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ABSTRACT

Performance Pay and Productivity in Health Care: Evidence from Community Health Centers*

Nearly half of high earning workers receive performance pay as part of their compensation, but we know strikingly little about the incentive effects of piece rate compensation on high-skilled workers. In this paper, we examine changes in medical providers' output in response to a piece rate compensation scheme. We use data from a Federally Qualified Health Center that changed from a salary-based plan to one that rewarded providers for seeing more patients on a monthly basis. Two key facts guide our empirical approach. First, the timing of the switch from salary to piece rates varied at the individual level depending on the provider's hire date, which allows us to control for other changes over time in patient demand for services. Second, most providers worked under both compensation schemes, which allows us to make within-person comparisons. We further address incomplete compliance by using providers' expected monthly compensation plan status as an instrument for their actual status. We find that providers working under the piece rate scheme see roughly 18 percent more patients monthly. Only a small portion of this difference is due to within-provider changes in output, and we find no evidence that the incentive scheme causes providers to become more productive. Instead, most of this difference derives from compositional changes in the workforce, likely due to increased retention of more productive providers.

JEL Classification: J22, J33

Keywords: piece rates, performance pay, medical providers, fee for service

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1 Introduction

Performance pay was used in 37 percent of U.S. jobs in 2013, and for 49 percent of earners in the highest income quartile (Gittleman and Pierce 2013). Performance pay is often intended to encourage workers to be more productive, especially in areas where employees have substantial independence over their time allocation. There are two main mechanisms by which incentive pay can affect the aggregate productivity of a firm's workforce (Lazear 1986). First, the incentives may induce the same employees to allocate more of their time toward the metric rewarded by the incentive.[1] Second, offering performance pay can increase productivity through recruitment and retention. An employer will become more attractive to highly productive individuals because their total compensation will increase relative to a traditional salary. Evidence for each channel exists in rote jobs requiring lower levels of education (Lazear 2000, Shearer 2004), but the evidence is more limited in high-skilled professions.[2]

In this paper, we use proprietary personnel data from a Federally Qualified Health Center to determine the impact of piece rate compensation on productivity among medical providers. In January 2008, this Multi-Site Community Health Center (MSCHC) changed its compensation plan from a pure salary system to a performance pay scheme that pays providers more for seeing more patients while also rewarding the complexity of their patients' medical situations. We focus on two key questions in evaluating the effects of this change: First, does average productivity rise under piece rates? Second, what channels led to that increase? Specifically, we consider changes in the composition of the workforce, strategic manipulation of compensation schemes by differentially productive employees, and providers' direct responses to the change in individual-level incentives.[3]

[1] This approach has been shown to lead to unintended consequences, such as cheating, in some settings (Jacob and Levitt 2003).

[2] As discussed in Prendergast (1999), the typical piece rate setting involves "'simple' jobs, in the sense that aggregate measures of performance are available".

[3] Lazear (2000) similarly examines the importance of changing composition and individual incentives, finding that each contributes roughly half of the total 44 percent increase in output that accrued to the firm.

Our empirical approach leverages the staggered rollout of the performance pay plan. While incumbent providers were all expected to switch to the new compensation scheme in a single month, providers hired after January 2008 were given at least a year to build their panel of patients while collecting a traditional salary. These implementation details lead to two key components of our identification strategy. First, the timing of participation in the piece rate scheme varies at the individual level, largely based on the provider's hire date. As a result, we are able to include very flexible time controls to absorb the influence of patient demand or other common time-varying unobservables that affect provider output. Second, we are able to observe output for most individuals under both the salary system and the piece rate system. We can therefore make within-person comparisons to determine whether individual providers are more productive when their pay depends on their output.

After controlling for demand conditions and for new hires' gradual increase in output as they build their portfolio of patients, we find that providers on the performance plan see roughly 18 percent more patients on a monthly basis. Less than five percentage points of that difference, however, results from within-person changes in productivity. Further, roughly half of the observed within-provider change in productivity is due to strategic self-selection into the piece rate plan. When we isolate the incentive effect by using a provider's expected participation based on a company-wide rule of thumb as an instrument for the provider's actual monthly status, we find a very small increase in output that cannot be distinguished from zero. We also present direct evidence that higher productivity workers were more likely to start the piece rate plan on time while lower productivity workers were more likely to negotiate a delay.

We conclude, therefore, that the largest mechanism behind the piece rate plan's increased productivity was an increase MSCHC's ability to hire and retain high productivity providers. The individual-level incentive effect was negligible, but the center as a whole was able to see more patients as a result of the piece rate plan. We also find that the piece rate plan did not

lead to negative consequences such as poorer quality coding of service provision for billing purposes or providers falling behind on administrative tasks. We do find evidence, however, that the piece rate compensation encouraged providers to see more patients with relatively low complexity medical issues, which is potentially an unintended consequence.

These findings contribute to multiple strands of the literature. First, our results complement the findings of studies of similar compensation changes for workers with rote jobs by finding that piece rates allow firms to recruit more productive individuals (Lazear 2000, Shearer 2004). In contrast to those studies, we find no evidence that incentive effects are important in a high-skilled setting where employees perform a variety of tasks and have substantial independence over how they complete their duties.

Second, we provide a novel empirical contribution to the literature examining the impact of monetary incentives in settings where individuals may have strong intrinsic motivation (Gneezy, Meier and Rey-Biel 2011). Our empirical results from a real-world setting are especially relevant to the strand of the literature related to the role of incentives in mission-oriented jobs, which has relied primarily on laboratory experiments. As laid out nicely in Carpenter and Gong (2016) and in Jones, Tonin and Vlassopoulos (2018), economic theory predicts that the impact of pay-for-performance incentives is likely to be substantially diminished in settings where employees are working in an organization whose mission aligns with their values. Many medical providers have prosocial motivations, and such providers are likely overrepresented in an FQHC setting that exists to provide care to patients who are uninsured, underinsured, or otherwise underserved. In particular, we confirm that incentive effects are relatively unimportant, with no evidence that individual productivity increases under piece rates. We do, however, find substantial composition effects, which suggest that even in mission-oriented fields, there is scope to recruit more productive individuals.[4]

[4]We are unable to determine whether sorting also occurs on the prosocial dimension, which has been shown in some experimental settings (Jones et al. 2018). It is certainly possible that prosocial motivation and productivity (as measured by number of patients who can be seen in a day) are negatively correlated.

Finally, our results are most directly related to a growing literature that examines the effects of incentives for medical providers in particular. The most closely related paper is Barro and Beaulieu (2003) who examine the effect of a profit-sharing compensation scheme on physician performance. Our conclusion that selection is important confirms their finding, and, relative to their design we have provider-level data, which allows us to demonstrate directly a lack of evidence for an incentive effect. Similarly, Dumont, Fortin, Jacquemet and Shearer (2008) examine changes in productivity around a policy change in Quebec that allowed physicians to move from a full fee-for-service compensation system to pay that provided a daily floor and a more moderate increase in pay with each service provided. Relative to their approach, we use an instrumental variables approach to account for within-person selection on unobservables, and we find evidence that nearly all of the observed within-provider differences in productivity are due to such selection. In addition, previous studies have looked at the effect of encouraging providers to meet quality metrics or other specific clinical targets (Mullen, Frank and Rosenthal 2010, Li, Hurley, DeCicca and Buckley 2014). These papers find only modest effects of these incentives on provider behavior.[5] Relative to all of these studies, our paper is unique in its ability to leverage within firm-month variation in the incentive scheme because the timing of the change to the incentive plan in our context was unique to the individual provider.

