP then chooses 20 percent of hospitals randomly from each stratus to form the *NIS*. The database provides discharge data for all payer types (e.g., self-pay, Medicare, and private payers) for the selected hospitals.

is that, because it is constructed at the hospital level, it provides information only on charge prices and not total payments. Our sample from the *NIS* database runs from 2003 to 2010, so we do not examine PTR website disclosure dates before or after this period (i.e., Pennsylvania and Wyoming).[11]

Table IA1 Columns (1) and (2) report the number of unique hip replacement and appendectomy observations by state in the *NIS* database, 239,862 and 168,767, respectively. In general, the sample compositions for both procedures correspond to state populations, with Florida and California having the largest number of observations and South Dakota and Montana the smallest.

B. Research Design

To examine the effect of PTR on charge prices we estimate the following linear model (suppressing time, patient, and state subscripts):

$$Ln(Total\ Charge) = \beta_0 + \beta_1 PTR + \sum \beta_j Controls_j + \sum \beta_i Fixed\ \ Effects_i + \varepsilon. \qquad (1)$$

The dependent variable, *Ln(Total Charge)*, is the log of charge prices from the *NIS* database. *Total Charge* includes all costs incurred for a hospital admission excluding professional fees, where hip replacement and/or appendectomies are the principle procedures.[12] *PTR* is an indicator variable coded as '1' after a website in

[11] We exclude Maryland from our analyses because the state restricts healthcare price increases through other regulation.

[12] We identify hip replacements in the *NIS* database using the International Statistical Classification of Diseases and Related Health Problems 9-CM ("ICD") code. We use ICD code 81.51, which indicates a total hip replacement (i.e., replacement of the femoral head and acetabulum by prosthesis). We identify appendectomies in the *NIS* database using ICD code 47.01, which indicates a routine laparoscopic appendectomy.

a given state first discloses charge prices, and '0' otherwise.[13] $Controls_j$ denotes a set of patient- and hospital-level variables. The patient-level variables control for the complexity and the total volume of care for a particular procedure and include the patient's age, the patient's gender, the length of the patient's hospital stay, the number of diagnoses in the patient's record, and the median household income quartile for the patient's zip code. The hospital-level variables control for variation in the cost of delivering services and include: the log of the number of beds and indicators for whether the hospital is classified as a teaching hospital and whether the hospital is located in an urban area. We provide further details on variable measurement in internet appendix (IA) IA Section 2.

The first panel of Table IA2 reports descriptive statistics for the variables used in the charge price regression analyses for the sample of hip replacement procedures. The average (median) total charge (*Total Charge*) for a hip replacement in our sample is \$42,893 (\$38,937).[14] The variance and tails of the distribution reflect wide variation in prices, with a standard deviation of \$17,503 and a 1st (99th) percentile of \$16,450 (\$94,125). In terms of our control variables, the median patient is 67 years old (*Age*), female (*Female*), spends three days in the hospital (*Days in the Hospital*), has six diagnoses (*No. of Diagnoses*), lives in

13 Because the exact month of the PTR website launch is difficult to determine and because prior research finds that hospitals often change charge prices at the end of the year (e.g., Reinhardt 2006), to avoid mismeasuring the onset of the PTR regime, we exclude the year of adoption from the analysis.

14 To limit the influence of outliers, we exclude charge prices below \$5,000 and above \$100,000 (for both hip replacements and appendectomies). Inferences with respect to the effects of PTR on charge prices are robust to less restrictive truncation levels, although the statistical estimates are less precise.

a middle income zip code (*Income in Zip* = 3), and visits a non-teaching hospital (*Teaching Hospital* = 0) in a relatively densely populated location (*Urban* = 1).[15]

Table IA2 reports the descriptive statistics for the sample of appendectomy procedures. The price variance of appendectomies is similar to hip replacements (coefficient of variation 0.56 versus 0.41, respectively). On average, charge prices for appendectomies are less than hip replacements ($24,989 versus $42,893) and appendectomy patients are younger, more likely to be male and have fewer diagnoses. Other patient and hospital characteristics are very similar to hip replacements.

C. Baseline Results

Our assessment of the effect of PTR on charge prices is based on the results of four separate specifications, each designed to control for different potential sources of endogeneity.

Between-State Specification.—In the first specification, we separately estimate the effect of PTR on hip replacement and appendectomy prices and include fixed effects for state, year and patient insurance plans. This specification relies on heterogeneity in states' PTR implementation dates to estimate the effect of PTR. In particular, the inclusion of year-specific indicators controls for any contemporaneous changes in the healthcare market, such as improvements in

[15] A potential concern is that patients over the age of 65 may be less price sensitive because of Medicare coverage (which begins at age 65). We note that our inferences are nearly identical if we limit to the subset of patients under age 65.

medical technology, which likely affect all hospitals but are unlikely to be correlated with the dates of PTR implementation.

A comparison of the effect of PTR on hip replacement versus appendectomy charge prices is useful because, like hip replacements, appendectomies are routine, uncomplicated, and have little variation in outcome quality (Hsia et al. 2012). However, unlike hip replacements, appendectomies are typically not an elective procedure and thus must be carried out soon (typically within a few days) after doctors reach a diagnosis.[16] Because patients are unlikely to have an incentive or opportunity to compare prices for appendectomies, the disclosure of charge prices should have a limited effect on patients' search costs. Thus, a comparison of the effect of PTR on hip replacements and appendectomies is informative as to whether search or an alternative mechanism, such as political or regulatory pressure to reduce costs, is the dominant explanation.

Column (1) of Table 2 reports results for hip replacements. In terms of patient-level controls, the age and gender indicators suggest that hip replacements are cheaper for older and female patients. Both the length of stay and the number of diagnoses are significant and exhibit the expected positive signs. The indicator for urban hospitals, the only significant variable among the hospital-level controls, is positive, consistent with higher costs in more densely populated areas (Thompkins et al. 2006). The coefficient on our variable of interest, *PTR*, is

[16] In our *NIS* sample, 74 percent (18 percent) of all appendectomies are classified as emergency (urgent) procedures whereas only 4 percent (6 percent) of hip replacements are classified as emergency (urgent) procedures.

negative and statistically significant. The coefficient of -0.076 indicates that, on average, the disclosure of charge prices leads to a 7.3 percent reduction in charge prices, or approximately $3,130.

Column (2) of Table 2 reports results for appendectomies. Appendectomy charge prices are higher for older patients who spend more days in the hospital and have a larger total number of diagnoses. Teaching hospitals in rural locations have lower charge prices on average. The remaining control variables are statistically insignificant. The point estimate for PTR indicates that the change in charge prices for appendectomies is less than 1.0 percent and statistically indistinguishable from zero.

Within-State Specification.—A concern with identifying the effect of PTR across different states based on variation in the implementation dates is that the timing of the regulation is not randomly assigned and thus additional state-level factors may also influence charge prices (e.g., Ball 1980; Mulherin 2007). To address this potential endogeneity, we next examine variation in hip replacement charge prices *within* a particular state relative to appendectomies.

In our within-state analysis, in addition to insurance plan type, we also include fixed effects for *State*Year* (to control for any differential trend in prices across states) and *State*Hip Replacement* (to control for the average state-level difference between the prices for hip replacements and appendectomies). In this specification, our identification of the *PTR* effect comes from variation in the difference between the prices for hip replacements relative to appendectomies, within a state, following the PTR implementation date.

Column (3) of Table 2 reports the results of our second specification. The magnitudes and significance levels of the control variables are similar to Columns (1) and (2). The test variable, *PTR*, is significantly negative and has a coefficient of -0.053. In economic terms, this result implies that the disclosure of charge prices is associated with a 5.2 percent reduction in the charge prices for hip replacements relative to those for appendectomies.

Procedure-Year Fixed Effects Specification.—In our third specification, in addition to the variables included in the Column (3) specification, we include fixed effects for procedure-year (*Year*Hip Repl.*) to control for any differential trend in the prices of hip replacements relative to appendectomies. A potential downside of this specification is that the effect of PTR is likely to be understated if it takes more than one year to manifest.

