Tit-for-tat compensation*

JOB MARKET PAPER

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ABSTRACT

In this paper I study tit-for-tat pairs, i.e. situations where CEOs serve on each others' boards in a way that makes it possible for them to reward (punish) favourable (negative) compensation outcomes partly influenced by the other player. I find that the residuals from predictive regressions of CEO compensation are positively correlated in such pairs, implying that these relationships are indeed relevant. Although I cannot exclude the possibility of outright corruption, the results hold true when allowing large time lags between the two compensation decisions. I therefore lean towards an explanation where the varying cordiality of the individuals' personal relationship, which is likely stable over some years, is the driving factor. The result is robust to the inclusion of various CEO and board centrality measures as well as a dummy soaking up the average effects of tit-for-tat relationships. When studying a sample of non-CEO top executives (whose compensation is typically recommended by the CEO, rather than the board) none of the effects are present. This indicates that the results are not driven by some unobserved characteristic of the firms whose CEOs form tit-for-tat pairs.

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1. Introduction

The board of directors is responsible, among other things, for setting the compensation of the CEO on behalf of the shareholders. It is crucial for our trust in this arrangement that the board members do not have a personal stake in that compensation, or at least that they are not unduly influenced by such a stake. In accordance with this, CEOs that also serve as board members are routinely excluded from voting on their own compensation. In this paper I will examine a situation where the stake is more subtle and where the affected board members are therefore not barred from voting. This situation occurs when a board member serves as a CEO in some other company on whose board the CEO of the first company serves, i.e. the two individuals switch roles in the two companies. As it is the shareholders that ultimately pay for the compensation which benefits the CEOs directly, these individuals are able to play a non-zero-sum tit-for-tat game where they reciprocally raise or lower each other's compensation levels. I therefore refer to such relationships as tit-for-tat pairs and in the following I will show how tit-for-tat-like behaviour is indeed common within these pairs.

Although studies of the conditions described above are scarce, other but similar situations have received much attention. In 1914 the US congress passed the Clayton Antitrust Act, making it illegal for directors of competing companies to serve on each others' boards. The intent of this law was to discourage collusion between companies, such as price fixing, and did not focus on any agency problems between the board members and the owners. Interlocking directorships therefore remained legal and quite common in non-competing firms. There is an old and rich literature examining the functions of such interlocks. Theories range from giving influence to important stakeholders (Thompson & McEwan (1959) and Stiglitz (1985)) to signaling legitimacy (DiMaggio & Powell (1983) and selection issues (Zajac (1988) and Mills (1956)).

More recently, an empirical literature that focuses on the potential agency conflicts inherent in such connections has emerged. Much of this literature draws on methods in sociology to map the entire social networks of financial agents. Particularly relevant for this study are papers that relate these measures to executive compensation. Barnea & Guedj (2007) map the network of directors in S&P 1500 firms and find a positive relation between the centrality of a company's board and the compensation of its CEO. They interpret this as a sign of weaker monitoring by more connected board members. Others have studied the connections of CEOs themselves, rather than those of board members. Hwang & Kim (2008) map the dependence between CEOs and board members via social ties, as proxied by a shared alma mater, military service, regional origin, academic discipline or industry. They find that boards with a majority of independent members that lack social ties to the CEO give lower compensation. Fracassi & Tate (2008) also map social, educational and professional ties between CEOs and board members and associate this with fewer company initiated earnings restatements and more unprofitable takeovers, which they argue indicates weaker monitoring. Larcker at al (2006) map the network of US board members (not counting CEOs and board members of the same company as directly linked) and calculate the geodesic distance between CEOs and board members in the same company. They find these measures negatively correlated to CEO compensation. In an early, but methodologically somewhat different paper, Hallock (1997) defines interlocks as occurring when the CEO of some company A serves on the board of some other company B, while the CEO of company B serves on the board of company A. He shows that firms whose board members and CEO interlock in this sense tend to give their CEOs higher compensation. Like most papers in this literature, Hallock struggles to nail down the mechanism through which the effect works. He observes that two interlocking CEOs "may have both the incentive and the opportunity to raise each other's pay" but lacking a good understanding of how such interlocks arise this remains an unproven hypothesis.

This paper takes off by merging Hallock's study with the more recent literature on social networks. I show how the positive effect of interlocks on compensation is due to the covariance of such interlocks with social network centrality. I expand on the literature by building a social network spanning both CEOs and board members simultaneously. Being able to control for the highly correlated centralities of both these groups I show that it is CEO centrality that is economically relevant. This finding fits several alternative stories. It could be due to some functional value of CEO networks. For instance, a large professional network may allow the CEO to better acquire information, solicit advice or call in favours. Alternatively, it could be that the same characteristics that foster a central position in the network, being exceptionally sociable say, also make people better leaders and CEOs, which warrants higher compensation. Yet another possible explanation is that a central CEO can use that social influence to put pressure on board members to raise her compensation. This kind of influence has received much attention in the literature, most prominently in the seminal book by Bebchuk and Fried (2004). I leave it to others to disentangle these effects. Instead, I focus on documenting the effects of the tit-for-tat relationships described in the first paragraph. Rather than focusing on the average effect on compensation of a tit-for-tat relationship being in place as Hallock did, I view these relationships as a stage on which tit-for-tat games are potentially being played and examine the covariation of compensation within such pairs. If the individuals in such pairs are explicitly agreeing to cooperate or if they are in some other way motivated by the effects on their own compensation they would be engaged in an ethically and legally highly dubious practice. I would not expect everyone who is given the opportunity to do this to take it. Furthermore, the extent to which the game is played should vary even among pairs that fall for the temptation. I exploit this variation to show that tit-for-tat behaviour is indeed common when the situation allows for it and its' effects are economically significant. I will discuss whether the covariation of compensation within tit-for-tat pairs can be the result of varying personal relationships between the two individuals and argue that this is a more likely explanation than explicit corruption.