The remainder of the paper is structured follows: the next section provides more information on the performance pay plan and on the data available; Section 3 provides descriptive results; Section 4 provides the main empirical results; Section 5 concludes and discusses the implications of the results.

If that were true, the results in this paper would also be consistent with that experimental evidence.

[5]In a different but related context, Alexander and Schnell (2019) find that increasing providers' reimbursement rates from insurance affects their willingness to see patients covered by that insurance.

2 Background

2.1 Community Health Centers and Piece Rate Compensation

Community Health Centers (CHCs) form the core of the health care safety net in the United States, providing comprehensive primary and preventative care services to individuals regardless of their health insurance status or ability to pay. Given their mission, CHCs must be located in federally designated medically underserved areas or serve medically underserved populations. As a result, a large share of CHC patients are on Medicare or Medicaid.

Importantly for our study, CHCs are designated as Federally Qualified Health Centers (FQHCs), which provides them with special reimbursement rates for Medicare and Medicaid patients. During the time frame of our study, FQHCs received a fixed all-inclusive reimbursement fee for each visit by a Medicare or Medicaid patient, regardless of the complexity of the visit (Ku, Cunningham, Goldberg, Darnell, Hiller, Shin, Levy, Buchanan and Byrne 2012). This is in contrast to private practices that tend to be reimbursed based on the complexity of the visit.

Our data comes from a single Community Health Center that employs about 100 medical providers (physicians, nurse practitioners etc.) across multiple office locations. In an effort to align the incentives of their healthcare providers with the federal reimbursement system, MSCHC altered their employee compensation plan. Initially, all medical providers received a flat annual salary that had no direct relationship with output volume. Starting in late 2007, existing employees were transitioned to a piece-rate scheme that paid providers based on two components: 1) the number of patient visits; and 2) the difficulty of each visit (relative value units). At the same time, providers transitioning to the piece-rate scheme were provided an initial guarantee of their previous base salary. If after one year on piece-rate pay the individual's piece-rate earnings were significantly below the salary guarantee, they would receive a corresponding cut to their baseline pay for the subsequent years. If their piece-rate

pay was above the guarantee, they received the difference with no cap on compensation.

Implementation of the piece-rate compensation plan occurred in staggered fashion. Incumbents were scheduled to transition to piece-rates in January 2008. New hires were initially placed on salary, before being transitioned to the piece-rate scheme at the beginning of the next quarter following twelve months of employment. For example, a provider hired April 12, 2008 would be scheduled to start piece-rate pay July 1, 2009. Finally, providers from a site acquired in 2013 were scheduled to transition in January 2014. In practice, deviations from the rollout plan were reasonably common, with some providers adopting piece-rates early and others receiving delayed starts. We explore the possibility of strategic manipulation in the analysis section.

2.2 Data Source

Our primary data is derived from personnel files that document the number of patient encounters for each medical provider every month. While multiple measures of output exist, encounters (the number of patient visits) is the most common measure analyzed in the literature. Additionally, encounters comprise the largest component of the piece-rate scheme because they are the output measure that FQHCs are reimbursed for when seeing Medicare or Medicaid patients. To account for part-time workers, we normalize the output measure to encounters per full-time equivalent (FTE).[6] Thus, a full-time physician with 400 encounters in a month is treated as equally productive compared to a half-time physician with 200 encounters.

The panel data on output is linked to a personnel record for each employee that includes

[6]Full-time equivalent status is missing for about 9% of the sample. Because changes to FTE for a given employee are exceedingly rare - occurring only five times during our sample period - we interpolate missing values in the following manner: missing FTE at the end of an employment spell is replaced with the last observed FTE for that individual. Missing FTE at the start of an employment spell is replaced with the first observed FTE. Missing FTE in the middle of an employment spell is replaced with average FTE for that employee.

time-invariant information on that individual. Characteristics include sex, degree year, date hired, and provider type. The MSCHC employs two categories of medical providers: physicians and advanced practice providers (nurse practitioners and physician assistants). While duties can vary, in this setting both types of providers independently see patients and maintain control over their day-to-day schedule.

Our sample consists of all medical providers in positions eligible for piece-rate pay at the MSCHC over the period from 2007-2014. We exclude employees who are primarily administrators and providers working at walk-in clinics who do not develop and maintain their own panel of patients. We drop observations missing provider characteristics, person-months of known leave, and presumably incomplete records of encounters (fewer than 30 monthly encounters for employees with over 6 months tenure).[7] The cleaned sample consists of 3,921 person-months for 96 unique providers.

3 Descriptive Results

The first large shift to piece rates occurred in 2008, with approximately 45 percent of provider-months in piece-rate status. This share rises over our analysis period, reaching a maximum of 78 percent in 2014. Importantly, there are a substantial number of provider-months in salary status throughout the period of the data.[8] A portion of the salaried months are due to new hires who were exempt from the piece rate until the start of the first quarter after they had worked for MSCHC for 12 months. The remainder of these provider-months are due to individuals who were scheduled to be on the piece-rate plan but who managed not to be. We explore the implications for endogenous selection onto a particular scheme in the next section. Specifically, we develop an instrument for piece-rate compensation based

[7] Only 2 observations are dropped due to exceedingly few encounters.

[8] Figure A-1 in the appendix provides an annual breakdown of provider-months in each compensation status in each year from 2007-2014

on the normal adoption schedule for employees. Further, we directly examine differences in "permanent" productivity for individuals based on whether they comply with the intended compensation scheme.

Table 1 provides summary statistics for the variables used in our analysis. The typical provider sees 220-260 patients per month (the typical full-time provider sees roughly ten percent more than this average), and the unadjusted averages show that monthly encounters are higher when providers are paid via the piece rate plan.[9] Table 1 further reveals that most covariates are balanced between the two regimes, with the notable exception of tenure. Salaried observations are disproportionately drawn from providers who are relatively new to MSCHC. Because it takes time to build a panel of patients, properly accounting for the role of tenure is a key component of our analysis. We control for tenure flexibly by including individual dummy variables for each month of tenure up to month 9 and grouping months higher than that into a single "experienced employee" category. Appendix section A-2 provides more detailed analysis supporting this empirical approach.

