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BARGAINING IN THE SHADOW OF A GIANT:
MEDICARE'S INFLUENCE ON PRIVATE PAYMENT SYSTEMS

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ABSTRACT

We analyze Medicare's influence on private payments for physicians' services. Using a large administrative change in payments for surgical procedures relative to other medical services, we find that private payments follow Medicare's lead. On average, a $1 change in Medicare's relative payments results in a $1.30 change in private payments. We find that Medicare similarly moves the level of private payments when it alters fees across the board. Medicare thus strongly influences both relative valuations and aggregate expenditures on physicians' services. We show further that Medicare's price transmission is strongest in markets with large numbers of physicians and low provider consolidation. Transaction and bargaining costs may lead the development of payment systems to suffer from a classic coordination problem. By extension, improvements in Medicare's payment models may have the qualities of public goods.

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Textbook treatments of Coase (1960) emphasize that, absent transaction costs, resources flow to their efficient uses irrespective of initial conditions. As Coase noted, however, costless transactions are "very unrealistic."[1] When transactions are costly, default arrangements may significantly influence final outcomes. From this perspective, we analyze the outcomes of bargaining between physicians and private health insurers.

Advance negotiations determine how insurers pay physicians for treating insured patients. These negotiations take place on ostensibly open, moderately competitive markets (Dafny, Duggan and Ramanarayanan 2012). The employers and beneficiaries who purchase private plans have much at stake, both medically and financially (Enthoven and Fuchs 2006). It is thus puzzling that insurers' payments to providers are rarely rooted in either the medical benefits or cost-effectiveness of care (Baicker and Chandra 2011, Cutler 2011).

One explanation for the scarcity of value-oriented payment systems involves the influence of Medicare, the federal insurer of the elderly and disabled. Medicare may influence private markets through multiple channels. First, as the largest buyer of physicians' services, Medicare competes with private insurers for medical resources (Foster 1985). High Medicare rates may bid up private fees, resulting in co-movement between public and private payments.

Second, the environment is replete with complex transactions. Millions of physician-insurer pairings could, in principle, negotiate payments for thousands of recognized treatments. The expense of bargaining and subsequent claims billing (Cutler and Ly 2011) may leave private players in search of payment models around which they can coordinate. As a large, publicly administered payer, Medicare may naturally provide such a focal point. Medicare itself is legislatively bound to base payments on input costs (Newhouse 2002), potentially driving the prevalence of cost-based payment.

Empirically, we examine how private payments respond to administrative changes in Medicare's fee schedule. Our main analysis studies a 17 percent shock to Medicare's valuations of surgical procedures relative to other medical services.[2] This one-time change was

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[1] Coase (1960, 15). The size of legal and financial institutions makes the point (Wallis and North 1986).

[2] Administratively, the payment change was associated with the "conversion factors" used to determine

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implemented in 1998 and varied substantially in dollar terms across individual services. We also examine a set of across-the-board payment shocks that varied across geographic areas.

We find that private payments move tightly with Medicare's payments. On average, a $1 decrease in Medicare's payment for a surgical service led to a $1.30 decline in private payments for that service. In response to across-the-board payment changes, we find that a $1 decrease in Medicare's payments led to a $1 decrease in private payments. These findings support the view that Medicare's pricing decisions exert substantial influence over private payments. Medicare strongly influences both relative valuations of and aggregate expenditures on physicians' services.

Private prices reflect the outcomes of negotiations between physicians and private insurers. Medicare's influence on these prices must thus be mediated by the bargaining process. Since knowledge of this process may shed light on the welfare effects of Medicare's payments, we investigate the mechanisms underlying our baseline results.

Industry participants describe two modes of negotiation between providers and private insurers.[3] Insurers often make take-it-or-leave-it offers, based on fixed fee schedules, to small providers. These schedules tend to be based in large part on Medicare's payment menu, perhaps with a scalar markup.[4] In contrast, insurers negotiate with hospitals and large provider groups over payments for bundles of services. We show in section 4 that both arrangements are readily rationalized. The value of an insurer's product can be enhanced by improving on Medicare's cost-based prices, but complex negotiations are costly.[5] Expected gains from actively negotiated payments, which rise with the provider's scale, must exceed these substantial transaction costs for active negotiations to take place.

We find empirical evidence consistent with a role for both modes of negotiation. If

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the generosity of payments across broad classes of services within Medicare Part B. We provide a detailed characterization of the relevant institutions in section 2.

[3]In Appendix A we allow industry participants to characterize these negotiations in their own words.

[4]This point is made specifically by Nandedkar (2011), Gesme and Wiseman (2010) and Mertz (2004).

[5]The absence of "health care entrepreneurs" (Cutler 2011) is particularly puzzling in light of the health sector's ubiquitous transaction costs and coordination problems, both emphasized by Coase (1937) as rationales for folding activities under the umbrella of a firm.

payments to small group practices work directly from Medicare's menu, then the transmission of Medicare's rate changes should be particularly powerful in markets, and among specialties, with low levels of provider concentration. Conversely, highly concentrated specialties and markets should exhibit greater independence. We find empirically that this is indeed the case. Medicare's prices are transmitted most strongly in low-concentration markets, as measured both across specialties within a geographic area and across geographic areas. We also find relatively strong price transmission in markets with large numbers of providers. This too is consistent with a role for transaction costs.

In a world of active bargaining, price transmission depends on the relative sizes of public and private markets. When Medicare comprises a larger share of the market for a service, public payment changes lead to significant shifts in the resources available for private sector care. Large Medicare markets should thus predict relatively strong transmission of Medicare's payments into private prices. We find this to be the case, providing evidence for traditional bargaining considerations.

The welfare implications of public payment changes differ under the two modes of private sector bargaining. For physicians that receive take-it-or-leave-it offers linked to Medicare's fees, those fees have significant and immediate importance. When Medicare pays generously for low value services, incentives for this portion of the private sector echo that mistake. The value of improvements in public payment schedules will be similarly magnified.

When insurers bargain with large providers, the welfare consequences of Medicare's payment reforms are more subtle. In this setting, Medicare influences private markets by shifting resources across sectors. Consequently, a reduction in payments for a low value service may optimally increase its short-run supply to the private sector. Over the long run, however, the co-movement of public and private prices unambiguously worsens the returns to the affected medical specialties. Future entry (Dezee et al. 2011), long-run investment decisions (Acemoglu and Finkelstein 2008, Clemens and Gottlieb forthcoming), and innovation should

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reflect these changes in the returns to practice.[6]

Recent decades have seen a trend towards consolidation on the part of health care providers (Gaynor and Haas-Wilson 1999, Dunn and Shapiro 2012). Our analysis highlights the relevance of this trend for Medicare's role in health care markets. We find that large-scale providers are less likely to repeat Medicare's mistakes and are, more generally, less likely to follow its lead. The development of value-oriented payment systems may suffer from a classic public goods problem; diffuse private players appear to have insufficiently strong incentives to innovate beyond Medicare's menu. Overcoming this problem of coordination may be an under-emphasized benefit of provider consolidation.[7]

1 Payment Reform with Private-Market Spillovers

As the largest U.S. purchaser of health care, Medicare may exert significant influence over private markets for physicians' services. We begin with a general characterization of the channels through which Medicare's payments may influence welfare. We maintain sufficient generality to nest a variety of possibilities. These include models in which private markets mimic Medicare's payments, models of cost-shifting, and models in which Medicare influences physician/insurer bargaining by shifting resources across sectors.

1.1 The Costs and Benefits of Public- and Private-Sector Care

Medicare pays for health care at reimbursement rate r_M, leading providers to offer q_M units of care for each of its N_M beneficiaries. This care has a per-beneficiary benefit $B_M(q_M)$, with marginal benefits denoted $b_M(q_M)$. Private sector quantities and benefits are similarly

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[6]Finkelstein (2007), Acemoglu and Finkelstein (2008) and Clemens and Gottlieb (forthcoming) provide evidence that investments by health care providers respond to their returns. Evidence from Acemoglu and Linn (2004), Finkelstein (2004), Blume-Kohout and Sood (2013), Budish, Roin and Williams (2013), and Clemens (2012) point to further dynamic gains as innovation responds to the size of potential markets.

[7]The following passage from Coase (1960, 16–17) reads as though it were intended as a description of health insurance contracts. "But where contracts are peculiarly difficult to draw up and an attempt to describe what the parties have agreed to do or not to do... would necessitate a lengthy and highly involved document, and, where, as is probable, a long-term contract would be desirable, it would be hardly surprising if the emergence of a firm or the extension of the activities of an existing firm was not the solution adopted..."

defined, with a private reimbursement rate of r_p, quantity of q_p, and patient population of size N_p. Both the public and private quantity may exhibit own- and cross-price responses, leading us to write $q_M = q_M(r_M, r_p)$ and $q_p = q_p(r_M, r_p)$.

Since Medicare's reimbursement rate r_M is the relevant policy parameter, we write the social welfare function as:

$$U(r_M) = N_M B_M(q_M(r_M, r_p)) + N_p B_p(q_p(r_M, r_p)) - C(q_p N_p, q_M N_M), \qquad (1)$$

where $C(q_p N_p, q_M N_M)$ describes production costs. We allow production costs to depend generally on both the private and public sector quantities. We write the marginal costs for private and public care as c_p and c_M and take no stand on the form of the cost function.

1.2 The Welfare Effects of Payment Reform

A change in Medicare's reimbursements may affect welfare through both public and private channels. Differentiating equation (1) yields a welfare impact of:

$$U'(r_M) = \underbrace{(b_M - c_M)N_M \left[\frac{\partial q_M}{\partial r_M} + \frac{\partial q_M}{\partial r_p} \frac{dr_p}{dr_M} \right]}_{\text{Public-Sector Impact}} + \underbrace{(b_p - c_p)N_p \left[\frac{\partial q_p}{\partial r_p} \frac{dr_p}{dr_M} + \frac{\partial q_p}{\partial r_M} \right]}_{\text{Private-Sector Impact}}. \qquad (2)$$

We characterize the public and private components of equation (2) in turn. The first term on the right-hand side describes the public-sector consequences of Medicare's payment changes. Had public payments been optimized, this term would vanish as $b_M - c_M = 0$. This is unlikely, as Medicare is legislatively bound to reimburse on the basis of average cost rather than value. If payments have induced inefficiently large quantities of care, then $b_p < c_p$ and an increase in care provision will reduce welfare.[8]

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[8] We take care in our choice of words to allow for the possibility that own-price supply responses are negative in markets for health care services. This view, though non-standard in most settings, is embedded in the federal budgeting process through CBO's "volume offset" assumption (Codespote, London and Shatto 1998). The volume offset assumption is closely related to the target income hypothesis, which is shown by McGuire and Pauly (1991) to require physicians to exhibit large income effects. Papers finding evidence of

The magnitude of the public-sector response depends significantly on how public prices move private prices $\left(\frac{dr_p}{dr_M}\right)$. If private prices move *with* public prices $\left(\frac{dr_p}{dr_M} > 0\right)$, the impact on public sector quantities may be muted. If private prices move against public prices $\left(\frac{dr_p}{dr_M} < 0\right)$ the impact on public sector quantities may be magnified. The latter scenario is conventionally known as cost-shifting.[9] In addition to raising questions of access, as it implies an expanded wedge between public and private payments, cost shifting has pessimistic implications for Medicare's capacity to constrain aggregate costs.

The second term of equation (2)'s right-hand side describes the private-sector consequences of Medicare's payment changes. As in the public sector, the welfare change vanishes if private payments are optimized, as $b_p - c_p = 0$. This is what one might anticipate in a world of efficient, undistorted insurance markets.[10] Two broad classes of reasons make this scenario unlikely.

A first, traditional set of distortions may lead the wedge between private costs and benefits to be either positive or negative. Insurance carriers' market power could lead to monopoly pricing and inefficiently low levels of care consumption (Dafny 2010, Dafny et al. 2012). Adverse selection may similarly result in inefficiently little insurance and thus inefficiently little care consumption from an *ex ante* perspective (Cutler and Reber 1998). Alternatively, the tax exclusion for employer-provided health insurance may drive system-wide excesses in both insurance generosity and care provision (Feldstein 1973).

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volume offsets include Rice (1983) and, more recently, Jacobson, Chang, Newhouse and Earle (2013). Papers finding evidence of positive own-price supply responses include Hadley and Reschovsky (2006) and Clemens and Gottlieb (forthcoming).

[9]For overviews of the cost-shifting literature, see Frakt (2011, 2013). Evidence in favor of cost-shifting comes primarily from the hospital context (Cutler 1998, Kessler 2007, Wu 2010, Robinson 2011). Foster (1985) and Dranove (1988) highlight that cost-shifting behavior will tend to be inconsistent with profit maximization, making it more plausible in the hospital context than among the physician groups we study. Recent work in the hospital setting finds evidence against cost shifting (White 2013, Wu and White 2013).

[10]The optimal insurance problem is typically characterized in terms of coinsurance and demand. In this characterization, there is no implementable first-best efficient contract. Our interest in this paper centers on the other side of the problem, namely provider payments and supply. In principle, optimal insurance considerations impose no constraint on selecting the efficient reimbursement rate that leads providers to supply care until the point at which marginal benefit equals marginal cost. Determining this rate is made difficult by the need to know the relevant portions of the marginal benefit and marginal cost curves; in most settings, aggregation of such information is left to market mechanisms.

A second type of distortion more mechanically involves Medicare itself. Given its status as a large, public payer, Medicare's prices may serve as benchmarks, or even defaults, for private sector negotiations. At present we wish only to raise this possibility, saving additional institutional detail for section 4. With Medicare bound legislatively to reimburse on the basis of cost, distortions of this form likely imply reimbursement rates that deviate from marginal benefits.

We summarize all relevant distortions from the second-best as a wedge between benefits and costs of care. This wedge is a function $\phi(q_p)$ that drives consumers away from their marginal benefit curve. Instead of experiencing the marginal benefit of q_p units of care as $b(q_p)$, consumers subject to the distortion perceive the benefit as $b(q_p)+\phi(q_p)$. In equilibrium, marginal costs equal the distorted marginal benefits of care, so that

$$b(q_p^*) + \phi(q_p^*) = c_p(q_p^* N_p, q_M^* N_M) \tag{3}$$

at equilibrium care levels q_p^* and q_M^*. Given such a wedge, the welfare effects of Medicare payment reform include a private-sector spillover given by

$$\text{Welfare Spillover} = -\phi(q_p^*)N_p \left[\frac{\partial q_p^*}{\partial r_p^*}\frac{dr_p^*}{dr_M} + \frac{\partial q_p^*}{\partial r_M} \right]. \tag{4}$$

The size of the welfare spillover depends on the size of the relevant distortion, the size of the private market, the manner in which Medicare's payments are transmitted to the private sector, and the responsiveness of supply. Given that private markets for physicians' services are 2.5 times that of Medicare, the welfare implications of private-sector spillovers may exceed those within Medicare itself.