Results for the procedure-year fixed effects specification are presented in Column (4) of Table 2. Similar to the results in Column (3), the PTR coefficient is -0.065, indicating a decrease in the charge price for hip replacements relative to appendectomies of 6.3 percent.

Within-Hospital Specification.—To investigate the response of hospitals to increased search, in our fourth specification, we additionally (relative to Column 3) include hospital fixed effects. Unfortunately, because of their sampling procedures, the *NIS* database does not include a constant set of hospitals across years. Hence, although we include all observations in the regression, identification stems only from the subset of hospitals that is included in the dataset both before and after PTR.

If the documented decrease in charge prices is attributable only to patients selecting cheaper hospitals, within-hospital prices should remain relatively constant and thus there should be no association between *PTR* and charge prices once we include hospital fixed effects. Alternatively, if the observed effect is driven (at least in part) by hospitals decreasing prices, we expect some portion of the observed effect to remain. Furthermore, the inclusion of hospital fixed effects helps to account for any residual selection bias resulting from the *NIS* sampling procedures. This addresses the concern that cheaper hospitals are differentially included in the sample over time.[17]

Column (5) of Table 2 reports results. Patient-level controls exhibit the same signs and similar magnitudes as in the earlier specifications except that *Income in Zip* is now negative and significant. The estimated coefficient on our test variable, *PTR*, is significantly negative. The coefficient of -0.032 implies that the

[17] Any bias to our specification without hospital fixed effects would have to occur through differentially including hospitals over time that are cheaper for hip replacements relative to appendectomies.

disclosure of charge prices is associated with a 3.1 percent reduction in charge prices. The magnitude of this effect suggests that approximately half of the observed mean reduction in charge prices is attributable to providers reducing prices whereas the other half is attributable to patients switching to cheaper hospitals. Overall, although charge prices are list prices, the evidence supports the notion that consumers use the list price as a mechanism to facilitate their choice of hospital.

Throughout the remainder of the paper, for parsimony, we frequently report results only for the within-state specification in Column (3) of Table 2. We choose this specification because it provides tighter identification of the effects of PTR than the between-state specification and also because it is not subject to the measurement and sampling concerns in the procedure-year and hospital fixed effects specifications.[18]

Sensitivity Analyses.—We conduct a variety of additional analyses to assess the sensitivity of the results in Table 2 to: 1) restricting our sample to patients with the least complex cases; 2) repeating our analyses with two alternative searchable procedures: knee replacements and scheduled caesarean sections and;[19] 3)

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[18] Although coefficient magnitudes and significance levels differ somewhat depending on the specification, our subsequent conclusions with respect to the effects of PTR are similar using the between-state, procedure-year, and hospital fixed effects specifications.

[19] As a shoppable procedure, scheduled C-Sections offer some advantages over hip replacements. For example, C-section patients are often younger and the total procedure costs are lower, meaning that for insured patients the marginal costs of care are more likely to fall below their annual out-of pocket maximum. The inferences from our charge price analyses are almost identical (with the exception of our procedure-year specification, which is negative but not statistically significant)

excluding all control variables. Overall, the results from these sensitivity tests, tabulated in Table IA4 Panel A of the Internet Appendix, are similar to those reported in our baseline specification (i.e., Column (3) of Table 2).

D. Assessing the Sharpness of the Charge Price Effect

In this section, we assess the temporal sharpness of the charge price effect of PTR. This analysis further addresses the potential concern that the association between PTR and charge prices may reflect the fact that the timing of the implementation of PTR at the state level is not randomly assigned and, therefore, could reflect unmodeled state-level factors that simultaneously influence both politicians' decision to regulate and the price of hip replacements.

In the within-state analysis in Table 2, we estimate the effect of PTR on charge prices for hip replacements relative to appendectomies, which precludes general inflationary trends as a plausible alternative explanation. For these findings to be a result of state-level shocks, it would have to be the case that the unmodeled state-level factors affect hip replacements but not appendectomies. The most plausible alternative explanation is that state-level shocks affect procedures for which patients can actively shop differently than those for which they cannot. We perform two additional analyses to address this concern.

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if we instead use C-sections as our primary shoppable procedure of interest. We choose hip replacements as our primary shoppable procedure, rather than appendectomies, because hip replacements are considered a more standardized procedure and are usually non-life threatening, meaning that differences in quality are likely to be less important (Rosenthal et al. 2013).

First, we note that evidence from a subset of the states in our sample suggests that it generally takes (at least) a year from the initiation of the political process and enactment of any regulation before charge prices become available online.[20] Unless one believes that politicians have the ability to anticipate future shocks to healthcare pricing, a necessary condition for the alternative explanation that an unmodeled state-level shock causes both the PTR and charge price reductions is that both effects occur contemporaneously with the shock itself (i.e., the price effect should occur at, or very near to, the time of the enactment of, or debate over, PTR). The fact that we estimate the effects of PTR at the date of the initial public price disclosure, rather than the date the regulation was passed, helps to mitigate this concern.

Second, we more directly examine the timing of the onset of the PTR effects by repeating the analyses in Table 2 including three separate PTR indicators: one for the year leading up to the disclosure; one for the year after disclosure; and one for all subsequent years. To allow time for hospitals to update their charge prices, we exclude the year of disclosure in this analysis.

The results reported in Table 3 provide no indication that *PTR* had an effect on charge prices in (*t-1*), the calendar year leading up to the initial public price disclosure. Similar to our baseline specification in Table 2, we document a

[20] We are able, with reasonable accuracy, to identify the date when the legislation that lead to the subsequent establishment of PTR websites was introduced in California, Colorado, Florida, Illinois, Iowa, Massachusetts, Minnesota, New Hampshire, Ohio, and South Dakota (which together comprise more than 50 percent of the hip replacement observations in our sample). For these states, the average number of days from the beginning of the legislative process to the website availability date is 711 days.

significant negative relation of approximately 5 percent between *PTR* and charge prices in the calendar year after adoption (*t+1*). As a further indication of the sharpness of the PTR effect, we note that the coefficient in (*t+1*) is similar to that in subsequent years (*t+2 and beyond*).

E. Cross-sectional Variation in the Effect of PTR on Charge Prices

In this section, we conduct two additional cross-sectional analyses to provide further support for the inference that PTR has a causal effect on charge prices and to further assess the role of search costs as a mechanism through which PTR affects charge prices.

Effect of PTR on Charge Prices Conditional on Population Density.—First, we investigate whether the effects of PTR vary based on whether a hospital is located in an urban (high population/hospital density) or rural (low population/hospital density) location. Muir et al. (2013) argue that hospitals face greater competition in urban than rural areas because a higher concentration of providers facilitates search and reduces the market power of individual hospitals. Accordingly, we expect that, if competition plays an important role, the effects of PTR will be strongest in (or limited to) hospitals in urban locations.

We use an indicator from the *NIS* database for whether a hospital is located in an urban or rural area as a proxy for the extent of competition among hospitals and the feasibility of patient search. Consistent with the urban classification capturing more intense competition, there are, on average, fourteen (two) healthcare providers in urban (rural) counties.

To test whether the effect of PTR is stronger in urban areas, we extend Eq. (1) to the following model:

$$\begin{aligned} \mathit{Ln(Total\ Charge)} = \beta_0 + \beta_1 PTR\_Urban + \beta_2 PTR\_Rural \\ + \sum \beta_j Controls_j + \sum \beta_i Fixed\ Effects_i + \varepsilon. \end{aligned} \quad (2)$$

PTR_Urban (*PTR_Rural*) is an indicator variable coded as '1' after a website in a given state first discloses charge prices if the hospital is classified as urban (rural) in the *NIS* database, and '0' otherwise. We then test for significant differences between the coefficients β_1 and β_2 to assess whether the treatment effects differ between urban and rural areas. We include the same control variables and fixed effect structures as in our baseline specification in Table 2, including the *Urban* indicator, which here is the main effect of the interaction. We also include fixed effects for *Year*Urban* to account for differential price trends across population areas.