4 Main Results

4.1 Results for Number of Visits

Column (1) of Table 2 presents OLS results from a regression of the natural log of encounters per FTE on an indicator for whether the provider is on the piece rate scheme along with other controls. These results indicate that individuals who are paid via piece rates are more productive, producing roughly 17 percent more patient encounters compared to similar individuals paid on salary. This difference in productivity derives from three potential sources. First, the piece rate scheme may increase the average productivity of MSCHC's workforce by

[9]Appendix Figure A-2 shows the entire distribution of productivity by regime with the piece rate distribution notably shifted to the right.

incentivizing higher productivity providers to join and lower productivity workers to leave. Second, conditional on working for MSCHC, more productive individuals may be attracted to the piece rate scheme and agree to participate rather than taking steps to remain on salary. Third, the incentives created by the piece rate scheme may directly affect a given provider's choices about how many patients to see. The remainder of the results are structured to systematically isolate one or more of these components.

The specification in column 2 adds individual fixed effects as additional controls. These fixed effects remove the influence of changes in the composition of MSCHC's workforce due to the piece rate scheme. These results compare providers' productivity when they are on the piece rate scheme to their own productivity when they are on salary. The differential productivity represented by the coefficient on piece rates therefore includes any within-person selection into the piece rate scheme as well as any incentive effect. Notably, the coefficient is much smaller – the typical provider sees only five percent more patients when paid via piece rates compared to when they are paid via salary. Thus, much of the increased productivity revealed in column (1) comes from the selection of employees into the workforce at MSCHC.

4.1.1 IV Strategy and Results

In order to further isolate the incentive effects of piece rate compensation, we use the planned timing of the switch to the incentive plan as an instrument for how a provider is compensated in a given month. Recall that there were two different rules of thumb for when a provider was expected to leave the salary plan to join the piece rate plan. For new hires, the provider was expected to join the piece rate plan at the start of the first quarter following their completion of twelve months at MSCHC. Incumbents, who were all paid on salary at the time the policy change was announced, were expected to switch in January 2008.

There are three sources of non-compliance with this expectation. First, some providers managed to start the piece rate plan ahead of schedule. Second, many incumbents were

able to avoid switching into the piece rate plan in January 2008 – only about 50 percent of providers participated in January, even though more than 80 percent were scheduled to based on the rule of thumb. Finally, some new hires did not switch to the piece rate on time.[10] There was therefore a noticeable amount of manipulation in the timing of the transition into piece-rates, but much of the variation in compensation scheme was driven by the plausibly exogenous rule of thumb. Non-compliance with the rule of thumb likely derives from two sources. First, individuals may manipulate their joining date based on their permanent productivity. Highly productive individuals may attempt to join early while lower-productivity individuals will prefer to delay. Second, providers may respond to known within-person variation in productivity. For example, a provider with a variable childcare situation may attempt to time their transition to coincide with a more reliable schedule.

Columns (3) and (4) of Table 2 present the corresponding IV results to columns (1) and (2). As expected, these specifications feature strong first stages, and each of the IV coefficients is less positive than the corresponding OLS coefficient, which is consistent with the interpretation that more productive providers self-select into piece rate pay. The specification in the fourth column isolates only the individual incentive effect by making within-provider comparisons and eliminating within-person selection into the piece rate plan. The resulting coefficient demonstrates that the individual incentive effect is small in magnitude – slightly more than a 2 percent increase, or roughly 4-5 additional monthly encounters on average. This effect is statistically indistinguishable from zero. Notably the point estimate in column (4) is roughly half as large as the coefficient in column (2), which implies that self-selection into the piece rate scheme contributes a large portion of the observed within-person difference in productivity.

Figure 1 provides a visual representation of the data underlying the reduced form of the

[10] Appendix Figure A-4 provides additional descriptive evidence showing what share of MSCHC's providers were scheduled to be on the piece rate scheme and what share actually were.

IV specification in column (4) of Table 2. In this figure, observations are split by incumbency because the expected switch to the piece rate plan came at different points in a provider's tenure depending on their hire date. The x-axis is measured in months with Month 0 corresponding to the month an individual was scheduled to begin the piece rate scheme. The circles represent average residuals from a regression of log encounters per FTE on individual fixed effects and month × year dummies. For the new hires, productivity is generally lower in months prior to the rule-of-thumb-based expected start date but this difference merely mirrors the typical tenure profile (see Appendix Figure A-3). There is no discernible difference in productivity comparing observations to the right of zero to observations just to the left of zero when providers have built a panel of patients. Panel (b) shows similar analysis using incumbents. Typically these providers had built a panel of patients well before they were supposed to switch to the new compensation plan; thus, the tenure profile in productivity does not affect the mean number of encounters shown to the left of zero. As with the new hires, there is no noticeable change in productivity associated with a move to the right of zero, which again suggests that the individual incentive effects were small.

Figure 2 provides direct evidence that providers who do not comply with the rule of thumb have lower productivity. The figure is constructed similarly to Figure 1, but the regressions omit the individual fixed effects. We then average the residuals separately for two sets of providers – the red circles represent providers whose compensation plan always matches the rule of the thumb; the blue circles are providers who had at least one month of non-compliance. In nearly every month, compliers are more productive than are non-compliers.

The totality of these results therefore provide a straightforward decomposition of the overall observed difference in productivity between person-months when a provider is on salary compared to person-months subject to the piece rate. Of the total 17.7 percent increase in encounters, only 2.4 percentage points are due to providers' responses to the

incentives of the piece rate scheme. An additional 2.4 percentage points are due to within-person selection or timing effects, with providers choosing to join the piece rate scheme for months when they are more productive. The remaining 12.9 percentage points in higher productivity results from changes in the composition of the provider workforce, likely through better retention of high productivity providers.

4.2 Results for Case Complexity

One remaining question is whether the difficulty or complexity of patient encounters (as measured through relative value units or RVUs) changes as a result of the piece rate plan. Because RVUs were directly rewarded in the piece rate compensation plan, providers may have sought to increase their average complexity, either by intentionally treating more difficult patients and/or by more aggressively "upcoding" the complexity of the patients that they see. Alternatively, a provider may have sought out less complex medical situations in order to treat their patients more quickly and thereby increase the number of patient encounters. Table 3 addresses this question using the same specifications as Table 2 but with the provider's monthly average RVUs as the dependent variable.

The coefficient in column (1) reveals no difference in average visit complexity when comparing salaried provider-months with piece rate provider months. Importantly, this lack of a difference results from offsetting forces. Column (4) reveals that the individuals respond to the piece rate incentives by lowering their average RVUs by 0.11 – roughly a four percent decline. Before correcting for endogenous timing of the piece rate switch, however, the within-person difference was smaller (-0.06 in column (2)), which implies that providers avoiding the piece-rate scheme tend to have lower complexity visits. A comparison of the results in columns (1) and (3) shows that the selection into employment at MSCHC works similarly – those who see more complex patients are overrepresented among the person-

months compensated using piece rates.

