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Relative Prices, Payer Mix and Regional Variations in Medical Care

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Abstract: In this article we propose that the standard model of stepwise demand for medical care may explain the regional variations in Medicare utilization and spending. Existing explanations of Medicare variations have been largely atheoretical and assumed that a region's private utilization and spending correlates positively with Medicare through a "signature style." In contrast, the stepwise demand model predicts that Medicare utilization and spending vary due to differences in Medicare's profitability relative to privately insured, even all else equal. The model predicts that providers seek to alter their payer mix in response to Medicare fee increases by increasing their privately insured prices to increase their supply to Medicare patients and reduce supply to the privately insured.

We utilize exogenous changes in service-specific Medicare payments in conjunction with a large proprietary dataset on private insurers' prices to test the prediction that changes in Medicare and privately-insured prices are positively related. Conditional on service and region fixed effects, we find that a $10 increase in Medicare fees from 2003-2009 corresponds to a $4.82 increase in prices paid by privately- insured patients and their plans. We also find that these positive relationships are widespread. Specifically, 86 percent of markets, 72 percent of the studied CPTs, and 87 percent of the CPT-market pairs exhibit positive relationships in the price changes for Medicare and private insurers. This suggests that the stepwise demand model may have power to explain variations in Medicare spending, although a number of additional predictions from the model remain to be tested.

Keywords: Medicare, small area variations, cost-shifting

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1. Introduction

One of the most significant puzzles within the US health care system is what causes large differences in Medicare spending between geographic areas of the US.[1] Given the paucity of insights from research, academics and policy makers have invoked explanations based on differences across markets in physician greediness, social norms and ethics, degree of competition, practice patterns, or available capacity of technology and access to specialists.[2] Despite the lack of evidence supporting these explanations, without research pointing to any alternatives, policy makers have used the available explanations to justify reductions in Medicare and Medicaid payment rates, reallocation of Medicare payments across regions in the US, and inhibiting greater competition between and supply of hospital and physician services.[3] In fact, a cornerstone of the health care payment and delivery reforms embedded within the Affordable Care Act (ACA) is the idea that a sizeable share current US health care spending represents waste. Peter Orszag, the Obama administration's budget director during the design, negotiation and passage of the ACA, referenced Wennberg et al (2002) and Fisher (2005) to testify to Congress that "nearly 30 percent of Medicare's costs could be saved without negatively affecting health outcomes if spending in high- and medium-cost areas could be reduced to the level in low-cost areas" (Congressional Budget Office, 2008).

In this paper we propose and test an alternative explanation for variations in Medicare spending that is grounded in economic theory and yields a number of implications that diverge from conventional wisdom. Specifically, we test whether the predictions of the "stepwise-demand model" explain a substantial amount of the between-region differences in Medicare costs and utilization. The stepwise-

[1] As an example of the spending variations that exist, the Medicare Payment Assessment Commission (2011) reported that the region at the 90th percentile in the spending distribution had Medicare spending that was 55 percent higher than the region at the 10th percentile, based on services provided between 2006 and 2008, after adjusting for enrollees' health status and demographics.

[2] For example, Atul Gawande's award-winning, highly-influential article in the *New Yorker* promulgates differences in physicians' cultural norms (greediness) as the primary explanation for differences in Medicare costs in McAllen and El Paso (Gawande, 2009).

[3] For example, Elliot Fisher, one of the primary researchers behind the Dartmouth Atlas, was quoted as saying "If we sent 30 percent of the doctors in this country to Africa, we might raise the level of health on both continents." (Shannon Brownlee, 2007).

demand model refers to a demand curve with downward-sloping segments from privately-insured patients, for whom physicians/hospitals set a price, and horizontal segments where physicians/hospitals accept the price set by Medicare (and Medicaid to the extent that a provider participates). The stepwise-demand model is consistent with that of McGuire and Pauly (1991) and has been used by many economists (e.g., Hadley and Reschovsky, 2006; Sloan and Steinwald, 1978; and Dranove, 1987), although to the best of our knowledge never in the context of geographic variations.

The model predicts that a profit-maximizing provider will respond to an exogenous Medicare fee cut by reducing its volume of Medicare services and raising its volume of services provided to privately-insured patients. The mechanism that providers have available to accomplish this without expanding capacity is to lower the price charged to privately-insured consumers. One implication from this is that geographic variations in Medicare spending and utilization will exist even if Medicare payment rates and enrollee characteristics are identical across markets. That is, differences in private insurance prices alone can generate Medicare variations by creating between-market differences in the relative profitability of Medicare versus privately-insured patients.

To test the model, we capitalize on a newly-available national data set that reports the actual prices paid by private insurers for specific physician services (i.e., Current Procedural Terminology, or CPT, codes) over a long time period. We use within-service changes in Medicare reimbursement rates as an exogenous source of variation for changes in within-region profitability of Medicare relative to privately-insured patients. With this, we test the first distinguishing hypothesis from the model: private prices should fall in response to reductions in Medicare prices. For example, if Medicare revises the Resource Based Relative Value System (RBRVS) such that orthopedic surgeons in Ohio experience a large reduction in hip replacement fees (relative to orthopedic surgeons in other markets and relative to other CPT codes in Ohio), we examine whether private insurance prices for hip replacements fall (relative to private prices for hip replacements in other markets and private fees generally in Ohio). This hypothesis, directly contrary to the predictions of a cost-shifting model, is supported by the data. Specifically, we find that a $10 increase in Medicare fees corresponds to a $4.82 increase in prices paid

by privately- insured patients and their plans (that is, this represents the sum of what the insurer pays and the patient's required cost sharing). We also find that these positive relationships are widespread. Specifically, 86 percent of markets, 72 percent of studied CPTs, and 87 percent of the CPT-market pairs exhibit positive relationships in the price changes for Medicare and private insurers. In the next section we motivate the predictions of the stepwise-demand model, and their relevance for variations in Medicare spending. In Section 3 we describe the data and data construction. Section 4 provides descriptive results and results from the empirical models. We follow in Section 5 by placing this model in the broader context of research on health care providers' responses to fee changes, on variations in Medicare spending, and on cost-shifting. We conclude in Section 6.

