ProComp Achievement Outcomes by Duration in ProComp

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INTRODUCTION

What is the nature of student achievement effects associated with teacher incentive-based compensation programs? The current study addresses one type of achievement effect (a productivity effect) associated with one of the nation's most prominent and longest-running teacher performance pay systems. The idea of an incentive program's "productivity" effect is that the availability of incentives will motivate participants to change their practice in some way that would lead to better outcomes (i.e., greater student achievement). ProComp's inclusion of incentives for knowledge and skill development might enhance likelihood of productivity effects, as teachers may receive added compensation not only for exceeding achievement expectations, but also for participating in the activities (e.g., completing Professional Development Units; pursuing advanced degrees) more likely to promote such achievements.

What about ProComp effects with the program's maturation? It is well known that school reform takes substantial time to gain traction and catalyze desired changes in behavior among participants; perhaps stable achievement effects associated with ProComp will appear only after several years have passed. On the other hand, several studies (see, e.g., Ariely, Gneezy, Loewenstein, & Mazar, 2009; Deci & Ryan, 1985; Lepper, Greene, & Nisbett, 1973), at least one of which is particular to teacher incentives (Glewwe et al., 2010), have suggested that incentive programs may foster short-term effects that are only transitory in nature.

This study builds on our previous studies by examining whether ProComp about changes in achievement effects for incumbent teachers. In particular, we take on the question of whether any observed ProComp effects are transitory or stable in nature.

METHODOLOGY

Achievement analyses focused upon panel student and teacher data for the eight school years 2001-02 to 2009-10; the district provided data on a rolling basis from Spring, 2006, to Spring, 2011. Data included information regarding school characteristics, teacher experience and demographic characteristics, student achievement and demographic characteristics, and student course-taking with links to individual teachers. Student Growth Percentiles (SGPs) from the Colorado Growth Model served as the achievement measure. SGPs are calculated based on mathematics and reading scale scores from the Colorado Student Assessment Program (CSAP; C. D. of Education, 2010b). The CSAP is designed to measure achievement relative to the Colorado K-12 Model Content Standards. Required of all students in grades three through ten, it serves as Colorado's state standardized assessment. CSAP scale scores follow a vertical scale established by the state's contractor; scores range from a minimum of 150 to a maximum of 999. The contractor has established benchmarks to delineate four performance categories specific to each grade; these are labeled “Unsatisfactory", “Partially Proficient", Proficient", and “Advanced". The district provided data for all students with CSAP scale scores.

DATA ANALYSES

Mathematics and reading achievement effects particular to individual teachers were estimated in by taking median Student Growth Percentiles achieved by students assigned to each individual teacher. The degree to which variability in these effect estimates might be attributable to ProComp was estimated via the general two-step process recommended by Rubin, Stuart, and Zanutto (2004).

MODELING ACHIEVEMENT ON PROCOMP PARTICIPATION

Estimated teacher effects based on SGPs were subsequently modeled on ProComp participation. Participation in ProComp was not random; upon implementation, incumbent teachers (those employed at the district as of 12/31/05) could choose whether to opt into the program. To address the potential for selection bias due to the voluntary nature of the reform, I employed a propensity score matching strategy (PSM; Rosenbaum, 2002; Rosenbaum & Rubin, 1983). Matching was carried out on the basis of teacher characteristics, experience, and compensation variables, via generalized boosted regression (GBM; McCaffrey, Ridgeway, & Morral, 2004). GBM was chosen for this study primarily because of its superior performance in the presence of missing data.

RESULTS

Though ProComp is intended to affect all participating teachers, the student achievement analyses presented below pertain only to those teachers of math and reading in

grades 4 through 10. Estimates detailed in Tables 1 and 2 suggest the following patterns over the first five years of ProComp (measured in median SGPs):

Year 1: Small positive effects in favor of ProComp (+2.1) for math, with only marginal differences in favor of ProComp (+0.2) for reading.

Years 2-5: In reading, effects associated with ProComp participation increase in year two (to +1.9) then gradually fall in years three to five, at which point ProComp effects are negative (-2.5). A slightly different pattern emerges in mathematics; effects decrease in year two (to +1.2), increase slightly in year three (+2.2), then become negative in years four (-0.8) and five (-1.9).