One long-recognized concern with incentive-based contracts is that workers may increase output on incentivized tasks while neglecting other duties (Holmstrom and Milgrom 1991). One method to protect against reduced quality in other dimensions is through quality monitoring. MSCHC monitored quality under both regimes, and we examined compliance with these requirements as additional outcomes. The analysis mirrors the specifications from Table 2 with two minor exceptions. First, data availability begins in 2009, creating a shorter panel. Second, coding audits occur quarterly, generating a panel with fewer observations per provider relative to the baseline monthly panel. For both of these additional outcomes, the point estimates on piece rate status are uniformly positive across specifications, although the standard errors are large. There is therefore no strong evidence that the piece rate scheme affected performance on these metrics.[11]

We therefore conclude that there is no evidence that piece rates led to shirking on other dimensions. This finding could result, in part, due to the mission orientation of the jobs we study, with providers committed to quality job performance on all dimensions because the job aligns with their sense of mission. It is also plausible that this additional monitoring reduced the incentive response by limiting the degree to which providers could re-allocate their effort within a given amount of time.

5 Conclusion

In this paper we found that a pay-for-performance plan increased the number of patient visits produced by providers at a Federally Qualified Health Center. Importantly, nearly all of the increase in productivity occurred due to changes in the composition of personnel. Our individual-level data and within-firm-month variation in incentive plan status allow us

[11] These results are included in Appendix Tables A-2 and A-3.

to demonstrate that within-provider changes in patients seen are small. Further, a large portion of that change derives from selective entry into the piece rate plan rather than from the incentives themselves.

These results provide new evidence on the effectiveness of piece rates in a mission-oriented setting, demonstrating that the incentive effects are weak. Our findings suggest that providers are unwilling to change their method of practicing medicine in response to the incentives. This reluctance could occur if, for example, providers recognize that they could increase quantity by reducing quality, but they are unwilling to do so because of the financial risks (malpractice lawsuits) and social costs (worse health outcomes for patients). Nevertheless, we demonstrate that MSCHC was able to increase the number of patient visits it produced by selecting individual providers whose practice methods allow them to see more patients. Although we find no evidence that the incentive scheme selected providers who put in less effort on other dimensions of the job (coding accuracy and paperwork), additional research is needed to determine the effects on patient outcomes.

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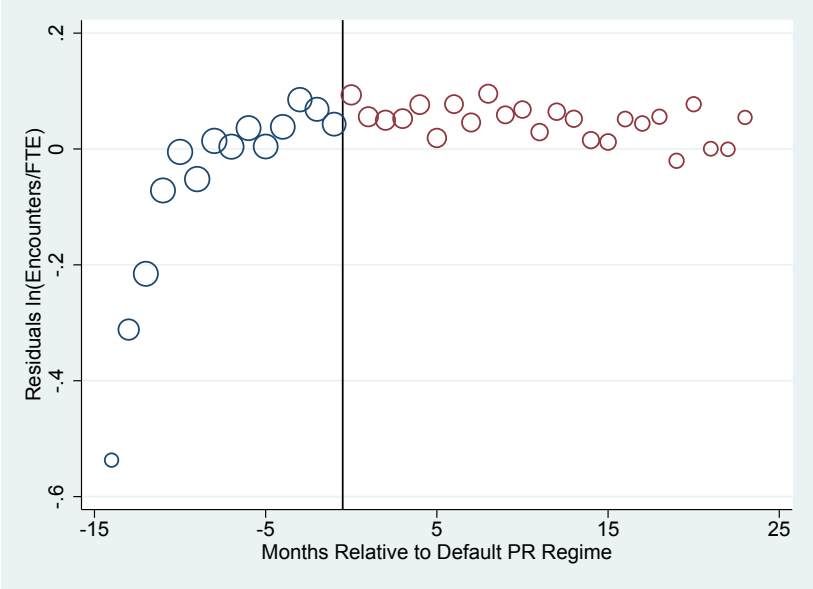
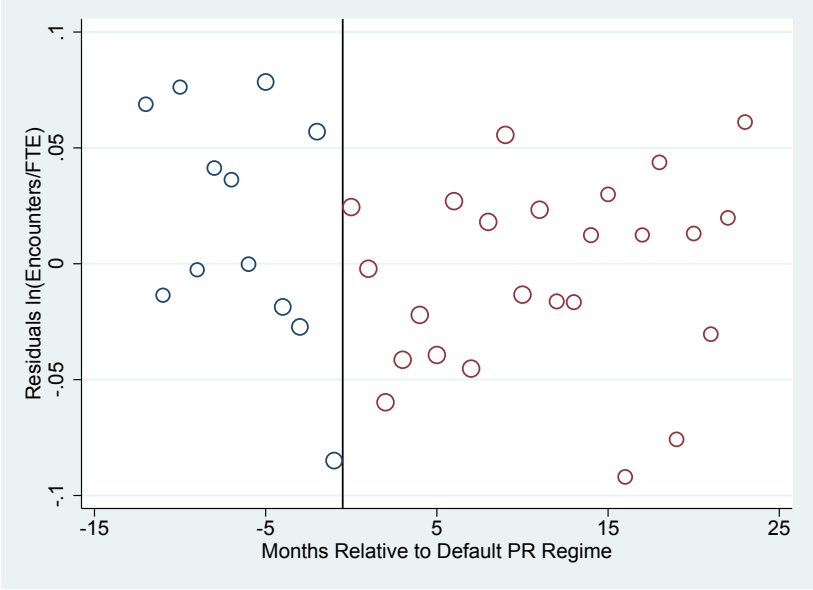
Figure 1: Reduced Form Results - Productivity Relative to Rule-of-Thumb Start Date for Piece Rates

