Spillover between Medicare and Medicaid: Evidence from Decreasing Physician Reimbursements

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Abstract

This paper studies the effect of large changes in Medicaid reimbursement rates on the quantity of care supplied to Medicare beneficiaries. In 2015, the payment parity provision of the Affordable Care Act (ACA) ended, causing widespread decreases in reimbursements to primary care providers for Medicaid services. Difference-in-differences and triple-difference model estimates show that decreasing physician payments for Medicaid caused a small increase in the number of services provided to Medicare beneficiaries. I explore the mechanisms driving this result, giving context and insight into some current puzzles regarding the effects of the ACA's Medicaid expansion.

Keywords: Medicare, Medicaid, physician reimbursement, insurance expansion, mixed-economy

JEL Classification: TBD

1 Introduction

Increasing access to health care was a main objective of the Patient Protection and Affordable Care Act of 2010 (ACA). The ACA expanded Medicaid coverage to an additional 17 million people, and economics literature has found a positive impact of the expansion: more people received care, health outcomes improved, and there is little evidence that non-Medicaid populations were disadvantaged as a result of spillover (Alexander & Schnell, 2019; Carey, Miller, & Wherry, 2020; Miller, Johnson, & Wherry, 2021).

However, these results are at odds with research concerning non-ACA institutional changes. Several studies (Garthwaite, 2012; McInerney, Mellor, & Sabik, 2017; Glied & Hong, 2018)

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have found that an exogenous increase in access or demand for health care among a certain group causes a decrease in the amount of health care provided to other groups.

Why did the access-increasing provisions of the ACA have a different impact, specifically regarding spillover to other populations, than non-ACA provisions? To answer this question, this paper studies changes in Medicare provider service volumes in response to the end of the payment parity provision in the ACA that decreased Medicaid reimbursements significantly. By focusing on physician outcomes, I leverage variation across provider type aiding in identification of small effects. I find that primary care physicians responded to decreased Medicaid reimbursements with a small increase in services provided to Medicare beneficiaries. This result helps to reconcile the spillover question by providing evidence that reimbursement changes across patients causes physicians to substitute providing care of one for another.

In 2013 and 2014, all states with fee-for-service Medicaid programs received federal funding to increase payments to physicians for Medicaid services so that they are equal to payments to physicians for Medicare services. This nearly doubled the payment physicians received from Medicaid. Along with the contemporaneous expansion of Medicaid coverage, this so-called Medicaid "fee bump" increased the access to care and the amount of care received by Medicaid beneficiaries, and further improved health and behavioral outcomes (Alexander & Schnell, 2019; Maclean, McClellan, Pesko, & Polsky, 2023). Focusing on Medicare beneficiary utilization, Carey et al. (2020) finds no crowd out and that increasing access to care to Medicaid beneficiaries did not diminish the care received by Medicare beneficiaries.

In this paper, I take a new approach to identify spillover to Medicare by looking at *provider* outcomes. Focusing on providers allows me to exploit exogenous variation in Medicaid payment that varies across providers, in addition to across states and time. This permits identification of a causal effect with standard difference-in-differences (DID) methods, as well as identification with a more elaborate triple-difference with continuous treatment specification.

Regardless of specification, I consistently find a small, yet economically and statistically significant effect of decreasing Medicaid reimbursements on Medicare service volume. Specifically, the DID specification shows that primary care providers (PCPs), who's Medicaid reimbursements decreased in 2015, increased the number of services provided to Medicare beneficiaries by 0.94%. I also estimate triple-difference models that exploit additional variation across states and years in the Medicaid-to-Medicare fee-ratio. With the additional variation, I identify a positive spillover of decreased Medicaid reimbursements to Medicare service volume of up to 4%.

Recent research has generally been favorable towards both the Medicaid expansion and the accompanying increase in Medicaid payments to physicians. For example, Miller et al. (2021) find a 0.132 percentage point decrease in mortality in states that expanded Medicaid, implying roughly 15 thousand people died between 2014 and 2017 because some states did not expand Medicaid eligibility. Concerning the fee bump specifically, Maclean et al. (2023) finds that higher Medicaid reimbursement rates improved behavioral health outcomes, specifically substance use disorders and tobacco product use. Alexander & Schnell (2019) shows that higher reimbursement for Medicaid services decreased reports of providers turning away patients, increased office visits for Medicaid enrollees, and improved overall health.

An important critique of the Medicaid expansion is that increased service use by Medicaid beneficiaries may spill over and impact the access to and amount of care individuals covered by other insurers receive. Garthwaite (2012) applies the seminal model of Sloan, Mitchell, & Cromwell (1978) to deduce that due to crowd out of private insurance, upon implementation of the State Children's Health Insurance Program, which expanded insurance coverage to low-income Americans below the age of 19, physicians that serve few Medicaid patients under 19 should decrease the quantity of medical services provided. Survey data from physicians confirm this hypothesis. In a similar analysis using a survey of beneficiaries, McInerney et al. (2017) find that a one percent increase in the Medicaid-eligible population causes a decrease in spending among Dual Eligible patients. Finally, Glied & Hong (2018) find that factors increasing demand in the non-Medicare population cause a decrease in Medicare utilization and spending, and the total quantity of services provided did not change.

Contrary to Garthwaite (2012) and McInerney et al. (2017), Carey et al. (2020) finds no evidence of spillover between Medicare and Medicaid. Using a large sample of Medicare claims, the authors find that Medicaid expansions did not reduce utilization among Medicare beneficiaries. Furthermore, Maclean et al. (2023) and Alexander & Schnell (2019) find no change in behavioral health and access to care among non-Medicaid populations due to the Medicaid fee bump in secondary analyses.