Specifically, I estimate a number of regressions of CEO compensation. Apart from the standard controls proposed in the literature, the effects of CEO and board centrality in the social network are controlled for. I also include a dummy variable indicating whether the CEO in question is in a position to play the kind of tit-for-tat compensation game that I want to examine.[1] My focus is on the residuals from these regressions. As this is the unexplained part of the observed compensation, the effects of any tit-for-tat behaviour would be in there. This should cause the residuals of CEOs within these pairs to line up, i.e. an unduly (and otherwise unexplained) high compensation would be repaid with a similarly high compensation. By regressing the average residuals in each pair on each other, I show that this is indeed the case and that the effect is statistically and economically significant. This is the case whether I use only contemporaneous compensation decisions or allow for favours to be returned with some lag. The point estimates from these residual regressions are also quite stable to the specification of the original compensation regressions. The lowest estimate, which occurs when using the full set of controls and only contemporaneous compensation decisions, is 0.27. This should be interpreted as an elasticity, i.e. a one percent increase of the compensation given by the first individual in a pair is repaid by an average 0.27 percent increase given by the second individual. A one standard deviation increase in the residual would result in an average increase of $426,000 of the other individual if evaluated at the mean compensation of the entire sample and in an increase of $1,223,000 if evaluated at the mean of those individuals that are part of a tit-for-tat pair (and who

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[1] The definition of this dummy variable will differ slightly from that in Hallock in order to exploit the time dimension in my dataset.

tend to work for larger firms which give higher compensation). This corresponds to 18 percent of their annual compensation.

I contribute to the existing literature by showing how specific and economically significant actions are taken within the context of social networks. This is the first paper to document this kind of tit-for-tat behaviour. The actions taken are of particular interest as they appear to have little to do with the interest of shareholders, on whose behalf they are ostensibly taken. Even if we are not dealing with explicit corruption, which is one potential explanation of the behaviour, these actions arguably constitute neglect of the board members' fiduciary responsibility to the shareholders.

The research design depends crucially on the specification of the original compensation regressions. Although the results seem robust to the choice of control variables, the concern remains that there is some omitted variable that relates to both compensation and the formation of tit-for-tat pairs. Such a variable would show up in the residuals and possibly be responsible for the covariation within the pairs. To get at this I replicate my methodology on a sample of non-CEO executives, whose compensation is typically set either by the CEO directly or by the board on the recommendation of the CEO. The scope for tit-for-tat games between board members and these executives should be greatly reduced whereas most stories depending on a misspecification of the compensation regressions should apply equally in this case. However, there is no corresponding effect in the sample of non-CEO executives in spite of comparable sample sizes. It is therefore highly unlikely that my results are driven by an omitted variable in the original compensation regression.

2. DATA

I obtain data on board membership and board member characteristics for the years 1996 to 2006 from the RiskMetrics (former IRRC) Directors dataset. This dataset covers all directors of S&P 500, S&P MidCaps and S&P SmallCaps companies during the period. Data on executives is retrieved from the ExecuComp dataset for the same time period. Matching companies on CUSIP codes and individuals on name and their affiliated companies, I merge the two datasets. In order to ensure a full and accurate match I double check it by matching both datasets to the Thomson Reuters Insider Filing dataset, which assigns a personal ID number to each individual regardless of why she has insider status, e.g. whether she is a board member or a manager. The result is a dataset with a total of 26196 unique individuals and 2708 unique firms. Control variables are obtained from Compustat and the RiskMetrics Governance datasets. Following Barnea & Guedj (2007), I drop all observations where the CEO has a salary that is lower than $50,000 a year. The purpose is to avoid cases where the CEO has voluntarily taken an exaggerated pay cut (or completely waived a salary) as a gesture of good will. Summary statistics are given in Table 1.

A. Social network centrality

In order to get a measure of each individual's importance in a social network I calculate standard measures of network centrality. To construct the network, I let each individual in my dataset be a node and let two nodes be linked in a given year if the two individuals are affiliated with the same company that year. To be affiliated with a company an individual can either be a member of its board of directors or be reported as a manager in the company's proxy statement (and hence appear in ExecuComp). These nodes and links, i.e. the network, is described by an adjacency matrix, G, in which each row represents a node and each element the linking status of two nodes so that $G(i, j) = G(j, i) = 1$ if individual i and j are linked and $G(i, j) = G(j, i) = 0$ otherwise. By convention $G(i, i) = 0$, i.e. individuals are not considered to be linked to themselves. The network is remapped each year. I calculate a number of centrality measures that give a sense of the importance of each node. The most straightforward is degree centrality, which is simply the number of links of each node. The vector of degree centralities is *Degree = G* $\mathbb{1}$. Two more sophisticated measures, *betweenness* and *closeness centrality*, is based on the idea of *geodesics*, or *shortest paths*. A path between two nodes, *i* and *j,* exists when they are linked to each other (possibly via other nodes) such that no node is passed twice. The shortest path between the two nodes is the path with the fewest intermediate nodes and the required number of steps is called the *geodesic distance, d(i, j)*. Summing the geodesic distances from a particular node to all other nodes gives the *closeness centrality* of that node as in Sabidussi (1966). This measure is commonly inverted so that higher closeness means that a node is more central in the network, $Closeness_i = \left(\sum_{j \neq i} d(i,j)\right)^{-1}$. Counting the number of times that a node lies on the shortest path between two other nodes gives the *betweenness centrality* measure of Freeman (1979). I further calculate two measures based on *walks*. A walk is like a path, except it places no restrictions on the repetition of nodes or links. The eigenvector associated with the largest eigenvalue of the adjacency matrix, *G*, is the vector of *eigenvalue centralities*. The eigenvector centrality of a given node is proportional to the sum of the centralities of the nodes to which it is connected and it is therefore important to connect to central rather than to peripheral nodes. The final measure considered is the *Bonacich centrality* of Bonacich (1972). The measure is the (weighted) number of walks starting in a given node *i*, $Bonacich_i = \sum_j \sum_{k=0}^{\infty} a^k G^k(i,j)$. The parameter *a* determines the relative weight of walks of different lengths in that walks of length *k* are weighted by a^k. There is little theory to guide the choice of *a*. Hanaki et al (2006) set *a = 0.1* and claim that it is a standard choice. I have set *a = 0.02*, mainly for computational tractability.[2] If *a* is very low, the Bonacich centrality measure converges to Degree centrality.