DISCUSSION

The pattern of positive initial effects that subsequently fall is consistent with much of the literature on the effects of incentives on intrinsic and extrinsic motivation (Deci, Koestner, & Ryan, 1999, 2001), and subsequent performance (Ariely et al., 2009). Though it is tempting to conclude that a similar phenomenon is at play with ProComp, several other factors must first be ruled out before such a conclusion is supported. For example, ProComp includes incentives for improving one's practice by setting student growth objectives, completing specialized professional development, and other activities. It is possible that these channels did initially help ProComp teachers, leading to initial differences associated with ProComp participation that subsided as non-participants eventually gained similar experience and training. ProComp may also operate differentially for subsets of the teacher population (e.g., younger, more

recently graduated teachers). Analyses are currently examining additional questions, such the degree to which program effects vary as a function of characteristics of teachers; and the degree to which outcomes might be associated with particular ProComp incentives.

In considering these results it is instructive to consider DPS teachers' choices with regard to ProComp participation and attrition from CSAP-eligible positions (teachers of mathematics and/or reading in grades 4-10). These results provide evidence of the degree to which the composition of the CSAP-eligible workforce might be changing with the maturation of the ProComp program. Figure 1 details teachers' decisions with regard to ProComp participation and attrition. In general, among teachers incumbent as of 12/31/2005, attrition rates are roughly double for non-participants than for participants. Figure 2 details teachers' achievement effects in years leading up to their decisions to join or remain in ProComp, remain a non-participant, or leave their CSAP-eligible positions. In general, leavers have lower scores than both participants and non-participants.[1] Taken together, these results suggest that, despite little evidence for sustained productivity effects, ProComp may be affecting the composition of the CSAP-eligible teacher workforce as higher-performing teachers are drawn into the program while lower-performers tend to be more likely to leave their positions.

[1] Also evident in Figure 2 is the pattern reflected in the matched comparison results: achievement effects shift from favoring ProComp participants in the beginning of the program, to favoring non-participants in more recent years in the program.

SUPPORTING TABLES

Table 1: ProComp and Teacher Effects in Reading

		Estimate	Std. Error	t value	Pr(>|t|)
YEAR 1	(INTERCEPT)	50.1366	1.9102	26.25	0.0000
	TREATMENT	0.2039	4.4139	0.05	0.9632
YEAR 2	(INTERCEPT)	47.0057	1.5740	29.86	0.0000
	TREATMENT	1.9163	2.8299	0.68	0.4990
YEAR 3	(INTERCEPT)	50.5960	1.3493	37.50	0.0000
	TREATMENT	0.8416	2.5035	0.34	0.7370
YEAR 4	(INTERCEPT)	49.7743	1.1891	41.86	0.0000
	TREATMENT	-0.8865	2.3224	-0.38	0.7029
YEAR 5	(INTERCEPT)	52.3208	0.8302	63.02	0.0000
	TREATMENT	-2.5471	1.9495	-1.31	0.1920

TABLE 1.

Estimated Effects of ProComp on ProComp Participants (Reading): Years 1-5

Table 2: ProComp and Teacher Effects in Mathematics

		Estimate	Std. Error	t value	Pr(>|t|)
YEAR 1	(INTERCEPT)	46.7322	4.9454	12.63	0.0000
	TREATMENT	2.1321	2.173	0.92	0.4338
YEAR 2	(INTERCEPT)	50.5080	1.4606	36.14	0.0000
	TREATMENT	1.1880	2.3056	0.52	0.6070
YEAR 3	(INTERCEPT)	50.5080	1.5942	31.68	0.0000
	TREATMENT	2.1795	2.4637	0.88	0.3773
YEAR 4	(INTERCEPT)	49.5535	2.3290	21.28	0.0000
	TREATMENT	0.7566	2.7949	0.27	0.7869
YEAR 5	(INTERCEPT)	51.9908	1.8211	28.55	0.0000
	TREATMENT	-1.9327	2.3871	-0.81	0.4188

TABLE 2.