Some more recent studies have established significant provider response to changes in Medicaid reimbursement. Gottlieb et al. (2023) show that 6% of the federal funding of insurance expansions are captured by physician incomes, and argue that policies regarding physician remuneration play a significant role in determining specialty choice. Counterfactual simulations of a structural model of speciality choice show that imposing income parity between PCPs and non-PCPs would double the share of medical school graduates entering primary care.

Neprash et al. (2021) studies the effect of the Medicaid Expansion on the provider side. In staggered-timing event-studies of Medicaid expansion by state, the authors find consistent increases in physician service volume in response to expanded insurance. Specifically, Medicaid appointment count, patient count, and billing increased by approximately 10% by the second year post implementation. Neprash et al. (2021) also find that the *total* labor supply of physicians was *unchanged* post implementation of the Medicaid expansion, implying there must have been a substitution from Medicaid patients to another payer. In a payer-mix analysis, the authors show that the Medicare appointment share of physicians did not decrease after Medicaid expansion, but rather commercial appointment share and other-pay appointment share decreased.

Recent work by Benson & Lopez (2023) leverages an exogenous change in relative Medicare reimbursements for substitutable spinal fusion surgeries to estimate the pseudo-elasticity of service volume with respect to the reimbursement change. The authors find that providers substitute to the high-cost procedure, responding to reimbursement changes as indicated by economic theory. The study by Benson & Lopez (2023) gives additional evidence that provider behavior changes in response to changes in reimbursements, this time in the Medicare market, which supports the hypothesis of this paper.

This paper provides new evidence surrounding physicians' responses to changes in payment for health services and the extent of spillover between public payers, Medicare and Medicaid. In the following section, Section 2, I discuss the background of this analysis, including descriptions of the conceptual framework and data. The framework is an application of the mixed-economy model of Sloan et al. (1978).

The empirical analysis is presented next in Section 3. The empirical results of this paper indicate a small but measurable increase in the number of services provided to Medicare patients in response to Medicaid reimbursement decreases. This response is identified, estimated, and presented in difference-in-difference, triple-difference, and event-study analyses. Finally, Section 4 discusses the results and concludes.

2 Background, Conceptual Framework, and Data

This section presents the broad setting of the analysis. I begin with a discussion of the background of the Medicaid Expansion of the Affordable Care Act, its payment parity provision, and Medicaid-to-Medicare fee ratios. Next, I explain the conceptual framework of the setting, and apply the Sloan et al. (1978) model to explain anticipated outcomes in Medicare from changes in Medicaid reimbursement. Finally, I detail and summarize the Medicare provider data used in the empirical analysis.

2.1 Background

Medicaid is the United State's public health insurance program for low-income individuals, and each US state administers their its own Medicaid program. This drives substaintial variation in the Medicaid policy in each state, lending the setting to empirical studies of outcomes based on state policy variation. Medicare, on the other hand, is the US Federal Government's public health insurance for those older than 65 or disabled. This public insurance is run by the Centers for Medicare and Medicaid Services (CMS), a division of the US Federal Government Department of Health and Human Services. Accordingly, Medicare's federal administration has made it substantially different than Medicaid.

The differences between Medicare and Medicaid would be important upon designing the Medicaid expansion in the ACA. The results of Sloan et al. (1978), as well as contemporary work by Cutler & Gruber (1996); Finkelstein (2007), indicated that expansion would be most effective if it was accompanied by an increase in Medicaid reimbursements. Medicaid has historically reimbursed providers at a far lower rate than Medicare and private insurance.

According to Zuckerman & Goin (2012), the Medicaid-to-Medicare fee ratio averaged 59% for primary care services in 2012, and half of all states had a fee ratio below 70%. This was a central concern to policymakers when expanding Medicaid eligibility in the ACA. While Medicaid eligibility would be expanded to an additional 17 million people in 2013, providers may still decide to not treat them, given they earn nearly two times the pay for providing the same service to Medicare or privately insured beneficiaries.

Accordingly, the so-called Medicaid "fee bump" was included in the ACA.[1] The provision mandates that in 2013 and 2014, for 146 primary care services and for certain provider types/specialties, the payment for those services from Medicaid will be 100% of the Medicare rate.[2] This provision applied to every state's Medicaid program, regardless of the state's decision to expand Medicaid.[3] The federal government paid states for the full costs of the fee bump until December 2014. From 2015 onwards, states had the decision to continue the fee bump, and in 2015, more than half of US states elected to decrease Medicaid reimbursement rates to pre-bump levels. By 2019, all but a few US states had decreased reimbursements for Medicaid to approximately their 2012 level.

The research question of this paper is to what extent did Medicare service volume increase in response to decreases in reimbursements. In order to answer this question, I analyze outcomes only in the states that ended the fee-bump in 2015. I make this determination because policy choices of states that end the fee-bump at a later date may be correlated with unobserved factors causing problems for identification, and because I can avoid the methodological concerns of difference-in-differences estimation with treatment timing variation. States that have a Medicaid program substantially different than most others are also excluded from analysis, following the literature of Alexander & Schnell (2019); Gottlieb et al. (2023). All together, my analysis includes 31 US states and excludes 19 US states, Washington, D.C. and Puerto Rico.

Figure 1 displays the Medicaid-to-Medicare primary care fee ratio, FR_{st}, by state and year. This data was gathered from the Medicaid-to-Medicare fee-ratio reports issued by

[1] See Section 1202 of the ACA.