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[2] If *a* is low enough the Bonacich centrality will converge to $\left[I - aG\right]^{-1} \cdot \mathbb{1}$, considerably simplifying computations.

These centrality measures give a value to each node (representing an individual) each year. For executives, this value makes up the relevant variables. I take the average of each centrality measure of all directors in a company a given year to make up the board centrality variables. Summary statistics for the different centrality measures are given in Table 2. A correlation matrix is given in Table 3. The high correlation between the different measures makes it less important exactly which one is used in the regression specifications below. For briefness I will often report results for the eigenvector measure only. In these cases all analysis has been made for all centrality measures with the same qualitative results.

3. Research hypotheses

My main concern in this paper is the compensation games that are potentially being played within tit-for-tat pairs (H_3 below). I will, however, examine two other issues of some interest in preparation of that analysis (H_1 and H_2 below). Much of the existing literature focuses on links between board members even though the person with the highest stake in CEO compensation is arguably the CEO herself. Intuitively, it seems that hers would be the most important links. This is especially troublesome as the CEO by definition works in the same company as the board members and CEO centrality measures are highly correlated to those of board members as is evident in Table 3. Failing to account for this introduces a risk that board member centrality simply proxies for the centrality of the CEO. This is not a serious econometric problem, as the CEO centrality measures will themselves only be proxies for some more intangible social phenomenon. If we use board member centrality rather than CEO centrality we simply use a weaker proxy. However, interpretations may differ greatly depending on what we think the proxy captures. Using the centrality of board members as a proxy is a short step away from thinking that there is something about board member centrality that effects CEO compensation, for instance that the social ties of more central board members make them weaker monitors . Some papers, such as Larcker et al (2006), recognize the importance of CEO connections, but do not use these as controls when investigating board connections. Furthermore, their network measures are not as developed as those of e.g. Barnea & Guedj (2007). I fill this gap by studying the networks of CEOs and board members simultaneously, hypothesising that CEO network centrality should have the strongest effect on CEO compensation:

> **H_1**: CEO centrality is positively correlated to CEO compensation. Board member centrality is mainly correlated to CEO compensation via CEO centrality.

As is evident from the last line in Table 3, the tit-for-tat pair dummy is positively correlated with measures of network centrality. This makes intuitive sense, as individuals with many board and management positions tend to be more central and are more likely to end up in a tit-for-tat pair. It is therefore hard to interpret a tit-for-tat dummy in a compensation regression that does not control for centrality. Hallock's results may, at least in part, be driven by such a misspecification. I hypothesize that introducing controls for network centrality will reduce the apparent effects of tit-for-tat relations:

> **H_2**: The estimated effects of tit-for-tat relationships will be reduced when controlling for network centrality.

The central hypothesis of the paper concerns tit-for-tat pairs, i.e. situations where individual 1 is the CEO of company A while serving on the board of company B and individual 2 is the CEO of company B while serving on the board of company A. These individuals are in a position to reciprocally change each other's compensation and I hypothesize that they seize that opportunity:

H_3: A high (low) compensation for one CEO in at tit-for-tat pair is associated a high (low) compensation for the other CEO.

By focusing on correlations rather than on the level effects of centrality, which has been the main approach in the existing literature, I will be able to separate my story from the alternatives.

4. EMPIRICAL ANALYSIS

In this section I proceed to test the three hypotheses given in section 3, with focus on H_3.

A. CEO VS. BOARD MEMBER CENTRALITY

In order to test H_1, I first seek to establish that both CEO and board centrality are positively related to CEO compensation. In order to do this I regress compensation on centrality and a set of control variables. Specifically, my dependent variable is the natural log of total executive compensation including the value of any option grants.[3] I use three sets of control variables. Specification 1 includes only basic firm characteristics. Specification 2 also includes corporate governance variables. Specification 3 adds several additional controls, which are all standard in the literature. The *Pair dummy* variable is a dummy that takes the value of one if the executive is part of tit-for-tat pair that year and zero otherwise. It will be important to control for this level effect when testing H_2. It has no significant effect in this regression and may be excluded without affecting the results. The regressions take the following form:

[3] Varible TDC1 in the ExecuComp dataset.

$$\ln\left(TC_{i;t}\right) = \alpha + \sum_j \beta_j^{Ctrl} Ctrl_{i;t}^j + \beta_{Pair} Pair_{i;t} + \beta_{Cent} Cent_{i;t} + \beta_{BoardCent} BoardCent_{i;t}$$
$$+\sum_y \beta_y^{Year} Year_t^y + \sum_z \beta_z^{Industry} Industry_{i;t}^z + \varepsilon_{i;t}$$