2. The Stepwise-Demand Model in the Context of Variations in Medicare Utilization and Spending

The central insight from the stepwise-demand model in the context of variations in Medicare spending is the idea that Medicare's profitability relative to other payers affects Medicare spending by altering providers' optimal payer mix. Figure 1 illustrates this idea using two geographic regions, A and B, where region A has higher private demand than region B, for example due to higher income, higher prevalence of illness, and/or stronger preferences for health. Physicians face a downward-sloping marginal revenue curve from private health insurers, a horizontal segment at the exogenously-set Medicare price, and an upward sloping marginal cost curve due to decreasing returns to scale and/or increasing value of leisure. This pattern gives rise to the term "stepwise-demand." The intersection of marginal costs with the Medicare price determines the optimal total supply of services. The health care provider sets the private price to produce the optimal private supply, conditional on the given Medicare reimbursement and marginal costs.

We make some simplifications in Figure 1 to focus on the key aspects of the stepwise-demand model as they relate to variations in Medicare spending. If a physician participates in Medicaid, then the downward-sloping private marginal revenue curve would continue once Medicare demand has been exhausted, and this would eventually intersect with a horizontal segment at the exogenous Medicaid

price.[4] Realistically a physician would set a private price for each type of service she provides. In Figure 1 the price therefore represents an average price across the relevant CPT codes for a physician of a particular specialty. Finally, we assume for simplicity that marginal costs are equal in Markets A and B.

As indicated in Figure 1, when Medicare's payment rates and the marginal cost of health care production are identical in the two regions, the total quantity of services provided in the two markets is equal but the mix is different. In both markets, the total quantity supplied is Q^T, with Q^A privately insured treated in market A and Q^B in market B. Physicians provide a relatively large amount of services to privately-insured patients in the market with a high private demand (Market A) and a relatively large amount of services to Medicare patients in the market with relatively low private demand (Market B). Medicare spending and utilization is higher in Market B, by the amount represented in the orange rectangle, simply due to providers in Market B seeking to treat more Medicare and fewer privately-insured patients. As a result, there would be no variation across markets in total services provided but analysis of either private or Medicare spending data alone would show differences between Markets A and B, as is standard in the existing research on Medicare variations. Further, there would be a negative correlation between a market's private supply of services and its Medicare supply.

While economic theory predicts that differences in private demand are important determinants of Medicare spending, as demonstrated in Figure 1, empirically estimating the role of relative profitability using such between-market differences in private demand is difficult given the standard concerns about endogeneity and simultaneity bias. Instead, changes in Medicare reimbursement rates provide the exogenous variation for our empirical identification, as described in more detail below.

Figure 2 provides an illustration of the basic theoretical model adapted to incorporate our empirical identification strategy. Rather than differences in private demand between Markets A and B, here the differences in patient profitability are driven by changes in the Medicare payment rate. Consider

[4] In 2008, Medicaid physician fees were lower than Medicare fees in 40 states using a fee index that weights each service according to its contribution to Medicaid spending (Zuckerman, Williams, and Stockley, 2009). Medicaid physician fees are more than 10 percent higher than Medicare fees in only two states. As a result, Medicaid should have relatively little influence on the relationships we are examining in this paper.

a situation where initially Market A and Market B have the same private demand, the same Medicare payment rate, and the same cost function, and thus in both markets private spending is P_A*Q^A and Medicare spending is $(Q^T - Q^A)*P^{MA}$, where P^{MA} refers to the Medicare price and P^A the price physicians charge private health insurers. Over time, the Medicare price in Market B decreases to P^{MB}. Such changes can exist in practice from several sources, e.g. due to imperfect geographic cost adjustments that do not accurately capture the changes in local costs of operating a practice (Institute of Medicine, 2011).

In the stepwise-demand model, physicians in Market B respond to the lower Medicare price by reducing the total quantity of care provided (to Q^{TB}), reducing the price they charge private health insurers to P_B, and increasing the quantity of services provided to privately-insured patients to Q^B. The lower private price can be achieved by renegotiating contracts, or it can occur mechanically if fee-for-service contracts with private health insurers are pegged to Medicare payment rates, which they often are (Bodenheimer, Berenson, and Rudolf, 2007). Although we do not depict dynamic adjustment in Figure 2, physicians in Market B may respond in the short run by run by reducing the private price but not reducing the total quantity of services to the full extent indicated in Figure 2 (i.e. from Q^{TA} to Q^{TB}). For example, in the short run physicians in Market B may work fewer hours while maintaining their non-physician staff; in the long run they may reduce some nursing staff and decide not to replace selected medical technologies or invest in new medical technologies, which will eventually result in the full decrease to Q^{TB}.

The implications of the Medicare fee are that if one used Medicare data only, Market A would appear to be high spending area relative to Market B, whereas if one used claims data from private health insurers, the opposite relationship would be true. Notice also that the reduction in Medicare spending in Market B is larger than one would expect based on the price effect alone. The quantity of Medicare services in Market B falls also, both because the Medicare price is now lower and also because physicians shift their supply from Medicare to privately-insured patients.

To summarize, the stepwise-demand model offers two primary testable hypotheses that contrast with the existing explanations of variations in Medicare spending:

1. Exogenous increases in Medicare fees will cause private fees to rise as providers seek to alter their payer mix toward the patient population that has become relatively more profitable. Thus, services (CPT codes) with relatively large increases in Medicare prices will also see relatively large increases in private prices, even accounting for underlying changes in market- and service-specific input costs.
2. CPT codes and markets with high Medicare fees relative to private fees will have:
    a. Higher Medicare utilization (supply) and Medicare spending, due to both higher prices and higher quantities. The difference in spending will exceed that due to prices alone due to physicians' supply responses.
    b. Higher private prices and lower private utilization and spending, as the reduction in spending due to lower quantities more than offsets the increase from higher prices under any downward-sloping privately-insured demand curve.