[2] A few states opted to increase rates for all physician types, rather than just those specified by the ACA: Maryland did so from 2013 through 2016, and Colorado, Idaho, Indiana, Nevada, and Utah did so in 2016.

[3] The exception to this is Tennessee, which does not have a Medicaid FFS program.

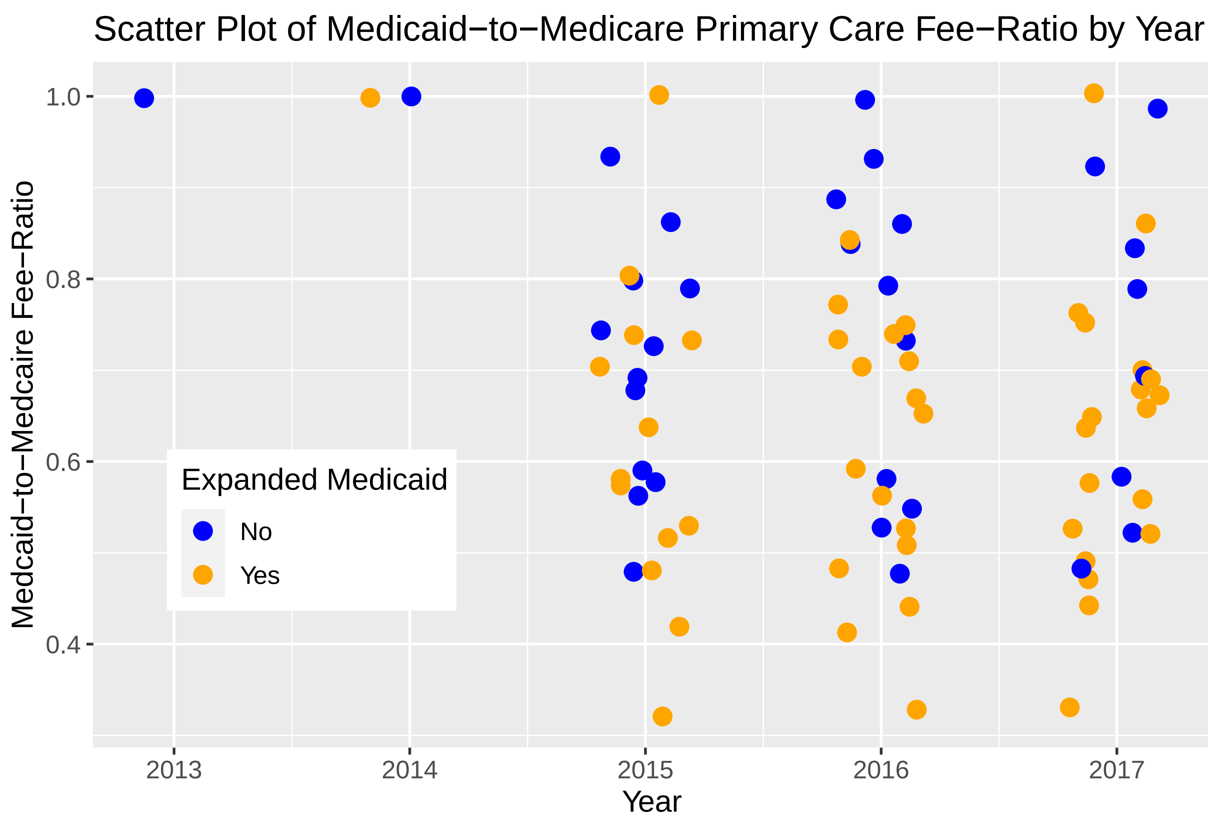

Figure 1: **Scatter Plot of Fee-Ratios.** This figures plots the Medicare-to-Medicaid primary care fee-ratio FR_{st} by year from the estimation sample, which excludes 19 US States plus DC and PR. These data were gathered by the author from Zuckerman & Goin (2012); Zuckerman et al. (2014, 2017, 2021) and crossed referenced with data presented in Alexander & Schnell (2019).

Zuckerman & Goin (2012); Zuckerman, Skopec, & McCormack (2014); Zuckerman, Skopec, & Epstein (2017); Zuckerman, Skopec, & Aarons (2021). These reports, along with Figure A.2 in Alexander & Schnell (2019), allow me to construct a state-by-year panel of Medicaid-to-Medicare fee-ratios for primary care for 2012 to 2019. I also gather information on the timing of Medicaid Expansion in each state, which is displayed in the colors of points in Figure 1.

Several points in Figure 1 indicate a state did not decrease reimbursements in 2015 despite remaining in the sample. These points are states that legally discontinued the Medicaid fee-bump in 2015 but nontheless kept Medicaid fees at or near parity with Medicaid. To account for this, I conduct a triple-difference analysis leveraging variation in the actual Medicaid to Medicare fee ratio along with standard DID analysis.

Increased fees were given only to certain types of providers providing certain types of services to Medicaid patients. In particular, a service provided to a Medicaid beneficiary received the Medicare payment rate if the physician rendering or supervising the service had specialty designation of family medicine, general internal medicine, pediatric medicine, a subspecialty within these designations, or at least 60% of services provided by the physician in the previous year were among the services qualifying for the fee bump. The services qualifying for the fee bump have Healthcare Common Procedure Coding System (HCPCS) Level I codes 99201-99499, 90460, 90461, and 90471-90474.[4] The first range of HCPCS codes (99201-99499) are for Evaluation and Management Services, and the others are for Vaccine Administration. Table 1 contains some examples of services with and without bumped fees. There are over 6000 unique HCPCS codes.