Estimated Effects of ProComp on ProComp Participants (Mathematics): Years 1-5

Figure 1. ProComp Participation, Retention, and Attrition

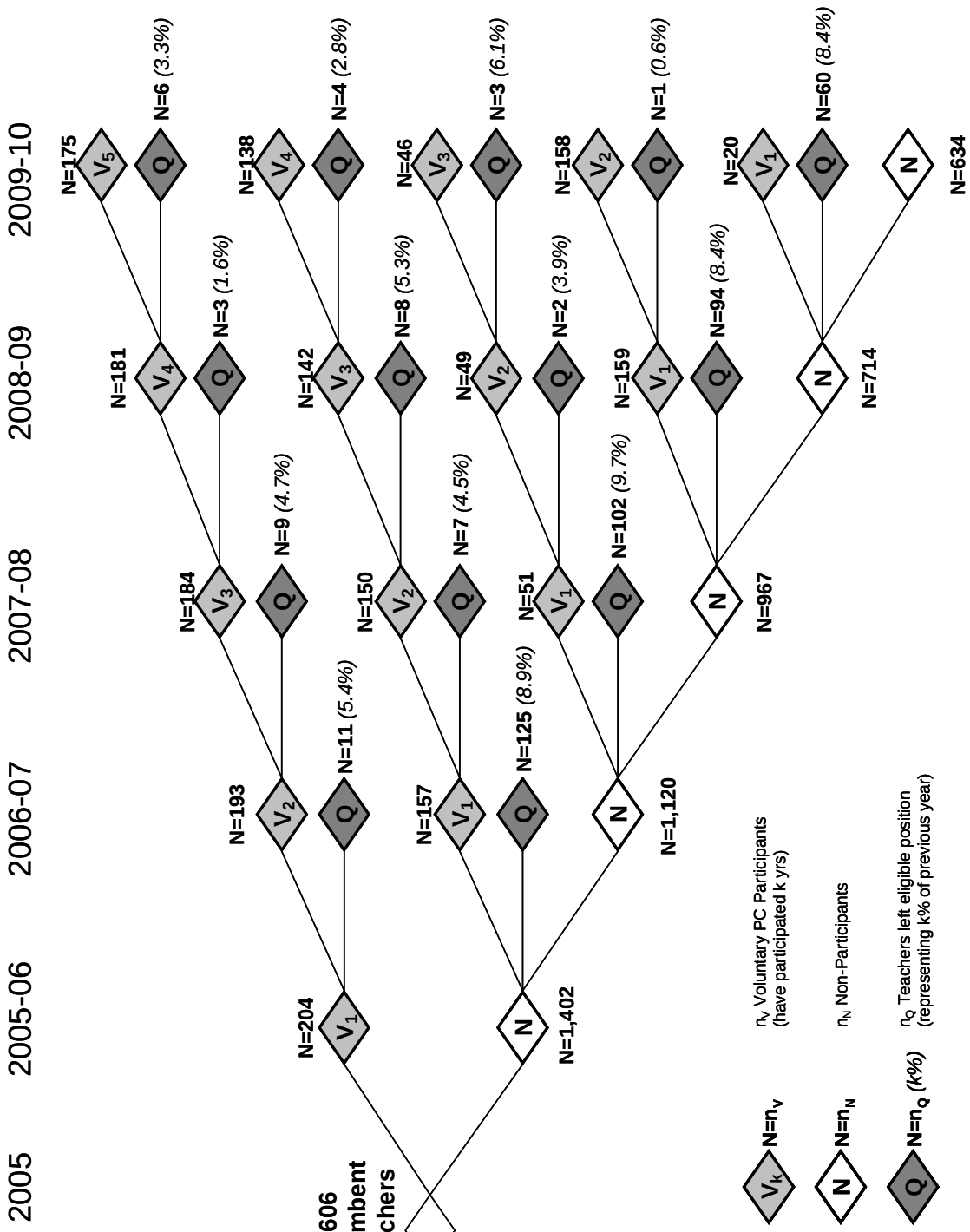
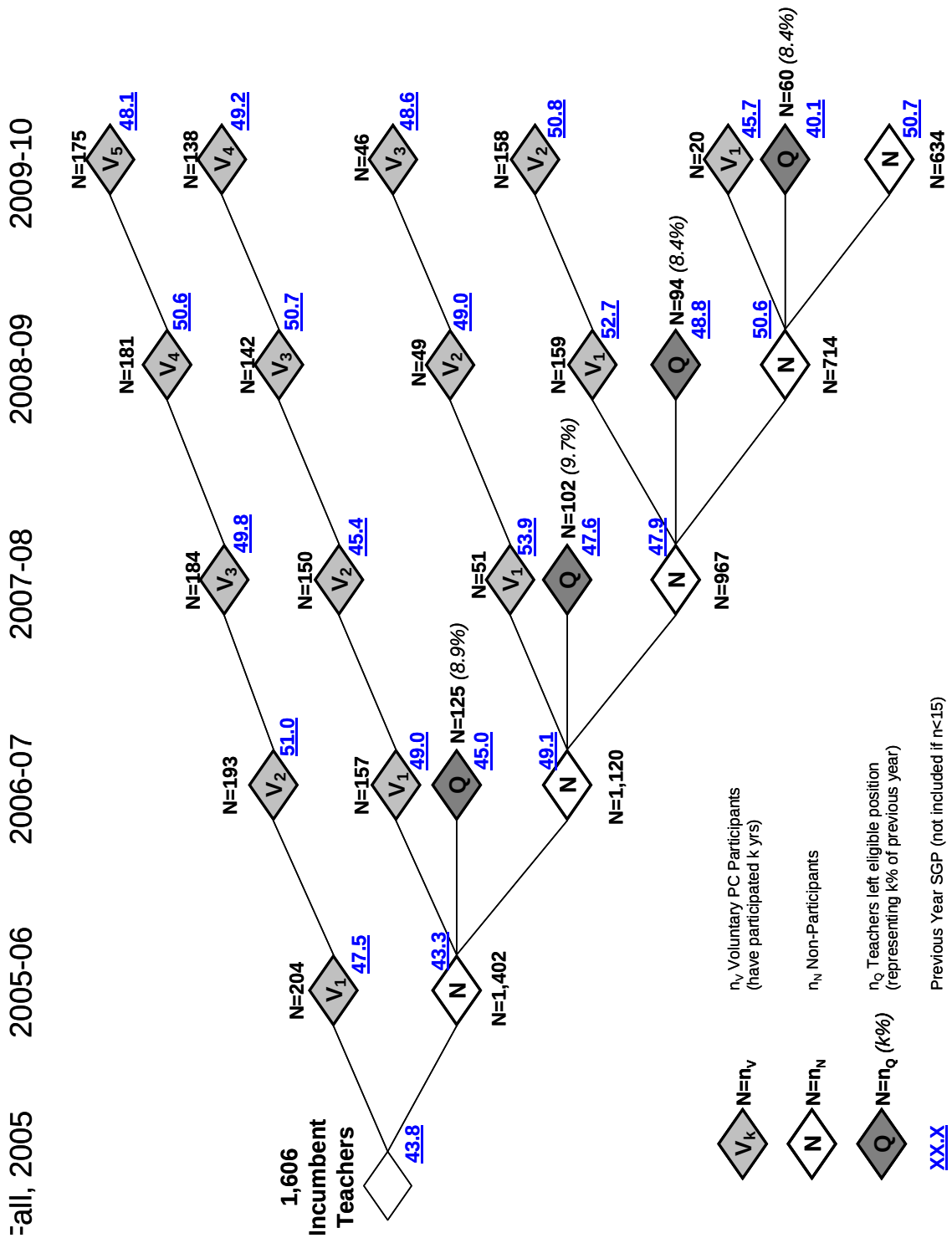


Figure 2. Achievement Effects for ProComp Participants, Non-Participants, and Leavers


Fall, 2005
2005-06
2006-07
2007-08
2008-09
2009-10
1,606 Incumbent Teachers
43.8
N=204
V1 47.5
N=193
V2 51.0
N=184
V3 49.8
N=175
V5 48.1
N=181
V4 50.6
N=138
V4 49.2
N=157
V1 49.0
N=150
V2 45.4
N=142
V3 50.7
N=125 (8.9%)
Q 45.0
N=46
V3 48.6
N=49
V2 49.0
N=1,402
N 43.3
N=51
V1 53.9
N=158
V2 50.8
N=102 (9.7%)
Q 47.6
N=159
V1 52.7
N=1,120
N 49.1
N=94 (8.4%)
Q 48.8
N=20
V1 45.7
N=60 (8.4%)
Q 40.1
N=967
N 47.9
50.6
N=714
N
N=634
N 50.7
Vk N=nV
nV Voluntary PC Participants (have participated k yrs)
N N=nN
nN Non-Participants
Q N=nQ (k%)
nQ Teachers left eligible position (representing k% of previous year)
XX.X
Previous Year SGP (not included if n<15)