A related expression characterizes the spillover effects of Medicare payment changes on aggregate health expenditures:[11]

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[11]Though not a welfare measure *per se*, the magnitude of aggregate health expenditures make them of considerable independent interest. A growing body of research documents the strain these expenditures cause for federal (Baicker, Shepard and Skinner 2013), state (Baicker, Clemens and Singhal 2012), corporate (Cutler and Madrian 1998), and household (Gross and Notowidigdo 2011) budgets.

$$\text{Expenditure Spillover} = \frac{dr_p^*}{dr_M} q_p^* N_p + r_p^* N_p \left[\frac{\partial q_p^*}{\partial r_p^*} \frac{dr_p^*}{dr_M} + \frac{\partial q_p^*}{\partial r_M} \right]. \tag{5}$$

The relevance of the price-transmission process for Medicare's influence on aggregate health expenditures is readily apparent. A cost-shifting world, where $\frac{dr_p^*}{dr_M} < 0$, is a world in which Medicare's payment changes are, at least in part, mechanically offset by changes in private expenditures. A world of positive price transmission, $\frac{dr_p^*}{dr_M} > 0$, is a world in which Medicare exerts significant influence over total spending. This will be particularly true over the long run, when $\frac{\partial q_p^*}{\partial r_p^*}$ and $\frac{\partial q_M^*}{\partial r_M}$ reflect changes in physician entry. This paper seeks to characterize the price-transmission relationship and understand its underlying mechanisms.

2 Estimating the Effects of Changes in Medicare's Reimbursement Rates

To estimate Medicare's influence on private sector pricing, we exploit a large, administratively driven change in Medicare's reimbursement rates. While Medicare's fees are set according to administrative rules, these rules can be changed by acts of Congress. Such changes deliver variation in payment rates that can be taken as plausibly independent of patient demand, technological change, and supply-side market pressures. Before describing the relevant shocks, we first characterize price determination in markets for health care services.

2.1 How Are Private Medical Payments Set?

Public and private payments for health care services are set through very different mechanisms. In the physician setting we study, public rates are set through an administrative apparatus mandated to set payments according to the resource costs of providing care. In the world of private health insurance, payment rates are set on markets with varying degrees of competition (Dafny 2010).

U.S. private sector health care prices are largely unregulated.[12] Rather than being set

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[12]Some exceptions apply to this statement. For instance, private insurer hospital payment rates in

according to measured resource utilization, as in Medicare, they are agreed upon through negotiations between insurance carriers and the provider networks with whom they contract.[13] Negotiated prices are often unknown to final consumers and can vary substantially, for ostensibly similar services, across both providers and insurers (Dunn and Shapiro 2012). Providers themselves may have little information about payments received by others and hence of the "competitive" rate. The details of these negotiations are also not transparent, and our limited knowledge about private sector prices comes from claims data that reveal the reimbursements actually paid for specific services.

Previous work sheds light on several broad economic determinants of health care pricing. Cutler, McClellan and Newhouse (2000) find significant differences between the prices negotiated by HMOs and traditional health insurance plans, with HMOs paying 30 to 40 percent less for comparable services. Price variation also stems from producer heterogeneity, with more attractive hospitals commanding higher prices (Ho 2009, Moriya, Vogt and Gaynor 2010, Gowrisankaran, Nevo and Town 2013). Robust insurance-market competition increases payments to physicians and hospitals (Town and Vistnes 2001, Dafny 2005, Dafny et al. 2012), while competition among provider networks reduces them (Dunn and Shapiro 2012).

2.2   A Large Shock to the Relative Prices of Outpatient Services

Compared to the private sector, Medicare's pricing is a model of transparency. Since 1992, Medicare has paid physicians and other outpatient providers through a system of centrally administered prices, based on a national fee schedule. This fee schedule, known as the Resource-Based Relative Value Scale (RBRVS), assigns relative values to more than 10,000 distinct health care services according to the resources they are believed to require.

Maryland are set by a state government board.

[13]When serving self-pay patients (generally meaning the uninsured), prices are simply set by the provider as in traditional markets for goods and services, and consumers can choose which firm receives their business. In these transaction, however, the threat of personal bankruptcy filings leads to substantial price renegotiations after treatment has taken place (Mahoney 2012).

It also recognizes that goods and services have different production costs in different parts of the country; Congress mandates price adjustments to offset these differences in input costs.[14] For service j, supplied by a provider in payment area i, the provider's fee is approximately:

$$\text{Reimbursement}_{i,j,t} = \text{Conversion Factor}_{t,c(j)} \times \text{Relative Value Units}_{j,t}$$

$$\times \text{Geographic Adjustment Factor}_{i,t}. \tag{6}$$

The Conversion Factor (CF) is a national adjustment factor, updated annually and generally identical across broad categories of services, $c(j)$. In the early 1990s, wrangling over payments across specialties led to the institution of separate CFs for surgical procedures and other services. Surgeons argued successfully that lower late 1980s growth in procedure use than in the use of other medical services should be rewarded with a higher payment per RVU (Newhouse 2003). Congress implemented this plan, and distinguished between the CFs for surgery, primary care, and other non-surgical services from 1993 through 1997. From 1993 to 1995, payments for surgical procedures escalated dramatically relative to payments for other services. 1995 to 1997 marked a period of relative stability. Discontent had arisen, however, due to the emergence of an average bonus of 17 percent for surgical RVUs relative to primary care and other non-surgical RVUs.[15] In 1998, this 17 percent bonus was eliminated through a budgetarily neutral merger of the CFs.[16]

The merger of the CFs resulted in a large change to relative payments across broad categories of services, with substantial service-level variation in the dollar value of the payment shocks. In appendix B we present additional analysis of across-the-board payment changes associated with an overhaul of the system of geographic adjustments. While complementary, these natural experiments are best suited for answering somewhat different questions. Shocks to relative prices are best suited for assessing the link between Medicare and the

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[14]Pub. L. 101-239 (1989).

[15]The American Medical Association presents data on historical Conversion Factor rates at `http://www.ama-assn.org/ama1/pub/upload/mm/380/cfhistory.pdf` (accessed March 26, 2011).

[16]62 *Federal Register* 59048, 59102 (1997)

private sector's relative valuation of services; resulting estimates will thus speak to Medicare's role as a driver of cost-based reimbursement. Across-the-board payment shocks more directly affect physicians' bottom lines; resulting estimates are thus relevant to questions related to cost shifting and to Medicare's effects on aggregate health expenditures.

2.3   Estimation Strategy

We use these administrative changes to see how actual Medicare payments affect private sector reimbursement rates. To do this, we use the conversion factor shock as an instrument for the average Medicare payments observed in the claims data. Our private sector claims data, described in section 2.4 below, do not permit identification of individual insurers or physician groups. As we therefore cannot estimate a structural bargaining model, we summarize the data using average prices across firms for identifiable services.

Practitioner characterizations of private payment negotiations inform our estimation framework (e.g. Gesme and Wiseman 2010, Mertz 2004). These characterizations suggest that private prices respond linearly to Medicare, for instance according to

$$P^{\text{Private}} = a + b \cdot P^{\text{Medicare}} + \text{other factors},$$

where b is a positive scalar. Under this model, the parameter of interest, b, must be estimated using the levels of Medicare payment shocks as opposed to logs.[17] This is especially true if there is economically interesting heterogeneity in b. Estimation in levels is also consistent with the mechanics of traditional models of bargaining over a fixed surplus (e.g. Abowd and Lemieux 1993). These considerations drive the specific framework laid out below. We also present estimates of the relationship between log public and log private prices. The latter estimates are qualitatively similar, but with inferior model fit.

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[17]We are grateful to Michael Dickstein and Neale Mahoney for making this point.

Stage 0: Compute the Instrument: Predicted Price Change

Using the Medicare payment data from 1997 and before, we compute the average service-level price $\overline{P^{\text{Medicare}}}_{j,s,\text{pre}}$ before the policy change. We then use the merger of Conversion Factors in 1998 to compute the predicted Medicare price change in following years. Specifically, we define

$$\text{PredChg}_{j,s}^{\text{Medicare}} = \overline{P^{\text{Medicare}}}_{j,s,\text{pre}} \times \left(\begin{array}{c} -0.11 \times \text{Surgical}_j \\ +0.06 \times \text{Non-Surgical}_j \end{array} \right) \tag{7}$$

where the factors -0.11 and 0.06 are the average changes in the nominal Conversion Factors for surgical and non-surgical services, respectively.

Stage 1: First Stage

We then use this predicted price $\text{PredChg}_{j,s}^{\text{Medicare}}$ as an instrument for the actual Medicare reimbursement rate in period t. Specifically, we run the following first stage regression:

$$P_{j,s,t}^{\text{Medicare}} = \pi \cdot \text{PredChg}_{j,s}^{\text{Medicare}} \times \text{Post1998}_t + X_{j,s,t}\psi + \mu_j I_j + \mu_s I_s + \mu_t I_t$$

$$+ \mu_{j,s} I_j \times I_s + \mu_{t,s} I_t \times I_s + e_{j,s,t} \tag{8}$$

Observations are constructed at the service (j), by state (s), by year (t) level. This represents a linear formulation of Medicare prices with respect to the predicted policy-driven shock. We would expect to estimate a coefficient of $\hat{\pi} = 1$ in the absence of measurement error and correlated changes in reimbursement policy. Since our instrument varies at the service-by-year-by-state level, we are able to control for full sets of service-by-state $(I_j \times I_s)$ and state-by-year $(I_s \times I_t)$ fixed effects, as well as direct service, state, and year effects. We use state-level observations in preparation for our investigation of the roles of physician and insurer market power as mediators of the relationship between public and private prices.

The most important elements of the vector of additional controls $(X_{j,s,t})$ are indicators

that capture major payment changes for relevant services. Specifically, our first stage most cleanly tracks the policy change of interest when we account separately for major mid-1990s payment changes associated with cataract surgery.[18] To strengthen the case for the exclusion restriction, we also include controls for the types of insurance plans providing each service in $X_{j,s,t}$. Specifically, we control for an index that tracks shifts towards insurance plan-types associated with more generous payments and a measure of the average fraction of a procedure's payments that are paid directly by the beneficiary.[19] Construction of these variables is detailed below.

Stage 2: Second Stage

The Medicare price predicted in equation (8) then serves as an instrument for actual Medicare prices in the following second stage equation:

$$P_{j,s,t}^{\text{Private}} = \beta \cdot \widehat{P_{j,s,t}^{\text{Medicare}}} + X_{j,s,t}\phi + \nu_j I_j + \nu_s I_s + \nu_t I_t$$
$$+ \nu_{j,s} I_j \times I_s + \nu_{t,s} I_t \times I_s + \varepsilon_{j,s,t} \tag{9}$$

Our use of the predicted Medicare prices as an instrument is valid under the following assumptions. First, the predicted change $\text{PredChg}_{j,s,t}$ must be reflected in the actual Medicare prices in the first stage equation (8). Second, the shock used to generate predicted prices must be conditionally independent of other sources of change in private sector payment rates $\varepsilon_{j,s,t}$. These include technology shocks, demand shocks, and changes in market conditions. We use the large, one-time nature of the payment shocks to investigate the potential rele-

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[18]Cataract surgery has long been viewed as a procedure provided in excess and, in an effort to reduce its usage, was subjected to significant payment reductions in the years leading up to the 1998 price shock on which we focus. With cataract surgery accounting for a non-trivial fraction of Medicare's payments for surgical services, we find that "dummying out" these earlier payment reductions allows us to cleanly track the natural experiment of interest. Alternative specifications, including those that either do nothing to account for the cataract-surgery reductions or that drop cataract surgery from the sample, generate similar estimates of the effect of Medicare payment changes on private sector prices. In the first stage, however, these alternative specifications are inferior in terms of their ability to track the 20 percent reduction in the price of surgical procedures relative to other service.

[19]In practice, the inclusion of full sets of state-by-year interactions renders both of these controls largely irrelevant.

vance of threats to identification as carefully as possible. Most importantly, we check for the presence of pre-existing trends in both Medicare and private payments by graphically presenting parametric event study estimates from the following two equations:

$$P_{j,s,t}^{\text{Medicare}} = \sum_{t \neq 1997} \gamma_t \cdot I_t \times \text{PredChg}_j^{\text{Medicare}} + X_{j,s,t}\psi + \mu_j I_j + \mu_s I_s + \mu_t I_t$$

$$+ \mu_{j,s} I_j \times I_s + \mu_{t,s} I_t \times I_s + u_{j,s,t} \tag{10}$$

$$P_{j,s,t}^{\text{Private}} = \sum_{t \neq 1997} \delta_t \cdot I_t \times \text{PredChg}_j^{\text{Medicare}} + X_{j,s,t}\alpha + \upsilon_j I_j + \upsilon_s I_s + \upsilon_t I_t$$

$$+ \upsilon_{j,s} I_j \times I_s + \upsilon_{t,s} I_t \times I_s + \upsilon_{j,s,t} \tag{11}$$

Estimates of δ_t and γ_t for years prior to 1997 provide a sense for the importance of pre-existing trends, while estimates for 1998 and beyond trace out the dynamic effects of Medicare's payment shocks. For Medicare itself, the post-1997 coefficients should hew closely to 1.

The dollar magnitude of the payment change varies widely across individual services. We therefore cluster standard errors at the service code level. This clustering also accounts for persistent shocks to demand or technology for individual services.

2.4 Health Care Price Data

We study the public sector's influence on private sector health care prices by linking health insurance claims data across the two environments. In both settings, providers request reimbursement by submitting claims to the relevant third-party payer. For Medicare claims, we use a 5 percent random sample of the Medicare Part B beneficiary population for each year from 1995 through 2002. Part B, formally known as Supplementary Medical Insurance, is the part of Medicare that covers physician services and outpatient care. The data contain service-by-service reports of the relevant care purchased by Medicare for these beneficiaries. For pricing purposes, they include the Health Care Procedure Coding System (HCPCS) code for each service along with Medicare's payment (the "allowed charge").

We construct a measure of Medicare's payment rates by aggregating the claims for service j in state s in year t and computing the average allowed charge, $P_{j,s,t}^{\text{Medicare}}$.[20] We measure private sector prices similarly, using private insurance claims data from the ThompsonReuters MarketScan ("MedStat") database. Private insurers use procedure codes that overlap substantially with the HCPCS system. Participating insurers submit those codes, along with service-level payment rates and additional information, to MarketScan. The data are thus sufficient to allow us to estimate how the service-specific payments negotiated between insurers and providers vary across space and over time.[21] We again aggregate claims to the code-by-state-by-year level and compute $P_{j,st}^{\text{Private}}$.