PCPs are defined as providers with the following types: Family Practice, General Practice, Geriatric Medicine, Gynecological/Oncology, Internal Medicine, Pediatric Medicine, Nephrology, Allergy/Immunology.[5] These providers are the "treatment" group that received decreased Medicaid reimbursement, measured by the decrease in Fee-Ratio $FR^{\downarrow}_{st}$, in 2015 and after.

[4]HCPCS Level I codes are also known as Current Procedural Terminology (CPT) Level II codes.

[5]This also follows Section 1202 of the Affordable Care Act.

Table 1: **Procedure Code Examples**

HCPCS Code	Description	Medicaid Fee Bumped?
99202	New patient office or other outpatient visit, typically 20 minutes	Yes
99233	Subsequent hospital inpatient care, typically 35 minutes per day	Yes
99291	Critical care delivery critically ill or injured patient, first 30-74 minutes	Yes
17003	Destruction of 2-14 skin growths	No
36415	Insertion of needle into vein for collection of blood sample	No
73564	X-ray of knee, 4 or more views	No

Note: This table gives examples of services that were and were not affected by the payment parity provision of the ACA.

2.2 Conceptual Framework

The seminal work by Sloan et al. (1978) guides my predictions regarding the impact of decreasing Medicaid reimbursements on provider decisions. In this model, a physician's marginal revenue MR is weakly decreasing in number of services provided q. In Figure 2, the flat segments represent the fee-for-service payments made by Medicare and Medicaid to physicians, and the downward sloping segments represent marginal revenue for services provided to privately insured individual and uninsured individuals. In 2013 and 2014, the payment parity provision of the ACA is implemented, an all Medicaid and Medicare services offer the same reimbursement. The marginal revenue curve for this period is the solid line MR. When states end payment parity and decrease reimburesments for Medicaid, the marginal revenue function changes to the dashed line. In this case, services to Medicaid beneficiaries offer drastically lower payments to primary care physicians, and thus the Medicaid fee-for-service level declines to the flat portion of the dashed line. The downward sloping portion of the dashed MR curve represents privately insured and uninsured individuals with higher expected reimbursement for services than Medicaid services.

Note that Figure 2 does not depict any crowd-out between public and private insurance. This is the topic of Garthwaite (2012). I exclude this because crowd-out in this setting requires the unlikely occurrence of individuals changing insurance from one payer to another

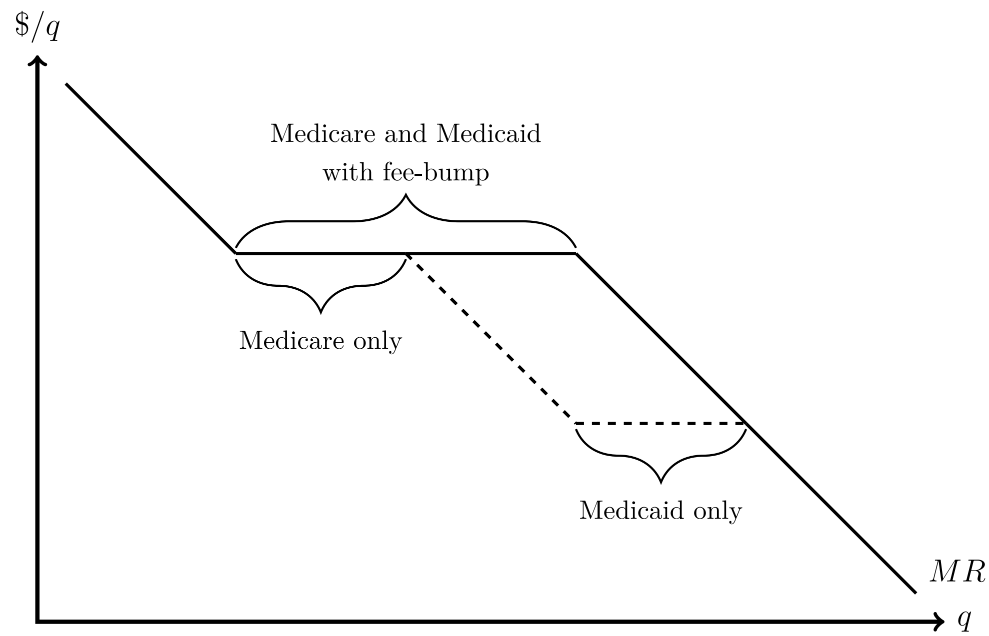

Figure 2: **Mixed-Economy Model: Marginal Revenue.** This figure depicts the marginal revenue curve of a physician in which Medicaid reimbursements may or may not be equal to Medicare reimbursements. The solid line represents physician marginal revenue MR in years 2013 and 2014 when all states had payment parity. The dashed lined represents marginal revenue in 2015 onward, in which Medicaid services are reimbursed at a fraction of the Medicare rate. Any downward sloping portion of the curve (solid or dashed) represents privately insured or uninsured individuals.

due to removal of the fee-bump. In other words, crowd-out would be driven by Medicaid beneficiaries deciding to switch to Medicare or private insurance because their payer reimburses less. This switch, from Medicaid to Medicare or private insurance, is extremely unlikely to be caused by the drop in payments to physicians, as individuals enroll in Medicare and private insurance as soon as they become available. On the other hand, crowd-out due to expansions and associated reimbursement rate increases may cause those to give up private insurance for Medicaid, as is the case in Garthwaite (2012).