Table 4 Panel A reports the results of estimating Eq. (2). As predicted, we find that the effect of PTR on charge prices is strongest in urban areas and that the difference between the estimated treatment effect in urban versus rural areas is statistically significant. The fact that the effect of PTR on charge prices is strongest in urban areas provides some evidence that competition among hospitals and the ability of patients to more easily identify alternative providers contributes to the observed effects.

Price Level Prior to Regulation.—Second, we examine how the treatment effect of PTR varies with the distribution of charge prices across hospitals prior to regulation. If PTR increases competition among hospitals, it is likely to cause relatively higher priced hospitals to lower their prices in an effort to capture or maintain market share.[21] Accordingly, if competition plays an important role in the observed decline in charge prices, we should observe that the relationship between PTR and charge prices is stronger among those hospitals with relatively higher charge prices prior to disclosure regulation.

To examine the effect of PTR on the distribution of prices, we divide hospitals into four groups based on a hospital's mean price for hip replacements the first year the hospital enters our dataset. We require that the hospital be in our sample both before and after the hospital's state discloses charge prices online for the first time.[22] We then run separate regressions based on Eq. (1) for these four groups. We include hospital fixed effects in the regressions to control for time invariant hospital characteristics that may be correlated with prior price levels (i.e., the regression is identical to our fourth specification in Column (5) of Table 2).

[21] It is less clear how lower priced hospitals will respond. In particular, if lower priced hospitals are already setting charges close to the competitive price (or to just cover costs), then it is not clear that lower priced hospitals will necessarily decrease prices.

[22] The number of observations varies across groups because of variation in the number of observations per hospital.

Table 4 Panel B reports results for this analysis. For the two groups with the highest charge prices for hip replacements prior to the price disclosure (i.e., those above the 50th percentile), the estimated treatment effect of PTR is significantly negative. For the lowest priced group of hospitals (i.e., those below the 50th percentile), *PTR* is insignificant. The magnitude of the *PTR* coefficient decreases monotonically from the highest to the lowest prior price quartile. Consistent with an increase in competition among hospitals, this evidence suggests that the observed decline in charge prices for hip replacements relative to appendectomies is primarily attributable to the highest priced hospitals reducing prices.

F. Procedure Quantity and Charge Prices

In this section, we estimate the association between procedure quantity and charge prices based on the following model:

$$\begin{aligned} Ln(No.\ Procedures) = {} & \beta_0 + \beta_1 Ln(Median\ Charge) + \\ & \beta_2 Ln(Median\ Charge) * Hip\ Repl. + \\ & \sum \beta_j Controls_j + \sum \beta_i Fixed\ Effects_i + \varepsilon. \end{aligned} \quad (3)$$

Ln(No. Procedures) is the natural log of the number of procedures within a particular hospital and year calculated separately for hip replacements and appendectomies. *Median Charge* is the median total charge price for a procedure within a particular hospital and year. *Hip Repl.* is an indicator variable coded as ‘1’ for hip replacement procedures, and ‘0’ otherwise. *Controls* include hospital-level variables for *No. of Beds*, *Teaching Hospital*, and *Urban* as defined previously. We include *Fixed Effects* for *State*Hip Repl.* and *State*Year*.

Stahl (1989) characterizes a dispersed pricing equilibrium driven by firms' decisions to set prices in response to the positive probability that some consumers engage in search while others do not. In such an equilibrium, the observed sensitivity of demand to differences in prices across hospitals is driven by the fraction of consumers who search. β_1 in Eq. 3 captures the association between procedure quantity and charge prices, which, conditioned on an exogenous shock to search costs, can be interpreted as an approximation of the intensity of this search effort for appendectomy procedures, while $\beta_1 + \beta_2$ captures the intensity of search for hip replacements.

Table 5 presents results for our estimates of the association between procedure quantity and charge prices. Point estimates indicate that there is a relatively weak association between the quantity of appendectomies and charge prices – a 1 percent difference in charge prices is associated with a decrease in the number of appendectomies of -0.135 percent. The coefficient on the interaction of *Ln(Median Charge)*Hip Repl.* is significantly negative indicating a stronger association between procedure quantity and charge prices for shoppable procedures. A 1 percent difference in charge prices is associated with a -0.591 percent decrease in the number of hip replacements. Although, the magnitude of the association between charge prices and the quantity for hip replacements suggests that these procedures are relatively insensitive to differences in charge prices (i.e., less than -1), the fact that charge prices have a significant association with the quantity of procedures is consistent with some consumer search based on these prices. This result suggests that charge prices have some relevance in patients' choice of provider.

In Column (2) of Table 5 we directly investigate the effect of PTR on the price sensitivity of hip replacements by interacting the *PTR* indicator with *Ln(Median Charge)*Hip Repl.* In addition to the control variables and fixed effects in Column (1) we include *Hip Repl.*PTR* so that the model is fully saturated. Our results indicate that the sensitivity of hip replacements to a 1 percent difference in charge prices increases by -0.464 percent following the adoption of PTR. The increased sensitivity of hip replacement quantity to charge prices following the adoption of PTR is consistent with increased consumer search.

To further assess the relevance of charge prices, we next examine the effect of PTR on the price sensitivity of quantity across sample partitions based on patient income.[23] The relevance of charge prices is unlikely to be the same for all patients. We argue that charge prices are likely to be most relevant for middle income patients for two main reasons.

[23] The most price sensitive patients are likely: 1) under- or uninsured and 2) have high enough assets and income not to qualify for charity care or bankruptcy. We partition only based on patient income because there are relatively few uninsured patients who receive hip replacements within each of the three income groups.

First, many patients, and particularly those with relatively high income (above $59k annually in the NIS sample), likely have some form of private insurance (Bernard et al. 2009). The total payment these patients make is often based on fee schedules negotiated in advance by their insurers. Although charge prices may serve as the basis for these negotiations, contractual gag clauses restricting the disclosure of these discounts make it impossible to assess the relation between insurer-negotiated rates and charge prices.

Second, low income patients (below $36k annually in the NIS sample) may qualify for substantially discounted treatments arranged through hospital charity care programs or may avoid payment altogether through personal bankruptcy if the cost of care substantially exceeds their personal assets (Mahoney 2012). Patients in the middle income range ($36k-$59k annually in our sample) are the most likely to be either uninsured or underinsured and have enough personal assets to pay for their own costs of care.

Table 5 Panel B reports the results of our analysis of the effect of PTR on the charge price sensitivity of demand for quintiles of patient income (for comparative purposes, we group the middle two quintiles together). Consistent with our predictions we find that the increase in price sensitivity subsequent to PTR is driven primarily by patients living in middle income zip codes.

III. Effect of PTR on the Prices Paid by the Privately Insured

In this section, we examine the effect of PTR on the total payments made by insured patients. Even given a charge price decline and an increase in the sensitivity of patient demand to price differences, because some patients are not responsible for paying the full charge prices, the extent to which the decline in charge prices following PTR adoption reduces the amount consumers pay for care is unclear for these patients.

A. Data

We examine actual patient payments using a separate sample of employer-sponsored health insurance claim reimbursement data from the *Truven Health Analytics Marketscan Commercial Claims* database ("*Marketscan*").[24] The database contains information on the healthcare choices of approximately 25 percent of the American population from over one hundred different private payers across the country. The advantages of *MarketScan* over the *NIS* database are that we know the actual amount paid by the patient and insurance company rather than the charge amounts. The main disadvantages are that the *MarketScan* database contains little hospital-specific information and that it only includes privately-insured patients that are likely to have good insurance coverage (i.e., employer-sponsored insurance plans).

[24] *MarketScan* data is obtained directly from insurers supplying coverage for employee-sponsored plans and includes actively employed patients, early retirees, COBRA continuees, and their dependents. The database is not representative of all payer types (e.g., the database does not include self-pay, Medicare-eligible patients or patients that buy their own health insurance).