The theoretical model also points to one exception to these predictions. In markets with excess supply, or where providers otherwise are not producing the profit-maximizing total quantity (conditional on input prices being held constant), Medicare fee changes may result in providers simply altering their quantities of Medicare services while leaving their private-pay quantities unchanged. For the geographic variations literature, this means that providers in some markets may have lower total production based on the relative profitability of Medicare, although this seems unlikely as it implies that physicians are sitting idle in some markets.[5]

[5] For example, in Gawande's (2009) consideration of McAllen versus El Paso, given the far higher Medicare spending observed in McAllen, the stepwise demand model predicts either that El Paso physicians are supplying higher quantities to privately-insured patients or that El Paso physicians are sitting idle relative to those in McAllen.

3. Data and Analytic Strategy

Data on Private and Medicare Prices for Physician Services

The primary data set we use is the set of physician services claims submitted to Ingenix and FAIR Health by its private health insurance clients. FAIR Health is a non-profit organization that exists to promote transparency in health care pricing and to create reimbursement rate tables for insurers to use to determine payments for out-of-network services. The organization was created as part of a settlement between Ingenix, a United Healthcare subsidiary, and the state of New York. These data include the "allowed charges," which are the actual, negotiated prices paid to in-network providers jointly by the insurer and insured patient. Although FAIR Health's clients must provide comprehensive data, the "allowed charge" field is not required because it is not essential for FAIR Health's purposes of determining the distribution of charges for a CPT code for a region (usually a three-digit zip code).

We use these claims data from 2003 and 2009, which represents the longest period available at the onset of the study to allow for maximal within-CPT variation in Medicare reimbursement. Overall, the FAIR Health data include about 900 million claims per year for physician services across the full spectrum of settings, including office-based practices, inpatient care, ambulatory surgery centers, imaging centers, and pathology laboratories. We omit claims from anesthesiologists in this study because FAIR Health retains that information in a separate data set. The sources of the FAIR Health claims represent the full range of client types, not simply large employers as represented by Thomson Reuters Market Scan. The data cover an estimated 23.4 percent of the total claims submitted to private health insurers in the United States in 2009.[6] Of these, about one-half (about 440 million claims) contain a non-zero value in the allowed charge field.

[6] The sum of the allowed charges across all of the 2009 FAIR Health professional services claims is $33.4 billion. If the claims without an allowed charge have the same mean allowed charge, then the total provider payments in the data set would have been $66.9 billion. The Centers for Medicare and Medicaid Services reported that private health insurers and privately-insured patients paid a total of $285.6 billion for physician and clinical services in 2009. Thus, the payments for physician services in the FAIR Health data set represent an estimated 23.4 percent of national payments by private insured patients and their insurers.

We further restrict our analysis to the "top-300" CPT codes, out of approximately 9,000 CPT codes total, as defined by a national health care underwriting firm. For these 300 CPT codes, we use publicly-available data on Medicare's region-specific physician reimbursement for each CPT in each year, where this reimbursement represents the total amount paid by Medicare and the beneficiary to the physician based on the Medicare Physician Fee Schedule. Medicare pays physicians based on the number of "relative value units" (RVUs) assigned to each CPT. Every CPT has its own work RVU amount based, in concept, on Medicare's assessment of the time, intensity of work, and resources required. These values are converted into dollars by multiplying by two factors: the "conversion factor," which applies nationwide for a given year (e.g., $34.04 in 2012), and set of region-specific geographic practice cost indexes, known as GPCIs. The GPCIs are intended to capture the wages of other healthcare professionals in a specific market, a physician's practice costs in that market, and a physician's malpractice costs in that market. Changes in the work RVUs for CPT codes over time are based largely on the recommendations of the American Medical Association's Specialty Society Relative Value Scale Update Committee (RUC). The RUC's members represent the 29 physician specialty colleges, and CMS generally accepts over 90 percent of the RUC's recommended revisions (Reinhardt 2010). In further support of the view that within-CPT changes in Medicare reimbursement are exogenous for our purposes, revisions to the RVUs, and the RUC's recommendations, must be budget neutral: increases in the RVUs for one CPT must be offset by reductions in another.

Using the Medicare payments for these 300 CPTs in 2003 and 2009 for each of Medicare's 87 physician services markets, we find that the average within-CPT change was a reduction of $2.96, with a median of $0. However, there is considerable variation across CPTs in the fee change: the standard deviation in within-CPT changes is $29.9, ranging from a reduction of $273.9 to an increase of $198.1. We use the allowed charges amount in the FAIR Health data set to find comparable changes in private payments for these same CPT codes for the same 87 markets. At the national level, the within-CPT changes in private payments have a very similar distribution as the Medicare changes, with a mean change of -$0.23, a standard deviation of $28.6, and values ranging from -$108.9 to $318.5.

Analytic Strategy

We capitalize on exogenous changes in Medicare payments for specific CPT-market combinations from 2003 to 2009. Given that these Medicare prices are defined for entire Medicare regions, we use these regions to define the level of analysis in this study as well. This includes 87 different markets, yielding 26,100 (87*300 CPTs) different market-CPT combinations. For each of these market-CPT pairs, we calculate the change in the mean private insurer payment rate from 2003 to 2009. With these data, we estimate the following regression:

$$\Delta private\_price_{ij} = \beta_1 \Delta Medicare\_price_{ij} + \theta_i + \theta_j + \varepsilon_{ij} \quad (1)$$

for the CPT code *i* in market *j*, where ε_{ij} is an idiosyncratic error term. Theory predicts that β_1 will be positive. Under this approach, the CPT fixed effects eliminate procedure-specific shocks to input prices that affect Medicare and privately insurers equally. Likewise, the market fixed effects eliminate market-specific input price shocks that affect all CPTs equally. Further, while the within-CPT changes in work RVUs are identical across the 87 markets, even within a CPT, the Medicare fees in dollar terms change differently between markets because of differences in the GPCIs. For example, a given increase in a CPT's work RVU will have a larger dollar increase in the Medicare price in a market with a higher GPCI. This approach also eliminates the need for inflation adjustment, by analyzing within-CPT changes from 2003 to 2009, and for adjusting by the GPCIs, which are eliminated via the market fixed effects.

