How Career Concerns Influence Teachers’ Effort

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DECEMBER 9, 2009

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Teachers Not Rewarded for Output

- Input-based
- Not contingent on outcome
- Could create moral hazard where shirking is optimal

Source: Fairfax County School District, Fiscal Year 2009
Teacher Outputs Weakly Correlated with Inputs

1. Q: Do teachers’ effort levels respond to incentives?
   A: Yes, teachers respond as predicted by theory.

2. Q: Are the effects causal?
   A: Yes, external variation and additional measure of effort both show similar patterns.
Overview of Today’s Discussion

- Career Concerns, Incentives, and Teacher Effort
  - Theoretical predictions
  - Empirical evidence

- Generalized Model of Career Concerns
  - Career concerns on two dimensions
  - Discrete jump in effort

- Data and Methods
  - Teacher absences proxy effort
  - Teacher and school-year fixed effects
  - Exogenous variation from principal turnover
  - Unobservable measure of effort corroborates findings

- Conclusion and Discussion
Most evidence is *output* based
- Scores increase when rewarding on scores
- You get what you pay for

Few studies have addressed how teachers’ effort changes
- Few available studies rely on reported measures
- Only evidence from America shows adverse outcomes
Is Teacher Effort Driven by Career Concerns?

**Standard Approach**
- Teacher
  - Chooses Effort
    - High
    - Low

**Career Concerns Approach**
- Teacher
  - Choices today affect every subsequent payoff
Hölmstrom’s Model of Career Concerns

How it works:
1. The market learns of teachers’ ability over time.
2. Each observation increases the precision on ability.
3. Rewards are based on past performance.

What it predicts:
1. Incentives decline naturally with experience.
2. Effort declines accordingly over time.
Optimal Effort Path Under Career Concerns

![Graph showing the relationship between effort and experience with an optimal effort path for the market]

- **Effort** versus **Experience**
- **Optimal Effort for Market**
Review of Career Concerns Literature

- Persist across multiple types of contracts
  - Explicit Incentives (Gibbons & Murphy 1992)
  - Implicit Incentives (Murharjee 2008)
  - Multitask Moral Hazard (Dewatripont et al. 1999)

- Argued even more important in public sector
  - Lack of more formal output-based rewards (Tirole 1994)
  - Enhance intrinsic motives in inducing effort (Dixit 2002)
Generalized Model of Career Concerns

- Output is random, but directly observable to teacher and school only:

\[ y_t = \theta + e_t + \varepsilon_t \]

- Outcomes are reported to market, but imperfectly:

\[ z_t = \theta + e_t + \varepsilon_t + \eta_t \]
Predictions of General Model

- Market and school hold separate estimates of teacher ability

Market optimization: \( \sum_{j=t}^{\infty} \beta^{j-t} \frac{h_{(e+\eta)}}{h_j^m} = g'(e_t^*) \)

School optimization: \( \sum_{j=t}^{\infty} \beta^{j-t} \frac{h_{\varepsilon}}{h_j^s} = g'(e_t^*) \)

- Transferring to a new school renews a teacher’s career concerns incentives—resulting in higher initial effort that collapses relatively quickly
NCERDC Data

- Covers universe of public school teachers in North Carolina, spanning 14 years to 2008
- Observe teacher variables including pay period and reason for teacher absences
- Personnel files document administrative turnover
Teacher Absences as Proxy for Withholding Effort

- **Teacher sick leave absences:**
  - Are considerably higher than other industries
  - Show strong evidence of being non-random
  - Are costly to schools
  - Suggest a causal relationship with student learning

- **But—**
  - Are noisy measures of effort
# Descriptive Statistics for Data

Table 1. Descriptive Statistics of Teachers in Data

<table>
<thead>
<tr>
<th></th>
<th>All sick data</th>
<th>Sample</th>
<th>2005 Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sick absences</td>
<td>7.190 (6.937)</td>
<td>6.173  (4.268)</td>
<td>6.370 (4.297)</td>
</tr>
<tr>
<td>Female</td>
<td>0.799 (0.401)</td>
<td>0.794  (0.404)</td>
<td>0.792 (0.406)</td>
</tr>
<tr>
<td>White</td>
<td>0.845 (0.362)</td>
<td>0.846  (0.361)</td>
<td>0.845 (0.362)</td>
</tr>
<tr>
<td>Highest degree is BA</td>
<td>0.701 (0.458)</td>
<td>0.701  (0.458)</td>
<td>0.707 (0.455)</td>
</tr>
<tr>
<td>NBPTS certified</td>
<td>0.077 (0.267)</td>
<td>0.076  (0.266)</td>
<td>0.085 (0.280)</td>
</tr>
<tr>
<td>Elementary teacher</td>
<td>0.527 (0.499)</td>
<td>0.526  (0.499)</td>
<td>0.523 (0.499)</td>
</tr>
<tr>
<td>Age</td>
<td>41.150 (10.941)</td>
<td>41.161 (10.937)</td>
<td>40.761 (11.206)</td>
</tr>
<tr>
<td>Observations (teachers)</td>
<td>425,282</td>
<td>403,331</td>
<td>63,479</td>
</tr>
</tbody>
</table>
## Panel B. Tenure and Experience Entered as Indicator Variables

