Corporate Governance Spillovers*

Appendix E

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Abstract

This Appendix outlines an alternative model to that of the main paper, "Corporate Governance Spillovers," where manipulation is a strategic substitute in $x_t$.

Keywords: corporate governance, relative performance evaluation, CEO turnover, peer effects, governance spillovers, competitive pressure, earnings manipulation

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The model in Cheng (2008) supposes that, if one manager is caught manipulating earnings (with instantaneous probability $\rho_i m_i$), the second manager receives $w/\beta$ as compensation. I interpret this as meaning that a scandal freezes the relative performance evaluation mechanism, so that the opposing manager receives $w/\beta$ as a consequence.

This assumption is clearly limiting, since its realism is in doubt. This Appendix addresses another, perhaps more realistic, possibility. Suppose that, once manipulation is discovered at either firm, the SEC conducts an investigation of the whole industry. Specifically, assume that an industry-wide investigation occurs with instantaneous probability $(\rho_A m_A + \rho_B m_B)$. From the results of this investigation, managers who are "clean" (were not manipulating at the moment detection occurred at either firm) keep their jobs and receive $w/\beta$, and managers who are "dirty" get fired and receive zero. The investigation, however, is not perfect, so that a "dirty" manager escapes detection by the SEC with probability $(1 - F(m_i))$, where $F$ is some cumulative distribution function. Another interpretation of this imperfect investigation mechanism is that a "dirty" manager may plead his case before the SEC based on the severity of his manipulation and escape with some probability.

This model is not exactly a generalization of the model in the paper, but rather is a different model. In the model of the paper, manipulation is a strategic complement in $x_t$: for a fixed $\rho_A, \rho_B$, high manipulation by one manager is associated with high manipulation by the other manager. The detection structure in this Appendix creates the possibility of strategic substitutes in $x_t$. Intuitively, when one manager is manipulating more, the other manager has an incentive to manipulate less, since this increases his chances of obtaining $w/\beta$, conditional on an industry investigation occurring. In the model of the paper, because detection at one firm does not lead to an investigation at the other firm, the manipulation strategy is dependent primarily on the relative performance payoffs, creating the strategic complementarity. Thus, this model should be viewed as complementary to the model in the paper.

In this Appendix, I show that governance spillovers - that is, that manipulation is still a strategic complement in $\rho$ - still occur even when manipulation is a strategic substitute in $x_t$. That is, low values of $\rho_i$ increase the manipulation profile of $m_{-i}$, even though $m_i$ and $m_{-i}$ may be strategic substitutes in $x_t$. Thus, the strategic complementarity in $x_t$ does not drive the governance spillover result. Furthermore, the "U-shape" pattern predicted in the model only occurs for sufficiently high $w_H$. That is, managers only manipulate when ahead when the payoff for winning is sufficiently high. This makes sense in the context of mergers and acquisitions, since the payoffs from successfully acquiring a target are very high for the acquiring CEO.

1Note that I am still assuming that detection only occurs as a function of current manipulation, which is still a limitation.
2The direct generalization (in a solvable form) is much less interesting than this case.
3Additionally, the probability of detection is no longer convex in manipulation, which also moves the model towards strategic substitutability in $x_t$. 


Model and Equilibrium. The HJB for the game described above is

\[
\max_{m_A} \left\{ \frac{1}{2}\sigma^2 U'' + (m_A - m_B) U' - \beta U + (\rho_A m_A + \rho_B m_B) \left[ \frac{w}{\beta} (1 - F(m_A)) - U \right] + w \right\} = 0
\]

\[
\max_{m_B} \left\{ \frac{1}{2}\sigma^2 V'' + (m_A - m_B) V' - \beta V + (\rho_A m_A + \rho_B m_B) \left[ \frac{w}{\beta} (1 - F(m_B)) - V \right] + w \right\} = 0
\]

The FOC for manager \(A\) is

\[
U'(m_A) + (\rho_A m_A + \rho_B m_B) \left[ -\frac{w}{\beta} f(m_A) \right] + \left[ \frac{w}{\beta} (1 - F(m_A)) - U \right] \rho_A = 0
\]

\[
U'(m_B) + (\rho_A m_A + \rho_B m_B) \left( -\frac{w}{\beta} \right) + \left[ \frac{w}{\beta} (1 - m_A) - U \right] \rho_A = 0
\]

\[
U' - \frac{w}{\beta} \rho_A m_A - \rho_B m_B \frac{w}{\beta} + \frac{w}{\beta} \rho_A - \frac{w}{\beta} \rho_A m_A - \rho_A U = 0
\]

\[
\frac{U' + \rho_A \left( \frac{w}{\beta} - U \right) - \rho_B m_B \frac{w}{\beta}}{2\frac{w}{\beta} \rho_A} = m_A
\]

and similarly for manager \(B\) where I use the uniform distribution \(F(m) = m\). The two first order conditions are then

\[
m_A = \frac{U' + \rho_A \left( \frac{w}{\beta} - U \right) - \rho_B m_B \frac{w}{\beta}}{2\rho_A \frac{w}{\beta}}
\]

\[
m_B = \frac{-V' + \rho_B \left( \frac{w}{\beta} - V \right) - \rho_A m_A \frac{w}{\beta}}{2\rho_B \frac{w}{\beta}}
\]