A handful of the possible market-CPT combinations are not represented in the FAIR Health data for both 2003 and 2009. While a large majority of markets have data for all 300 CPTs, some markets lack a few of the CPTs, for example if the CPT is typically provided by a specialist that does not practice in a particular market. As a result, the final sample for our panel data models includes 25,974 market-CPT observations (99.9 percent of the total possible number). However, another 110 of the top 300 CPTs were

not covered by Medicare in either 2003 or 2009, yielding no within-CPT variation in the change in Medicare reimbursement between markets.

To demonstrate how changes in Medicare prices affect the volume of Medicare patients, in the future we will estimate the following regression equation:

$$\Delta Medicare\ volume_{ij} = \theta_i + \theta_j + \beta_1 \Delta Medicare\_price_{ij} + \varepsilon_{ij} \qquad (2)$$

Likewise, once we obtain information from the FAIR Health data set on the CPT-specific change in the quantity of services provided to privately-insured patients for each market, we will estimate a regression similar to that of equation (2), but instrumenting for the change in the private price with the change in the Medicare price. This will allow us to examine how private quantities and spending change due to exogenous changes in Medicare prices, controlling for market and CPT fixed effects. Despite having incomplete data on privately insured volume, the use of market fixed effects eliminates any bias as long as any changes in reporting by FAIR Health affect each CPT similarly. Finally, we will use the results from these three regression equations to examine the extent to which changes in Medicare prices create regional variations in private and (separately) Medicare spending across markets. For example, how much of the variation between markets in private spending in 2009 can be explained as an adjustment to changes in Medicare prices between 2003 and 2009?

4. Results

In Figure 3 we depict the average correlation (across all 300 CPT codes) between the change in Medicare prices and the change in private prices from 2003 to 2009 calculated separately for each of the 87 Medicare regions. The correlation is positive, as predicted by the stepwise demand model, for 86 percent of the markets, with correlation coefficients exceeding 0.20 for 80 percent of the markets and exceeding 0.50 for 43 percent of them. As the map indicates, the smallest correlations were clustered

around the upper Midwest and New England, while the markets with the largest correlations range from New Jersey west to Kansas, as well as a few others such as Florida, Washington State, and Los Angeles.

To determine how Medicare and private prices are associated at the national level, we calculated the average within-CPT change by payer, averaged across all 87 markets. In Figure 4, for each of the 300 CPT codes, we plot the average change in the Medicare price on the horizontal axis versus the average change in the private price on the vertical axis.[7] The figure demonstrates a strong, positive association between changes in Medicare prices and private insurer prices, with a correlation coefficient of 0.51. These results, which are consistent with the stepwise-demand model, are virtually identical when we restrict the sample to those CPTs reimbursed by Medicare in both time periods. Of those CPT codes covered by Medicare, 72 percent have a positive correlation between the change in the Medicare and private prices.

These relationships persist at our analytic level of observation as well, i.e., the market-CPT pairs for CPTs that were covered by Medicare in either or both 2003 or 2009. The histogram in Figure 5 shows, for each CPT covered by Medicare, the correlation between the within-market change in Medicare and private prices. Of those covered by Medicare, 87 percent had a positive association between Medicare and private prices, with an average correlation coefficient across CPTs of 0.19. Of the 10 CPT codes with the largest correlations, four are for magnetic resonance imaging (MRI), while another four regard physician services for visiting patients in hospitals or critical care units. The remaining two CPT codes are for ultrasounds and for "neuromuscular re-education" (i.e., physical therapy).

We report the regression results in Table 1, demonstrating a large, positive, statistically-significant effect of changes in Medicare physician prices on changes in private physician prices, even conditional on CPT and market fixed effects. Specifically, the results show that a $100 increase in Medicare prices corresponds to an average increase in private prices of $48.20. Likewise, a 100 percent increase in Medicare prices corresponds to a 42.7 percent increase in private prices.

[7] Several CPT codes with the largest changes are omitted from the figure for ease of presentation.

5. Comparing These Results With the Existing Literature

The stepwise-demand model traditionally is used to demonstrate that profit-maximizing providers will not "cost-shift;" that is, providers cannot increase their profitability by raising prices charged to private payers in response to an exogenous fee reduction by Medicare or Medicaid.[8] Two cases are commonly presented (Sloan and Steinwald, 1978; Sloan, Cromwell, and Mitchell, 1978). First, if providers do not face capacity constraints, for example if marginal costs are not upward-sloping, then the optimal payer mix is independent of Medicare's prices. As a result, Medicare fee cuts will not alter private prices or private quantities, nor will it alter Medicare quantities as long as Medicare reimbursement remains above marginal costs. Thus, Medicare fee cuts will not affect Medicare utilization and will affect Medicare spending only through the change in prices. In the second case, capacity-constrained providers alter their payer mix in response to changes in Medicare prices, so that providers' private prices respond positively to changes in Medicare fees, i.e., the opposite of cost-shifting.

It is worth noting that even other seminal models of provider behavior that do not assume that providers strictly maximize profit do not predict cost shifting. For example, the McGuire-Pauly (1991) model indicates that large income effects can prompt utility-maximizing physicians to increase the amount by which they induce treatment among privately-insured and Medicare patients in response to Medicare fee cuts. Although this greater inducement could cause total spending to rise for private patients, this is entirely a consequence of higher utilization, with private prices treated as exogenous and constant. Similarly, large income effects in conjunction with utility-maximizing, rather than profit-maximizing, physicians could yield higher inducement even for Medicare patients in response to Medicare fee cuts.[9]

[8] Dranove (1998) shows that a utility-maximizing non-profit hospital might increase private prices in response to a reduction in public prices if it has market power and if the quantity of services it provides to privately-insured patients increases its utility.