(a) New Hires

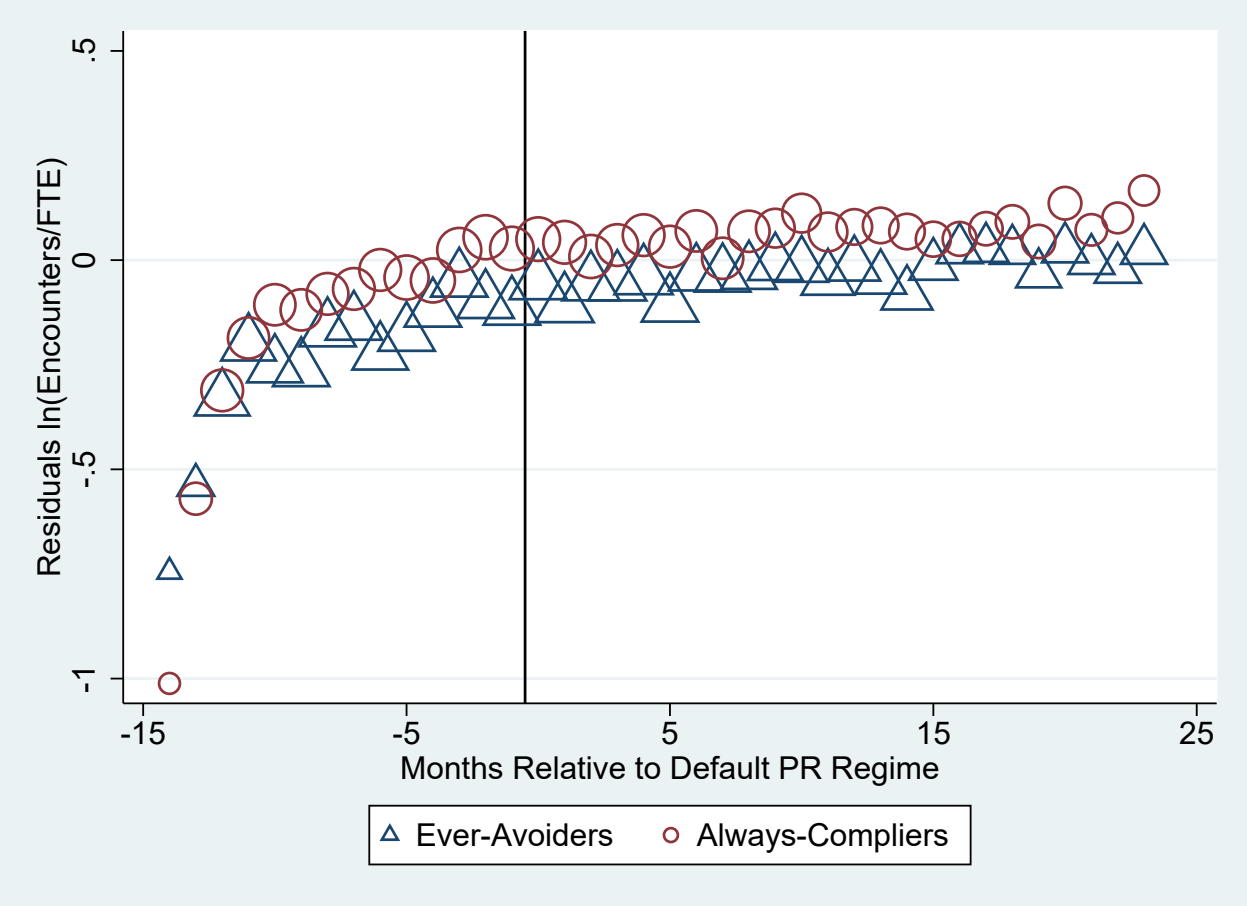


(b) Incumbents



See the text for a complete description of data sources. Each dot represents the average of residuals from a regression of log(encounters/FTE) on individual fixed effects and time controls. Time control for panel A are month x year dummies. Time controls for panel B are month dummies because incumbents were scheduled to shift on the same date. The x-axis is measured in months and shows the time relative to when the rule of thumb suggests the provider should have transitioned onto the piece rate compensation scheme. New hires were hired after January 1, 2007. Incumbents already worked for MSCHC on December 31, 2006 or were existing employees at site acquired in 2013.

Figure 2: Reduced Form by Avoiding Status: Non-Compliers Are Lower Productivity Providers



See the text for a complete description of data sources. Each dot represents the average of residuals from a regression of log(encounters/FTE) on month × year dummies. Larger dots indicate larger underlying monthly samples. The x-axis is measured in months and shows the time relative to when the rule of thumb suggests the provider should have transitioned onto the piece rate compensation scheme. Ever-Avoiders have at least one month in a non-compliance status. Always-Compliers are always compensated according to the rule of thumb.

Table 1: Summary Statistics

Variable	**Overall Sample**	**Salary**	**Piece-Rate**
Monthly Patient Encounters	239.0	219.5	250.7
	(98.6)	(103.0)	(94.0)
Monthly Encounters per FTE	262.9	238.4	277.6
	(91.3)	(99.61)	(82.6)
Average RVU per visit[a]	2.67	2.57	2.72
	(0.43)	(0.44)	(0.42)
Months Tenure	74.9	49.1	90.4
	(89.6)	(80.5)	(91.2)
Female	0.74	0.72	0.76
	(0.44)	(0.45)	(0.43)
Physician	0.50	0.53	0.48
	(.50)	(.49)	(.50)
Degree Year	1995.7	1996.6	1995.1
	(10.4)	(11.4)	(10.1)
FTE	0.91	0.92	0.90
	(0.18)	(0.17)	(0.18)
Piece-Rate Pay	0.62		
	(.48)		
Observations	3921	1474	2447

Standard deviations appear in parentheses below the mean. Sample of all person x months in jobs eligible for piece-rate pay with valid entries for every control variable. [a]Average RVU per visit was not recorded in 2007, n across columns is 3565; 1174; 2391.

Table 2: Productivity Differences Due to Piece Rates

	OLS		IV	
	Cross-Sectional	Individual FE	Cross-Sectional	Individual FE
	(1)	(2)	(3)	(4)
Piece-Rate Regime	0.177***	0.0478**	0.155***	0.0235
	(0.0365)	(0.0237)	(0.0499)	(0.0341)
Physician	0.0236		0.0223	
	(0.0436)		(0.0439)	
Female	-0.124		-0.122	
	(0.0797)		(0.0797)	
Observations	3,921	3,921	3,921	3,921
R-squared	0.261	0.232	0.260	0.231
Month x Year FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
Tenure Control	Months 1-9 Dummies		Months 1-9 Dummies	
First Stage F-stat			337.5	124.8

Notes: Dependent variable: Ln(Patient Encounters/FTE); Standard errors clustered at the employee level. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Piece Rates Lead to Lower Visit Complexity

	OLS		IV	
	Cross-Sectional	Individual FE	Cross-Sectional	Individual FE
	(1)	(2)	(3)	(4)
Piece-Rate Regime	-0.0122	-0.0559*	0.0149	-0.114**
	(0.0530)	(0.0318)	(0.0594)	(0.0455)
Physician	0.119**		0.121**	
	(0.0577)		(0.0564)	
Female	0.0232		0.0213	
	(0.0819)		(0.0797)	
Observations	3,565	3,565	3,565	3,565
R-squared	0.408	0.545	0.407	0.542
Month x Year FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
Tenure Control	Months 1-9 Dummies		Months 1-9 Dummies	
First Stage F-stat			268.1	93.89