The Columns (3) and (4) of Table IA1 report the number of hip replacement and appendectomy observations by state from the *MarketScan* database. Similar to the *NIS* database, the number of observations reflects state-level populations. Focusing on hip replacements, Texas and California have the largest number of observations, while New Hampshire and Vermont have the fewest.

Table IA3 reports descriptive statistics for the variables used in the regression analyses. Section 2 of the internet appendix provides further details on variable measurement. Not surprisingly, the average total payment (*Total Payment*) for hip replacements, which, similarly to *Total Charge* from the *NIS* database, includes all services rendered for a particular admission, and reflects the sum of the patient's and the insurer's payments, is smaller than the average charge price in Table IA2 ($26,007 versus $42,893), reflecting the pricing discounts typically received by insurance providers.[25] The average patient's portion of this total payment (*Patient Payment*) for a hip replacement is $2,179. *Patient Payment* includes any coinsurance paid by a patient related to a particular procedure. With respect to the control variables, the median *MarketScan* hip replacement patient is 56 years-old, male, spends three days in the hospital and has a total of eight procedures associated with the hip replacement.

[25] To limit the influence of outliers and for consistency with the charge price sample, we limit the sample to observations where total payments are above $5,000 and below $100,000 (for both hip replacements and appendectomies). We further restrict the sample to observations where the patient's coinsurance exceeds $1,000 and is less than $7,000 to ensure that patients have incentive to search and to limit the influence of outliers. Inferences with respect to the effect of PTR on patient payments are robust to less restrictive truncation levels.

We report descriptive statistics for appendectomies in the *MarketScan* database in the second panel of Table IA3. The characteristics of patients that receive appendectomies (except for patient age) are generally similar to hip replacements.

B. The Effect of PTR on Total Patient Payments

To investigate the effect of PTR on actual patient payments, we begin by estimating Eq. (1) using the log of *Patient Payment* as the dependent variable. Because *MarketScan* does not provide detailed characteristics at the hospital-level, we control only for whether a hospital is located in an urban area. At the patient-level we control for: age; gender; the length of stay; and the number of procedures. We use the same fixed effect structures as in our 'within-state', 'baseline' and procedure-year fixed effects specifications in Table 2. In this set of analyses, we exclude results based on within-hospital comparisons because the *Marketscan* database provides specific hospital identifiers for only a very small proportion of our total sample (less than 25 percent).[26]

Table 6 reports results for the average effect of PTR on actual patient payments. With the exception of the length of stay which is generally positive and significant, the patient-level controls are statistically and/or economically insignificant. On the contrary, the hospital-level control for location (*Urban*) is significantly negative, which is consistent with prior research (e.g., Thompkins et

[26] Results (untabulated) including hospital fixed effects are generally statistically insignificant, although it is unclear whether this insignificance is driven by low statistical power or the absence of an effect of PTR.

al. 2006). Our primary variable of interest, *PTR*, provides no evidence of a reduction in actual patient payments subsequent to the disclosure of charge prices. Across all four specifications, the *PTR* coefficient is statistically insignificant. In both the between-state and within-state specifications we can reject with 95 percent confidence that PTR is associated with a price reduction that exceeds 1.8 percent.[27] Sensitivity analyses in Panel B of Table IA4 further support the conclusion that PTR had little effect on the actual payments of insured patients for the least complicated hip replacements, for knee replacements or when we exclude all control variables.

C. The Effect of PTR on the Total Payment for Lower Cost Procedures

The relatively high cost of hip replacements is one potential explanation for the lack of an effect of PTR on actual insured-patient payments. Specifically, despite the presence of substantial price differences across providers, because the cost of a hip replacement frequently exceeds most insured patients' 'out-of-pocket' maximum reimbursement costs, there may be little actual difference in a patient's marginal costs.[28]

[27] The fact that we document a significant effect of PTR on charge prices, but not actual payments, may be because we are unable to identify the actual payments of the most price sensitive group of patients (e.g., the uninsured and those purchasing individual health plans). It is also possible that patients may search based on the (incorrect) belief that charge price differences will affect their marginal cost of care when in fact they do not, for example, because of unanticipated charity care discounts or because out-of-pocket maximums put a cap on the total payment. Commentators have noted a similar phenomenon in the college selection process (e.g., Walton 2013).

[28] For example, in our sample, the average hip replacement cost is approximately $26,000, while total patient cost sharing per year typically ranges from $1,000 – $6,000. For a patient with an insurance plan that stipulates a $5,000 out-of-pocket maximum and 20% coinsurance, the maximum payment for any hip replacement costing greater than $25,000 would be the same, $5,000, with the patient's insurance provider paying the remainder.

To address this possibility, we next examine the effect of PTR on the actual price paid for a less expensive shoppable procedure – a routine, uncomplicated, C-section scheduled because the patient has previously given birth by C-section. Like hip replacements, C-sections are common shoppable medical procedures frequently disclosed on PTR websites. Unlike hip replacements the median cost of a Caesarean section is only $8,213 (with an inner-quartile range of $3,547), meaning that the direct patient share of most C-sections is likely to fall below many patients' out-of-pocket maximums.[29]

Results are presented in Panel B of Table 6. Despite the lower total costs, across all three specifications, we find limited evidence that PTR had a significant effect on the average C-section coinsurance payment. The point estimates indicate that PTR decreases C-section costs by less than 2 percent.

A persistent concern is that our sample of patients with employer-provided group insurance excludes individual insurance plans, which often require patients to directly pay for a larger portion of their costs of care.[30] As an attempt to capture the segment of the employer-provided insurance market with less comprehensive insurance coverage, we separately examine the subsample of hourly, non-union employees. Prior studies (e.g., Long 2013) of employee

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[29] For example, for a patient with an insurance plan with 20% coinsurance and a $5,000 annual out-of-pocket maximum, the savings of a switch from a C-section at the 75th percentile ($10,229 total payment; $2,046 patient payment) to a C-section at the 25th percentile ($6,682 total payment; $1,336 patient payment) would be $710.

[30] Group insurance plans, which typically include employer-provided insurance coverage, cover multiple individuals under a single policy. This type of policy gives the group more bargaining power and frequently leads to lower overall costs and more comprehensive coverage relative to individual insurance plans.

benefits suggest that salaried union employees have more comprehensive insurance (i.e., lower deductible, lower coinsurance) and also earn higher wages.[31]

Table 7 presents the results for this analysis. Among this subsample of patients whose insurance contracts likely provide the greatest incentives to consider costs (i.e., hourly non-union employees) we find that PTR decreased average C-section coinsurance payments by approximately 13.3%, or $217. Overall, however, our analysis of insured patients suggests that PTR had a limited effect on the actual payments of patients with employer-provided insurance.

IV. Conclusion

Increased transparency is a commonly proposed regulatory solution for perceived failures of a market to reach a socially optimal level of disclosure. Our analysis expands our understanding of disclosure regulation to the effects of mandatory increases in price transparency in the healthcare sector.

Using micro data on actual healthcare purchases, and exploiting both between- and within-state variation to address endogeneity concerns, we find that PTR reduces the price charged for common, shoppable medical procedures by approximately 5% relative to non-shoppable emergency procedures. Although it is difficult to completely rule out additional explanations (such as the political

[31] Consistent with this notion, we find that, controlling for other determinants of actual patient payments (including the total cost of the procedure), hourly non-union employees directly pay for nearly 5 percent more of the total procedure cost than other types of employees.

costs of publicly disclosing relatively high prices), our analyses indicate that the decline in charge prices is at least partly attributable to increased patient search. Regardless of the mechanism, this decline in charge prices implies lower medical costs for anyone who pays charge prices (or a discounted price based directly on the charge price) for such procedures, even patients who themselves do not engage in search.