Cent and *BoardCent* vary between the different centrality measures described above. I alternatively restrict either β_{Cent} or $\beta_{BoardCent}$ or neither to zero. The full regression results using the Eigenvector measure of centrality are given in Table 4. For testing H_1, the variables of interest are the centrality measures on the first two rows. When one measure is restricted to zero the other has a significantly positive impact, as one would expect from the earlier literature. When both measures are included, however, only CEO centrality appears to matter and board member centrality even gets a negative (but statistically insignificant) point estimate. I re-estimate these regressions while varying the way I calculate CEO and board member centrality. The other control variables are not sensitive to this variation, and in Table 5 I only report the two variables of interest. The findings are still in line with H_1, except when using the smallest set of controls and *Betweenness* to measure centrality. For specification 2 and 3 when using the *Betweenness* measure, the point estimates of the board member variable are positive smaller than that of the CEO centrality variable and statistically insignificant. As the two centrality variables are highly correlated that insignificance is possibly due to collinarity. With this caveat H_1 should be accepted. It is likely that the CEO centrality is the relevant factor and this should be kept in mind when interpreting any findings concerning the centrality of board members.

B. CEO CENTRALITY AND TIT-FOR-TAT PAIRS

H_2 can be evaluated directly by looking at Table 4. The tit-for-tat pair dummy is positive but not statistically significant even in the absence of a control for CEO centrality. Though not immediately comparable to the results in Hallock (1997) this is in line with his findings. When controlling for CEO centrality the point estimate is roughly halved, in accordance with H_2. It is likely that Hallock is, at least in part, capturing the same thing that is captured by CEO centrality.

C. TIT-FOR-TAT COMPENSATION GAMES

I collect the residuals from the compensation regressions and match them within each tit-for-tat pair whenever the relationship is active in both companies in a given year. That is, when in a given year individual X is the CEO of some company A and serves on the board of some other company B while in that same year individual Z is the CEO of company B and serves on the board of company A. Formally, I construct the indicator variable $I_{i;j;t;s}$ that takes the value of one when individual *i* is an executive in a company on which board individual *j* serves in year *t*, *and* individual *j* is an executive at some other company on which board individual *i* serves in year *s*:

$$I_{i;j;t;s} = \begin{cases} 1 \text{ if } (i;j;t;s) \text{ constitutes a tit-for-tat pair as described above} \\ 0 \text{ otherwise} \end{cases}$$

Using this indicator variable, I define the two vectors ${}^1P^1$ and ${}^1P^2$ as follows:

$$\begin{aligned} {}^1P^1_{(i;j);t} &= I_{i;j;t;t}\varepsilon_{i;t} \\ {}^1P^2_{(i;j);t} &= I_{j;i;t;t}\varepsilon_{j;t} \end{aligned}$$

The first superscript refers to the window length which I shall vary below. For now it is not important. The second superscript is arbitrarily assigned to designate one individual player one and the other individual player two. For simplicity, I will assign each pair *(i,j)* an ID so that ${}^1P^1$ and ${}^1P^2$ can be given scalar indices rather than be indexed by ordered pairs. $\varepsilon_{i;t}$ refers to the residual from the CEO compensation regression for individual *i* in year *t*. If the individuals in tit-for-tat pairs are indeed playing some kind of reciprocal compensation game, the effects of this will be in $\varepsilon_{i;t}$. As the extent of any coordination is likely to vary, an implication is that these residuals will be correlated. Eyeballing the residuals, which are plotted against each other in Figure 1, gives some support to this idea. The figure shows residuals from the compensations regression using all controls and the eigenvector measure of centrality, but is representative for the residuals from variations of that regression. To make a formal test I regress the residuals on each other and present the results in the first three columns of Table 6. As these are residuals from regressions of logged total compensation, the point estimates can be interpreted as elasticities. That is to say that 27 percent or more of a compensation increase in the average tit-for-tat pair is reciprocated, depending on the specification. The standard deviation of the residuals plotted in Figure 1 is 0.67, meaning that a one standard deviation increase in the residual translates to an average total compensation increase of 18 percent. At the mean compensation levels that are given in Table 1, this corresponds to $426,000 for the entire sample and $1,223,000 for the subsample of active tit-for-tat pairs. It is worth reiterating that this is the average for all CEOs in tit-for-tat pairs. Since it is improbable that all of them actually take part in these ethically dubious games, the true elasticity conditional on the CEO actually playing the game is likely higher.

It is not obvious how the decision to start playing the game is reached. It is possible that an explicit agreement is made, but it could also be more subtle. Since both individuals in a pair work closely together they are likely to develop a personal relationship of some sort. Such a personal bond may induce both individuals to be more generous in the compensation decision even if there has been no formal agreement. Helping out a friend and college in this way may not even be perceived as unethical by the players themselves. Of course, personal relationships between board members and CEOs are not unique to individuals in tit-for-tat pairs. I am not claiming that such individuals on average have more cordial relationships than others only that the relationships, and whatever effects they have on compensation, carry over from one company to the other. That personal relationships are unlikely to be more or less cordial within tit-for-tat pairs may help to disentangle that story from a story that builds on more explicit agreements. I would expect blatant corruption to be highly beneficial to the players on average since I am disregarding any legal or career consequences it might have. The two stories therefore have different predictions on the tit-for-tat dummy, which was found to be positive but not significantly significant in Table 4. This supports the relationship rather than the explicit corruption story.