Our baseline estimation sample includes 2,048 individual HCPCS codes that satisfy two criteria. First, they must be linked across the Medicare and MarketScan databases. Second, we require that our panel be balanced in the following sense: a state-by-service pair is only included in the sample if it appears in both the public and private databases for each year from 1995 through 2002.[22] Summary statistics describing Medicare and private sector prices across services and states are shown in Table 1, separately for surgical and non-surgical services. In this sample, the average surgery price is \$226 in Medicare and \$354, or nearly 60 percent higher, in the private market. The average non-surgical service is reimbursed \$112 in Medicare and \$125 in the private sector. Both the public and private price data represent in excess of 100 million underlying services.

We observe private sector prices from a range of insurance plan types. In 1996, 38 percent

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[20]We do this after eliminating claims with payments less than \$1 and with line items reporting in excess of 100 instances of the service.

[21]We again eliminate claims with payments of less than \$1 or with a line item service quantities in excess of 100. We also eliminate claims associated with capitated payment arrangements, which do not reflect the per unit prices of interest.

[22]Although our estimation sample includes only 2,048 of the 12,729 unique HCPCS codes observed in MarketScan during our sample period, the codes included represent the majority of care provided. This is because the commonly used codes are more likely to (a) be officially recognized by public and private payors, (b) appear in both our Medicare and MarketScan samples, and (c) have a balanced panel. Of the 12,729 codes observed in MarketScan, 4,306 match Medicare claims with complete pricing information, and they represent 66 percent of services provided. When we balance the panel across years we are left with our final estimation sample, representing 55 percent of the MarketScan services.

of service claims came from Major Medical or Comprehensive Insurance (CI) plans, 52 percent from less generous Preferred Provider Organization (PPO) plans, and 10 percent from even more restrictive Point of Service (POS) plans. By 2006, 8 percent of Medstat service claims came from CI plans, 59 percent from PPO plans, 12 percent from POS plans and roughly 27 percent from other less generous plans including Health Maintenance Organizations (HMO) and Consumer-Driven Health Plans (CDHP). The data thus reflect a national trend away from comprehensive coverage towards forms of coverage designed to control costs. To ensure that our results are not driven by differential shifts towards different plan types over time, we construct a control variable "Plan Type Payment Generosity" to capture the evolution of generosity in plan types across space and over time. The variable is constructed by regressing payments on plan types and aggregating the resulting predicted payments at the state-by-year-by-service level. We also construct a control for plan generosity based on cost sharing. This variable, "Service Specific Cost Sharing," is constructed at the state-by-year-by-service level by dividing out-of-pocket payments by the total payments made to providers for the service in question.

3 Empirical Effect of Medicare Prices on Private Prices

Panel A of Figure 1 illustrates the raw correlation between public and private prices. Public and private payments are tightly related in the cross-section, with Medicare paying roughly 40 percent less than private insurers for identical services. Despite substantial variation in private payments both across and within geographic markets, average Medicare payments predict 84 percent of the variation across services in the average private payment. Changes in public and private prices over time are also tightly related, as illustrated in Panel B.

Figure 2 plots event study estimates the effect of Medicare payment changes using equations (10) and (11). First stage results, marked on the graph with "x" symbols, show that

the predicted service-level price changes translate approximately one-for-one into observed Medicare payment rates. This gives us confidence in our specification of the shock. The figure also plots reduced form estimates of the shocks' impact on private sector prices. Changes in private prices were uncorrelated with the payment shocks during the years preceding the shock, providing evidence against pre-existing trends driven by changes in technology, demand, or other market conditions. From this point forward, a \$1.00 increase in Medicare's payment led, on average, to a \$1.30 increase in private payments.

In Table 2, we summarize these results in single coefficients using the framework described by equations (7) through (9). Column 1 reports the first-stage estimates of equation (8). We find $\hat{\pi}$ to be 1.1, which is statistically indistinguishable from 1. The cluster-robust F statistic for testing the null hypothesis that our instrument is weak is 375.27, which easily satisfies the robust weak instruments pre-test threshold of Olea and Pflueger (2013).[23]

Column 2 shows the reduced form results we obtain when $P_{j,s,t}^{\text{Private}}$ replaces $P_{j,s,t}^{\text{Medicare}}$ as the outcome variable in (8). The coefficient of 1.44 suggests that a one dollar predicted change in Medicare prices translates into a \$1.44 change in private sector prices. The IV estimate of equation (9) in column 3 effectively rescales this private sector response by the actual Medicare response (from column 1), and represents our best estimate of how the private sector reacts to Medicare price changes. Each dollar change in Medicare payments leads to a \$1.30 change in private reimbursements, in the same direction as the Medicare change, confirming the baseline result in Figure 2.

Columns 4 through 6 run comparable specifications in which public and private prices are expressed in logs. The instrument in these specifications is a binary indicator for surgical services performed in or after 1998. Column 4 shows that Medicare's elimination of the surgery-specific conversion factor resulted in a 20 percent decline in relative payments for surgeries. The point estimate is statistically indistinguishable from the 17 percent decline

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[23]Their Table 1 reports a critical value of 23.11 for the effective F statistic (which is equal to the cluster-robust F statistic with one instrument) to reject the null hypothesis of a two-stage least squares bias above 10% of the OLS bias with one instrument in the absence of homoskedasticity.

called for by the payment reform. We report a reduced form estimate of this policy change's impact on private prices in column 5. Column 6 reports the IV estimate, showing that, on average, a 10 percent change in Medicare's payment for a service resulted in a 5.3 percent change in private payments for that service. This is reconciled with the $1.30 from column 3 by the fact that the average private payment for a service is significantly higher than the average Medicare payment.[24]

Appendix Table C.1 demonstrates the robustness of our main finding that Medicare prices pass through into the private sector. Column 1 repeats the baseline IV estimate from column 3 of Table 2. Columns 2 and 3 show that the results are not sensitive to dropping our controls for the insurance plans represented in the sample.[25] Column 4 shows that our baseline estimate is not qualitatively sensitive to our controls for mid-1990s payment changes targeted at cataract surgery, although omitting them changes the magnitude of the price transmission coefficient from 1.35 to 1.05. Column 5 removes the service weights, which again reduces the estimate to around 1 but maintains precision.[26] Column 6 includes a control for the number of Relative Value Units (the quantity metric that appears in equation [6], Medicare's payment formula) assigned to each service. Minor updates to RVU assignments strongly predict Medicare's allowable charges, which they impact formulaically (result not shown). These updates are modest predictors of changes in private prices, however, and

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[24]Table 1 shows that Medicare pays $226 on average for surgical services and $112 for non-surgical. Its surgical payments fell by 11 percent, or $25, while medical reimbursement rates increased by 7%, or $8. So the relative change is $8 − (−$25) = $17. As private non-surgical reimbursements average $125, and surgical fees average $354, identical percentage changes to the private sector would have required a $39 decline in surgical fees and a $9 increase in medical payments, or a $30 (= $9 − (−$39)) relative change. But the private sector cost-following coefficient of 1.34 that we have estimated means that Medicare's $17 relative change only led to a $23 (= 1.34 × $17) relative change in the private sector. Since ln($23/$30) ≈ 0.53, this is the coefficient we estimate in logs in column 6.

[25]These controls are more strongly predictive of private payments in specifications that do not include full sets of state-by-year effects, but even then have little impact on our baseline estimate. State-by-year effects account for most of the variation in plan design contained in the MedStat data.

[26]Accounting for the reductions to payments for cataract surgery improves our ability to correctly track the reduction in payments for surgical procedures relative to other services. Cataract surgery exerts a significant impact on our regressions because it is a very high volume service. Changes in service-specific Part B payments must, as a general rule, be implemented in a budgetarily neutral fashion, making it essential to weight each service by its baseline share of total part B payments.

controlling for them has little impact on our baseline result. Finally, column 7 shows that the baseline is robust to controlling directly for a linear trend in payments for surgical procedures relative to other services. As Figure 2 shows, there is no such trend.

We also estimate the effects of a set of across-the-board payment changes that varied across geographic areas. We present this analysis in Appendix B. The estimated price-transmission coefficient is on the order of 1, and is thus qualitatively quite similar to the transmission of relative price shocks. For reasons discussed in Section 2.2, these responses to across-the-board payment shocks are relatively direct evidence against cost shifting. Taken together, the estimates suggest that Medicare's payment changes exert significant influence over aggregate spending on physicians' services. We turn next to an exploration of the mechanisms underlying the price-transmission process.

4   What Underlies Medicare's Impact On Private Prices?

Private prices reflect the outcomes of negotiations between physicians and private insurers. Medicare's influence on these prices must thus be mediated by the bargaining process. Here we develop the implications of two bargaining frameworks that match practitioners' descriptions of their negotiations. Practitioner characterizations of the bargaining process can be found in Appendix A.

Practitioners describe two modes of negotiation between providers and private insurers. Insurance carriers typically offer small providers, such as sole practitioners and small physician groups, contracts based on a fixed fee schedule. Whether this schedule is copied directly from Medicare or modified by the insurer, the parties then negotiate a constant markup over these rates (Nandedkar 2011, Gesme and Wiseman 2010, Mertz 2004). In contrast, insurers are said to negotiate in more detail with hospitals and large provider groups over payments for bundles of services. Below we characterize when each bargaining model would be efficient and what each means for the welfare consequences of Medicare payment reforms.

4.1 When To Reference Price and When To Bargain

We characterize physicians and insurers as having two options: they can bargain from scratch over service- or bundle-specific prices or they can adopt a default. As characterized by practitioners, Medicare's payments are the standard defaults.[27] Default adoption may be optimal due to the substantial negotiation and coordination costs in our setting (Coase 1937, 1960).

For each service j, there is a price $p_{j,g}^*$ such that physician group g will supply j to its patients to the point at which marginal costs equal marginal benefits. A notable feature of this payment is that it maximizes the value (to beneficiaries) of the insurer's product. Consequently, insurers can benefit from actively negotiating away from Medicare's rates and towards $p_{j,g}^*$. These negotiations may not result in this optimal payment due to uncertainty over $p_{j,g}^*$ and to physician market power. We assume that engaging in such negotiations has a fixed cost of c.

Alternatively, the insurer and physician group can adopt Medicare's payment menu.[28] Since Medicare's payments are cost based, they deviate from the $p_{j,g}^*$ described above.[29] Let $\Delta\pi_j(r_{M,j})$ describe the average, per-patient loss of profitability associated with the care provision induced by Medicare's reimbursement, $r_{M,j}$. Then the insurer will prefer active negotiations to reference pricing when the following condition holds:

$$N_g \cdot \Delta\pi_j(r_{M,j}) > c \tag{12}$$

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[27]Medicare's position as the single-largest payer for health care services further reinforces its relevance as a setter of default prices. Providers themselves may find deviating from Medicare's menu costly due to increasing in the non-trivial administrative expenses associated with billing (Cutler and Ly 2011). Regulations requiring insurers to pay sufficiently to ensure access to "medically necessary" services may also contribute to such a role for public players in these markets.

[28]The Medicare menu may be particularly relevant for relative prices across services. Practitioners describe the offers made by insurers to sole practitioners, for example, as being take-it-or-leave it, scalar mark-ups (or occasionally slight mark-downs) of Part B prices.

[29]Cost-based pricing is, of course, a slippery concept in the presence of fixed costs and non-constant marginal costs. In this context, cost-based is meant to mean the average cost of care at observed quantities. Since Medicare beneficiaries, in particular those with supplemental insurance, are comprehensively insured, there may be a substantial wedge between marginal cost and marginal benefit at these quantities.

where N_g is the number of patients seen by group g.[30] Insurers prefer active negotiations when Medicare's deviation from the negotiated price is large and when a service is a substantial driver of cost (both being determinants of $\Delta\pi_j(r_{M,j})$). Importantly, active negotiations are more likely to be preferred when insurers encounter large physician groups with many patients. From the providers' perspective, deviations from Medicare's menu may be costly due to increases in the complexity of their billing operations (Cutler and Ly 2011).

Medicare's payment policies have substantial welfare implications under reference pricing. In the extreme, reference pricing means that Medicare's prices are transmitted, unadulterated, into the private sector. When Medicare pays generously for low value services, incentives for this portion of the private sector echo Medicare's mistake. The value of improvements in Medicare's payment policies will be similarly magnified. More plausibly, the incentives faced by sole practitioners and small groups may be anchored closely to, but not bound entirely by, Medicare's payments. As equation (12) emphasizes, insurers and small physician groups will find value in bargaining if Medicare's deviations from actively negotiated payments are particularly costly.

4.2 Price Transmission with Active Bargaining

Actively bargaining rather than adopting the Medicare default can move prices towards a more competitive level. We now analyze Medicare's influence on these negotiated private prices. We characterize the equilibrium private payment as the reimbursement rate, r_p^*, that equates supply with demand in the private sector:

$$S(r_p^*, r_M) = D\left(r_p^* - \phi(q_p^*)\right). \tag{13}$$

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[30]To adopt Coase's (1960, 15–16) language, such negotiations "will only be undertaken when the increase in the value of production consequent upon the rearrangement is greater than the costs which would be involved in bringing it about."

We think of demand in an *ex ante* and second best sense. That is, it reflects marginal benefits after taking into account the distortions associated with acquiring care through insurance. We are interested in those distortions that drive the market away from the second-best outcome it would achieve in the presence of unavoidable moral hazard. This second-best demand may itself be distorted by institutions like the tax exclusion for employer provided health insurance or by adverse selection. Such distortions, which we introduce through the function $\phi(q_p)$ as in section 1, may lead people to over- or under-insure from an *ex ante* perspective.

Differentiating equation (13) with respect to r_M yields:

$$\frac{dr_p^*}{dr_M} = \frac{-s_M\left(r_p^*, r_M\right)\left[1 + D'\left(r_p^* - \phi\left(q_p^*\right)\right)\phi'\left(q_p^*\right)\right]}{s_p\left(r_p^*, r_M\right)\left[1 + D'\left(r_p^* - \phi\left(q_p^*\right)\right)\phi'\left(q_p^*\right)\right] - D'\left(r_p^* - \phi\left(q_p^*\right)\right)}, \tag{14}$$

where s_p and s_M denote the derivatives of supply with respect to the first and second arguments, respectively. Equation (14) characterizes Medicare's influence on private prices in the world of active negotiation. With a constant (including zero) distortion, so $\phi'(q_p^*) = 0$, straightforward assumptions that supply slopes upward ($s_p > 0$) and demand downward ($D' < 0$) ensure that the denominator of (14) is positive. The direction of Medicare's price transmission is then governed by the sign of the numerator. In the standard case, where increases in Medicare's payments draw physicians away from the private sector, s_M would be negative and equation (14) will take the positive sign of $-s_M$.[31]

Positive price transmission, as predicted by equation (14) when $\phi' = 0$, is economically intuitive. With zero or constant distortions, Medicare's influence on private market equilibrium works entirely through a shift along the demand curve. In negotiations between physicians and private insurers, Medicare can be viewed as the physicians' outside option. If

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[31] The signs of the own- and cross-price elasticities are questioned by the target income hypothesis and the notion of volume offsets (Codespote et al. 1998). These concepts, and the relevant literatures, were discussed in footnote 8. Here we note a connection between these views and the cost-shifting hypothesis, discussed in footnote 9. By adding further to the ambiguity of the signs of both the numerator and denominator of equation (14), target income and volume offsets ensure the indeterminacy of the sign of $\frac{dr_p^*}{dr_M}$. Target income and volume offsets make cost-shifting more plausible in the active-bargaining framework than it would otherwise be.