Figure 3 depicts the mixed-economy model with a super-imposed marginal cost curve MC. Profit maximization occurs at the points where $MR = MC$, which are labelled q_H and q_L. In this setting, physicians are indifferent between Medicare and Medicaid patients when reimbursements are equal. Thus, the services counted by q_H are services to both Medicare and Medicaid patients, as well as privately insured patients with higher marginal revenue.

Upon removal of the fee-bump however, the quantity of services provided decreases to

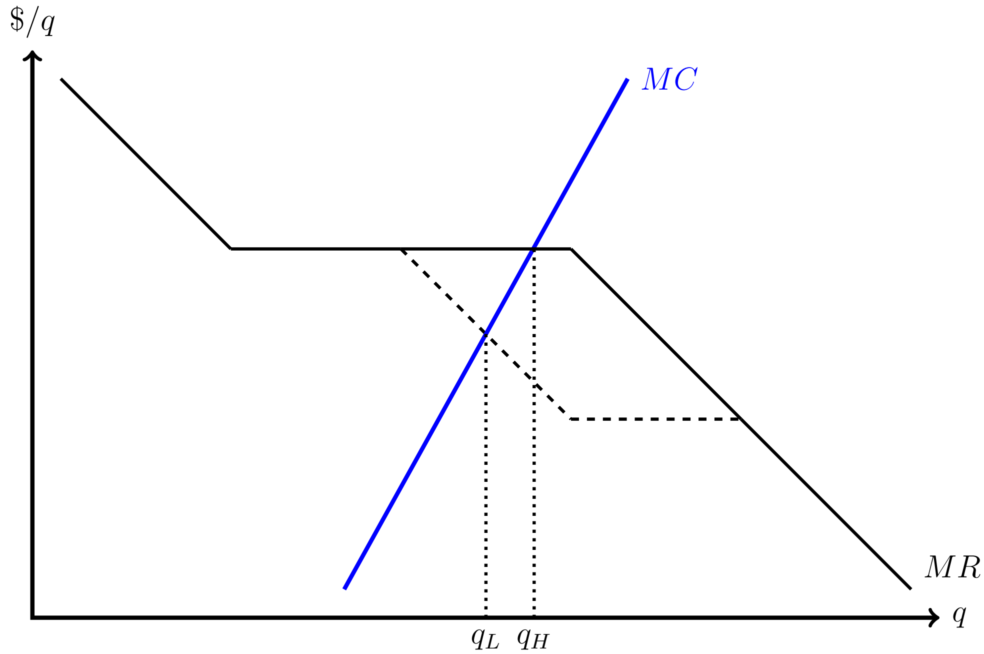

Figure 3: **Mixed-Economy Model: Solution.** This figure depicts the solution to a physician's profit maximization problem in which Medicaid reimbursements may or may not be equal to Medicare reimbursements. The solid line represents physician marginal revenue MR in years 2013 and 2014 when all states had payment parity. The dashed lined represents marginal revenue in 2015 onward, in which Medicaid services are reimbursed at a fraction of the Medicare rate. Any downward sloping portion of the curve (solid or dashed) represents privately insured or uninsured individuals. Marginal cost is indicated by MC.

q_L. Higher paying Medicare services (flat portion of MR) and privately insured services (downward sloping and dashed portion of MR) are provided instead of Medicaid services. This means increases in the number of services provided to Medicare benficiaries and possibly privately insured beneficiaries, and decreases in the number of services provided to Medicaid beneficiareies. The magnitude of the effect of the reimbursement rate change on Medicare service volume therefore depends on the extent to which physicians treated both types of patients—Medicare and Medicaid insured—and the extent to which they substitute time with patients of either type.

2.3 Data and Summary Statistics

The purpose of this study is to measure the impact of changing Medicaid reimbursement rates on the decisions of Medicare providers. To do so, the main source of data is the Physician and Other Supplier data (henceforth "provider data") from the Centers for Medicare and Medicaid Services (CMS). This data provides utilization, charge amount, and actual payment amount for nearly every Medicare Part B provider for the years 2013 to 2021. I use data until 2017, when states ended all payment parity provisions.

Providers are identified in data by a National Provider Identifier (NPI). In each year of data, each NPI carries information regarding the provider's zip-code, type/specialty, patient characteristics, and service volume. I use provider location and specialty data as fixed effects in regression analysis to follow. Similarly, the (log) total number of Medicare services provided by a specific NPI in a year will be used as the dependent variable.

I combine the provider-level data with state level data on the Medicaid fee bump (discussed above). Specifically, I use data on each state's participation in the fee bump in each year and each state's Medicaid-to-Medicare fee ratio in each year.

2.3.1 Provider Data Construction

The provider data contains observations by year and NPI and requires significant refinement. An important characteristic of this data, and any public Medicare data, is that any observation providing information on 10 or fewer beneficiaries is censored. This means some NPIs are excluded some years if their number of Medicare patients dropped to 10 or below. I account for this by keeping only a balanced panel of providers that treat at least 11 patients in all years of analysis. This represents an overall decrease in sample size of about 10%.

To combat the censoring issue, to account for the specific details of the fee bump law, and to handle for idiosyncrasies in policy adoption across states, I do the following. First, I keep only observations where services were provided in an office setting (rather than a facility), and only if the NPI is associated with an individual provider (rather than an organization). I drop observations for supplier and non-medical taxonomies.[6] Providers who switch specialty from PCP to non-PCP from 2013 to 2017 are dropped from the data as well.