Furthermore, there is no reason to think that the effects of personal relationships would be restricted to simultaneous compensation decisions. A CEO that has developed a cordial (or antagonistic) relationship with a board member is likely to act on that relationship even if their roles are not reversed until later. Explicit agreements, on the other hand, are less likely to be made when the repayment cannot be made until years later or when the opportunity for repayment is not certain. To explore this I calculate moving averages of the residuals in each tit-for-tat pair. Formally I construct the variables

$$
\begin{aligned}
{}^{w}P^{1}_{(i;j);u} &= \sum_{t=u-w/2}^{u+w/2} \sum_{s=u-w/2}^{u+w/2} I_{i;j;t;s}\varepsilon_{i;t} \Bigg/ \sum_{t=u-w/2}^{u+w/2} \sum_{s=u-w/2}^{u+w/2} I_{i;j;t;s} \\
{}^{w}P^{2}_{(i;j);u} &= \sum_{t=u-w/2}^{u+w/2} \sum_{s=u-w/2}^{u+w/2} I_{j;i;t;s}\varepsilon_{j;t} \Bigg/ \sum_{t=u-w/2}^{u+w/2} \sum_{s=u-w/2}^{u+w/2} I_{j;i;t;s}
\end{aligned}
$$

where *w* is the window length over which the moving averages are taken and the other variables are defined as above. I then regress ${}^{w}P^{1}_{(i;j)}$ on ${}^{w}P^{2}_{(i;j)}$ for varying values of *w*. The results are presented in columns four to twelve in Table 6. I take care to cluster the standard errors on both tit-for-tat pairs and years as described in Cameron et al (2008).[4] The results using these moving averages are even stronger. The point estimates are higher, as is the statistical significance and R^2.

[4] I am gratefully for the Stata code implementing this that I retrieved from Douglas Miller's webpage.

When considering this together with the weak average effect of being in a tit-for-tat pair, it seems plausible that the observed behaviour is due to varying cordiality of personal relationships rather than explicit agreements on corruption.

D. The position on the board

Regardless of how explicit the agreements on adjusting compensation are, it is crucial that the players have some real influence over the compensation decision. The more power a board member in a tit-for-tat pair has on her board the more important any personal relationships or explicit corruption will be to the board's compensation decision. I will let the board members formal position on the board proxy for such power. Specifically I construct dummy variables for being the chairman of the board, a member of the compensation committee and being in any relevant position, to which apart from the two aforementioned positions I also count the board vice chairmanship and membership on the governance committee. For instance, if the board member in a tit-for-tat pair is the chairman of the board in any year included in the window over which moving averages are taken, the *Chairman* and *AnyPos* variables will take the value one. I also construct a dummy that takes the value of one whenever the board has less than seven members. The idea here is that each individual member should have more influence if the board is smaller. I include these variables alone and interacted with the residuals from the compensation regressions on the right hand side and run regressions very similar to those estimated in Table 6. The variables of interest are the interactions, which are interpreted as additional correlations that kick in whenever the relevant conditions are fulfilled. The results that are presented in Table 7 for a window length of one and in Table 8 for a window length of eleven are mixed. There is no statistically significant effect for wither window length, although the point estimates of the *SmallBoard* interactions are fairly large. I struggle to find a plausible explanation for these results.

E. Using lagged residuals

Regressing the residuals on each other is not the only way to test my hypothesis. In order to further exploit the time dimension of the data I re-estimate the compensation regressions, while including lagged residuals from the original regressions as an explanatory variable. That is, I estimate the following regressions:

$$\ln\left(TC_{i;t}\right) = \alpha + \sum_{j} \beta_j^{Ctrl} Ctrl_{i;t}^{j} + \beta_{Pair} Pair_{i;t} + \beta_k^{Cent} Cent_{i;t}^{k} + \beta_k^{BoardCent} BoardCent_{i;t}^{k}$$
$$+ \sum_{y} \beta_y^{Year} Year_t^{y} + \sum_{z} \beta_z^{Industry} Industry_{i;t}^{z} + \beta_{\hat{\varepsilon}} \sum_{j} \sum_{s=1}^{S} I_{j;i;t-s;t} \hat{\varepsilon}_{j;t-s} + \varepsilon_{i;t}$$

$\hat{\varepsilon}_{i;t}$ are the residuals from the predictive regression described above and estimated in Table 4. The parameter *S* determines the maximum lag used when summing up these residuals. Since the individuals forming a pair are not randomly selected I want to cluster my standard errors on pairs. As a few individuals are part of more than one pair this is cumbersome and I therefore arbitrarily limit the number of pair relations to one. The results are qualitatively the same if I estimate the regressions with all pairs included and do not cluster on pairs. The one year lagged residuals should be interpreted as the unexpected compensation that the CEO gave her pair partner last year. If it was high (or low) I expect the partner to repay in kind, and I therefore expect to find a significant positive effect of this variable. I also estimate the regressions using the sum of the one and two year lagged residuals, as well as the sum of the one to five year lagged residuals. All standard errors are clustered on pairs, individuals, years and firms. The results for the variables of interest are given in Table 9. For brevity I do not report the control variables which are all similar to the original estimates given in Table 4. The effects are consistently very significant and positive. When using longer lags the point estimates are lower, as one would expect. This again supports H_3. It may be worth noting that the tit-for-tat pair dummy remains statistically insignificant, again supporting the notion that the compensation coordination is based on relationships rather than explicit agreements.