<table>
<thead>
<tr>
<th></th>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omitted category is teacher in year 1 of tenure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2 of school tenure</td>
<td>0.693**</td>
<td>0.678**</td>
<td>0.760**</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.029)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Year 3 of school tenure</td>
<td>0.733**</td>
<td>0.718**</td>
<td>0.973**</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.030)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>Year 4 of school tenure</td>
<td>0.695**</td>
<td>0.675**</td>
<td>1.040**</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.031)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Year 5 of school tenure</td>
<td>0.702**</td>
<td>0.690**</td>
<td>1.134**</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.034)</td>
<td>(0.029)</td>
</tr>
</tbody>
</table>

Indicator variables for experience and tenure after year 5 are included in regression but omitted in output.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>403,331</td>
<td>403,331</td>
<td>403,331</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.05</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>√</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>School-year fixed effects</td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Teacher fixed effects</td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

Note: * significant at 5%; ** significant at 1%. Robust standard errors in parentheses. Teacher controls include the following: gender, race and ethnicity, highest degree, NBPTS certification, elementary teacher, imputed age, fertility, and retirement eligibility.
Predicted Shape of Absences

Predicted Sick Leave

Experience

Predicted sick leave

Non-mobile teacher
Renews tenure after 5 years
Renews tenure after 10 years
Renews tenure after 15 years
Renews tenure after 20 years
Renews tenure after 25 years
Are Career Concerns Causal?

Tenure variable is potentially endogenous:
- Teachers choose where to teach and how long to stay
- Need exogenous variation in career concerns

Natural experiment arises from principal turnover:
- New principals have uninformed prior
- Teachers exert effort to influence principals’ perception
- Principal turnover is strictly exogenous
Table 4. Causal Test of Career Concerns: Principal Tenure

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Omitted category is year 1 of principal tenure</td>
<td>0.073**</td>
<td>0.090**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.018)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Year 2 of principal tenure</td>
<td>0.047*</td>
<td>0.090**</td>
<td>0.199**</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.028)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Year 3 of principal tenure</td>
<td>0.060*</td>
<td>0.105**</td>
<td>0.237**</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.036)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>Year 4 of principal tenure</td>
<td>0.019</td>
<td>0.090*</td>
<td>0.192**</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.041)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Year 5 or more of principal tenure</td>
<td>0.019</td>
<td>0.090*</td>
<td>0.192**</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.041)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Observations</td>
<td>402,713</td>
<td>402,713</td>
<td>402,713</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.05</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Principal-school fixed effects</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Teacher fixed effects</td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

Note: * significant at 5%; ** significant at 1%. Robust standard errors in parentheses. Teacher controls include the following: gender, race and ethnicity, highest degree, NBPTS certification, elementary teacher, experience (entered as vector of indicators), tenure in school (when less than principal's), and imputed age, fertility, and retirement eligibility.
Criticism of Evidence

- Correlation between absences and effort assumed, but not verified
- Absences observable, but may be manipulated
- Findings replicable using an alternate measure in different data?
Using Evidence from SASS

- Nationally representative: 40,000+ teachers
- Number of hours worked outside of school time on school-related work (not directly involving students)
- Most likely subject to inflationary bias among those who work least (Li et al. 2003); magnitude of effects lower bound
### Table 11. Teachers' Self-reported Work Hours

<table>
<thead>
<tr>
<th>Year of School Tenure</th>
<th>Incidence Rate Ratio (Robust Standard Error)</th>
<th>Incidence Rate Ratio (Robust Standard Error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2 of school tenure</td>
<td>0.980 (0.026)</td>
<td>0.961* (0.015)</td>
</tr>
<tr>
<td>Year 3 of school tenure</td>
<td>0.930* (0.028)</td>
<td>0.944** (0.016)</td>
</tr>
<tr>
<td>Year 4 of school tenure</td>
<td>0.927* (0.029)</td>
<td>0.911** (0.017)</td>
</tr>
<tr>
<td>Year 5 of school tenure</td>
<td>0.910** (0.028)</td>
<td>0.928** (0.019)</td>
</tr>
</tbody>
</table>

Omitted categories are year 1 of tenure and experience. Indicator variables for experience and tenure after year 5 are included in regression but omitted in output.

- **Observations**: 38,375, 38,095
- **District Conditional Fixed Effects**: √

Note: * significant at 5%; ** significant at 1%. Robust standard errors in parentheses. Source: 1999-2000 Schools and Staffing Survey. Coefficients are estimated incidence rate ratios from negative binomial regression. Teacher controls include the following: race, class organization, degree, outside income level, school enrollment, month of survey completion and cubic polynomial on age.
Conclusion: Does Teacher Effort Respond?

- Teachers’ behavior conforms to model predictions
- Findings suggest effort responds in *levels*
- Magnitude of absence differentials is large

Caveats:

- Learning of ability may happen over many channels
- Uncertain how broad explicit incentives must be
Policy Discussion

- Rewarding teachers’ performance (and perhaps inputs) could increase effort inputs overall
- Policy intervention may influence teacher absences
- Explicit performance incentives could counter those from declining career concerns incentives