[6] The following provider types/specialties are dropped: All Other Suppliers, Clinic or Group Practice, Clinical Laboratory, Independent Diagnostic Testing Facility, Independent Diagnostic Testing Facility (IDTF), Mass Immunization Roster Biller, Mass Immunizer Roster Biller, Multispecialty Clinic/Group Practice, Portable X-Ray Supplier, Portable X-ray, Slide Preparation Facility, Undefined Physician type, Unknown Physician Specialty Code, Unknown Supplier/Provider, and Unknown Supplier/Provider Specialty. These amount to less than one out of every 2000 observations.

	# Obs.	# Unique	Mean	Std. Dev.	Min.	Med.	Max.
Provider	2560426	531294					
Zip-5	2560426	14623					
State	2560426	31					
# Services (1000s)	2560426	80796	3.02	15.60	0.01	0.82	5811
PCP	2560426	2	0.22	0.42	0.00	0.00	1.00
Expanded Medicaid	2560426	2	0.50	0.50	0.00	0.00	1.00
Fee-Ratio FR_{st}	2560426	39	0.76	0.22	0.32	0.73	1.00
Fee-Ratio Decrease $FR_{st}^{\downarrow}$	2560426	55	0.18	0.21	0.00	0.04	0.68

Table 2: **Summary Statistics.** This tables shows summary statistics of the estimation sample, which is a physician-by-year panel from 2013 to 2017. 19 US States plus DC and PR are *not* in the estimation sample because the state either (1) did not implement a decrease in Medicaid reimbursements in 2015 and/or (2) has a Medicaid program substantially different than most states and is excluded in Gottlieb et al. (2023).

2.3.2 Summary Statistics

Table 2 displays summary statistics for the variables used in estimation. This table shows that the sample contains 531,294 providers in 14,623 zip-codes. Treated providers, PCPs, account for 22% of the sample. The Fee-Ratio decrease, $FR_{st}^{\downarrow}$, will be used as a continuous treatment later in analysis.

3 Empirical Analysis

I follow existing literature estimating the effects of Medicaid expansions in order to specify the empirical models. First, I follow Neprash et al. (2021) and Gottlieb et al. (2023) and estimate the physician response to a change in Medicaid payment with a difference-in-differences regression. Specifically, I estimate

$$\ln\left(serv_{it}\right) = \alpha \cdot PCP_i \times Post_t + \beta \cdot ME_{st} + \gamma_t + \gamma_z + \gamma_p + \varepsilon_{it} \tag{1}$$

where $serv_{it}$ is the total number of Medicare services provided by physician i in year t, PCP_i is an indicator variable taking the value of 1 if physician i is a primary care provider and 0 otherwise, and $Post_t$ is an indicator for observations in the year 2015 or later. I control for whether a state has expanded their Medicaid program with the variable ME_{st} which takes a value of 1 if physician i's state s expanded Medicaid in year t.

The parameters γ_t, γ_z, and γ_p respresent fixed effects by year t and physician i's zip-code z and specialty p. The fixed effect γ_t captures variation in service volume common across all physicians in a year, and the combination of γ_z and γ_p control for location- and specialty-specific factors, invariant over time, that determine the levels of demand and supply of care. In other words, γ_p and γ_z represent persistent characteristics of the *local market* and *specialty-specific market*.

I also estimate dynamic effects of the reimbursement drop by estimating the analogous two-way fixed-effects event-study:

$$\ln(serv_{it}) = PCP_i \times \sum_{\substack{\tau=2013 \\ \tau\neq 2014}}^{\tau=2017} \alpha_\tau \cdot \mathbf{1}\{t=\tau\} + \beta \cdot ME_{st} + \gamma_t + \gamma_z + \gamma_p + \varepsilon_{it}\,. \tag{2}$$

Rather than estimating a single treatment effect, this specification estimates the difference in service volume between PCPs and non-PCPs relative to the year before Medicaid rates decreased. This specification allows us to examine pre-trends as well as decompose the treatment effect across years.

Other closely related literature, specifically Maclean et al. (2023) and Alexander & Schnell (2019), rely on variation across states as well as years to identify the effect of reimbursement changes. I accordingly estimate the regressions

$$\begin{aligned} \ln(serv_{it}) = \delta \cdot \mathbf{1}\left\{FR_{st}^{\downarrow} > 0\right\} \times PCP_i + \theta_1 \cdot \mathbf{1}\left\{FR_{st}^{\downarrow} > 0\right\} \\ + \theta_2 \cdot ME_{st} + \gamma_t + \gamma_z + \gamma_p + \varepsilon_{it}\,. \end{aligned} \tag{3}$$

and

$$\ln(serv_{it}) = \delta \cdot FR_{st}^{\downarrow} \times PCP_i + \theta_1 \cdot FR_{st}^{\downarrow} + \theta_2 \cdot ME_{st} + \gamma_t + \gamma_z + \gamma_p + \varepsilon_{it}\,. \tag{4}$$

where $FR_{st}^{\downarrow}$ is the decrease in the Medicaid-to-Medicare fee ratio in from year $t-1$ to t in state s. Note that $FR_{st}^{\downarrow}$ is defined such that increases in its value reflect decreases in Medicaid reimbursements, and so the anticipated value of δ is positive like canonical DID parameter α in Equation 1.

In these regressions, our parameter of interest is δ, which measures the difference in utilization levels between PCPs and non-PCPs before and after Medicaid fees drop. Note that this is a triple difference-in-differences model, in which exogenous variation of the outcome variable occurs over years, across individuals, and now in Equations 3 and 4, states as well. The triple-difference, or 3DD, model in Equation 4 also contains a continuous treatment, as $FR_{st}^{\downarrow}$ takes some real number value between 0 and 1.