[9] For example, the Congressional Budget Office (2007) has estimated that physicians offset approximately 25 percent of Medicare's price reductions by increasing the volume and intensity of Medicare services, although this incorporates both the within-CPT changes that we study as well as shifting Medicare patients to higher-priced CPT codes.

Similar to the theoretical work, much of the prior empirical work on physician payer mix has focused on cost-shifting. Two articles are closest to ours in terms of conclusions. Showalter (1997) found large, positive relationships between Medicaid prices and private prices for office visits across a wide range of specialties, undermining claims of cost-shifting from Medicaid to private insurers. Dranove and White (1998) found similar positive relationships between Medicaid prices and private prices for hospital services, where Medicaid fee cuts were met with reductions in private insurers' fees as hospitals sought to shift their volume away from Medicaid and toward privately-insured patients.

The prior research on variations in Medicare spending has been largely atheoretical. While Dartmouth Atlas researchers and others have investigated a number of possible explanations of variations, relatively few theoretical models have been tested.[10] One exception is the work of Chandra and Staiger (2007), who find support for the "Roy Model" explanation of variations. This model and the empirical results demonstrate that regions may rationally choose to differ in their primary approach to treating a disease due to within-market "productivity spillovers" (i.e., positive network effects) among providers from sources such as knowledge-sharing. Furthermore, this model yields the two primary conclusions from the Dartmouth Atlas that there are large, between-region variations in spending, but that higher spending has little effect on average health outcomes of Medicare patients. Similar to the conclusions of the stepwise-demand model, the Roy model implies that reducing Medicare payment rates for higher-cost services cannot lower costs without harming quality. However, the static Roy model does not offer an explanation for why providers in different regions differ to begin with.[11]

One point of divergence between the predictions of the Roy Model and the stepwise-demand model is the idea that regions hold a signature style. Whereas the Roy model's productivity spillovers would create positive associations in treatment intensity between privately insured and Medicare patients,

[10] Interestingly, one paper by the Dartmouth Atlas team is titled "Prices Don't Drive Regional Medicare Spending Variations," but they only adjusted for Medicare prices (Gottlieb et al., 2010). The basic claim of our model is that prices do drive regional Medicare spending variation, but the relevant prices are Medicare prices relative to private insurer prices in the same market, not simply Medicare prices relative to other regions.

[11] In a footnote, Chandra and Staiger cite differences in "initial" patient characteristics but admit this lies beyond the scope of their static model.

the stepwise demand model hypothesizes that increases in volume and intensity of Medicare treatment would be met with reductions for privately-insured patients. Recent work by Franzini, Mikhail, and Skinner (2010) revisited the two markets reported by Gawande (2009) (McAllen and El Paso), yielding results inconsistent with the idea of a signature physician style that is applied consistently to Medicare and privately-insured patients. Specifically, they use Blue Cross Blue Shield claims data on privately-insured patients and, although they cannot observe prices, find a relationship for private spending that is opposite from what Gawande reported for Medicare spending. Specifically, they find that private spending per enrollee is higher in El Paso than in McAllen. This result is consistent with the predictions of the stepwise-demand model, although the empirical strategy used by Franzini, Mikhail, and Skinner (2010) does not provide direct evidence substantiating its relevance, nor do the authors suggest that the stepwise-demand model may be an explanation for their results.

Two recent studies have examined national geographic variations among privately-insured patients and compared these to Medicare variations. Chernew et al. (2010) calculated per-person physician and hospital services spending in 2006 for the 306 health referral regions in the United States, separately for a sample of non-elderly employees (and their dependents) who work for large employers and Medicare patients. They find greater geographic variation in spending among the privately-insured patients than among Medicare patients.[12] Markets with relatively high Medicare spending tended to have relatively low spending on privately-insured patients; the correlation between the two is -0.17. This is exactly what one would expect from the stepwise-demand model as physicians specialize in the payer type that is relatively generous.

Philipson et al. (2010) calculate annual medical spending for ischemic heart disease patients between 2000 and 2006 for about 100 metropolitan statistical areas (MSAs), separately for privately-

[12] Based on the Area Resource File (ARF), Chernew et al. (2010) find a positive correlation at the county level between private and Medicare hospital days per capita, which is consistent with providers applying a consistent style to both patient types. However, the ARF data set records inpatient days based on where hospitals are located rather than where people reside, so inter-county mobility creates possible measurement error. Because the ARF data set has aggregated data that is not risk-adjusted, health characteristics common to privately-insured and Medicare patients could also create a positive correlation in inpatient days.

insured and Medicare patients. They find greater variation in utilization between markets for Medicare patients than privately-insured patients, but the reverse result when measuring spending. This is consistent with their hypothesis that private insurers have stronger incentives to manage costs and utilization and use a broader set of management techniques than Medicare. These results are also consistent with the stepwise-demand model because one reason to expect less variation between markets in private spending is that providers are picking a position on the private-insured demand curve based, in part, on the relative profitability of various payers. That is, in some markets physicians are setting a high private price in order to restrict private quantity, whereas in others they are setting a low private price to promote private quantity. If private-insured demand is inelastic, spending (price multiplied by quantity) may not vary substantially across markets, all else equal. Philipson et al. (2010) also depict a crossplot between a market's hospital days for private patients and Medicare patients, which is close to zero.[13] This is not consistent with the notion that providers in a market have a treatment style that they apply equally to privately-insured and Medicare patients.

6. Conclusions

The results in this article represent a first step in determining whether the stepwise-demand model explains a substantial amount of the geographic variations in Medicare utilization and spending. We find large, positive effects of changes in Medicare prices on changes in private insurers' prices, contrary to the predictions of cost shifting. Although rarely directly observed by researchers, within the health care industry it is widely known that private insurers' contracts with physicians are often defined as a percent markup above Medicare. As a result, increases in Medicare prices automatically trigger a corresponding increase in private insurer prices, although the markup within the contract may be re-negotiated at a later time. Thus, the mechanism by which physicians alter their payer mix is embedded into the contracts themselves. Such contracts are justified by the stepwise-demand model, where both insurers and

[13] The crossplot is expressed as a market's deviation from the private sample mean, and its deviation from the public (Medicare) sample mean.

providers have incentives to increase private prices in response to increases in Medicare prices: providers, to shift their payer mix away from private-insured patients; and insurers, to ensure that their enrollees retain the ability to receive treatment from providers within their networks.