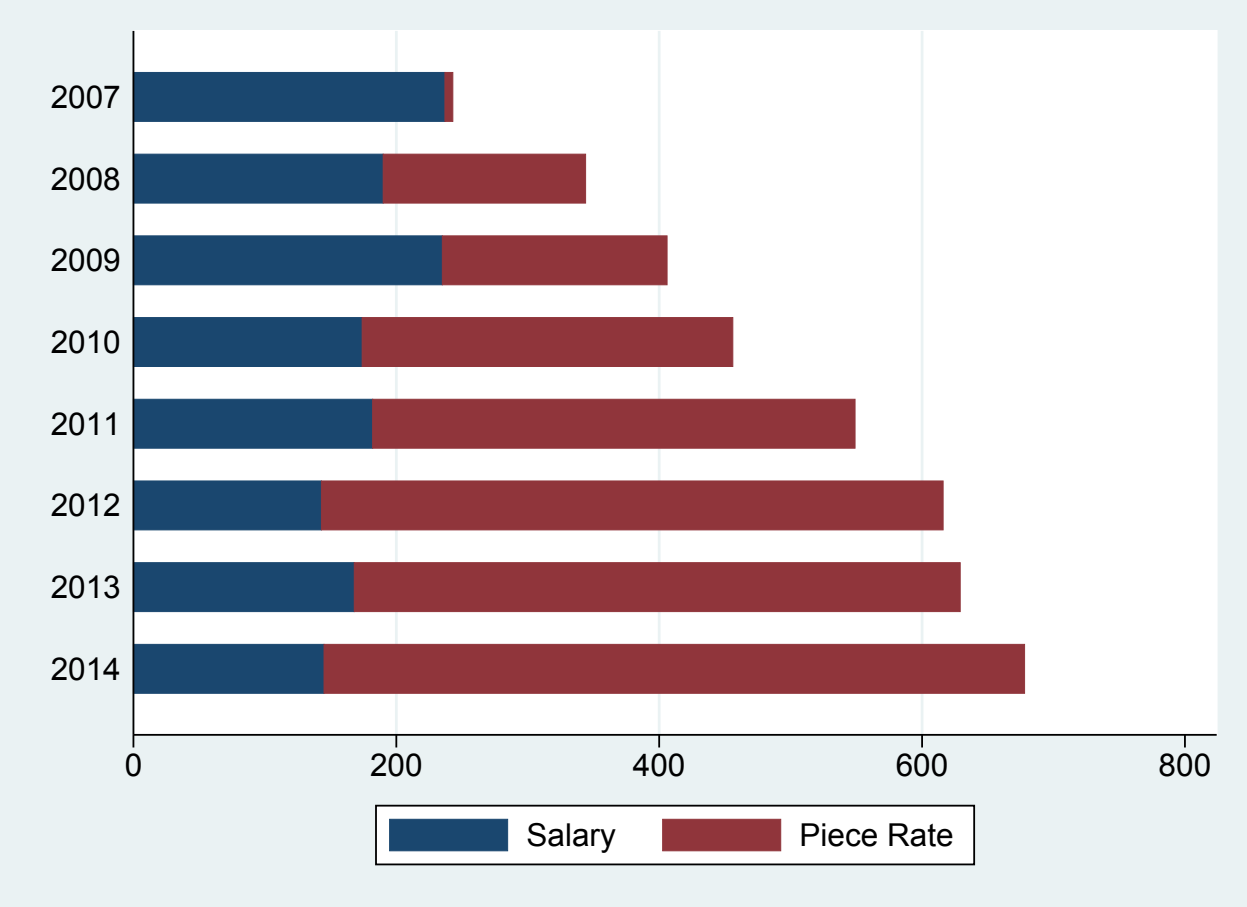
Notes: Dependent Variable: Relative Value Units per visit; Standard errors clustered at the employee level. *** p<0.01, ** p<0.05, * p<0.1.

Appendix - For Online Publication

A-1 Additional Descriptive Statistics

Figure A-1 shows the annual count of provider months under each payment regime. The largest change occurs between 2007 and 2008 when most existing employees were transitioned onto the piece rate plan. Eventually nearly 4 out of every 5 providers are compensated via the piece rate plan.

Figure A-1: Timeline of Identifying Variation: Observations by Pay Regime



See the text for a complete description of data sources. The bars show the number of provider-months compensated under either the fixed salary regime or the piece rate regime.

Figure A-2 shows the distribution of encounters/FTE for person-months under both compensation schemes, with the distribution for the piece rate scheme shifted noticeably to the right.

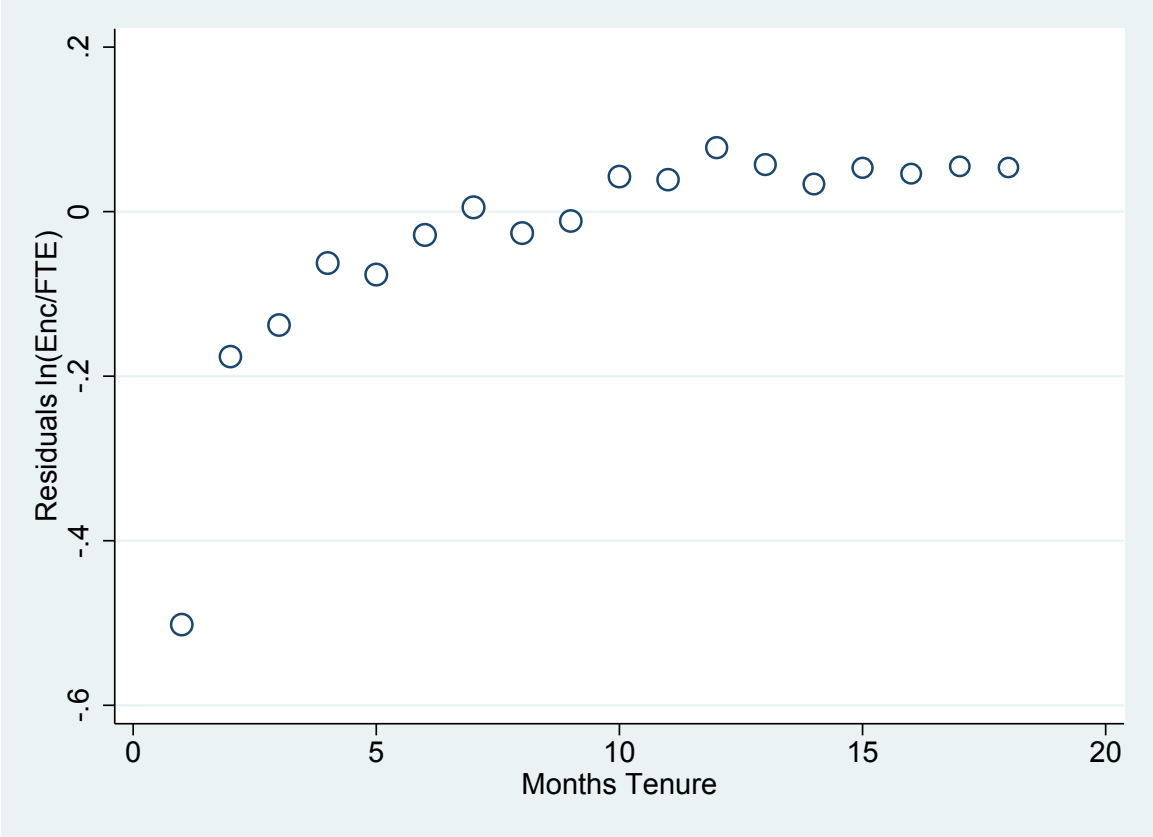
Figure A-2: Kernel Density of Output by Pay Regime

See the text for a complete description of data sources. The kernel densities show the distribution of productivity (measured as patient encounters per FTE) separately for each of the two pay regimes.

A-2 Controlling for provider tenure

Figure A-3 shows the tenure profile in productivity for all person-month observations with 18 months of tenure or fewer. To construct this figure, we first regress the natural log of encounters per FTE on individual fixed effects and a complete set of month × year dummies. We then save the residuals and average them by month. Each circle therefore represents the average within-provider difference in productivity for individuals in a given month of tenure, conditional on any changes in patient demand for services common across all providers in a given month. As expected, providers early in their tenure see many fewer patients, and encounters rise quickly over the first nine months. Beginning in month 10, however, encounters are roughly flat going forward. Therefore, in the main analysis, we control for tenure by including individual month dummies for the first nine months and then grouping later months into a single "experienced employee" category.