Substituting,

\[
m_A = \frac{U' + \rho_A \left( \frac{w}{\beta} - U \right) - \rho_B m_B \frac{w}{\beta}}{2\rho_A \frac{w}{\beta}} - \frac{1}{2} \left[ \frac{U' + \rho_B \left( \frac{w}{\beta} - V \right) - \rho_A m_A \frac{w}{\beta}}{2\rho_A \frac{w}{\beta}} \right]
\]

\[
= \frac{U' + \rho_A \left( \frac{w}{\beta} - U \right) - \frac{1}{2} \left[ U' + \rho_B \left( \frac{w}{\beta} - V \right) - \rho_A m_A \frac{w}{\beta} \right]}{2\rho_A \frac{w}{\beta}} + \frac{1}{2} \frac{m_A \rho_A \frac{w}{\beta}}{2\rho_A \frac{w}{\beta}}
\]

\[
\frac{3}{4} m_A = \frac{U' + \rho_A \left( \frac{w}{\beta} - U \right) - \frac{1}{2} \left[ U' + \rho_B \left( \frac{w}{\beta} - V \right) \right]}{2\rho_A \frac{w}{\beta}}
\]

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Figure 1: Equilibrium Manipulation.

Now suppose manipulation is constrained within $[0, \tilde{m}]$. Then

$$m_A = \max \left\{ \min \left\{ \frac{2}{3} \left[ \frac{U' + \rho_A \left( \frac{w}{\bar{x}} - U \right) - \frac{1}{2} \left( -V' + \rho_B \left( \frac{w}{\bar{x}} - V \right) \right]}{\rho_A \frac{w}{\bar{x}}} \right], \tilde{m} \right\}, 0 \right\}$$

$$m_B = \max \left\{ \min \left\{ \frac{2}{3} \left[ \frac{-V' + \rho_B \left( \frac{w}{\bar{x}} - V \right) - \frac{1}{2} \left( U' + \rho_A \left( \frac{w}{\bar{x}} - U \right) \right]}{\rho_B \frac{w}{\bar{x}}} \right], \tilde{m} \right\}, 0 \right\}$$

Implications. I compute the equilibrium for the same parameters as in the paper (in particular, $w_H = w$), except I first use $\rho_A = 5$ and $\rho_B = 500$ as a benchmark case, effectively making manipulation extraordinarily costly for $B$, both in a relative and absolute sense. I furthermore suppose $\tilde{m} = 1$ to justify the use of the uniform CDF $F$. This case is represented by the solid lines in Figure 1. I then compute the equilibrium for $\rho_A = 5$ and $\rho_B = 5$ as the "governance spillover" case, which is represented by the dashed lines. Governance spillovers still occur in the sense that weakening governance at firm $B$ increases the incentive for firm $A$ to manipulate. Intuitively, manager $A$ anticipates that manager $B$ can "keep himself alive" for longer (relative to the benchmark case) and thus must react by boosting his manipulation, thus keeping himself alive longer as well.

The main difference with the model in the paper is that managers no longer manipulate when they are ahead. In other words, manipulation is a strategic substitute, so that the prediction of manipulation as a U-shaped in relative performance breaks down. However, this is because I have
assumed $w_H = w$, so that the outperformance incentive is a guarantee of the manager’s current wage. As the figure illustrates, this is no longer strong enough to sustain the U-shaped pattern. For higher values of $w_H$, however, the U-shaped profile returns (in a slightly altered form), since the explicit payoff of outperforming the competing manager is increased. Again, this is perhaps more appropriate to the setting of mergers and acquisitions, where the payoffs for acquiring CEOs are high (see citations in paper). Figure 2 plots the equilibrium manipulation when $w_H = 1.5$. Each manager manipulates only when they are extremely far ahead and thus likely to win the game.\footnote{This is also an artifact of the linear detection probabilities. A convex detection probability would likely smooth out the manipulation by one manager when he is ahead, at a cost of reduction in level. However, this introduces a non-linearity in $m_A$ and $m_B$ that cannot be readily solved even using numerical methods.}