3.1 Identification

Identification of the causal effect of specific provisions of the ACA, and of health insurance expansions in general, is discussed broadly in health economics literature (Cutler & Gruber, 1996; Garthwaite, 2012; Carey et al., 2020; Miller et al., 2021). Furthermore, several studies have exploited exogenous changes in physician reimbursement to estimate supply changes (Alexander & Schnell, 2019; Neprash et al., 2021; Benson & Lopez, 2023; Maclean et al., 2023).

In the context of this paper, the primary assumption necessary for identification of treatment effects α and α_t in Equations 1 and 2 are that the trends of service volume for primary care physicians and non-primary care physicians are the same when states ended their fee-bump. I am able to examine pre-trends with the event-study plot, however, it is unlikely that this assumption holds in the first place. Because the Medicaid fee-bump started in 2013 and ended in 2014, the dynamic effects of that disproportionate *increase* in PCP's relative fees linger until the fee-bump is removed in 2015. Nonetheless, I argue this is not a significant issue for identification in this paper, as the trend of service levels between PCPs and non-PCPs observed in data would lead to a more conservative estimate of the effect.

Using a triple-difference specification to estimate δ does not require additional assumptions on top of what's necessary to identify α. Olden & Møen (2022) show that only one parallel-trends assumption must be satisfied for identification to be established in a 3DD model. In the case of this paper, the trend comparisons in question are between PCPs and non-PCPs and between states that have and have not decreased their fee ratios. The equivalence of the former trend, as I discuss above, is the assumption for α, and so no marginal assumption is required. However, it's worth noting that Maclean et al. (2023) and Alexander & Schnell (2019) both argue that the latter assumption, that the trends of service levels in states with and without the fee bump are the same, holds.

Continuous treatment requires an extension of the usual assumptions for differences-in-differences. Along with the assumption that there is no unobserved factor non-randomly driving decreasing fees, it requires that no unobserved factor non-randomly drives the variation in the actual level of the change in fee. Continuous treatment has been used for decades in economics (Card, 1992; Weber, 2014), and existing studies (Alexander & Schnell, 2019; Maclean et al., 2023) have already established continuous treatment using the Medicaid-to-Medicare fee ratio is sound causal inference. Nonetheless, because I use a triple-difference, parallel trends in PCPs and non-PCPs service level would render any assumptions regarding continuous treatment unnecessary. Intuitively, this is because any biased caused by correlation in treatment magnitude would be averaged out within a state across PCPs and non-PCPs.

3.2 Results

Table 3 shows results from estimating the difference-in-differences specification in Equation 1 in Column DID; Column 3DD shows triple-difference estimates of Equation 3; and finally Column 3DD-C shows triple-difference with continuous treatment estimates of Equation 4. Recall that each specification includes physician zip-code, specialty, and year fixed-effects. Because treatment is defined across providers, I cluster standard errors at the provider-level.

First, the parameter estimate for the standard DID model is $\hat{\alpha} = 0.0094$, representing a treatment effect of roughly 1%. Specifically, this means primary care physicians increased service volume by 1% to Medicare beneficiaries upon the decrease in Medicaid reimbursements in 2015. The parameter is estimated with substantial precision.

In Column 3DD, the triple-difference estimate for the effect of decreasing reimbursements is $\hat{\delta} = 0.0174$, or roughly a 1.7% increase in services. The magnitude of this estimate is larger

Dependent Variable:	$\ln(serv_{it})$		
Model:	DID	3DD	3DD-C
Variables			
$Post_t \times PCP_i$	0.0094^{***}		
	(0.0022)		
$\mathbf{1}\{FR_{st}^{\downarrow} > 0\} \times PCP_i$		0.0174^{***}	
		(0.0020)	
$FR_{st}^{\downarrow} \times PCP_i$			0.0466^{***}
			(0.0048)
Fixed-effects			
zip5	Yes	Yes	Yes
year	Yes	Yes	Yes
provtype	Yes	Yes	Yes
Fit statistics			
Observations	2,560,426	2,560,426	2,560,426
R^2	0.49282	0.49283	0.49283

Clustered (provider) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 3: **Difference-in-Differences Estimation.** This table displays estimates of treatment effect parameters α and δ in Equation 1 (Column DID), Equation 3 (Column 3DD), and Equation 4 (Column 3DD-C). Because the dependent variable is log-number of services, these point estimates (multiplied by 100) can be interpreted as percent-changes in number of services.

than in Column DID—this is due to the explanatory variable $\mathbf{1}\{FR_{st}^{\downarrow} > 0\}$ having variation across state and years, explaining more variation in service volume. In other words, using the fee-ratio decrease as an indicator for treatment accounts for states that ended the fee-bump but didn't decrease Medicaid fees. Column 3DD-C affirms this result: with the entire variation of $FR_{st}^{\downarrow}$ used to explain changes in service volume, we see the strongest difference between PCPs and non-PCPs at 4.7%.