Medicare begins paying more generously, treating Medicare beneficiaries becomes relatively attractive. This reduces the supply of services to the privately insured, which bids up the price.

Equation (14) also characterizes potential sources of heterogeneity in the magnitude of the price-transmission relationship. The numerator shows that the strength of Medicare's price transmission increases with the magnitude of s_M. Higher s_M reflects a more competitive environment in that doctors are more willing to switch between private and Medicare patients. We thus note first that equation (14) predicts greater price transmission when physicians are dispersed rather than consolidated.[32] This reinforces the importance of the size of physician groups, which also affects the choice between active bargaining and the Medicare default, as shown in section 4.1.

Second, cross-price supply responses likely increase with the relative sizes of the Medicare and private-sector markets for a service. A given reimbursement change within Medicare, with its concomitant supply response, represents a smaller shift for the private market when the private market is large.

Third, the magnitude of price transmission is decreasing in the private market's own-price supply elasticity, s_p. This may imply a role for the generosity of insurance arrangements. When physicians act as agents on their patients' behalf, patient cost sharing can influence the elasticity of supply. Specifically, cost sharing will tend to blunt supply responses, suggesting that less generous coverage leads to stronger price transmission. The relationship between price transmission and insurance generosity is made murky, however, by conceptual links between insurance generosity and terms associated with the distortion.

Finally, Medicare's influence on private markets may be mediated by the distortion, $\phi(q_p)$.

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[32]This story is consistent with pharmaceutical suppliers' response to government procurement policies. In the context of prescription drugs, production and pricing are highly sensitive to government payment policies. Yurukoglu (2012) finds that production of generic sterile injectables depend on Medicare payment rates; manufacturers close production lines when margins fall. Duggan and Scott Morton (2006) demonstrate the potential relevance of the next step in the logical chain: when payments received from one source depend mechanically on those from another, manufacturers set prices strategically to maximize total revenue.

We note first that, when the distortion is constant, terms including ϕ' vanish from equation (14); the distortion's only influence is through second-order terms in the demand curve. This would be the case, for example, if the distortion was driven exclusively by a per-unit subsidy of health care consumption. Alternatively, the distortion might be increasing in quantity. The negative $(\phi(q_p) < 0)$ distortion associated with adverse selection, for example, may be weak when the market equilibrates at relatively high quantities of care consumption. As shown by equation (14), the magnitude of Medicare's price transmission will tend to weaken as the slope of the distortion, $\phi'(q_p)$, increases. Figure 3 illustrates both the constant and variable distortion cases.

4.3   Active Bargaining and Medicare Payment Reform

As characterized above, movements in actively negotiated prices driven by Medicare's payment changes may have neutral efficiency implications. That is, when prices are actively negotiated, Medicare moves private prices and quantities because it shifts private-sector supply.

Suppose, for example, that Medicare improves policy by reducing cost-based payments for services, provided by a particular specialty, that are medically found to have low value. The payment reductions lead the relevant specialty to shift resources away from Medicare and thus towards the private sector. Importantly, this shift both reduces the optimal private payment *and* increases the optimal provision of the service to the privately insured. Consequently, it would be a mistake to view increases in private supply, as driven by the decrease in Medicare's payments, as evidence that Medicare's change has had an adverse effect.

Cross-sector effects and income effects may blunt efforts to reduce the utilization of low-value services in the short run. But theory speaks unambiguously to the long-run effect of reducing Medicare's payments for a particular specialty's services. The co-movement of Medicare and private payments unambiguously reduces the returns to practicing in the relevant specialty or making associated investments. In the long run, this reduction in the

returns to practice will shift the supply of physicians away from the specialty associated with the targeted low-value services.

5 Empirical Analysis of Provider Consolidation and Market Size as Drivers of Price Transmission

We next explore the empirical conditions under which Medicare's influence on private prices is weaker or stronger. Estimating heterogeneity in the strength of Medicare's price transmission serves two primary purposes. First, it allows us to explore the relevance of core features of the previous sections' framework. Second, we take advantage of an opportunity to describe outcomes associated with multilateral bargaining. Specifically, we provide evidence on how multilateral bargaining equilibria are altered by changes in the outside options available to suppliers. The facts generated by this analysis thus inform our understanding of bargaining in markets in which neither demand nor supply is perfectly competitive.

5.1 Measures of Physician Market Power

We begin by examining the importance of provider consolidation. We measure the degree of competition among physician groups using a Herfindahl-Hirschman Index (HHI) constructed with Medicare claims data. The claims data report both a unique physician identifier and the tax identifier of the group with which each physician is associated. In claims data from a 20 percent sample of all Medicare beneficiaries, we will come quite close to having this information for all Medicare-serving physicians in the country. Our first measure is constructed by estimating the HHI for all physician groups within a Hospital Referral Region (HRR).[33] We then average this measure across the HRRs within each state to obtain a state-level measure of the average degree of competition across the markets within that

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[33]Physician HHI is $\sum_{k=1}^{N} s_{k,i}^2$, where k indexes each of the N physician groups (identified in the claims data via their tax identifiers) operating in Hospital Referral Region i, and where $s_{k,i}$ expresses the number of physicians in group k as a share of all physicians in region i. The measure is constructed such that an index of 1 corresponds to a monopolist and a market approaches perfect competition as the index goes to 0.

state.

We next compute a more targeted measure of concentration that is allowed to vary across specialties as well as states. For this metric we construct HRR-level HHIs separately for each of the 32 largest physician specialties. We again average these specialty-specific HHIs across the HRRs within each state. Table 1 reports summary statistics describing both measures of provider consolidation. On average, the specialty-specific HHIs exhibit greater concentration (alternatively, less competition) for largely mechanical reasons. More importantly, they exhibit a great deal more variation than the all-physician HHIs.

Incorporating specialty-specific HHIs into our analysis requires restricting attention to services that tend to be provided primarily by members of a particular specialty.[34] Since they vary both across states and across specialties within each state, the specialty-specific HHIs give us our most compelling look in terms of econometric identification at the role of market power in mediating the effect of Medicare's price changes on private markets.

To estimate the influence of provider consolidation on Medicare's price transmission, we interact the Medicare price shocks with either the all-physician or specialty-specific HHI. In both cases, we standardize the HHI variables to have zero mean and unit variance. Because the first stage coefficient in Table 2's levels regression was so close to unity, making the IV and reduced-form results nearly identical, we now focus on reduced form estimates. Recalling that $\text{PredChg}^{\text{Medicare}}$ is the predicted Medicare price change, and using $HHI_{j,s}$ to denote the applicable HHI z-score, we run:

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[34]This is because the private sector claims data say little about the physicians associated with each service. The construction of specialty-specific HHIs and the linking of service codes with particular specialties could only be done consistently in the Medicare claims data. Consequently, the number of distinct service codes in our analysis sample falls from 2,048 to 1,252 for our analysis of provider consolidation.

$$P_{j,s,t}^{\text{Private}} = \beta_1 \cdot \text{PredChg}_{j,s}^{\text{Medicare}} \times \text{Post1998}_t$$

$$+ \beta_2 \cdot \text{PredChg}_{j,s}^{\text{Medicare}} \times \text{Post1998}_t \times HHI_{j,s}$$

$$+ X_{j,s,t}\gamma_1 + X_{j,s,t} \times HHI_{j,s}\gamma_2 + \mu_j^1 I_j + \mu_s^1 I_s + \mu_t^1 I_t$$

$$+ \mu_j^2 I_j \times HHI_{j,s} + \mu_s^2 I_s \times HHI_{j,s} + \mu_t^2 I_s \times HHI_{j,s}$$

$$+ \mu_{j,s}^1 I_j \times I_s + \mu_{t,s}^1 I_t \times I_s + \mu_{j,s}^2 I_j \times I_s \times HHI_{j,s} + e_{j,s,t} \tag{15}$$

We flexibly allow the coefficients on all time-varying controls to vary with the relevant HHI variable.[35]

5.2 Heterogeneity by Physician Market Power

Table 3 shows results from estimating equation (15). Column 1 shows that the average price-transmission coefficient continues to be roughly 1.5, but that it varies dramatically with physician HHI. The coefficient of -0.4 on the physician HHI interaction implies that as HHI increases by 1 standard deviation, the price-transmission coefficient falls just more than one-fourth its value at the mean HHI; the point estimate is statistically distinguishable from zero at the $p < 0.01$ level. Price transmission in relatively uncompetitive markets is thus much weaker than in the most competitive markets.

In column 2, we add an interaction between the predicted payment shocks and the number of physicians in a market (also measured as a z-score). This variable enters significantly, but with little impact on the coefficient associated with the HHI interaction. Thus the HHI coefficient is not merely capturing differences in the absolute sizes of the relevant markets. It is of independent interest that, conditional on HHI, the number of physicians is strongly associated with the strength of Medicare's price transmission. Together, the results suggest

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[35]We also graphically report results from specifications in which we divide the sample into terciles of provider consolidation. Estimation on sub-samples implicitly allows all controls to be "fully interacted" with the HHI variables at no additional computational cost. In equation (15) we have omitted interactions between the HHI variables and the state-by-service code fixed effects ($I_j \times I_s \times HHI_{j,s}$), of which there are in excess of 50,000.

that fragmented markets are relatively likely to follow Medicare's cues, perhaps because they are markets in which the gains from active bargaining are unlikely to outweigh its costs.

Columns 3 through 5 conduct a similar analysis using HHIs constructed at the specialty-by-market level. The results are statistically strong and consistent with the results associated with the all-physicians HHI z-score. The point estimate of interest is robust to controlling for interactions with the number of physicians, either within a specialty or throughout the market. Column 6 includes both the all-physician and specialty-specific interactions. When included jointly, both concentration measures remain strong predictors of the strength of Medicare's price transmission. Including the two physician count measures together renders each of the coefficients individually insignificant, but a joint test shows that the two coefficients together can still be distinguished from zero at $p < 0.01$. The results uniformly support the view that Medicare is more relevant in competitive markets than in markets characterized by high levels of provider consolidation.

Panel A of Figure 4 reports both the first stage and price-transmission coefficients separately for each tercile of the specialty-HHI distribution. The first stage coefficients are flat across the terciles, indicating that Medicare's payment changes were implemented consistently across markets. Consistent with the results in Table 3, the reduced form coefficients fall from nearly 2.5 in the most competitive tercile to 0.5 in the most concentrated.

Appendix Table C.2 demonstrates the robustness of this variation across HHIs to the inclusion of additional controls. We interact various area characteristics—ranging from Census region indicators to income per capita—with the predicted payment shock. Including these controls has little effect on the coefficients associated with our measures of provider consolidation.

5.3   Heterogeneity by Size of Service Market

We next examine the relevance of the size of the markets for individual health care services. Section 4 suggests two factors that may be relevant. First, equation (14), which

characterized price transmission under active bargaining, points to the relative size of the relevant public and private markets. As the relative size of the Medicare market expands, one would expect the cross-price response s_r to rise. Relatively large public markets may thus be associated with relatively strong price transmission. Second, equation (12) points to the absolute size of private markets as a determinant of whether or not active bargaining is pursued. Frequently utilized services may be services for which private pricing is relatively independent of the Medicare menu.

Our measure of private market size simply adds all instances in which each service appears during a baseline year of the MedStat database ("Private Market Volume"). We also construct a metric that proxies for the relative sizes of the Medicare market and private markets ("Medicare Relative Size"). This metric is the ratio of the number of times a service appears in a single year of the Medicare claims data and the number of times it appears in a single year of the MedStat data. Because MedStat is a non-random sample of the private market, with time-varying size, this variable may poorly measure the absolute level of the ratios between the size of the public and private markets for each service. Nonetheless, it should form a reasonable basis for dividing services into those with relatively large and small Medicare market shares.

We present summary statistics describing Private Market Volume and Medicare Relative Size in Table 1. Both of these variables are strongly right skewed; the lower bound of the relevant z-scores are roughly -0.2 for Private Market Volume and -0.4 for Medicare Relative Size. Consequently, we normalize them using percentile ranks rather than z-scores. We subtract 0.5 from the percentile ranks so that the resulting variables are symmetric about 0. We then interact these variables with the price shocks and controls as in equation (15).

We present the results of this exercise in Table 4. Column 1 shows that the public-private ratio enters significantly, with a coefficient of 1. Moving from the the first to the 99th percentile of the Medicare Relative Size distribution is associated with moving from a price transmission coefficient of 0.5 to a price transmission coefficient of 1.5. The larger

the relative size of the Medicare market, the stronger the transmission. Column 2 tests the impact of Medstat private market volume alone. The point estimate in this case is a statistically insignificant −0.3.

5.4   Implications of Provider- and Market-Size Results

Consistent with practitioner characterizations, we find that Medicare exerts influence as both a setter of defaults and a shaper of outside options. The dramatic difference between price transmission in high- and low-concentration markets (Figure 4 and Table 3) highlights Medicare's importance for the fee schedules used to pay small-group practices. The relevance of the relative sizes of public and private markets (Table 4) highlights the importance of Medicare's payments in shifting resources across sectors. The relative importance of these channels, as drawn out in section 4, is mediated in large part by provider scale. Trends in provider scale may thus shape the nature of Medicare's influence in coming years.

Kletke, Emmons and Gillis (1996) describe early episodes in a long-term trend towards consolidation among physician groups. Our analysis points to an under-emphasized benefit of this consolidation. From the insurer's perspective, provider scale is a core determinant of the benefit from aligning payments with value. A world of diffuse providers may be a world in which private players have insufficiently strong incentives to innovate over Medicare's menu. Gains associated with reduced fragmentation may thus extend beyond those associated with improvements in care coordination *per se* (Cutler 2010). Such gains must be weighed, however, against the cost of reduced competition. As shown in Figure 5, and consistent with Dunn and Shapiro (2012), consolidation is strongly associated with higher prices. Consumer gains from improvements in the structure of providers' incentives must thus be weighed against losses associated with their market power.

6 Price Transmission and Additional Market Characteristics

6.1 Does Payment Reform Affect Private-Sector Price Dispersion?

In this section we briefly explore additional pricing consequences of Medicare payment policy. One outcome of interest is price dispersion. Dispersion in private payments for ostensibly similar services is substantial, and its determinant are not fully understood. We estimate the extent to which price dispersion responded to our natural experiment, which involved a substantial reduction in payments for surgical procedures relative to other services. It may also have resolved a degree of uncertainty surrounding the future of Medicare's payments, at least temporarily.