A number of steps remain to thoroughly test the power of the stepwise-demand model in explaining variations in Medicare spending. These include demonstrating the effects of Medicare price changes on providers' optimal payer mix by quantifying how providers change quantities supplied to private payers and to Medicare. Obfuscating this relationship, however, is the fact that increases in Medicare prices may prompt providers to invest in capacity and technology to provide those services, thereby yielding higher quantities supplied to *both* Medicare and privately-insured patients (Clemens and Gottleib, 2011), rather than yielding lower privately-insured quantities as predicted by the stepwise-demand model alone. One solution to this challenge may be to examine the payer mix at a market level rather than the total volume of services provide to Medicare and privately-insured patients.

The results will be insightful regardless of the eventual outcome of this further investigation. If the stepwise-demand model does not provide a good explanation for variations in Medicare spending, economists must evaluate existing models, and perhaps even develop new ones, to explain the causes of variations. On this point we concur with Stigler and Becker (1977) who encourage economists to "…search for differences in prices or incomes to explain any differences or changes in behavior…" rather than demurring to unobserved tastes or norms.

If stepwise demand turns out to be a powerful explanation of Medicare variations, however, much of the current conventional wisdom will be unfounded. For example, rather than regions exhibiting a "signature style" of treatment intensity based on local norms, the model predicts within-region negative relationships between Medicare and private treatment intensities. In fact, some existing descriptive evidence suggests this is the case (Franzini, Mikhail, and Skinner, 2010). Demonstrating that stepwise demand is the operative model in this context would also rule out explanations based on oversupply of hospitals and physicians, eliminating one of the primary justifications for policies that inhibit competition between and greater supply of health care providers. Finally, such confirmation would mean that

variations in Medicare spending provide no insights about the wastefulness of higher total health care spending per se despite recent claims by policymakers.[14]

In addition to the analysis remaining to be conducted, one important limitation is that physicians may have methods of altering payer mix other than private insurers' prices. This could include adjusting quality, such as by shortening privately-insured patients' office visit length in response to increases in Medicare prices, although in general within-CPT changes in quality are difficult to define and observe. This would follow the spirit of the stepwise-demand model, where payer mix is altered via differences in quality-adjusted prices rather than the purely monetary prices observed in the FAIR Health data set. Similarly, as indicated by the McGuire-Pauly (1991) model, physicians may alter their payer mix not through private prices but rather by altering their degree of inducement. To date, however, empirical research supporting such responses to changes in Medicare or Medicaid fees is scant (Yip, 1998; Gruber and Owings, 1995).

A second source of remaining uncertainty is that our analysis excludes prices and quantities provided to Medicaid patients, uninsured patients, or patients enrolled in Medicare Advantage plans. Such patients represent other segments of the stepwise-demand curve faced by physicians. Finally, we note that the data does not permit us to examine within-physician changes in prices and payer mix. As a result, we leave open a number of questions regarding whether and how the market clears as physicians change their private-insurance prices.

[14] For example, in the quote provided in the introduction, Peter Orszag continued to say that the 30 percent waste observed for Medicare "could probably be extrapolated to the health care system as a whole" (Congressional Budget Office 2008).

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Figure 1. Variations in Medicare Spending due to Differences in Private Demand