Figure 4 displays estimation results of the event-study defined in Equation 2. This event study includes 95% confidence intervals computed with standard errors clustered at the

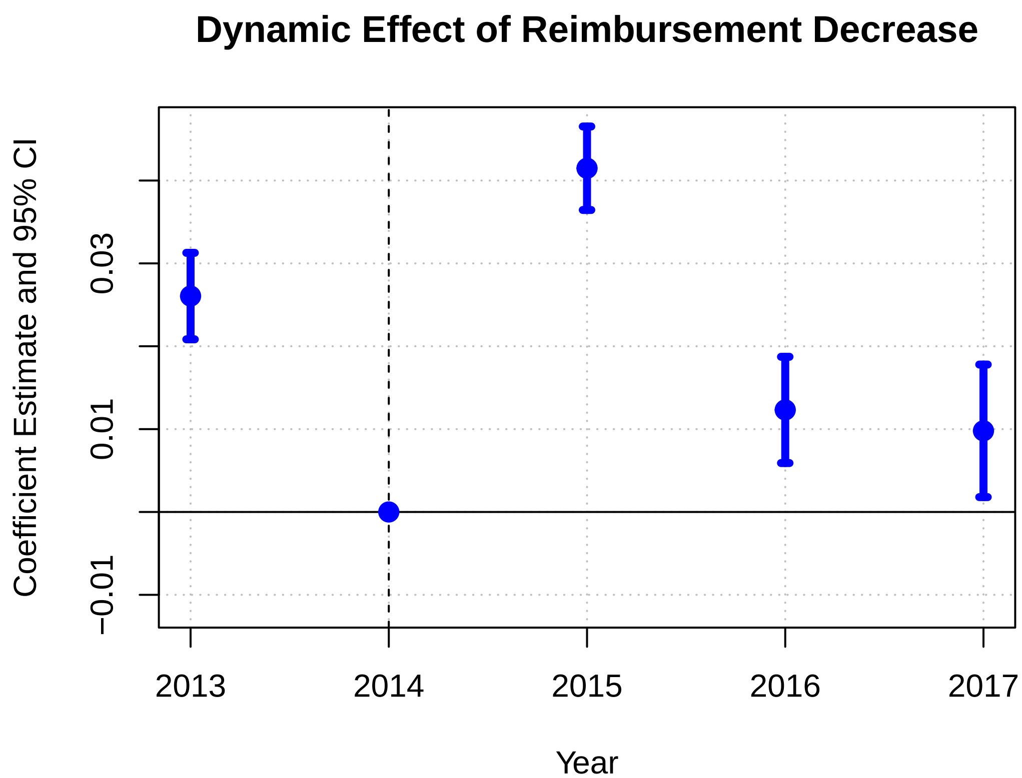

Figure 4: Caption

provider level. Again, provider-level clusters are used because treatment is defined at the provider level.

Inspection of the dynamic effects of the reimbursement rate decrease reveal substantial intertemporal variation. The difference in service volume between PCPs and non-PCPs is at its lowest in 2014, which is normalized to 0 in the estimation. Note that 2014 is accordingly the second year that all states have parity of Medicaid and Medicare reimbursements.

There is a substantially higher relative usage in 2013 than in 2014. While this would indicate a violation of parallel pre-trends in a typical DID analysis, this setting's context contends that service volume would be higher in 2013 than in 2014. The first year of implementation of the Medicaid fee-bump was 2013, and several studies such as Zuckerman et al. (2017) and Neprash et al. (2021) have established increased physician payments were not implemented in some states until late 2013.[7] This explains the decrease in relative service volume of PCPs and non-PCPs in 2013 to 2014.

The remaining point estimates displayed in Figure 4 represent an increase in services provided to Medicare beneficiaries upon the decrease in Medicaid reimbursements. There is an increase of over 4% in the number of Medicare services provided by PCPs relative to non-PCPs in 2015, and then smaller relative increases in 2016 and 2017 of about 1%. All of these estimates are precise, with standard errors of about one half of a percent.

These results are evidence that primary care physicians responded to the end of payment-parity in their state by increasing provision of care to Medicare beneficiaries. The dramatic intertemporal variation of the estimated effect corresponds to the drastically changing setting, in which primary care physicians saw their reimbursements for Medicaid services fluctuate by up to 100% over a period of four years. While extended analysis in 2012 and before would help to establish the pre-trend differentials between PCPs and non-PCPs are due to the policy setting, data limitations make this impossible, since the Medicare Physician and Other Supplier dataset is only available beginning in 2013.

[7] Zuckerman et al. (2017) note back-payment was later received by providers, but delayed implementation nonetheless slowed uptake.

4 Conclusion

In 2013 and 2014, the federal government allocated funding to all states with fee-for-service Medicaid programs to augment payments to physicians for Medicaid services, aligning them with the compensation levels for Medicare services. As Medicaid coverage expanded, this initiative, commonly referred to as the Medicaid fee-bump, not only enhanced access to care and the quantity of care received by Medicaid beneficiaries but also led to improvements in health and behavioral outcomes.

In this study, I adopt a novel approach to assess the spill-over effects on Medicare by examining outcomes at the provider level. By concentrating on providers, I can leverage naturally occurring variations in Medicaid payments, which vary not only across states and over time but also among individual providers.

In a variety of specifications, my findings consistently reveal a modest yet economically and statistically significant effect of reduced Medicaid reimbursements on the volume of Medicare services. Specifically, the DID model indicates that primary care providers (PCPs) whose Medicaid reimbursements decreased in 2015 increased the number of services they provided to Medicare beneficiaries by 0.94%. Furthermore, I estimate triple-difference models that take advantage of additional variations in the Medicaid-to-Medicare fee ratio across states and years. With this additional variation, I identify a positive spillover effect of reduced Medicaid reimbursements, resulting in an increase in Medicare service volume of up to 4%.

Future work will continue to address physician response to changes in reimbursement. As insurers, both public and private, become more interested in long-term cost saving, they are often driven incentivize physicians to provide more efficient care. In this context, and also in the public health insurance expansion context, research regarding physician response to payment changes, and measurements of specific labor-supply elasticities, will continue to be informative.

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