Table 5 reports the results, which involve specifications taking the same form as those reported in columns 2 and 5 of Table 2. The dependent variables measure price dispersion at the service-by-state-by-year level. In columns 1 and 2, the dependent variable is the standard deviation of prices within these markets, while in columns 3 and 4 it is the coefficient of variation. The results imply that increases in payments are associated with increases in dispersion. The coefficients of variation are uncorrelated with the payment shocks. Medicare's payment reform thus had little impact on normalized price dispersion.

6.2 Price Transmission by Insurance and Specialty Characteristics

Finally, we investigate the relationship between the strength of Medicare's price transmission and additional market characteristics of interest. These include the extent of competition among insurers, the consumer-side generosity of insurance contracts, and the exposure of different provider specialties to the downside of the reduction in payments for surgical procedures.

Our measure of insurer competition, which takes the form of a Herfindahl-Hirschman

Index (HHI), is taken directly from an analysis of insurance market competition by American Medical Association (2007).[36] The American Medical Association (2007) reports HHIs for all states but Kansas, North Dakota, Mississippi, Pennsylvania, South Dakota, West Virginia, and Washington, DC.[37]

We construct three variables that characterize the generosity of insurance. First, we calculate "Marketwide Cost Sharing" as a market-wide measure of generosity. This measure is the share of spending in our claims data paid directly by patients through deductibles and coinsurance. We construct a similar measure, namely Service Specific Cost Sharing, at a geographic market-by-service level. Third, we use the "Plan Type Generosity" variable, constructed as described in section 2.4, to capture differences in payment rates explained by the structure of different insurance plans (PPO, POS, etc.).

Finally, we use the Medicare claims data to calculate the share of each specialty's revenue that comes from surgical procedures as opposed to other medical services. We then link the resulting measure of specialty "exposure" to the payment shocks to the specialty-dominated services described in Section 5.1. We convert all of the variables just described into z-scores and interact them with the predicted payment shocks and controls as in equation (15).

Table 6 presents the results of this analysis. Column 1 shows a modest relationship between insurer concentration and the strength of Medicare's price transmission. More concentration (or less competition) is associated with stronger price transmission. This is surprising as small insurers—like small provider groups—should have relatively high costs

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[36]Insurer HHI is $\sum_{k=1}^{N} s_{k,i}^2$, where k indexes each of the N insurers operating in payment area i and where $s_{k,i}$ is insurer k's market share. The measure is constructed such that an index of 1 corresponds to a monopolist and a market approaches perfect competition as the index goes to 0.

[37]The AMA data on insurance carrier HHI that we use are far from a perfect measure of insurance competition in the state. They have a number of problems, many of which have been documented by Dafny, Dranove, Limbrock and Scott Morton (2011). Most significantly, they measure competition among carriers for fully-insured health plans, while the private sector data from Thompson Reuters are for self-insured companies. Second, the state-level HHI will naturally decline with the geographic size of the state, even if any one sub-state geographic market has limited competition. Third, these data are implausibly volatile over time, suggesting that observations from any one year are subject to significant measurement error. These issues suggest that regressions based on the AMA concentration data are likely to be subject to measurement error and may well underestimate the importance of concentration.

of developing novel fee schedules. A possible explanation is that relatively monopolistic insurers have diluted incentives to create value, and thus to actively improve upon Medicare's payment rates. The coefficient is economically quite small, however, in particular when compared with the coefficients associated with provider consolidation. This result is shown graphically, by tercile, in Panel B of Figure 4.

Results for the measures of insurance generosity are similarly small in economic terms. Relatively generous plans, as proxied for by relatively *low* cost sharing (column 2), or by relatively generous payments to providers (column 4), are associated with relatively weak price transmission. The coefficient associated with service-specific cost sharing is estimated with relatively little precision (column 3).

Finally, column 5 of Table 6 presents estimates of the relevance of specialties' exposure to the downside of the reduction in payments for surgical services. The cost-shifting hypothesis suggests that income effects will lead Medicare payment reductions to result in private payment increases. The bargaining framework from Section 4.2 has the opposite implication, while income effects are irrelevant when the Medicare menu is adopted by default. The point estimate is positive and statistically insignificant. This is consistent with the results presented in Appendix B, which we take as more direct evidence on the relevance of cost-shifting in markets for physicians' services. The analysis presented in Appendix B involves across-the-board payment shocks that varied across geographic areas. The price transmission coefficients are quite similar to those associated with the relative price shocks analyzed above. Income effects appear to mediate the price-transmission process weakly if at all.

7 Conclusion

We assess Medicare's influence on fees for physicians' services, finding its influence to be substantial. A $1 change in Medicare's relative, cross-service payments leads to a $1.30 change in private payments. When Medicare mistakenly pays generously for low-value ser-

vices, the private sector follows its lead. Medicare similarly moves the level of private payments when it alters fees on an across-the-board basis. Medicare thus influences both the relative valuation of, and aggregate expenditures on, physicians' services.

Medicare's influence derives from multiple sources. First, as a large public player, Medicare competes with private insurers for physicians' resources. Second, Medicare's payment menu provides the benchmarks from which bargaining begins. Bargaining costs and the expense of complex billing operations contribute to this role as an establisher of benchmarks and setter of defaults. Finally, health-care payment systems have the essential properties of public goods; public payers may thus be essential participants in payment-system experimentation and reform. Improvements in our understanding of these sources of influence should prove valuable as policy makers reckon with the high cost of health care in coming years.

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Figure 1: Cross-Service Relationship Between Private and Medicare Prices
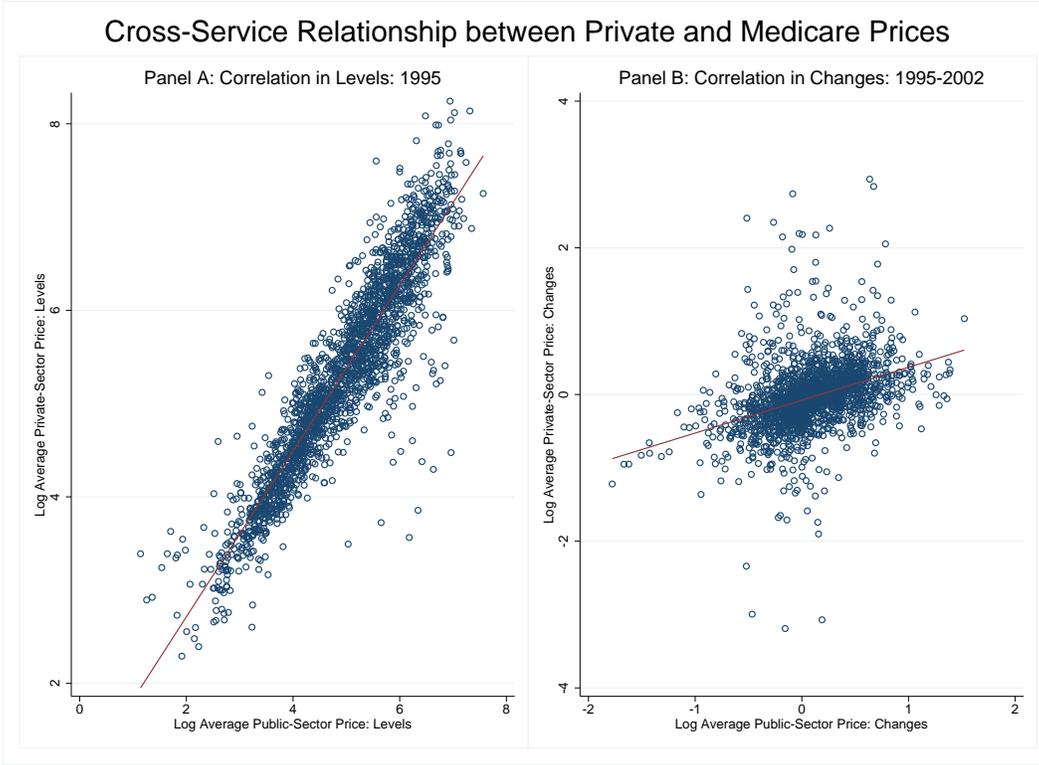
Note: This figure shows the raw cross-service relationships between average private reimbursements and average Medicare reimbursements. The payments are the natural logs of the average payment we observe in our public (Medicare) and private (Medstat) sector claims data. Panel A presents these average payments for 1995 while Panel B shows the changes in these average payments from 1995 to 2002. The best-fit line shown in Panel A results from estimating

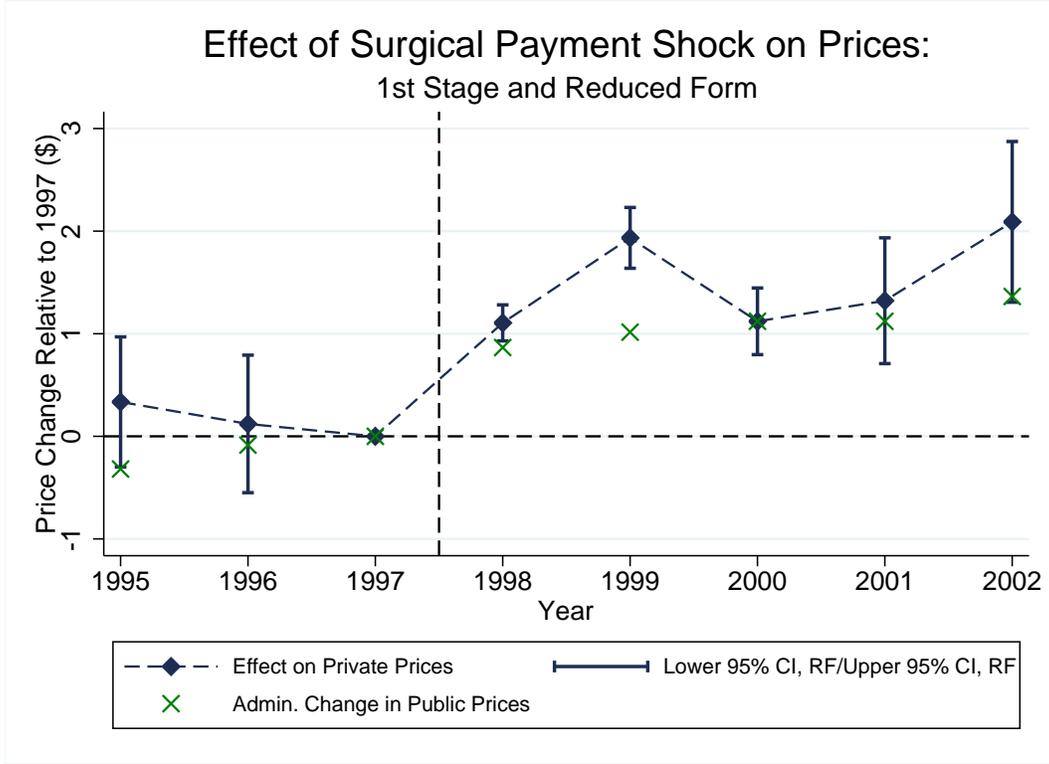$$\ln(P_j^{\text{Private}}) = \beta_0 + \beta_1 \ln(P_j^{\text{Medicare}}) + u_j.$$

The regression yields a coefficient of $\beta_1 = 0.89$ and $R^2 = 0.85$. The best-fit line shown in Panel B results from estimating

$$\triangle \ln(P_j^{\text{Private}}) = \gamma_0 + \gamma_1 \triangle \ln(P_j^{\text{Medicare}}) + v_j.$$

The regression yields a coefficient of $\gamma_1 = 0.45$ and $R^2 = 0.14$.

Figure 2: Effects of Medicare's Elimination of the Surgical Conversion Factor

Note: This figure presents the δ_t coefficients, with associated 95% confidence intervals, from estimates of the equation below:

$$P_{j,s,t}^{\text{Private}} = \sum_{t \neq 1997} \delta_t \cdot I_t \times \text{PredChg}_{j,s}^{\text{Medicare}} \times \text{Post1998}_t + X_{j,s,t}\alpha + \mu_j I_j + \mu_s I_s + \mu_t I_t$$
$$+ \mu_{j,s} I_j \times I_s + \mu_{t,s} I_t \times I_s + u_{j,s,t}$$

where $\text{PredChg}_{j,s}^{\text{Medicare}}$ are the predicted changes in Medicare payments associated with the elimination of the surgical conversion factor. The figure also plots the point estimates from the associated first stage, showing that our coding of $\text{PredChg}_{j,s}^{\text{Medicare}}$ correctly tracks the conversion factor's elimination. The dependent variable is the level of the average private payment, calculated at the service-by-state-by-year level, that we observe in our data on private sector claims. Controls include full sets of service-by-state ($I_j \times I_s$) and state-by-year ($I_s \times I_t$) fixed effects, corresponding direct effects, as well as indicator variables that account for sharp reductions in Medicare's payments for cataract surgery that occurred during the mid-1990s. Also included are two variables accounting for the insurance plan types associated with our data on private sector claims. Standard errors are clustered at the service code level. Sources: Authors' calculations using Medicare and Thompson Reuters MarketScan data.

Figure 3: Private Health Care Market With a Distortion
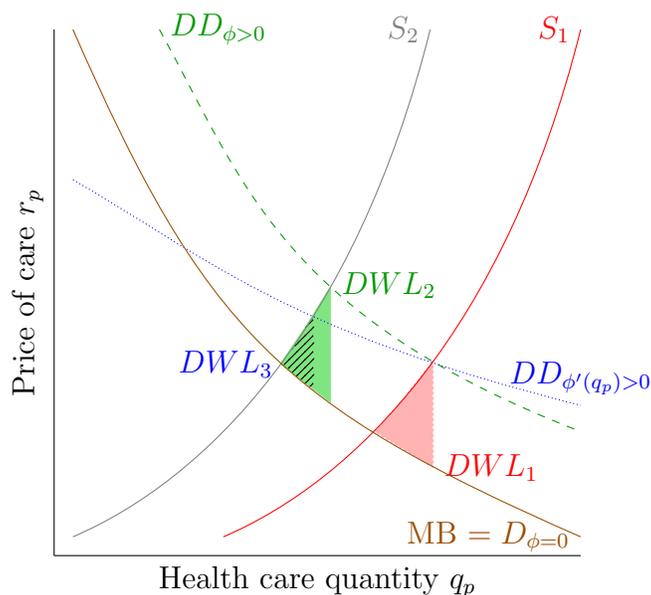
This figure illustrates the equilibrium and deadweight losses in the private market with and without a distortion ϕ. The true marginal benefit (MB) curve for health care is denoted $D_{\phi=0}$. One possible distortion is a demand curve exhibiting a constant shift relative to the MB curve. This is illustrated with the dashed curve, denoted $DD_{\phi>0}$. As this curve is above the MB curve, it could be illustrating a situation where the tax exclusion for employer-provided insurance is the dominant distortion. When the supply curve is S_1, the distortion leads to a deadweight loss denoted DWL_1. If the private sector supply curve moves to S_2, perhaps because of increased Medicare reimbursement rates, the new deadweight loss is given by the full DWL_2 area (both the dashed and solid portions) and is as large as DWL_1.