Figure A-3: Monthly Tenure Profile in Productivity - New Hires

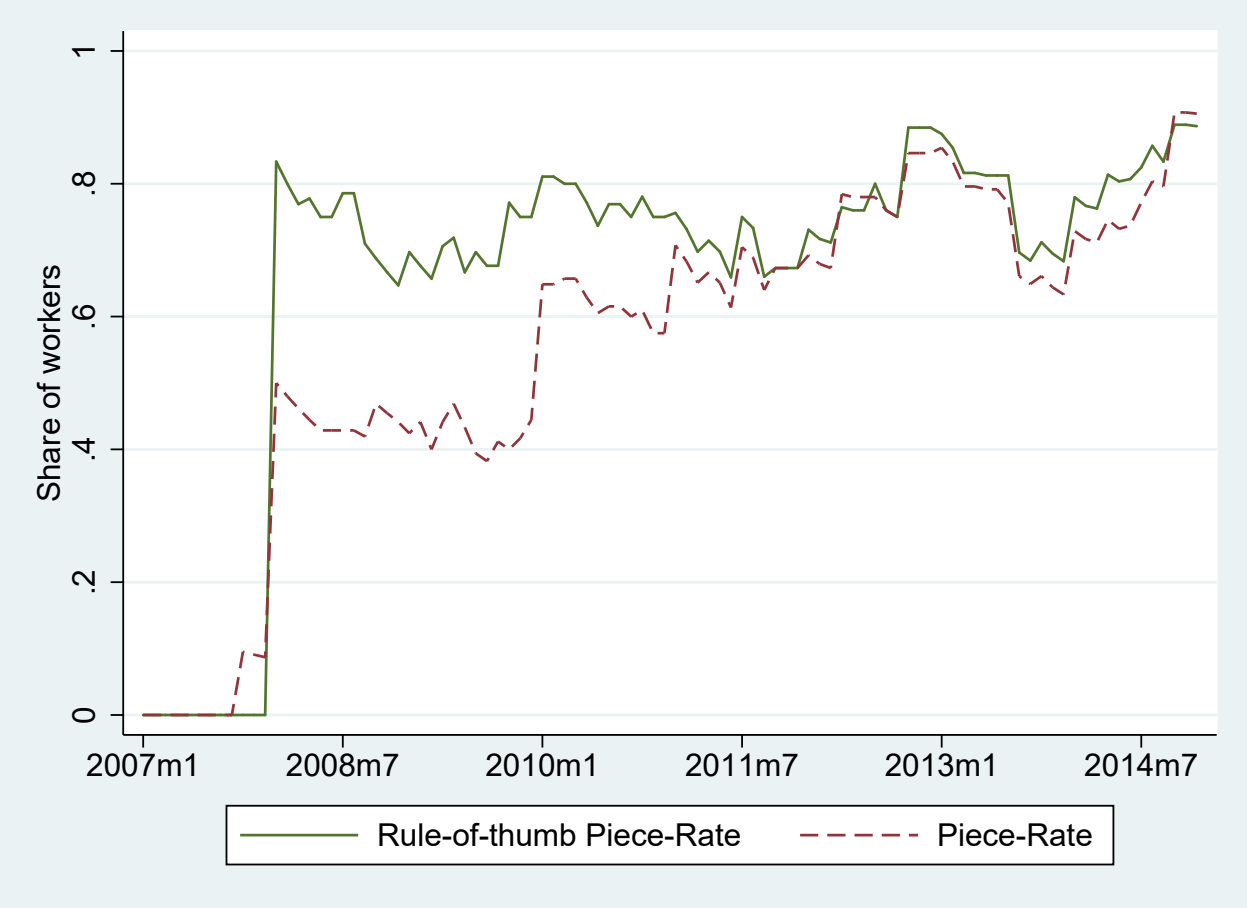


See the text for a complete description of data sources. Each dot represents the average of residuals from a regression of log(encounters/FTE) on individual fixed effects and month x year dummies using a sample of person-months when individuals had no more than 18 months of tenure. The x-axis is measured in months and shows the amount of time that has elapsed since the provider was hired.

A-3 Supporting evidence for main results

Figure A-4 shows expected (solid line) and realized (dashed line) participation rates in the piece rate plan by calendar month. The observations underlying this figure include both incumbents (hired prior to January 2007) and new hires. Although the lines closely track each other, there are notable differences between the two. The gap between the two lines shrinks noticeably as time progresses, primarily because incumbents were unable to delay the switch indefinitely and either accepted the piece rate compensation plan or left MSCHC.

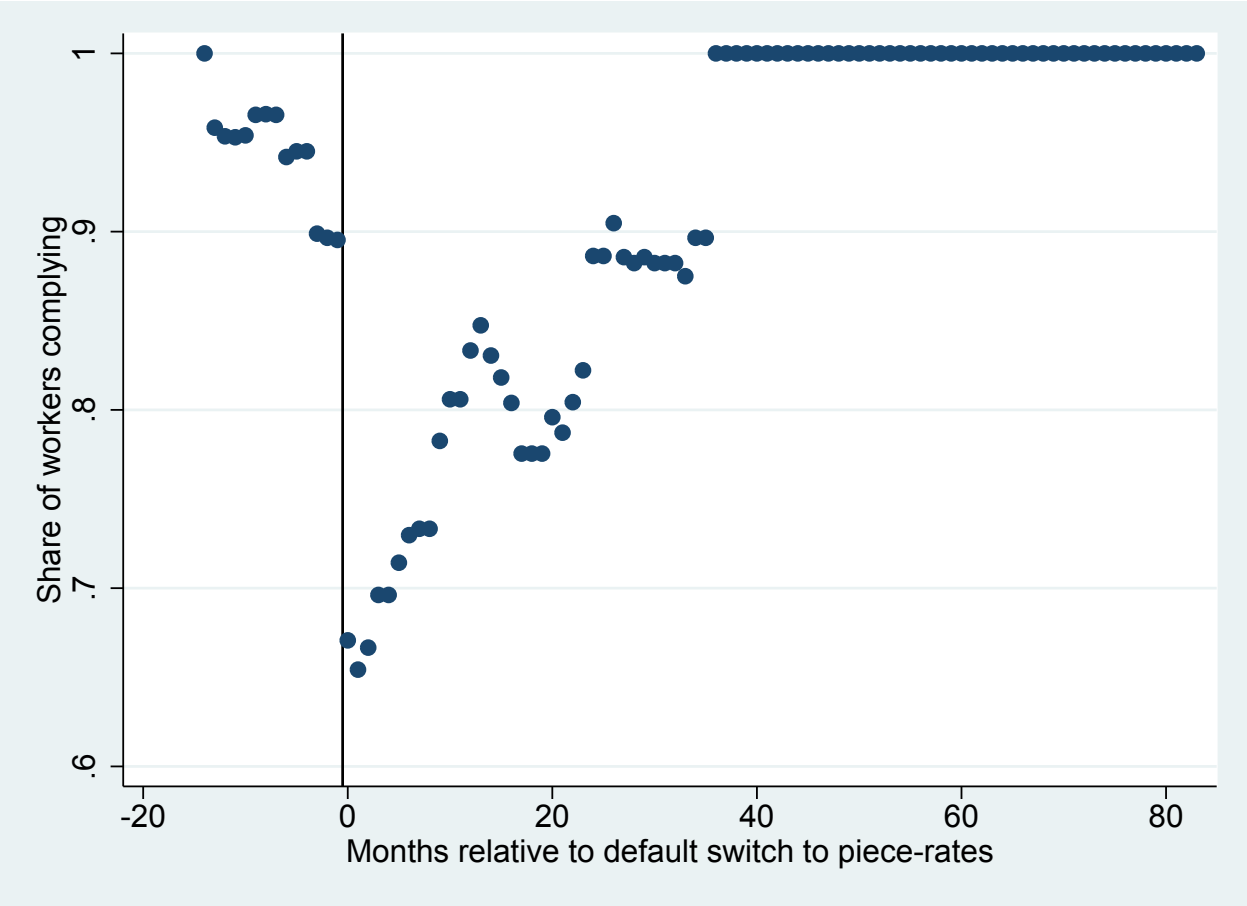
Figure A-4: Planned and Actual Participation in Piece-Rate Compensation Scheme - Calendar Months