We provide additional evidence that PTR increases the sensitivity of demand to a 1% change in charge prices by 0.5%, suggesting that charge prices have some relevance in a patient's choice of provider, particularly for patients likely to have less comprehensive insurance coverage and some means to pay for their own care.

However, because relatively few patients pay the full charge price and it is difficult to assess the relationship between charge prices and actual payments, the economic impact of a decline in charge prices is unclear. For this reason, we also examine the effect of PTR on the actual prices consumers pay for care.

For patients with employer-provided group insurance, we find that, on average, PTR has no effect on actual patient payments. Although we do find some evidence that PTR lowers the actual payments for a small subset of patients who pay a relatively higher proportion of the marginal cost of care, overall, for patients with limited incentives to search, the effects of PTR appear to be minimal.

That we can assess the effects of PTR on actual payments only for patients with employer-provided insurance, and not those who are uninsured or covered by less comprehensive individual insurance plans, is a limitation of our analyses. Without more complete data on the full spectrum of procedures patients receive and the actual prices they pay, it is difficult to more broadly estimate the economic implications of our findings. Nonetheless, as one of the first large scale examinations of the effects of price transparency regulation in the healthcare market, our study provides some initial evidence on the effects of increased charge price transparency, which should be useful for considerations of future price regulation in the healthcare market.

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Table 1 – Implementation Dates for Price Transparency Regulation

State	*Charges Available Online*	*State*	*Charges Available Online*
Arizona	Dec-07	Nevada	May-07
Arkansas	Dec-06	New Hampshire	May-06
California	Oct-06	New Jersey	Jan-07
Colorado	Aug-09	Ohio	2007 [1]
Florida	Nov-05	Oklahoma	2006 [2]
Georgia	2007 [1]	Oregon	Mar-05
Illinois	Nov-09	Pennsylvania	Dec-02
Iowa	Jan-09	South Dakota	Jul-05
Kentucky	May-05	Tennessee	Apr-07
Louisiana	Apr-06	Texas	Mar-07
Maine	Apr-09	Utah	Oct-06
Maryland	2006 [1]	Vermont	Jun-06
Massachusetts	Dec-08	Virginia	Oct-06
Michigan	Nov-07	Washington	Nov-06
Minnesota	Oct-06	West Virginia	Aug-07
Montana	Jan-09	Wisconsin	Feb-05
Nebraska	May-08	Wyoming	Feb-11

Notes: By July 2013, 34 states had price transparency websites. We exclude Maryland from our analyses because a specific state regulation limits healthcare price increases. We exclude Pennsylvania and Wyoming because these states implemented the regulation before, or after, our sample period. See internet appendix Table IA1 for sample composition.

[1]Health department, hospital association, and webmaster not responding or unable to disclose the implementation date: year of implementation is based on the first year that the transparency website appears in web archive.

[2]State health department is only able to disclose the year of implementation.

Table 2 – Effect of PTR on Charge Prices

Ln(Total Charge) as Dependent Variable	*Variation in PTR Dates among States*		*Hip Replacement Relative to Appendectomy within State*		
	Hip Replacement	*Appendec-tomy*	*Baseline*	*Procedure* Year Fixed Effects*	*Hospital Fixed Effects*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Transparency Regulation:					
PTR	-0.076***	0.008	–	–	–
	(-3.26)	(0.23)			
PTR_Hip	–	–	-0.053**	-0.065**	-0.032**
			(-2.21)	(-2.03)	(-2.50)
Control Variables:					
Ln(Age)	-0.139***	0.060***	0.063***	0.063***	0.052***
	(-11.76)	(6.09)	(6.58)	(6.59)	(10.03)
Female	-0.018***	0.002	-0.015***	-0.015***	-0.016***
	(-10.21)	(0.98)	(-6.30)	(-6.28)	(-8.98)
ln(Days in Hosp.)	0.251***	0.315***	0.302***	0.302***	0.322***
	(19.83)	(43.15)	(46.11)	(46.38)	(38.98)
No. of Diagnoses	0.011***	0.022***	0.013***	0.013***	0.010***
	(7.01)	(17.43)	(11.93)	(11.77)	(19.24)
Income in Zip	-0.001	0.003	0.003	0.003	-0.003***
	(-0.19)	(0.43)	(0.48)	(0.49)	(-4.99)
No. of Beds	0.015	0.009	0.010	0.010	–
	(0.99)	(0.91)	(1.07)	(1.08)	
Teaching Hospital	0.000	-0.067***	-0.022	-0.022	–
	(0.00)	(-2.58)	(-0.83)	(-0.83)	
Urban	0.097***	0.176***	0.126***	0.126***	–
	(3.09)	(7.51)	(4.74)	(4.74)	
Fixed Effects:					
Year	Yes	Yes	–	–	–
State	Yes	Yes	–	–	–
Insurance Plan	Yes	Yes	Yes	Yes	Yes
State * Hip Repl.	–	–	Yes	Yes	Yes
State * Year	–	–	Yes	Yes	Yes
Year * Hip Repl.	–	–	–	Yes	–
Hospital	–	–	–	–	Yes
Observations	239,862	168,767	408,629	408,629	408,629
R-squared	0.467	0.565	0.669	0.670	0.850

Notes: OLS coefficient estimates and (in parentheses) t-statistics based on standard errors clustered by state. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed). The sample includes observations from 31 states over the time period from 2003 to 2010. All variables are defined in the internet appendix Section IA2.

Table 3 – Assessing the Sharpness of the Charge Price Effect of PTR

Ln(Total Charge) as Dependent Variable	
Timing of Effect:	
Calendar Year Leading Up to Adoption (t-1)	-0.001
	(-0.07)
Calendar Year After Adoption (t+1)	-0.050**
	(-2.34)
Two Calendar Years After Adoption and Onwards (t+2 and beyond)	-0.055**
	(-2.12)
F-test for Differences in Coefficients (p-value):	
(t-1)=(t+1)	0.143
(t-1)=(t+2 and beyond)	0.103
Control Variables (see Table 2 Column 3)	Yes
Fixed Effects (see Table 2 Column 3)	Yes
Observations	408,629
R-squared	0.669

Notes: OLS coefficient estimates and (in parentheses) t-statistics based on standard errors clustered by state. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed). The sample includes observations from 31 states over the time period from 2003 to 2010. We include the full set of control variables and fixed effects from Table 2 as indicated. The first indicator variable marks the year before the price transparency websites went online (t-1). The second indicator variable marks the year after the price transparency websites went online (t+1). The third indicator variable marks all subsequent years (t+2 and beyond).

Table 4 – Cross-sectional Variation in the Effect of Transparency Regulation on Charge Prices

Panel A: Effect of PTR on Charge Prices Conditional on Population Density

Ln(Total Charge) as Dependent Variable	
Effect dependent on population density:	
PTR_Urban	-0.063***
	(-2.69)
PTR_Rural	0.044
	(1.22)
F-test for Difference in Coefficients (p-value):	
PTR_Urban = PTR_Rural	0.005
Control Variables (see Table 2)	Yes
Fixed Effects:	
Year*Urban	Yes
See Table 2 Column 3	Yes
Observations	408,629
R-squared	0.670

Panel B: Effect of PTR on Charge Prices Conditional on Prior Price Level

Ln(Total Charge) as Dependent Variable	*Price Level Prior to PTR*			
	Above 75 Percentile	*50 to 75 Percentile*	*25 to 50 Percentile*	*Below 25 Percentile*
	(1)	*(2)*	*(3)*	*(4)*
PTR	-0.067***	-0.063***	-0.013	0.022
	(-4.28)	(-4.31)	(-0.73)	(1.21)
Control Variables (see Table 2 Column 5)	Yes	Yes	Yes	Yes
Fixed Effects (see Table 2 Column 5)	Yes	Yes	Yes	Yes
Observations	38,762	52,275	55,338	60,548
R-squared	0.858	0.852	0.853	0.833

Notes: OLS coefficient estimates and (in parentheses) t-statistics based on standard errors clustered by state. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed). The sample includes observations from 31 states over the time period from 2003 to 2010. We include the full set of control variables and fixed effects from Table 2 as indicated. In Panel A we estimate the effect of PTR for urban versus rural hospitals by interacting the *PTR* indicator with a binary indicator variable for whether the hospital is based in an urban area (see variable definitions in internet appendix Section IA2). In Panel B we partition the sample into four groups based on the hospitals' price levels in the first year they enter our sample before the price transparency websites went online. We restrict the sample to hospitals that enter the NIS sample both before and after the price transparency websites went online. In Column (1) [Columns (2); (3); and (4)], we report the results for observations from hospitals with charge prices greater than the 75^{th} percentile [greater than the 50^{th} percentile but less than the 75^{th} percentile; greater than the 25^{th} percentile but less than the 50^{th} percentile; less than the 25^{th} percentile] before the price transparency websites went online.