Now consider a distorted demand curve when $\phi'(q_p) > 0$. This variable distortion could arise if adverse selection dominates when quantities are low and excess moral hazard when they are high. In this case, illustrated in the dotted curve denoted $DD_{\phi'(q_p)>0}$, the demand curve is more elastic and deadweight loss is lower under supply curve S_2 (the dashed area marked as DWL_3) than S_1 (where the deadweight loss remains DWL_1). If the supply curve shifted from S_1 to S_2 because of a Medicare price increase, cost-following is lower under this distorted demand curve than under either the $D_{\phi=0}$ or $DD_{\phi>0}$ demand curves.

Figure 4: First Stage and Reduced Form Coefficients by Tercile of Competition

Panel A: Coefficients by Tercile of Competition Among Physicians
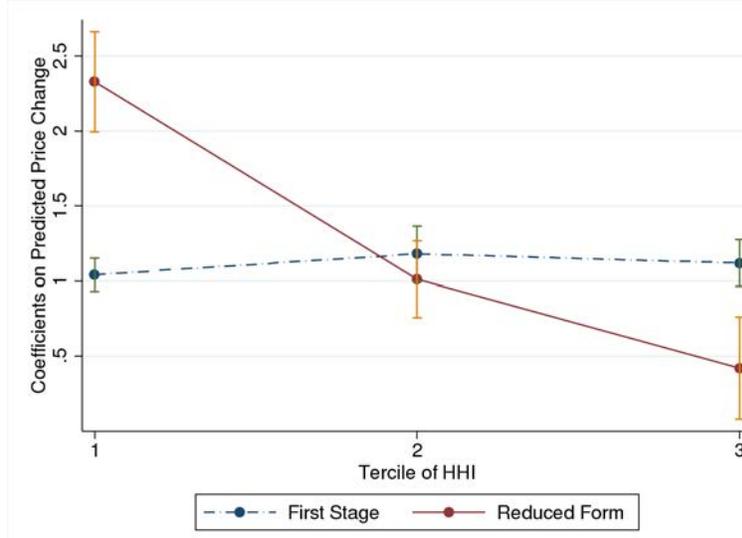
Panel B: Coefficients by Tercile of Competition Among Insurers
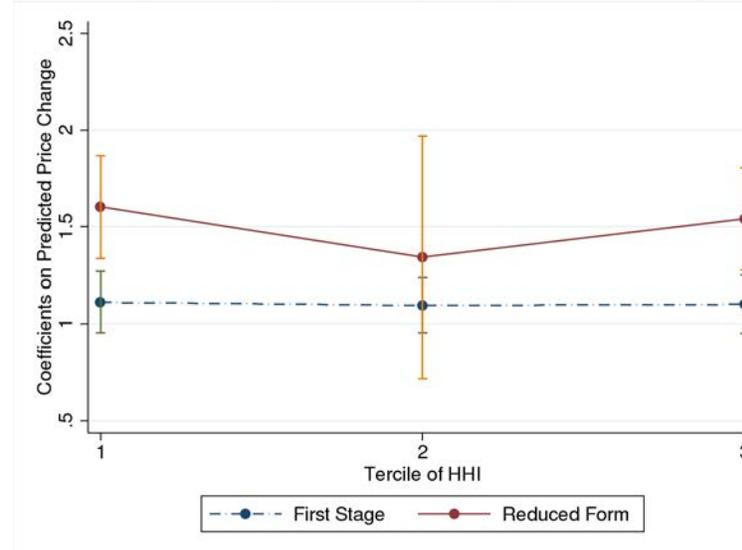
This figure shows coefficients of Medicare price and private prices on the predicted price change interacted with years following its implementation, from specifications based on equation (8), with associated 95% confidence intervals. Coefficients are estimated separately when cutting the sample by the HHI of (A) physician groups, computed at the specialty-by-state level, and (B) insurance carriers, taken from American Medical Association (2007). In each panel, the dashed line shows first-stage coefficients indicating the impact on Medicare payments. The solid line shows reduced form coefficients indicating the impact on private insurer reimbursement rates.

Figure 5: Variation in Private Prices with Provider and Insurer Market Power
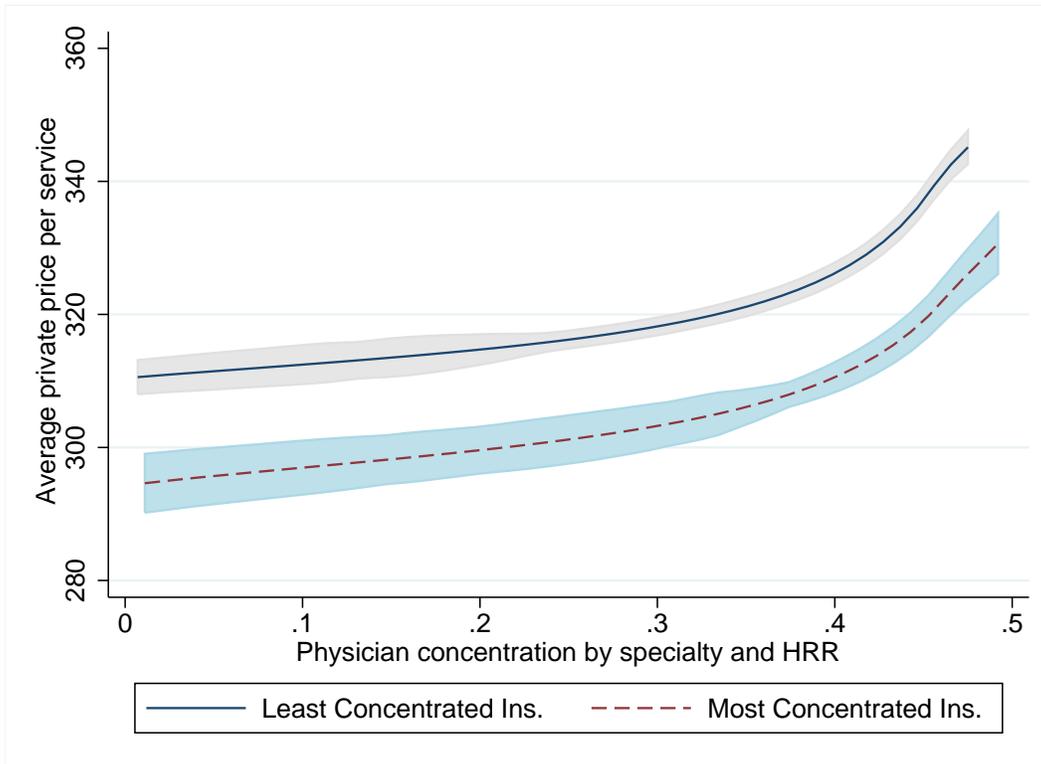
Note: This figure shows the relationship between average private sector payments between low-concentration (blue solid line) and high-concentration (red dashed line) insurance markets, with variation shown by the degree of provider concentration (x-axis). The private payments are averaged across all years, states, and services.

Table 1: **Summary Statistics**

	Non-Surgical Care ($N = 129,396$)			Surgical Services ($N = 135,228$)		
	Mean	Std. Dev.	Range	Mean	Std. Dev.	Range
Private Payment Per Service	$123.57	$130.47	($1.10, $4,137)	$351.02	$402.18	($0.30, $15,288)
Medicare Payment Per Service	$112.88	$147.05	($3.28, $1,150)	$226.20	$236.43	($3.51, $2,111)
Std. Dev. of Private Pmt./Svc.	$83.24	$124.48	($0, $9,503)	$243.03	$357.62	($0, $12,523)
Std. Dev. of Medicare Pmt./Svc.	$17.19	$26.56	($0.41, $260.65)	$72.62	$99.96	($0.20, $1,320)
Ins. Plan Type Control	83.03	42.59	(15.52, 586.00)	236.45	141.40	(19.06, 670.95)
Out of Pocket Share	0.228	0.186	(0.00, 1.00)	0.198	0.180	(0.00, 1.00)
State Level Insurer HHI	0.335	0.134	(0.15, 0.69)	0.322	0.122	(0.15, 0.69)
State Level Physician HHI	0.023	0.024	(0.003, 0.14)	0.021	0.019	(0.003, 0.14)
Physician Specialty HHI	0.157	0.099	(0.007, 0.79)	0.145	0.106	(0.007, 1.00)
Private Market Volume (1000s)	66.00	322.01	(0.01, 4898.08)	11.89	48.42	(0.01, 721.61)
Medicare Relative Size	7.07	19.64	(0.003, 459.83)	2.62	4.51	(0.015, 136.87)

Note: This table shows summary statistics for our data on public and private payments, characteristics of the private plans we observe, and the characteristics of the geographic and service-specific markets that we use to explore heterogeneity in the effect of Medicare price changes on public prices. Observations are constructed at the service-by-state-by-year level and the panel is balanced in the sense that each service-by-state pairing is only included if public and private prices could be estimated for each year from 1995 through 2002. Private and Medicare Payments Per Service are expressed in dollars and are the average payment within each service-by-state-by-year cell. The standard deviations are correspondingly standard deviations of claims-level payments within service-by-state-by-year cells. "Ins. Plan Type Control" was constructed by regressing claim-level private payments on plan-type indicator variables and using the estimated coefficients, together with the observed distribution of plan types within each cell, to compute average predicted payments at the state-by-year-by-service level. The "Out of Pocket Share" is the average out-of-pocket payment as a share of the total payments associated with the private-sector claims data. "State Level Insurer HHI" is an insurance-market Herfindahl-Hirschman Index (HHI) provided by the American Medical Association (2007), which does not provide HHIs for the following states: KS, ND, MS, PA, SD, WV, and DC. "State Level Physician HHI" is an HHI constructed using information, from a 20 percent sample of Medicare claims for 1999, on the aggregation of physicians under groups associated with a common tax identification number; the measure was first constructed at the level of Hospital Referral Regions (HRRs), then averaged across the HRRs within each state. "Specialty-Specific Physician HHI" is similar to "State Level Physician HHI," but varies within each state at the level of 32 distinct physician specialties. This variable is only constructed for services that are provided predominantly by a single specialty, resulting in fewer observations than are associated with other variables described in the table. "Private Market Volume" expresses (in tens of thousands of dollars) the total payments associated with each service in private sector claims data. "Medicare Relative Size" is the ratio of the number of times a service appears in the Medicare claims data and in the private-sector claims data. Sources: Medicare claims and Thompson Reuters MarketScan data.

Table 2: **Baseline Estimates of the Effect of Medicare Price Changes on Private Sector Prices**

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
	Payment Levels			Log Payments		
	Public	Private	Private	Public	Private	Private
	1st Stage	Red. Form	IV	1st Stage	Red. Form	IV
Payment Shock × Post-1997	1.111**	1.435**				
	(0.057)	(0.172)				
Public Payment			1.292**			
			(0.187)			
Surgical Procedure × Post-1997				-0.203**	-0.108**	
				(0.040)	(0.026)	
Ln(Public Payment)						0.534**
						(0.058)
Plan Type Controls	48.397*	-42.346	-104.878	0.214	0.078+	-0.036
	(22.961)	(48.812)	(78.895)	(0.143)	(0.047)	(0.091)
Cost Sharing Fraction	-4.615*	21.715	27.678	-0.037*	-0.020	-0.001
	(2.338)	(19.907)	(21.539)	(0.016)	(0.043)	(0.045)
N	264,624	264,624	264,624	264,624	264,624	264,624
Number of Clusters	2,048	2,048	2,048	2,048	2,048	2,048
Weighted	Yes	Yes	Yes	Yes	Yes	Yes
State By Year FE	Yes	Yes	Yes	Yes	Yes	Yes
HCPCS By State FE	Yes	Yes	Yes	Yes	Yes	Yes
Eye Procedure Reductions	Yes	Yes	Yes	Yes	Yes	Yes
RVUs Per Service Control	No	No	No	No	No	No
Panel Balanced	Yes	Yes	Yes	Yes	Yes	Yes
Other Sample Restrictions	None	None	None	None	None	None

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. The table shows the results of OLS and IV specifications of the forms described in Section 2.2. Columns 1 and 2 report estimates of equations (8) and its associated reduced form respectively, where the payment shock and outcome variables are expressed in dollar terms. Column 3 reports an estimate of equation (9). Columns 4 through 6 report otherwise equivalent specifications in which the dependent variables are expressed in logs and the instrument is an indicator for surgical procedures performed in years following 1997. Observations are constructed at the service-by-state-year level. Observations are weighted according to each service's average share of payments made through Medicare Part B. The panel is balanced in the sense that each service-by-state pairing is only included if public and private prices could be estimated for each year from 1995 through 2002. Standard errors are calculated allowing for arbitrary correlation among the errors associated with each service. Additional features of each specification are described within the table. The construction of all variables is further described in the note to Table 1 and in the main text. Sources: Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.

Table 3: **Heterogeneity in Surgical CF Shock's Effect by Provider Concentration**

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:			Private Payment Level			
Payment Shock × Post-1997	1.456**	1.560**	1.145**	1.273**	1.302**	1.431**
	(0.161)	(0.195)	(0.077)	(0.102)	(0.106)	(0.168)
Payment Shock × Post-1997	-0.402**	-0.362**				-0.481**
× Physician HHI	(0.057)	(0.058)				(0.051)
Payment Shock × Post-1997			-1.000**	-0.936**	-0.910**	-0.521**
× Specialty HHI			(0.211)	(0.199)	(0.195)	(0.123)
Payment Shock × Post-1997		0.371**		0.386**		0.160
× Physician Count		(0.052)		(0.057)		(0.147)
Payment Shock × Post-1997					0.588**	0.339
× Specialty Count					(0.114)	(0.297)
N	214,096	214,096	214,096	214,096	214,096	214,096
Number of Clusters	1,252	1,252	1,252	1,252	1,252	1,252
Weighted	Yes	Yes	Yes	Yes	Yes	Yes
State By Year FE	Yes	Yes	Yes	Yes	Yes	Yes
HCPCS By State FE	Yes	Yes	Yes	Yes	Yes	Yes
Fully Interacted	Yes	Yes	Yes	Yes	Yes	Yes
Eye Procedure Reductions	Yes	Yes	Yes	Yes	Yes	Yes
Plan Type Controls	Yes	Yes	Yes	Yes	Yes	Yes
Panel Balanced	Yes	Yes	Yes	Yes	Yes	Yes
Other Sample Restrictions	Phys Merge	Phys Merge	Spec Merge	Spec Merge	Spec Merge	Spec Merge

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. The table shows the results of reduced form specifications of the form described by equation (15) in section 5.1. Observations are constructed at the service-by-state-year level. The panel is balanced in the sense that each service-by-state pairing is only included if public and private prices could be estimated for each year from 1995 through 2002. Observations are weighted according to each service's average share of payments made through Medicare Part B. The dependent variable in all columns is the level of the average private payment. Standard errors are calculated allowing for arbitrary correlation among the errors associated with each service. The "HHI" and "Count" variables have been converted to z-scores, and further details of the construction of all variables are described in the note to Table 1 and in the main text. Sources: Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.