5. Robustness test

Since the story I'm telling depends crucially on the ability of individuals in tit-for-tat pairs to influence each other's wages, my findings should be less evident or absent when that ability decreases. Since the compensation of non-CEO executives is typically recommended to the board by the CEO, the influence of board members on these compensations should be lower and tit-for-tat gaming with non-CEO executives less common. I will use this to address some potential econometric concerns. If there were some unobserved characteristics that made executives with low compensation (residuals) more likely to enter tit-for-tat pairs with other low compensation executives, this could give rise to the residual correlation that I have documented. One possibility could be that my industry classification is too coarse and that executives in lower compensation sub industries, for business reasons or otherwise, tend to serve on boards in the same sub industry. The sub industry fixed effects (that are omitted from my original regressions) would then show up as tit-for-tat correlations. However, unless those sub industry effects (or whatever effects I might have failed to control for) are present for CEOs but not for non-CEO executives (which seems implausible) they would give me significant results when re-estimating my regressions on a sample of top non-CEO executives. I do this in Table 10 (corresponding to Table 6) and Table 11 (corresponding to Table 9). Despite roughly comparable sample sizes, none of my earlier results are replicated in this sample. There is, of course, still no way of knowing for certain whether there is some relevant omitted variable, but I cannot think of any candidate that would not be relevant in the non-CEO executive sample as well.

6. CONCLUSION

In this paper I have studied tit-for-tat pairs, i.e. situations where CEOs serve on each other's boards in a way that makes it possible for them to affect each other's compensation. I have found that the residuals from predictive regressions of CEO compensation are positively correlated in such pairs, implying that these tit-for-tat pair formations are indeed important for CEO compensations. I cannot say with certainty whether this is due to more or less explicit agreements between the parties or whether it has more to do with how cordial their personal relationship is, but given that the existence of a tit-for-tat pair relationship does not seem to have much of an average effect on compensation the latter explanation appears more likely. This is also supported by the fact that the tit-for-tat effect is present even over lags of several years, where explicit agreements would be hard or impossible to make.

When studying a sample of non-CEO top executives (whose compensation is typically set by the CEO rather than the board) none of the effects are present. This indicates that the results are not driven by some unobserved characteristic of the firms whose CEOs are part of tit-for-tat pairs.

When building up to these results I also document how CEO and board centralities are highly correlated. When controlling for both in CEO compensation regressions board centralities tend to become insignificant. This warrants caution when interpreting any results that crucially depend on the social network centralities of board members rather than CEOs.

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TABLE 1. SUMMARY STATISTICS

This table gives summary statistics for the control variables. Columns one to three includes all observations in the sample whereas columns four to six includes only observations where the executive is in an active tit-for-tat pair.

	Entire sample			Tit-for-tat pairs only		
Variable	Observations	Mean	Standard deviation	Observations	Mean	Standard deviation
Salary	115851	374.71	262.69	977	758.22	448.93
Bonus	115851	357.32	1055.66	977	1070.27	1740.27
Other anual compensation	108637	29.94	658.94	943	104.56	945.20
Restricted stock grants	108637	229.96	2502.27	943	725.34	2397.27
LTIP payments	108637	86.93	633.36	943	405.24	1421.30
All other compensation	115851	130.20	1114.92	977	516.89	2497.32
Option grants (B&S value)	97827	1069.98	4300.40	915	3158.88	9366.87
Total compensation	105036	2335.47	5845.07	949	6710.09	11083.97
Assets	115713	12138	60488	977	41676	136941
Tobins q	112405	2.49	17.96	969	2.38	4.09
Return on Assets	115669	2.10	51.85	977	3.97	8.73
Total Debt-to-Assets	114826	0.24	0.25	974	0.25	0.17
Volatility	99927	0.0263	0.0130	948	0.0210	0.0089
Male dummy	115851	0.94	0.24	977	0.97	0.18
GIM governance index	84651	9.31	2.62	882	9.77	2.32
Independence dummy	87370	0.84	0.37	976	0.80	0.40
Board interlock	87370	0.009	0.036	976	0.049	0.068
Boardsize	87370	9.65	2.90	976	11.98	3.46
5 Year Return to Shareholders	112823	96.61	4671.54	977	15.64	41.74
Market-to-book	113255	3.88	60.97	972	3.36	6.35
Executive's Age	46631	53.04	8.34	768	58.50	7.85
CFO dummy	115851	0.01	0.11	977	0.00	0.03
Executive share ownership	94017	0.0000	0.0001	902	0.0000	0.0001
Executive is listed as interlocked	115851	0.02	0.13	977	0.18	0.38
Pair dummy	115851	0.01	0.09	977	1	0

TABLE 2. CENTRALITY MEASURE SUMMARY STATISTICS

This table gives summary statistics for the centrality measures used in the analysis.

Variable	Obs	Mean	Std. Dev.	Max
Betweenness	13257	.0001555	.0002498	.0029081
Board Betweenness	13943	.0001983	.0002222	.0023197
Closeness	13257	.0007028	.0005094	.0048483
Board Closeness	13943	.0008053	.0004428	.0035121
Eigenvector	13257	.00421	.0106311	.220851
Board Eigenvector	14623	.0041574	.0078595	.157268
Bonacich	11801	1.673397	.6391964	7.41978
Board Bonacich	14618	1.596235	.4714465	4.89108

TABLE 3. CENTRALITY MEASURE CORRELATION MATRIX

This table gives the correlations between the used centrality measures. The bold numbers are the correlations between the CEO centrality and board centrality for each measure.

	Betweenness	Board Betweenness	Closeness	Board Closeness	Eigenvector	Board Eigenvector	Bonacich	Board Bonacich	Pair dummy
Betweenness	1								
Board Betweenness	**0.6573**	1							
Closeness	0.8264	0.6174	1						
Board Closeness	0.5761	0.8417	**0.7879**	1					
Eigenvector	0.4637	0.3982	0.5223	0.4407	1				
Board Eigenvector	0.3101	0.4465	0.3776	0.4735	**0.7871**	1			
Bonacich	0.7703	0.6303	0.9466	0.7985	0.6084	0.4577	1		
Board Bonacich	0.4708	0.6707	0.6613	0.8200	0.4821	0.6043	**0.7730**	1	
Pair dummy	0.2155	0.1877	0.2978	0.2539	0.1974	0.1805	0.3054	0.2673	1

TABLE 4. BASIC REGRESSIONS USING EIGENVECTOR CENTRALITY

This table shows regression results for Eigenvector centrality and the three sets of control variables presented above. The dependent variable is the natural log of total CEO compensation. All specifications include year and industry fixed effects. Standard errors are clustered on individuals. Robust p-values are given in brackets.