See the text for a complete description of data sources. Each line represents the share of individuals intended to participate (green line) or actually participating in (red line) the piece rate compensation scheme. The x-axis is measured in calendar months. Variation arises within calendar months because the individual-specific intended start dates for the piece rate scheme depend on the individual's hire date.

Figure A-5 provides insight into how individuals managed to avoid complying with the rule of thumb. The figure shows monthly non-compliance rates with the x-axis measuring time relative to when a provider was scheduled to switch to piece rates. Non-compliance for months to the left of zero means that a provider was on the piece rate plan ahead of schedule while non-compliance to the right of zero means that a provider was not yet on the piece rate plan despite have been scheduled to switch. Although there is a small amount of early adoption, most of the non-compliance results from providers delaying the switch to the performance pay plan.

Figure A-5: Non-Compliance Usually Due to a Delay



See the text for a complete description of data sources. Each dot represents the share of providers complying with the rule of thumb assignment to salary or piece rates. The x-axis is measured in months and shows the time relative to when the rule of thumb suggests the provider should have transitioned onto the piece rate compensation scheme. Non-compliance prior to month 0 represents early adoption of the piece rate scheme. Non-compliance after month 0 represents workers paid on a salary despite becoming eligible for piece rates.

Table A-1 examines the sensitivity of the OLS results to way in which we control for provider tenure. Columns 1 and 4 include no controls for tenure. Columns 2 and 5 include a quadratic control. Columns 3 and 6, which match columns 1 and 2 of Table 2, respectively, include dummies for each of the first nine months, treating later months as a single "experienced worker" bin. Controlling for tenure flexibly makes a noticeable difference in the estimated coefficient. For example, in the first column, which includes no controls for tenure, participating in the piece rate scheme is associated with a roughly 28 percent increase in the number of encounters. Controlling for a quadratic in tenure reduces the coefficient somewhat, and including the individual month dummies motivated by Figure A-3 decreases the estimated difference to roughly 18 percent.

Table A-1: OLS Results - Productivity Higher Under Piece Rates

	Cross-Sectional			Individual FE		
	(1)	(2)	(3)	(4)	(5)	(6)
Piece-Rate Regime	0.282***	0.215***	0.177***	0.115***	0.108***	0.0478**
	(0.0349)	(0.0298)	(0.0365)	(0.0231)	(0.0227)	(0.0237)
Physician	0.0373	-0.000449	0.0236			
	(0.0444)	(0.0390)	(0.0436)			
Female	-0.130	-0.0525	-0.124			
	(0.0812)	(0.0414)	(0.0797)			
Observations	3,921	3,921	3,921	3,921	3,921	3,921
R-squared	0.198	0.282	0.261	0.127	0.132	0.232
Month x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	No	No	No	Yes	Yes	Yes
Tenure Control	None	Quadratic	Months 1-9 Dummies	None	Quadratic	Months 1-9 Dummies

Notes: Dependent variable: Ln(Patient Encounters/FTE); Standard errors clustered at the employee level. *** p<0.01, ** p<0.05, * p<0.1.

A-4 Auxiliary outcomes unaffected by piece rates

Tables A-2 and A-3 present the results of linear probability models examining the effects of the piece rate plan on passing the coding audit and paperwork requirements respectively. The specifications used in these tables mirror the specifications from Table 2 with two minor exceptions. First, data availability begins in 2009, creating a shorter panel. Second, coding audits occur quarterly, generating a panel with fewer observations per provider relative to the baseline monthly panel.

Table A-2: Insignificant Changes in Coding Quality Due to Piece Rates

	Cross-Sectional		Individual FE	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Piece-Rate Regime	0.0773*	0.0373	0.0453	0.0733
	(0.0399)	(0.0561)	(0.0422)	(0.0777)
Physician	-0.0419	-0.0426		
	(0.0393)	(0.0391)		
Female	-0.0264	-0.0236		
	(0.0424)	(0.0423)		
Observations	770	770	770	767
R-squared	0.171	0.169	0.192	0.192
Individual FE	No	No	Yes	Yes
Quarter x Year FE	Yes	Yes	Yes	Yes
Tenure Control	Quarter 1-3 dummies		Quarter 1-3 dummies	
First Stage F-stat		210.7		82.26

Notes: Dependent Variable: Dummy variable equal to one if the provider passes the coding audit; Observations at provider-quarter level; Data spans 2009-2014; Standard errors clustered at the employee level. *** p<0.01, ** p<0.05, * p<0.1.

Table A-3: Insignificant Changes in Paperwork Timeliness Due to Piece Rates

	Cross-Sectional		Individual FE	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Piece-Rate Regime	0.0785**	0.0744	0.0571*	0.0977
	(0.0383)	(0.0541)	(0.0313)	(0.0621)
Physician	-0.0195	-0.0197		
	(0.0370)	(0.0364)		
Female	0.0805	0.0807		
	(0.0606)	(0.0605)		
Observations	3,140	3,140	3,140	3,138
R-squared	0.076	0.076	0.043	0.041
Month x Year FE	Yes	Yes	Yes	Yes
Individual FE	No	No	Yes	Yes
Tenure Control	Months 1-9 Dummies		Months 1-9 Dummies	
First Stage F-stat		283.5		96.93

Notes: Dependent Variable: Dummy variable equal to one if the provider passes the unsigned documents audit; Observations at provider-month level; Data spans 2009-2014; Standard errors clustered at the employee level. *** p<0.01, ** p<0.05, * p<0.1.