Table 5 – Effect of PTR on the Sensitivity of Demand to Charge Prices

Panel A: Baseline Results

Ln(No. Procedures) as Dependent Variable	*Unconditional* (1)	*Conditional on PTR* (2)
Price Sensitivity of Demand:		
Ln(Median Charge)	-0.135**	-0.238***
	(-2.23)	(-2.99)
Ln(Median Charge) * Hip Repl.	-0.456***	-0.217**
	(-5.35)	(-2.10)
Price Sensitivity of Demand Conditional on PTR:		
Ln(Median Charge) * PTR	–	0.182*
		(1.95)
Ln(Median Charge) * Hip Repl. * PTR	–	-0.464***
		(-3.79)
Control Variables:		
No. of Beds	0.679***	0.679***
	(31.12)	(31.12)
Teaching Hospital	0.685***	0.686***
	(15.00)	(15.04)
Urban	1.150***	1.151***
	(27.48)	(27.47)
Fixed Effects:		
Hip Repl. * PTR	–	Yes
State * Hip Repl.	Yes	Yes
State * Year	Yes	Yes
Observations (hospital-year-procedure)	7,446	7,446
R-squared	0.476	0.477

Panel B: Effects Conditional on Patient Income

Ln(No. Procedures) as Dependent Variable	*Low Household Income (Below $36k)*	*Middle Household Income ($36-$59)*	*High Household Income (Above $59)*
Ln(Median Charge) * Hip Repl. * PTR	-0.172	-0.364***	-0.018
	(-1.56)	(-3.15)	(-0.15)
Control Variables (see Panel A Column 2)	Yes	Yes	Yes
Fixed Effects (see Panel A Column 2)	Yes	Yes	Yes
Observations (hospital-year-procedure)	6,134	7,090	3,566
R-squared	0.576	0.454	0.377

(continued)

Table 5 continued

Notes: OLS coefficient estimates and (in parentheses) t-statistics based on standard errors clustered by state. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed). The sample includes observations from 31 states over the time period from 2003 to 2010. The unit of observation is hospital-year-procedure. All variables are defined in the internet appendix Section IA2. In Panel B we include the same control variables as in Panel A Column 2 but only report the coefficient that estimates price sensitivity of demand for hip replacements relative to appendectomies conditional on PTR.

Table 6 – Effect of Price Transparency Regulation on Actual Payments made by Patients with Employer-Provided Insurance

Panel A: Hip Replacements

Ln(Patient Payment) as Dependent Variable	*Variation in PTR Dates among States*		*Hip Replacement Relative to Appendectomy within State*	
	Hip Replacement	*Appendec-tomy*	*Baseline*	*Procedure* Year Fixed Effects*
	(1)	*(2)*	*(3)*	*(4)*
Transparency Regulation:				
PTR	0.037	0.003	–	–
	(1.11)	(0.30)		
PTR_Hip	–	–	0.009	0.027
			(0.55)	(1.00)
Control Variables:				
Ln(Age)	-0.026	-0.009	-0.009*	-0.009*
	(-1.34)	(-1.58)	(-1.70)	(-1.67)
Female	0.001	-0.003	-0.006	-0.006
	(0.13)	(-0.35)	(-1.08)	(-1.05)
Ln(Days in Hosp.)	0.004	0.076***	0.054***	0.054***
	(0.49)	(10.54)	(9.40)	(9.12)
No. of Procedures	-0.002	0.001	0.000	0.000
	(-1.13)	(1.41)	(0.17)	(0.18)
Urban	-0.033***	-0.039**	-0.034**	-0.034**
	(-2.96)	(-2.25)	(-2.48)	(-2.48)
Fixed Effects:				
Year	Yes	Yes	–	–
State	Yes	Yes	–	–
Insurance Plan	Yes	Yes	Yes	Yes
State * Hip Repl.	–	–	Yes	Yes
State * Year	–	–	Yes	Yes
Year * Hip Repl.	–	–	–	Yes
Observations	26,126	26,340	52,466	52,466
R-squared	0.057	0.049	0.090	0.090

(continued)

Table 6 continued

Panel B: Searchable Caesarean Section

Ln(Patient Payment) as Dependent Variable	*Variation in PTR Dates among States*	*Caesarean Relative to Appendectomy within State*	
		Baseline	*Procedure* Year Fixed Effects*
	(1)	*(2)*	*(3)*
Transparency Regulation:			
PTR	-0.003	–	–
	(-0.30)		
PTR_C-Sec	–	-0.019*	-0.003
		(-1.81)	(-0.25)
Control Variables:			
Ln(Age)	-0.044***	-0.013**	-0.013**
	(-3.90)	(-2.36)	(-2.34)
Ln(Days in Hosp.)	0.036	0.065***	0.065***
	(3.51)	(8.16)	(8.14)
No. of Procedures	0.001***	0.001	0.001
	(0.41)	(1.39)	(1.39)
Urban	-0.041***	-0.045***	-0.045***
	(-4.20)	(-3.74)	(-3.76)
Fixed Effects:			
Year	Yes	–	–
State	Yes	–	–
Insurance Plan	Yes	Yes	Yes
State * Hip Repl.	–	Yes	Yes
State * Year	–	Yes	Yes
Year * Hip Repl.	–	–	Yes
Observations	42,071	68,411	68,411
R-squared	0.047	0.064	0.064

Notes: OLS coefficient estimates and (in parentheses) t-statistics based on standard errors clustered by state. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed). The sample includes observations from 31 states over the time period from 2003 to 2011. All variables are defined in the internet appendix Section IA2.

Table 7 – Effect of Price Transparency Regulation on Actual Payments made by Patients with Employer-Provided Insurance Conditional on Employment Type

Ln(Patient Payment) as Dependent Variable	*Variation in PTR Dates among States*		*Caesarean Relative to Appendectomy within State*			
			Baseline		*Procedure * Year Fixed Effects*	
	Hourly Non-Union	*All Other*	*Hourly Non-Union*	*All Other*	*Hourly Non-Union*	*All Other*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Transparency Regulation:						
PTR	-0.044	-0.023	-0.134***	-0.008	-0.154***	0.015
	(-0.94)	(-0.65)	(-4.52)	(-0.39)	(-3.23)	(0.31)
Control Var. (see Table 6)	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (see Table 6)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,951	11,394	5,119	17,805	5,119	17,805
R-squared	0.050	0.072	0.089	0.090	0.088	0.090

Notes: OLS coefficient estimates and (in parentheses) t-statistics based on standard errors clustered by state. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed). The sample includes observations from 31 states over the time period from 2003 to 2011. All variables are defined in the internet appendix Section IA2. We include the full set of control variables and fixed effects from Table 6 as indicated. *Hourly Non-Union* employees are patients that are paid hourly and not union members (observations for which we cannot establish whether the patient has hourly non-union status are excluded).