Table 4: Heterogeneity in Surgical CF Shock's Effect by Service Market Characteristics

	(1)	(2)
Dependent Variable:	Private	Payment
Payment Shock × Post-1997	0.981**	1.481**
	(0.158)	(0.401)
Payment Shock × Post-1997	1.066**	
× Public-Private Ratio	(0.392)	
Payment Shock × Post-1997		-0.321
× Medstat Volume		(0.906)
N	264,624	264,624
Number of Clusters	2,048	2,048
Weighted	Yes	Yes
State By Year FE	Yes	Yes
HCPCS By State FE	Yes	Yes
Fully Interacted	Yes	Yes
Eye Procedure Reductions	Yes	Yes
Plan Type Controls	Yes	Yes
Panel Balanced	Yes	Yes
Other Sample Restrictions	None	None

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. The table shows the results of reduced form specifications of the form described by equation (15) in section 5.1. Observations are constructed at the service-by-state-year level. The panel is balanced in the sense that each service-by-state pairing is only included if public and private prices could be estimated for each year from 1995 through 2002. Observations are weighted according to each service's average share of payments made through Medicare Part B. The dependent variable in all columns is the log of the average private payment. Standard errors are calculated allowing for arbitrary correlation among the errors associated with each service. "Public-Private Ratio" and "Medstat Volume" are expressed as percentile ranks (across all services observed within a given market) minus 0.5; the variables thus have a mean of 0 and range from -0.5 to 0.5. Further details regarding the construction of all variables are described in the note to Table 1 and in the main text. Sources: Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.

Table 5: **Baseline Estimates of the Effect of Medicare Price Changes on Price Variation**

	(1)	(2)	(3)	(4)
Dependent Variable:	Private Payment SD		Private Payment CV	
Payment Shock × Post-1997	0.934**		0.000	
	(0.153)		(0.000)	
Surgical Procedure × Post-1997		-31.157		0.027
		(23.411)		(0.028)
Plan Type Control	165.114*	201.808**	0.260+	0.278+
	(69.377)	(77.448)	(0.140)	(0.143)
Cost Sharing Fraction	40.049	39.217	-0.045	-0.043
	(37.692)	(37.497)	(0.137)	(0.137)
N	258,502	258,502	258,502	258,502
Number of Clusters	2,048	2,048	2,048	2,048
Weighted	Yes	Yes	Yes	Yes
State By Year FE	Yes	Yes	Yes	Yes
HCPCS By State FE	Yes	Yes	Yes	Yes
Eye Procedure Reductions	Yes	Yes	Yes	Yes
Play Type Controls	Yes	Yes	Yes	Yes
RVUs Per Service Control	No	No	No	No
Panel Balanced	Yes	Yes	Yes	Yes
Other Sample Restrictions	None	None	None	None

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. The table shows the results of reduced form specifications of the forms described in section 2.2, but with measures of price dispersion, rather than average prices, as the dependent variables. Columns 1 and 3 report estimates that take the same form as that reported in column 2 of Table 2, while columns 2 and 4 report estimates that take the same form as that reported in column 5 of Table 2. In columns 1 and 2 the dependent variables is the standard deviation of payments, as calculated at the service-by-state-year level. In columns 3 and 4 the dependent variables is the coefficient of variation of payments, again calculated at the service-by-state-year level. Observations are weighted according to each service's average share of payments made through Medicare Part B. The panel is balanced in the sense that each service-by-state pairing is only included if public and private prices could be estimated for each year from 1995 through 2002. Standard errors are calculated allowing for arbitrary correlation among the errors associated with each service. Additional features of each specification are described within the table. The construction of all variables is further described in the note to Table 1 and in the main text. Sources: Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.

Table 6: **Heterogeneity in Surgical CF Shock's Effect by Other Market Characteristics**

	(1)	(2)	(3)	(4)	(5)
			Private Payment Level		
Payment Shock × Post-1997	1.433**	1.532**	1.176**	1.677**	1.438**
	(0.178)	(0.154)	(0.152)	(0.135)	(0.113)
Payment Shock × Post-1997	0.108+				
× Insurer HHI	(0.063)				
Payment Shock × Post-1997		0.146*			
× Marketwide Cost Sharing		(0.070)			
Payment Shock × Post-1997			-0.206		
× Service-Specific Cost Sharing			(0.197)		
Payment Shock × Post-1997				-0.146**	
× Plan Type Generosity				(0.045)	
Payment Shock × Post-1997					0.182
× Specialty Income Exposure					(0.285)
N	241,472	264,624	264,624	264,624	235,305
Number of Clusters	2,046	2,048	2,048	2,048	1,214
Weighted	Yes	Yes	Yes	Yes	Yes
State By Year FE	Yes	Yes	Yes	Yes	Yes
HCPCS By State FE	Yes	Yes	Yes	Yes	Yes
Fully Interacted	Yes	Yes	Yes	Yes	Yes
Eye Procedure Reductions	Yes	Yes	Yes	Yes	Yes
Plan Type Controls	Yes	Yes	Yes	Yes	Yes
Panel Balanced	Yes	Yes	Yes	Yes	Yes
Other Sample Restrictions	None	None	None	None	Spec Merge

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. The table shows the results of IV specifications of the form described by equation (15) in section 5.1. Observations are constructed at the service-by-state-year level. The panel is balanced in the sense that each service-by-state pairing is only included if public and private prices could be estimated for each year from 1995 through 2002. Observations are weighted according to each service's average share of payments made through Medicare Part B. The dependent variable in all columns is the log of the average private payment. Standard errors are calculated allowing for arbitrary correlation among the errors associated with each service. The interaction variables have been converted to z-scores, and further details of the construction of all variables are described in the note to Table 1 and in the main text. Sources: Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.

Appendix For Online Publication Only

A   Background on Physician-Insurer Negotiations

In this section, we present practitioner characterizations of negotiations between physicians and insurers. The characterizations come largely from physicians and consultants who work as physicians' representatives in these negotiations. Perhaps unsurprisingly, the latter sometimes seek to dispel small physician groups' concerns regarding their prospects for success in such negotiations. Two themes were regularly emphasized, namely the importance of the Medicare fee schedule and the importance of market power. Below we present consultants' characterizations of each.

A.1   The Role of Medicare's Fee Schedule

Practitioner characterizations of physician-insurer negotiations frequently emphasize the role of Medicare's fee schedule as a starting point from which negotiations take place. Some emphasize the relevance of "the fee schedule" in general, while placing varying degrees of relevance on Medicare itself. Examples follow:

- "All insurance companies will offer a fixed fee-for-service schedule. For some carriers, you may only be allowed to request a certain percentage above Medicare rates. Others may accept number values" (Nandedkar 2011).

- "The fee schedule will be the platform for negotiation" (Nandedkar 2011).

- "Today, most health plans operate with fixed fee schedules. Often these schedules have little in common with the RBRVS, and while some are roughly based on a percentage of what Medicare pays, they may be tied to payment levels that are three or more years old. Most physicians who question this methodology for paying for professional services are told to take it or leave it." (Mertz 2004).

- "The fee schedule in many contracts is stated as a percentage of the Medicare rate. All individuals interviewed for this article recommended specifying a year to be used for the Medicare rate to protect against potential Medicare cuts" (Gesme and Wiseman 2010).

Negotiating consultants recommend that physicians be wary of negotiating over payments for specific codes rather than negotiating over average payments. This line of advice is directly linked to the fee schedule's complexity. Consultants express the concern that insurers' negotiating sophistication, in particular relative to that of small physician groups, will give insurers an advantage when trading off increases and decreases in payments for individual service codes:

- "Why do we focus on Revenue per Visit and not, say, the fee schedule of your most important codes? For one very simple reason: Focusing on the fees for specific procedure codes plays right into the shell game the insurance companies love to play" (Reckenen 2013).

- "One difficulty in negotiating a fee schedule is the sheer number and variety of codes that may be covered within a negotiation. Companies may make this more difficult by offering irregular payment schedules that don't correspond to standard fee schedules like Medicare or an RVU based system" (Fontes 2013).

- "A physician should beware of companies that state average reimbursements either in terms of RVU or a Medicare fee schedule. One may find that the fee for a frequently used CPT code is well below average and CPT codes rarely billed are several multiples higher to skew the average. An effective method to counter this tactic is for the practice to submit its top 30 CPT codes by volume and have the insurance company specifically define the fee schedule for these high-volume codes." (Fontes 2013).

- "Bob Phelan, chief executive officer of Integrated Community Oncology Network (Jacksonville, FL), a multispecialty cancer services network spanning four northeast Florida counties, explains why his network initially assesses the aggregated fees: 'The payers try to slide the money from one bucket to another. They'll increase E&M [evaluation and management] codes by 20%, but that's really only approximately 12% to 13% of business. At the same time, they decrease drug reimbursement by 2%, which offsets the E&M increase"' (Gesme and Wiseman 2010).

Physicians who opt to negotiate over code-specific payments are encouraged to ensure that the codes over which they negotiate account for the bulk of their practice's revenues:

- "Be sure the codes on your list account for at least 75 percent of total practice charges.... Whatever method you choose, be sure to update your fee schedule annually based on changes to the Medicare fee schedule." (Mertz 2004).

While commenting on the evolution of provider networks, one consultant concludes with emphasis on one of the industry's few certainties:

- "It is not clear how or when these evolving provider structures and systems will be rewarded or remunerated. What is clear is that there will be complex negotiation occurring in the near future as result" (Fontes 2013).

A.2 The Importance of Market Power

Market power emerged as a common theme, both as a determinant of whether it makes sense to negotiate it all, and as a source of leverage over a negotiation's course:

- "Unless you dominate your market, payers are unlikely to grant sweeping fee increases. However, you may be able to negotiate increases for individual services if you can demonstrate inequities using your data analysis" (Mertz 2004).

- "Before negotiating a contract with any insurance company, first look at the state of your own company. Why should any carrier negotiate with you? What makes your practice unique relative to your competitors? What do you have that the carrier wants?" (Nandedkar 2011)

- "Negotiating strength comes from robust patient relationships..." (Nandedkar 2011)

- "If a health plans payment levels are extremely low, you may be tempted to bypass negotiations and simply no longer accept patients from that plan. Whether this is a sound strategy depends on your local market. For example, if you practice in a highly competitive market, those patients will easily find another physician and you will simply lose market share. However, in less competitive markets, patients may complain to their employers that the loss of your practice has created a hardship and they may pressure the insurance company to return to the bargaining table" (Mertz 2004).

Only the most optimistic of consultants actively encourage sole practitioners to pursue active negotiations:

- "Can a solo physician or small group practice really negotiate their payer contract language and increase reimbursement rates? The answer is YES!" (Glassman 2012).

- "I am told everyday that the large healthcare insurance companies (Such as Blue Cross, Blue Shield, Aetna, United Healthcare, Health Net, Cigna and Independent Physicians Organizations (IPAs), do not negotiate with solo physicians and small group practices. Although the health plans would love for you to believe that, it simply is not true" (Glassman 2012).

B Analysis of Additional Payment Shocks

In this section, we present complementary analysis of an additional source of payment shocks. Recall the formula characterizing Medicare's payments for physician services, which we reproduce below. For service j, supplied by a provider in payment area i, the provider's fee is approximately:

$$\text{Reimbursement}_{i,j,t} = \text{Conversion Factor}_{t,c(j)} \times \text{Relative Value Units}_{j,t}$$
$$\times \text{Geographic Adjustment Factor}_{i,t}. \qquad \text{(B.1)}$$

The Conversion Factor (CF) is a national adjustment factor, updated annually and generally identical across broad categories of services, $c(j)$. The Relative Value Units (RVUs) associated with service j are intended to measure the resources required to provide that service; the normalization of units is such that a brief office visit amounts to roughly a single RVU. RVUs are constant across areas while varying across services. The RVUs associated with each service are updated on a rolling basis to account for technological and regulatory changes that alter their resource intensity. Finally, the Geographic Adjustment Factor (GAF) is the federal government's adjustment for differences in input costs across payment regions. The adjustments are derived from Census and other data on area-level rents, wages, and malpractice insurance premiums. In summary, the payment for a service depends on its resource-intensity (RVUs), a local price index (the GAF), and program-wide budgetary limits (expressed through the CF).

In the main text we analyzed price changes driven by the elimination of separate conversion factors for surgical procedures and other forms of care. This resulted in a 17 percent reduction in the surgical payments relative to other payments, with substantial cross-service variation in changes in the dollar value of Medicare's payments. Here we analyze shocks associated with the system of geographic adjustments.

The main text's focus on the shock associated with the conversion factor is driven by its suitability for assessing this paper's central questions. Its virtues include its size, with 17 percent constituting a massive change in relative payments across broad classes of services, as well as its make-up and motivation, which are tightly related. The elimination of the surgical conversion factor was motivated by the concern, echoed in recent policy discussions, that payments for surgical procedures were excessive, and that the returns to primary care and other medical services needed to be improved. The changes in geographic adjustments are conceptually distinct in that, within each geographic area, they were implemented on an across-the-board basis. Importantly, these payment changes are thus well-suited for addressing the cost-shifting hypothesis. They are not well suited, however, for estimating the likely effect of Medicare moving from cost-based payments towards value-based payments.

B.1 Price Variation from Payment Region Consolidation

We begin our analysis of supplemental payment shocks using variation driven by an administrative shift in the system of geographic adjustments. These are the same payment shocks used in Clemens and Gottlieb (2013), from which we quote liberally and from which

we have reproduced the maps in Appendix Figure B.1.

> In 1997, the Health Care Financing Administration consolidated the payment regions in many states, leading to reimbursement rate shocks that vary across the pre-consolidation regions. The 210 payment areas that existed as of 1996 were consolidated to 89 distinct regions, as shown in Appendix Figure B.1. The top panel of Appendix Figure B.1 presents the regions as of 1996, with darker colors indicating higher GAFs; the middle panel shows the post-consolidation payment regions. As the maps indicate, the consolidation of payment regions dramatically changed the county groupings in many states, leading to differential price shocks.