Eigenvector	3.202		3.454	2.775		3.735	3.592		4.891
	[0.00114]***		[0.02123]**	[0.00314]***		[0.00771]***	[0.00036]***		[0.00153]***
Board Eigenvector		3.306	-0.518		2.763	-1.886		2.867	-2.424
		[0.01552]**	[0.81401]		[0.03586]**	[0.36177]		[0.02716]**	[0.25728]
ln(Assets)	0.480	0.493	0.490	0.482	0.492	0.484	0.474	0.479	0.476
	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***
Tobins q	0.002	0.016	0.017	0.068	0.028	0.068	0.060	0.059	0.060
	[0.40013]	[0.02014]**	[0.08856]*	[0.00000]***	[0.04783]**	[0.00000]***	[0.00001]***	[0.00000]***	[0.00001]***
Return on Assets	0.002	0.005	0.005	0.003	0.006	0.003	0.003	0.003	0.003
	[0.09014]*	[0.00025]***	[0.00252]***	[0.07814]*	[0.00557]***	[0.07839]*	[0.15069]	[0.07629]*	[0.15109]
Total Debt-to-Assets	-0.282	-0.248	-0.285	-0.216	-0.219	-0.216	-0.217	-0.129	-0.217
	[0.00446]***	[0.00493]***	[0.00657]***	[0.04855]**	[0.02272]**	[0.04869]**	[0.05708]*	[0.18315]	[0.05704]*
Volatility	8.309	11.747	10.076	10.908	12.460	10.913	10.306	10.817	10.306
	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***	[0.00000]***
GIM governance index				0.025	0.020	0.025	0.026	0.022	0.025
				[0.00000]***	[0.00003]***	[0.00000]***	[0.00001]***	[0.00001]***	[0.00001]***
Independence dummy				0.108	0.146	0.110	0.071	0.108	0.072
				[0.00739]***	[0.00004]***	[0.00649]***	[0.08346]*	[0.00234]***	[0.07584]*
Board interlock				0.311	0.014	0.318	0.697	0.376	0.707
				[0.39417]	[0.96577]	[0.38392]	[0.06595]*	[0.29146]	[0.06266]*
ln(Boardsize)				-0.049	-0.060	-0.046	-0.068	-0.074	-0.065
				[0.50210]	[0.32266]	[0.52695]	[0.34948]	[0.22279]	[0.37415]
Male dummy				-0.081	-0.058	-0.083	-0.169	-0.116	-0.171
				[0.56504]	[0.63087]	[0.55808]	[0.21743]	[0.31673]	[0.21212]
1 Yr Return to Shareholders							0.001	0.001	0.001
							[0.01011]**	[0.00085]***	[0.01034]**
Market-to-book							0.001	-0.000	0.001
							[0.10724]	[0.64745]	[0.10826]
Executive's Age							-0.002	-0.003	-0.002
							[0.42936]	[0.15974]	[0.40314]
CFO dummy							0.262	-0.786	0.259
							[0.14517]	[0.11136]	[0.14947]
Executive share ownership							-183.565	-241.220	-183.526
							[0.30781]	[0.29128]	[0.30732]
Executive is listed as interlocked							-0.299	-0.275	-0.300
							[0.00029]***	[0.00002]***	[0.00029]***
Pair dummy							0.043	0.085	0.043
							[0.48744]	[0.16044]	[0.48650]
Observations	11896	13630	10418	9545	12417	9545	8802	11411	8802
R-squared	0.46009	0.47803	0.47385	0.49496	0.49033	0.49502	0.49869	0.50485	0.49880

TABLE 5. CENTRALITY MEASURE REGRESSIONS

This table shows regression results for the three sets of control variables presented above. Each of the four panels represent a different regressions with a different centrality measure. The dependent variable is the natural log of total CEO compensation. All specifications include year and industry fixed effects. Standard errors are clustered on individuals. Robust p-values are given in brackets.