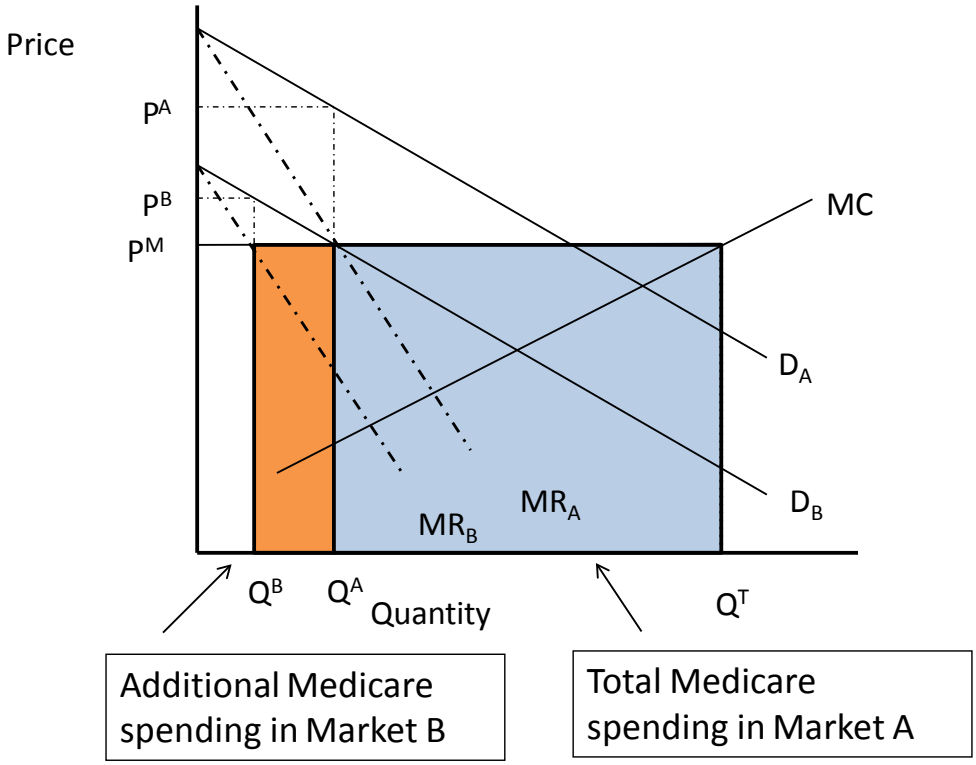

Figure 2. Changes in Response to a Medicare Fee Change

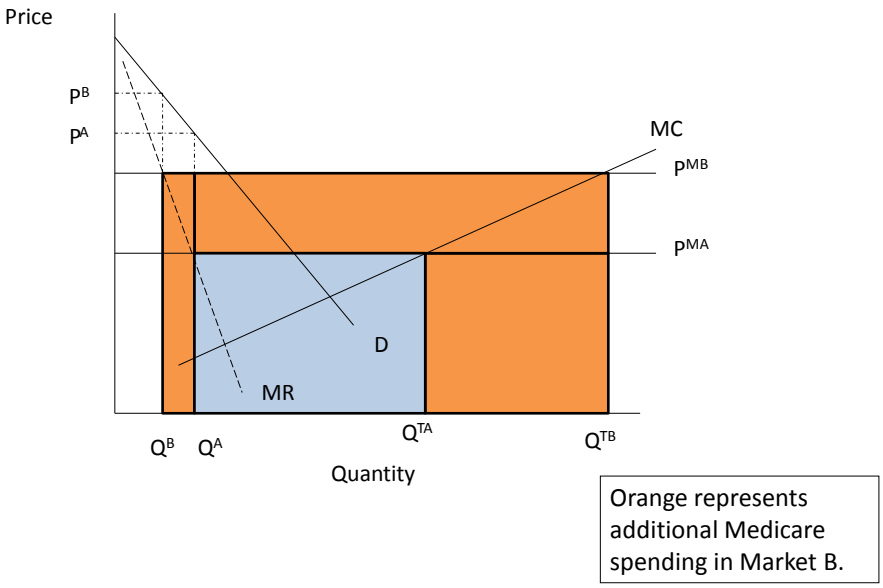

Figure 3. Average correlation between change in Medicare and Private Prices, 2003-2009