As in the analysis in the main text, the parameter of interest is a scalar mark-up relative to Medicare's payments. We thus express the payment changes in dollar terms by multiplying the changes in the geographic indices by the average pre-consolidation payment associated with the services in the sample. We denote the resulting, area-specific shocks Payment Shock$_a$. We proceed to estimate

$$P_{j,a,t}^{\text{Medicare}} = \sum_{p(t)\neq 1996} \beta_t \cdot \text{Payment Shock}_a \times I_t$$
$$+ \gamma_{j,a} + \gamma_{s(a),t} + \zeta' X_{a,s(a),t} + \varepsilon_{j,a,t}, \tag{B.2}$$

where I_t is an indicator for observations from year t $\gamma_{j,a}$ are a set of service type-by-payment area effects and $\gamma_{s(a),t}$ are a set of state-by-year effects. The analysis sample is balanced at the service type-by-payment area level, making the $\gamma_{j,a}$ a standard set of fixed effects at the level of the panel variable. The state-by-year effects subsume standard year effects. As all payment-area consolidations took place within a state, states are the lowest level of geography at which we can flexibly control for variation over time. The state-by-year effects capture the effects of other changes to payment policies and the structure of medical care that took place during this time period. We can further control for characteristics of the payment areas, such as the extent to which they are rural or urban, with little impact on the results presented below.[38]

The coefficients of interest are the β_t. Estimates of β_t for years prior to 1996 provide a sense for the importance of pre-existing trends. Estimates of β_t for years following 1996 trace out the effects of the payment shocks. In equation (B.2) above, which is essentially a first stage, coefficients of 0 prior to 1996 and of 1 following 1996 would indicate that we have effectively picked up the policy of interest. When we turn to private privates by estimating equation (B.3), written out below, the βt become estimates of the effect of Medicare's payment changes on private prices.

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[38] As illustrated in the results below, the consolidation-induced payment shocks were not correlated with pre-existing trends in private prices. This is not the case in the context of care utilization, as emphasized in Clemens and Gottlieb (2013).

$$P_{j,a,t}^{\text{Private}} = \sum_{p(t) \neq 1996} \beta_t \cdot \text{Payment Shock}_a \times I_t$$
$$+ \delta_{j,a} + \delta_{s(a),t} + \zeta' X_{a,s(a),t} + \varepsilon_{j,a,t}. \tag{B.3}$$

B.2 Effects of Across-the-Board Payment Changes

The results of estimating equations (B.2) and (B.3) appear in Appendix Figure B.2 and Appendix Table B.1. The figure shows both the first stage and reduced form estimates. The first stage estimates show that our coding of the payment shocks has effectively tracked the policy change as it was meant to be implemented. A one unit increase in the payment shock is associated with a one dollar increase in Medicare's allowed charge for each service. The reduced form estimates plot out the private sector response to these public payment changes. In contrast with the results associated with the change in relative prices for surgical and non-surgical services, the effect of these across-the-board payment changes appears to unfold over a couple of years. The end result, however, is indistinguishable. An increase in public payments is associated with decreases in private payments, and vice versa. Averaging across the point estimates associated with years after 1996, the estimates suggest that a one dollar increase in the public payment is associated with an increase in private payments of just over one dollar.

Appendix Table B.1 condenses the result of interest into a single coefficient by shifting from parametric event study specifications to a more standard parametric difference-in-differences estimator. The table shows that the baseline result is robust to several potentially relevant specification changes. These include replacing the full set of locality-by-service fixed effects with separate sets of service fixed effects and locality fixed effects, controlling additionally interactions between year dummy variables and proxies for the extent to which the localities are rural or urban, and replacing the full set of state-by-year effects with year effects alone (the state fixed effects are subsumed by payment locality effects). While precision falls substantially in the last of these specifications, the results are similar throughout.

Appendix Figure B.1: Medicare Payment Areas
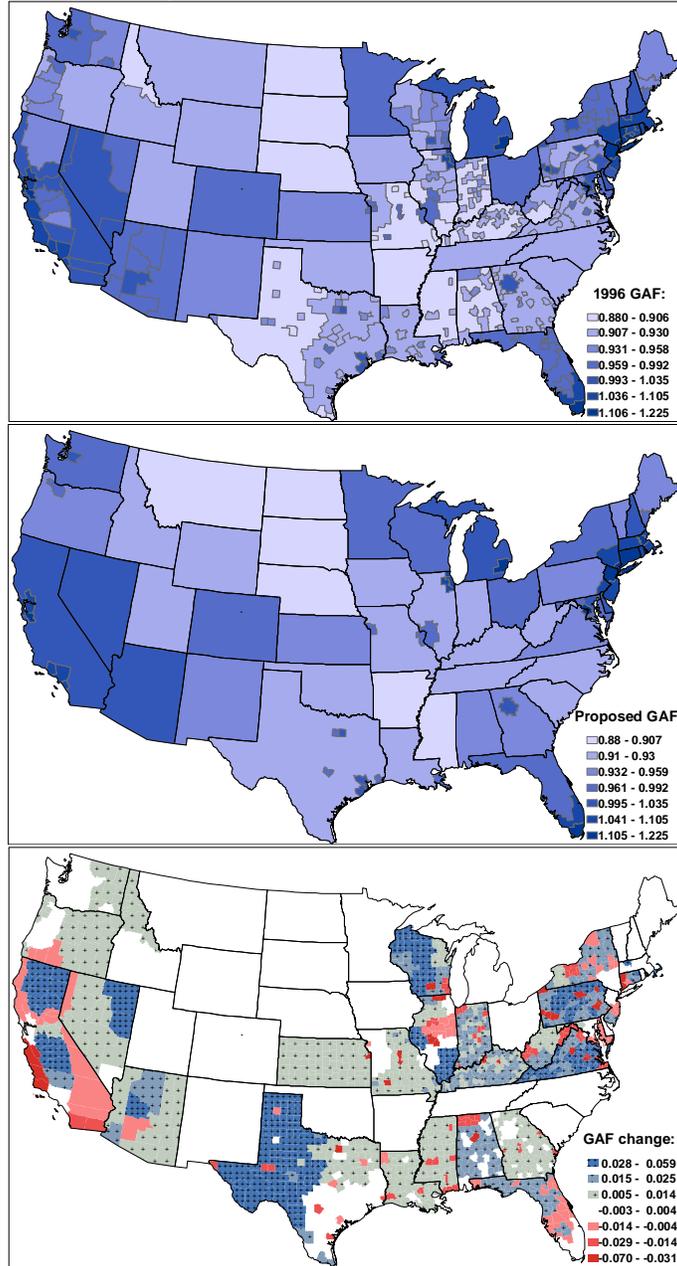
The first panel shows the 206 Medicare fee schedule areas in the continental United States as of 1996 and the second shows the 85 such localities after the consolidation in 1997. (These totals exclude Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands, each of which was its own unique locality throughout this period.) The colors indicate the Geographic Adjustment Factors (GAF) associated with each Payment Locality, with darker colors indicating higher reimbursement rates. The third panel shows the change in GAF for each county due to the payment region consolidation that took place in 1997. Source: *Federal Register*, various issues.

Appendix Figure B.2: Effect of Geographic Payment Shocks on Private Prices
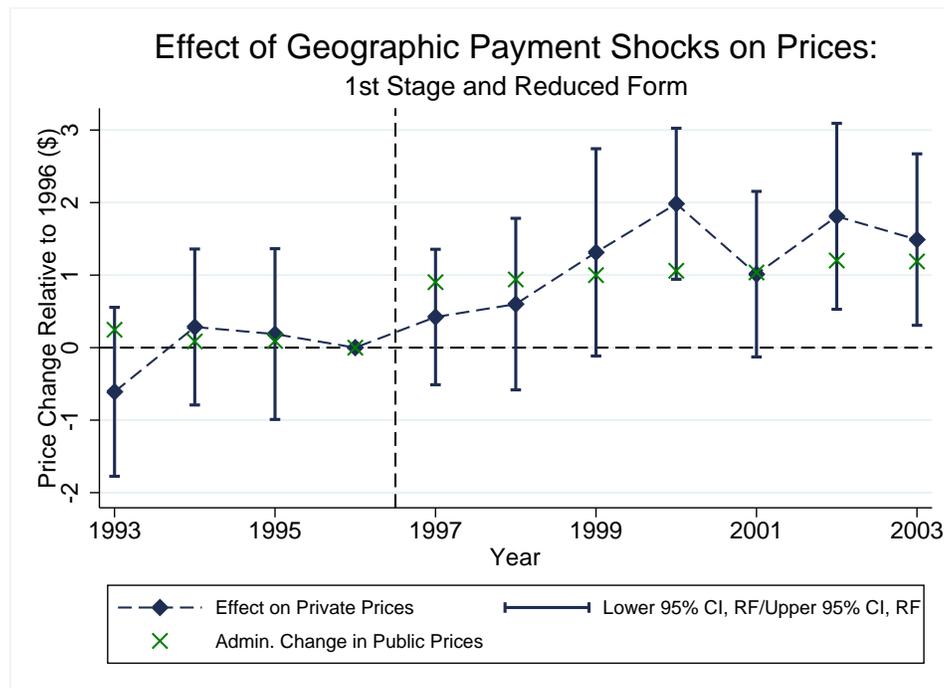
Figure shows the the results from estimating equations (B.2) and (B.3) as described in Appendix B.1. The payment shocks are constructed such that a one unit change in the payment shock should correspond to a one dollar increase in Medicare's payments. This is confirmed by the point estimates labeled "Admin. Change in Public Prices." Estimates labeled "Effect on Private Prices" are the corresponding estimates associated with the relationship between Medicare's payment shocks and private sector prices. Sources: *Federal Register*, various issues; Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.

Appendix Table B.1: **Estimates of the Effect of Across-the-Board, Area-Specific, Medicare Payment Shocks on Private Sector Prices**

	(1)	(2)	(3)	(4)
		Private Payment Level		
Payment Shock × Post-1996	1.268*	0.990*	1.267**	0.846
	(0.500)	(0.466)	(0.477)	(0.902)
N	176,960	176,960	176,960	176,960
Number of Clusters	199	199	199	199
State By Year FE	Yes	Yes	Yes	No
Year FE	No	No	No	Yes
HCPCS By Old MPL FE	Yes	Yes	No	Yes
Old MPL FE	No	No	Yes	No
HCPCS FE	No	No	Yes	No
Pop. By Year Controls	No	Yes	No	No
Panel Balanced	Yes	Yes	Yes	Yes

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. The table shows the results of OLS, reduced form specifications taking the form of equation (B.3). Observations are constructed at the service-by-payment locality level. The panel is balanced in the sense that each service-by-payment locality pairing is only included if public and private prices could be estimated for each year from 1993 through 2003. Standard errors are calculated allowing for arbitrary correlation among the errors associated with each payment locality, which is the level at which the relevant payment shocks occur. Additional features of each specification are described within the table. Sources: Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.

C   Robustness Tables

Appendix Table C.1: Robustness Checks on the Effect of Medicare Price Changes on Private Sector Prices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Private Payment Level			
Public Payment	1.292**	1.222**	1.293**	1.064**	0.763**	1.389**	1.237**
	(0.187)	(0.130)	(0.187)	(0.104)	(0.079)	(0.133)	(0.178)
Plan Type Controls	-104.878		-106.608	-147.477	41.344**	-61.068	-109.013
	(78.895)		(80.730)	(98.087)	(7.692)	(75.407)	(82.177)
Cost Sharing Fraction	27.678	30.009		28.657	9.808**	23.915	27.583
	(21.539)	(24.502)		(21.570)	(3.093)	(21.264)	(21.702)
N	264624	264624	264624	264624	264624	264624	264624
Number of Clusters	2,048	2,048	2,048	2,048	2,048	2,048	2,048
Weighted	Yes	Yes	Yes	Yes	No	Yes	Yes
State By Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HCPCS By State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eye Procedure Reductions	Yes	Yes	Yes	No	Yes	Yes	Yes
RVUs Per Service Control	No	No	No	No	No	Yes	No
Panel Balanced	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Sample Restrictions	None	None	None	None	None	None	None

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. The table shows the results of IV specifications based on those in column 3 of Table 2. Observations are constructed at the service-by-state-year level. Unless noted, observations are weighted according to each service's pre-1998 share of payments made through Medicare Part B. The panel is balanced in the sense that each service-by-state pairing is only included if public and private prices could be estimated for each year from 1994 through 2002. Standard errors are calculated allowing for arbitrary correlation among the errors associated with each service. Additional features of each specification are described within the table. The construction of all variables is further described in the note to Table 1 and in the main text. Sources: Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.

Appendix Table C.2: Robustness Checks on Heterogeneity in Surgical CF Shock's Effect by Provider Concentration

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:			Private Payment Level			
Payment Shock × Post-1997	1.425**	1.214**	1.501**	1.488**	1.474**	1.436**
	(0.150)	(0.107)	(0.200)	(0.194)	(0.196)	(0.176)
Payment Shock × Post 1997	-0.415**	-0.358**	-0.537**	-0.504**	-0.545**	-0.424**
× Physician HHI	(0.045)	(0.030)	(0.059)	(0.061)	(0.077)	(0.049)
Payment Shock × Post-1997	-0.686**	-0.919**	-0.553**	-0.418**	-0.412**	-0.539**
× Specialty HHI	(0.162)	(0.250)	(0.126)	(0.123)	(0.128)	(0.142)
Payment Shock × Post-1997	0.013	0.197	-0.865*	0.076	0.147	0.084
× Physician Count	(0.335)	(0.140)	(0.341)	(0.141)	(0.135)	(0.160)
Payment Shock × Post-1997	0.752	-0.079	0.448	0.273	0.243	0.378
× Specialty Count	(0.631)	(0.255)	(0.352)	(0.265)	(0.246)	(0.302)
N	214,096	214,096	214,096	214,096	214,096	214,096
Number of Clusters	1,252	1,252	1,252	1,252	1,252	1,252
Census Region	Yes	Yes	No	Yes	No	No
Census Division	No	Yes	No	No	No	No
Log Population	No	No	Yes	No	No	No
Log Density	No	No	No	Yes	No	No
Log Income Per Capita	No	No	No	No	Yes	No
Education (HS and BA Completion)	No	No	No	No	No	Yes

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. The table shows the results of reduced form specifications based on column 6 of Table 3. Observations are constructed at the service-by-state-year level. The panel is balanced in the sense that each service-by-state pairing is only included if public and private prices could be estimated for each year from 1994 through 2002. Observations are weighted according to each service's pre-1998 share of payments made through Medicare Part B. The dependent variable in all columns is the level of the average private payment. Standard errors are calculated allowing for arbitrary correlation among the errors associated with each service. In columns 1 and 2, "Payment Shock × Post-1997" is interacted with a full set of region or division fixed effects, and the coefficient shown is the average of those interactions. The construction of all variables is further described in the note to Table 1 and in the main text. Sources: Authors' calculations using Medicare claims and Thompson Reuters MarketScan data.