For Online Publication

Internet Appendix for "The Effects of Price Transparency Regulation on Prices in the Healthcare Industry"

This appendix provides supplemental discussion and analysis for our manuscript "The Effects of Price Transparency Regulation on Prices in the Healthcare Industry." We summarize the content of the tables as follows:

IA Section 1: The Economic Relevance of Charge Prices

Our first set of analyses relies on the use of charge prices to assess the impact of price transparency regulation on healthcare costs. One difficulty with assessing the economic implications of these analyses is the fact that many payers are rarely responsible for the full charge price. Despite this fact, many regulators nonetheless believe charge prices represent a "consistent, though imperfect, way to compare healthcare costs (Iowa Hospital Charges 2014)." The conjecture that charge prices have economic implications is consistent with the associations between price changes and procedure quantities we document in Table 5. In this Appendix, we discuss several arguments for why, despite the ubiquitous nature of discounting, charge prices are economically relevant.

A.1 Consumer groups potentially affected by charge prices

Foremost, charge prices, which apply uniformly across all payer types, may be relevant because they are the starting point for all hospital bills regardless of patients' insurance coverage (e.g., Tompkins et al. 2006; Anderson 2007; Muir et al. 2013). Recent surveys of common medical practices by policymakers and health economists increasingly suggest that, despite the fact that many large insurers negotiate fixed payment rates, charge prices nonetheless remain directly relevant for the many groups of patients not covered by these arrangements.

For example, a broad 2005 survey of hospitals, initiated by the Medicare Payment Advisory Commission and conducted by the Lewin Group, reviewed the charge practices of a sample of 238 hospitals nationwide in an effort to assess hospitals' charge setting practices and the significance of these prices (The Lewin Group 2014). Overall, the findings of the study suggest charge prices are a critical aspect of hospitals' competitive positions and their ultimate underlying profitability. More specifically, while the study highlights the widespread presence of negotiated fixed rate contracts for some influential payers, it also emphasizes that charge prices remain directly relevant for patients in any of the following groups: "1) individuals who are insured but pay a portion of the hospital bill directly; 2) those payers without a [fixed rate] contract; 3) uninsured and/or self-paying patients; and 4) those [with] contracts based on discounted charges." This survey suggests that, because charge prices are often set to capture revenue from these groups, a change in charge prices may have a significant effect on the bottom line of hospitals through their associated impact on these revenue groups.

From the hospital's perspective, the Lewin Group survey illustrates that financial and competitive pressures are a central concern in setting charge rates. More than half of the hospitals in the survey reported using their competitor's publicly available charge price data, such as the prices that PTR initiatives require them to report, as a basis of comparison for their charge prices. Hospitals in highly competitive markets also reported becoming increasingly sensitive to community perceptions of the competitiveness of their charge prices (although hospitals also acknowledged that the importance of community perceptions varies significantly based on the public availability of charge price information to patients). Hospitals note that because patients are increasingly responsible for a larger portion of their healthcare bills, there is a growing focus on patients' ability to shop for elective procedures based on price. For example, the Lewin survey cites a hospital in Florida, which reported that "the aging population has lots of time to shop hospital prices, and do research. This comes as their co-pays and out-of-pocket expenses are increasing and makes for more price competition."

Similarly, a 2003 article from the Society of Actuaries (SoA 2003), stresses the relation between charge prices and actual healthcare costs. The article argues against the misguided notion that, because few payers reimburse at 100 percent of charges, charge prices are irrelevant. As evidence, the article cites a decrease in the prevalence of negotiated fixed price contracts since the mid-1990s and the fact that many contracts are based on a specified percentage of charges. As specific examples, the article notes the existence in many HMO and PPO contracts of "outlier provisions," which stipulate that, once the charge for an admission reaches some predetermined threshold, the reimbursement (for the entire admission) then reverts to a percentage of charges. The article further notes that, for some hospitals, outlier provisions are in effect for between 50 to 90 percent of total inpatient charges. Finally, the SoA article notes that hospital charge prices are also relevant for services received "out-of-network," where patients are often required to shoulder a greater percentage of the payment burden and the absence of negotiated fixed rate contracts makes charge prices the basis of payment.

A.2 Charge prices and the uninsured

Second, charge prices are likely to be directly relevant for the forty-five million uninsured Americans who make up the majority of self-pay patients. Many of the transparency initiatives we examine are motivated by the ostensible political aim to protect uninsured patients. Although uninsured patients are routinely presented a bill based on prices from the hospitals' chargemaster file, for two reasons, they often do not pay the full charge price: 1) the availability of charity care and, 2) account default arising from, for example, bankruptcy.

AHA guidelines require that hospitals maintain a widely publicized written financial aid (or "charity care") policy (AHA 2007). Charity care is commonly offered to patients with low levels of income, where the extent is typically determined based on income relative to the federal or state poverty level. Some critics of PTR argue that the availability of charity care limits the relevance of charge prices for the uninsured. However, our analysis of the charity care policies of a sample of licensed Californian hospitals, suggests these policies generally do not vary by procedure. Specifically, we obtained the charity policies of all licensed hospitals in California from 2008 to 2011 from the Office of Statewide Health Planning and Development. Our examination of the charity care policies of these hospitals revealed that hospitals generally implement the AHA guidelines using a simple sliding scale where discounts depend on patient's income relative to the federal poverty level. None of the charity policies specify different scales for different procedures. The invariance of charity care policies across procedure means that, for example, if the charge price for a hip replacement declines by 5 percent relative to an appendectomy, an uninsured patient that receives a hip replacement will pay relatively less than an uninsured patient receiving an appendectomy, even if both patients receive charity care discounts.

Frequent account default (i.e., an inability of some uninsured patients to pay their medical bills) is another often cited reason why charge prices may not be relevant for the uninsured. For example, Mahoney (2012) argues that uninsured patients without sizeable assets can avoid paying their medical bills by declaring bankruptcy. While this argument may be valid for emergency procedures where hospitals cannot legally refuse care, for elective, non-emergency, treatments hospitals often require upfront payment or evidence of an ability to pay, effectively denying elective procedures to patients that are unable to pay (e.g., Rhonda et al. 2004; Weiner 2004). Consistent with this idea, we find that, based on the entire *NIS* database, 31 percent of the procedures consumed by privately insured patients are elective, whereas only 13 percent of the procedures consumed by self-pay patients are elective.

Overall, although uninsured patients may frequently not be responsible for the full charge price and we cannot observe uninsured patients' actual payments, there are nonetheless compelling reasons to believe that charge price levels have important economic implications for these patients. Still, our results do not address whether PTR makes the uninsured better off overall. For example, it is possible that providers compensate for a decrease in charge prices for shoppable procedures by increasing charges for non-shoppable procedures.

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IA Section 2: Variable Definitions

Transparency Regulation Indicators

PTR	Binary indicator that takes on the value of '1' for all observations beginning the year after the price transparency website in a hospital's home state went online, and '0' otherwise
PTR_Hip	Binary indicator that takes on the value of '1' for hip replacement observations beginning the year after the price transparency website in a hospital's home state went online, and '0' otherwise
PTR_C-Sec	Binary indicator that takes on the value of '1' for caesarean section observations beginning the year after the price transparency website in a hospital's home state went online, and '0' otherwise
PTR_Urban	Binary indicator that takes on the value of '1' for hip replacement observations performed at a hospital based in an urban area (*Urban*) beginning the year after the price transparency website in a hospital's home state went online, and '0' otherwise
PTR_Rural	Binary indicator that takes on the value of '1' for hip replacement observations performed at a hospital based in a rural area (*Rural*) beginning the year after the price transparency website in a hospital's home state went online, and '0' otherwise

Variables used in the Analyses of Charge Prices

(NIS)

Total Charge	The total amount a hospitals charges a patient for a particular procedure, including all costs incurred for that hospital admission, except physicians' fees, before any applicable deductions and discounts
Age	Patient age measured in years
Female	Binary indicator that takes on the value of '1' for female patients, and '0' for male patients