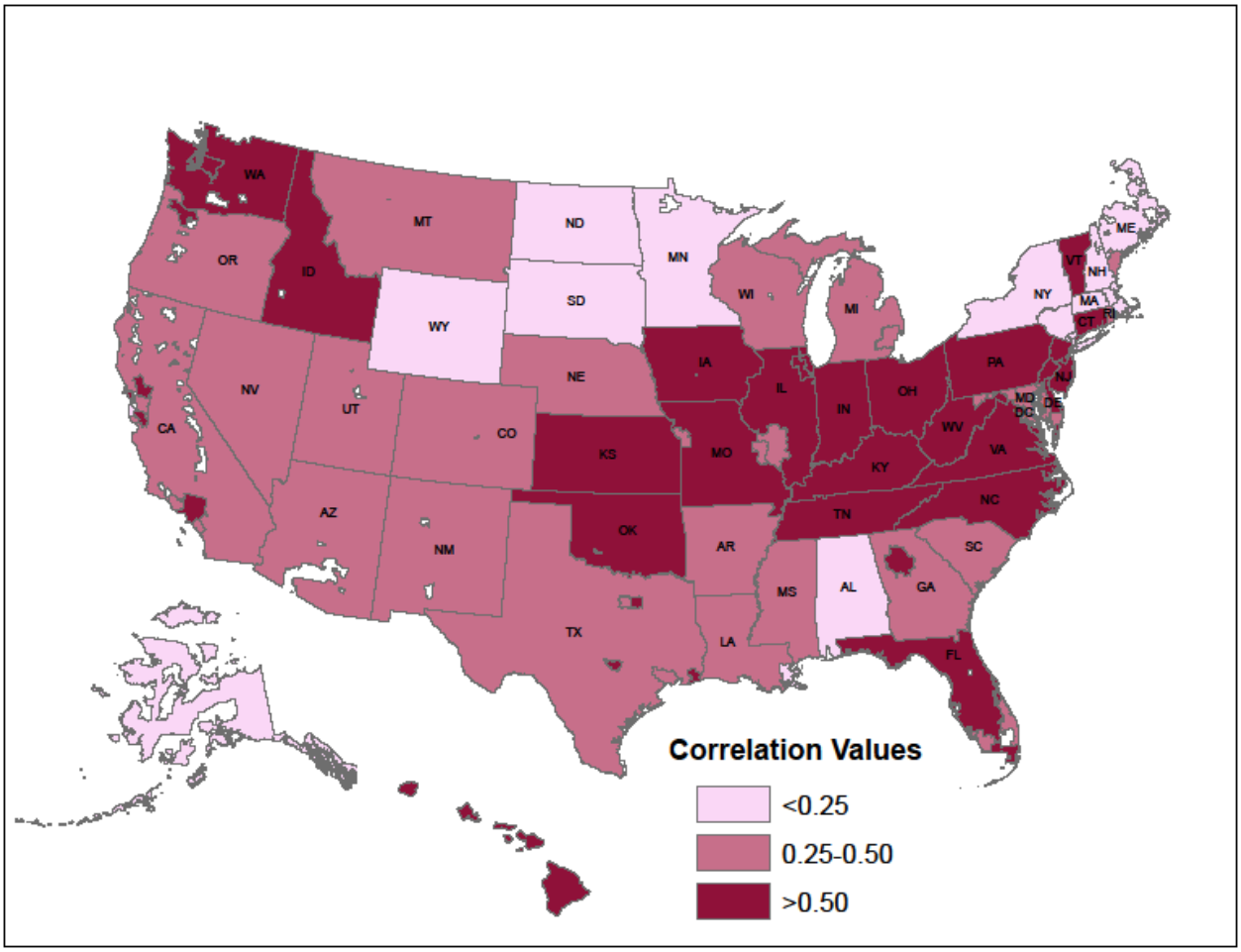

Figure 4. Within-Service (CPT) Change in Prices, 2003-2009

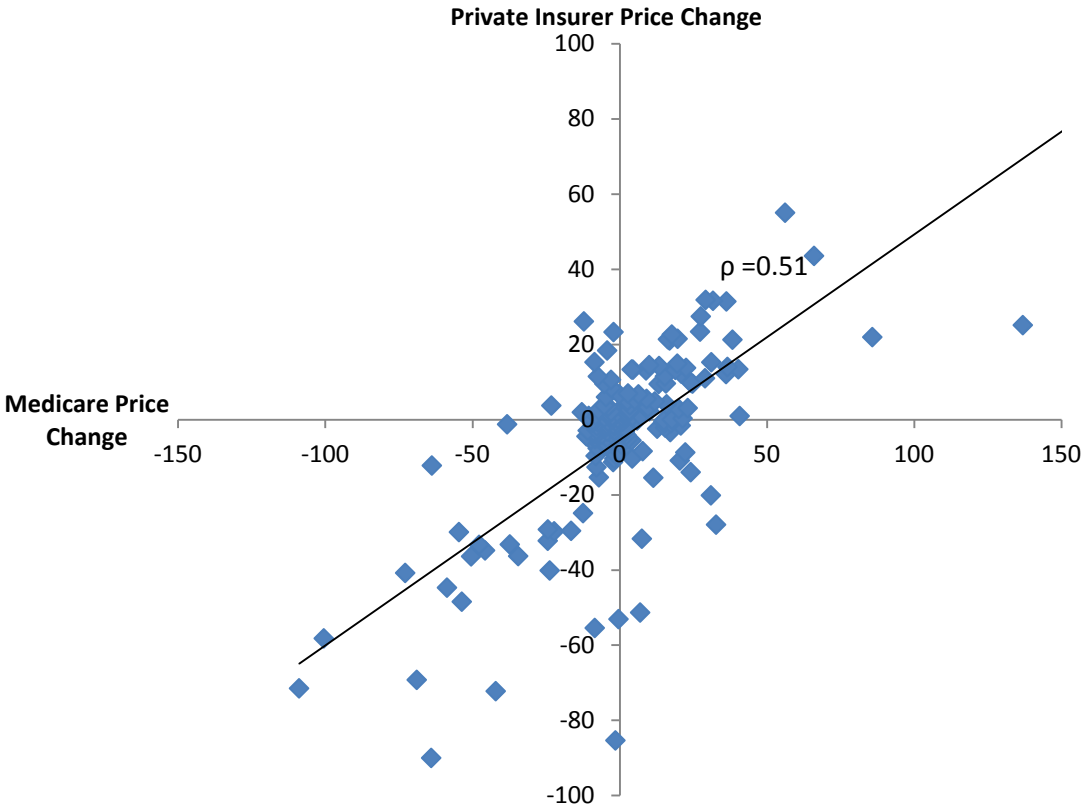

Figure 5. Correlation in within-market Medicare and Private Price Changes by CPT, 2003-2009

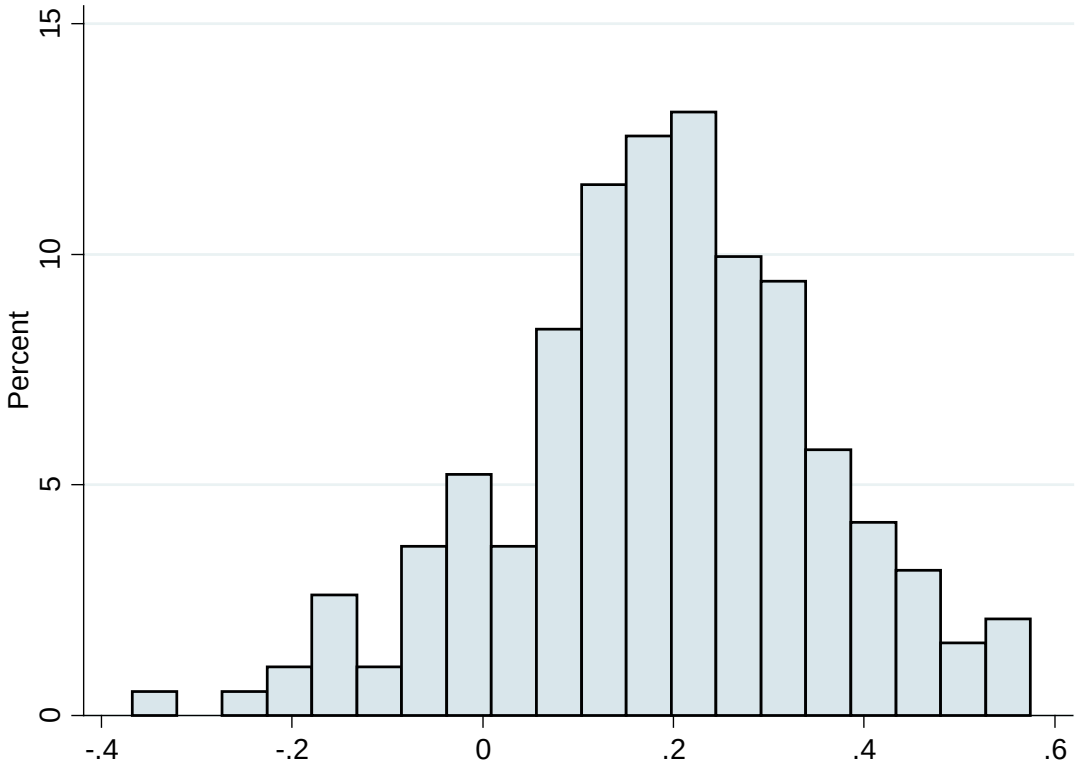

Table 1. Estimates from Models of Change in Private Price

Dependent Variable:	Change in Private Price ($)	Change in Private Price (%)
Change in Medicare Price ($)	0.482	
	[0.146]***	
Change in Medicare Price (%)		0.427
		[0.020]***
N	16,600	16,600
Dependent variable mean	1.24	0.00
Dependent variable standard deviation	75.74	0.08

NOTE: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. All models include fixed effects for CPTs and for markets.