Days in Hospital	Length of a patient's hospital stay measured in days
No. of Diagnoses	Number of diagnoses on a patient's record
Income in Zip	Median household income national quartile for a patient's ZIP Code
No. of Beds	Number of available beds in the hospital
Teaching Hospital	Number of available beds in the hospital
Urban	Binary indicator that takes the value of '1' for hospitals located in an urban area, and '0' otherwise
No. Procedures	Number of procedures within a particular hospital and year calculated separately for hip replacements and appendectomies
Median Charge	Median total charge price for a procedure within a particular hospital and year calculated separately for hip replacements and appendectomies

Variables used in the Analyses of Patient Payments by Employer Insured Patients

(Marketscan)

Total Payment	Net amount billed for all services rendered for a particular admission and reflects the sum of the patient's and the insurer's payments (excludes physician payments)
Patient Payment	Net amount billed to patients (excludes physician payments)
Age	Patient age measured in years
Female	Binary indicator that takes on the value of '1' for female patients, and '0' for male patients
Days in Hospital	Length of a patient's hospital stay measured in days
No. Procedures	Number of procedures performed on a patient during a particular hospital visit
Urban	An indicator for whether the hospital is located in an officially recognized Metropolitan Statistical Area

Table IA1-- Number of Observations by State

State	*Charge Price Observations*		*Insured Patient Observations*		
	Hip Replacement	*Appen-dectomy*	*Hip Replacement*	*Appen-dectomy*	*Caesarean Section*
Arizona	6,512	9,260	473	637	662
Arkansas	3,116	1,464	223	286	344
California	23,941	24,465	2,977	2,765	4,572
Colorado	7,592	3,533	573	397	685
Florida	26,713	22,882	1,341	1,872	2,476
Georgia	9,781	5,461	2,365	1,596	3,596
Illinois	14,589	8,548	*	*	*
Iowa	5,941	2,501	516	438	870
Kentucky	5,275	3,285	452	405	678
Louisiana	1,107	1,536	216	292	471
Maine	432	179	*	*	*
Massachusetts	11,372	6,422	312	359	427
Michigan	9,338	2,989	738	519	882
Minnesota	9,443	3,471	550	472	712
Montana	238	89	*	*	*
Nebraska	1,711	835	198	201	572
Nevada	3,284	3,198	407	296	476
New Hampshire	2,744	957	118	72	123
New Jersey	8,607	8,437	388	412	1,122
Ohio	17,058	6,911	1,813	1276	1,939
Oklahoma	3,173	3,149	750	971	1,443
Oregon	5,856	3,255	413	491	587
South Dakota	531	341	138	95	237
Tennessee	9,714	4,000	742	394	940
Texas	17,311	22,821	4,716	7,304	11,168
Utah	3,130	2,683	139	191	306
Vermont	1,414	505	22	17	21
Virginia	8,276	5,256	851	510	1,258
Washington	8,223	4,255	682	538	648
West Virginia	2,345	1,323	120	126	144
Wisconsin	11,095	4,756	757	785	998

Notes: The charge price sample includes observations from 2003 through 2010 with non-missing data in the *Nationwide Inpatient Sample* database. The insured patient sample includes observations from 2003 through 2011 with non-missing data in the *Truven Health Analytics Marketscan Commercial Claims* database.

*Statistics for these states cannot be disclosed due to contractual arrangements pertaining to the data.

Table IA2--Descriptive Statistics for the Analysis of Charge Prices

	Mean	*Std. Dev.*	*P1*	*P25*	*Median*	*P75*	*P99*
Hip Replacement (N=239,862):							
Total Charge	42,893	17,503	16,450	29,824	38,937	52,475	94,125
Age	65.530	12.879	32	57	67	75	90
Female	0.5694	0.4952	0	0	1	1	1
Days in Hospital	3.6275	1.6255	1	3	3	4	10
No. of Diagnoses	6.0805	3.3927	1	4	6	8	16
Income in Zip	2.6320	1.0808	1	2	3	4	4
No. of Beds	2.4724	0.7386	1	2	3	3	3
Teaching Hospital	0.4264	0.4946	0	0	0	1	1
Urban	0.8938	0.3080	0	1	1	1	1
Appendectomy (N=168,767):							
Total Charge	24,989	14,087	6,968	15,246	21,400	30,691	76,533
Age	32.488	18.375	4	17	29	45	81
Female	0.4735	0.4993	0	0	0	1	1
Days in Hospital	2.3317	2.0347	1	1	2	3	10
No. of Diagnoses	2.7830	2.4789	1	1	2	4	12
Income in Zip	2.5918	1.1112	1	2	3	4	4
No. of Beds	2.4744	0.7038	1	2	3	3	3
Teaching Hospital	0.3972	0.4893	0	0	0	1	1
Urban	0.9014	0.2982	0	1	1	1	1

Notes: The sample includes observations from 31 states over the time period from 2003 to 2010. All variables are defined in the internet appendix Section IA2.

Table IA3--Descriptive Statistics for the Analysis of Patients with Employer-Provided Insurance

	Mean	*Std. Dev.*	*P1*	*P25*	*Median*	*P75*	*P99*
Hip Replacement (N=26,126):							
Total Payment	26,007	11,738	8,108	18,019	23,697	31,432	67,202
Patient Payment	2,179	1,037	1,015	1,450	1,923	2,614	5,993
Age	54.350	7.7990	29	50	56	60	64
Female	0.4883	0.4999	0	0	0	1	1
Days in Hospital	3.0401	1.7810	1	2	3	3	10
No. of Procedures	8.4083	3.7371	2	5	8	11	15
Urban	0.8223	0.3823	0	1	1	1	1
Appendectomy (N=26,340):							
Total Payment	13,614	8,343	5,220	8,460	11,370	15,925	47,669
Patient Payment	1,839	761	1,009	1,312	1,649	2,093	4,874
Age	31.575	16.2905	5	17	30	45	63
Female	0.4588	0.4983	0	0	0	1	1
Days in Hospital	2.3026	2.1449	1	1	2	3	10
No. of Procedures	8.5787	3.9231	1	6	8	12	15
Urban	0.8278	0.3776	0	1	1	1	1
Caesarean Section (N=42,071):							
Total Payment	9,027	3,596	5,074	6,682	8,213	10,229	22,866
Patient Payment	1,688	620	1,008	1,259	1,556	1,940	4,012
Age	31.700	4.7832	21	28	32	35	42
Female	1.0000	0.0000	1	1	1	1	1
Days in Hospital	2.6523	0.8305	1	2	3	3	4
No. of Procedures	7.0521	3.6668	2	4	6	9	15
Urban	0.8488	0.3582	0	1	1	1	1

Notes: The sample includes observations from 31 states over the time period from 2003 to 2011. All variables are defined in the internet appendix Section IA2.

Table IA4--Sensitivity Analyses of the Effect of Price Transparency Regulation

Ln(Total Charge) as Dependent Variable	*N*	*PTR*
Panel A: Charge Prices		
(1) Restrict to Patients with one Diagnosis Only	78,127	-0.070**
		(-2.08)
(2a) Alternative Procedure (Knee Replacement)	688,752	-0.033*
		(-1.77)
(2b) Alternative Procedure (Searchable Caesarean Section)	519,852	-0.034***
		(-3.08)
(3) Exclude Control Variables	408,629	-0.068***
		(-3.32)
Panel B: Payments by Patients with Employer-Provided Insurance		
(1) Restrict to Patients with five or less Procedures (Hip Repl.)	13,163	-0.019
		(-0.67)
(2) Alternative Procedure (Knee Replacement)	77,706	0.012
		(0.75)
(3) Exclude Control Variables (Hip Repl.)	52,466	0.001
		(0.05)
(4a) Restrict to Patients with five or less Procedures (Caesarean)	25,379	-0.022
		(-1.30)
(4b) Exclude Control Variables (Caesarean)	68,411	-0.018*
		(-1.80)

Notes: OLS coefficient estimates and (in parentheses) t-statistics based on standard errors clustered by state. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed). The sample includes observations from 31 states. The time period covers 2003 to 2010 in Panel A and 2003 to 2011 in Panel B. All variables are defined in the internet appendix Section IA2.