Betweenness	193.125		97.470	153.574		118.976	171.602		139.558
	[0.00004]***		[0.08532]*	[0.00288]***		[0.03112]**	[0.00088]***		[0.01120]**
Board Betweenness		211.698	167.990		147.733	76.301		141.816	70.748
		[0.00003]***	[0.01921]**		[0.00533]***	[0.27924]		[0.00843]***	[0.32526]
Specification	1	1	1	2	2	2	3	3	3
Observations	11896	13016	10381	9545	11941	9527	8802	10975	8789
R-squared	0.46091	0.47901	0.47543	0.49547	0.49039	0.49570	0.49907	0.50595	0.49935
Closeness	73.656		61.195	66.689		79.038	91.476		106.180
	[0.00856]***		[0.10174]	[0.03991]**		[0.03019]**	[0.00646]***		[0.00453]***
Board Closeness		76.119	22.119		41.701	-26.991		45.099	-30.460
		[0.01540]**	[0.64203]		[0.22493]	[0.57578]		[0.20359]	[0.54238]
Specification	1	1	1	2	2	2	3	3	3
Observations	11896	13016	10381	9545	11941	9527	8802	10975	8789
R-squared	0.46008	0.47812	0.47427	0.49490	0.48984	0.49507	0.49871	0.50548	0.49895
Eigenvector	3.202		3.454	2.775		3.735	3.592		4.891
	[0.00114]***		[0.02123]**	[0.00314]***		[0.00771]***	[0.00036]***		[0.00153]***
Board Eigenvector		3.306	-0.518		2.763	-1.886		2.867	-2.424
		[0.01552]**	[0.81401]		[0.03586]**	[0.36177]		[0.02716]**	[0.25728]
Specification	1	1	1	2	2	2	3	3	3
Observations	11896	13630	10418	9545	12417	9545	8802	11411	8802
R-squared	0.46009	0.47803	0.47385	0.49496	0.49033	0.49502	0.49869	0.50485	0.49880
Bonacich	0.056		0.034	0.048		0.049	0.071		0.080
	[0.00923]***		[0.25609]	[0.04277]**		[0.09449]*	[0.00449]***		[0.00686]***
Board Bonacich		0.090	0.048		0.073	-0.002		0.064	-0.024
		[0.00381]***	[0.32031]		[0.02765]**	[0.95813]		[0.06325]*	[0.60331]
Specification	1	1	1	2	2	2	3	3	3
Observations	10750	13628	9900	9072	12416	9072	8360	11411	8360
R-squared	0.46616	0.47831	0.47808	0.49776	0.49041	0.49776	0.50240	0.50486	0.50243

FIGURE 1. SCATTER PLOT OF RESIDUALS

This figure shows a simple scatter plot of the residuals from the regression using all controls and the Eigenvector measure of centrality. Each dot represents a pair of residuals from the same year, i.e. the window length is one. The figure is representative for other regression specifications and window lengths.

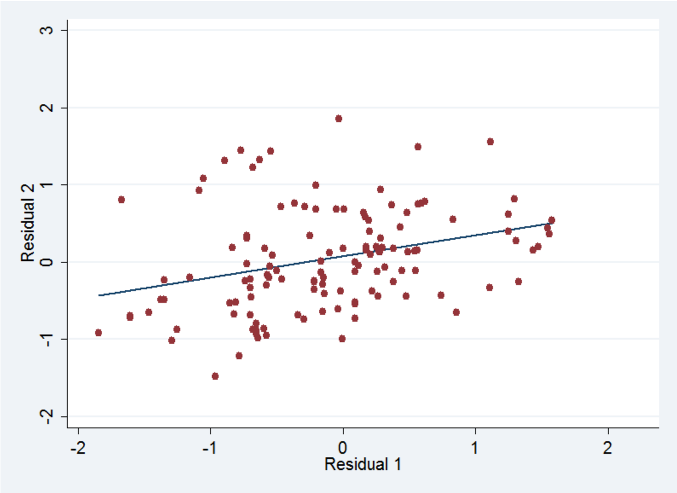

TABLE 6. RESIDUAL REGRESSIONS

This table shows the results of regressing the residual of the first player in a tit-for-tat pair on that of the other player. *Specification* refers to the set of controls used to generate the residuals as shown in Table 4. *Window length* refers to the window over which residuals are averaged, e.g. one for contemporaneous observations only and eleven for the entire sample. Standard errors are clustered on pair and year where applicable. p-values are given in brackets.

Specification	1	2	3	1	2	3	1	2	3	1	2	3
Window length	1	1	1	3	3	3	7	7	7	11	11	11
Average residual	0.361***	0.319**	0.272**	0.388***	0.341***	0.298**	0.472***	0.424***	0.398***	0.472***	0.424***	0.398***
	[0.0090]	[0.0116]	[0.0403]	[0.0006]	[0.0019]	[0.0125]	[0.0000]	[0.0000]	[0.0001]	[0.0000]	[0.0001]	[0.0012]
Constant	0.0999	0.0732	0.0735	0.0752	0.0648	0.0884	0.0579	0.0553	0.0735	0.0579	0.0553	0.0735
	[0.2043]	[0.3886]	[0.4633]	[0.2849]	[0.3776]	[0.2918]	[0.3105]	[0.3574]	[0.2869]	[0.3713]	[0.4176]	[0.3494]
Observations	162	142	130	265	243	228	270	240	225	54	48	45
R-squared	0.1626	0.1507	0.0957	0.1939	0.1691	0.1083	0.3043	0.2604	0.2032	0.3043	0.2604	0.2032

TABLE 7. CONTROLLING FOR CHAIRMANSHIP AND COMPENSATION COMMITTEE MEMBERSHIP, CONTEMPORANIOUS OBSERVATIONS

This table shows effects and cross effects of the board member in a tit-for-tat pair being the chairman of the board (*Chairman*), on the compensation committee (*CompCom*), serving on a board with less than seven members (*SmallBoard*) or being any position of influence (*Any*). Apart from the board chairmanship and compensation committee membership, the board vice chairmanship and membership on the governance committee counts as a position of influence. The regression includes contemporaneous observations only, i.e. corresponding to columns one to three of Table 6. Standard errors are clustered on pairs and year. p-values are given in brackets.

Specification	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3
Residual	0.361***	0.357***	0.369**	0.335**	0.29	0.319**	0.371***	0.370***	0.277**	0.285	0.272**	0.330***	0.308**	0.214	0.209
	[0.0090]	[0.0027]	[0.0180]	[0.0280]	[0.1888]	[0.0116]	[0.0001]	[0.0075]	[0.0493]	[0.1934]	[0.0403]	[0.0028]	[0.0456]	[0.1415]	[0.3922]
Chairman		0.15					-0.0065					-0.0515			
		[0.2259]					[0.9506]					[0.6765]			
Chairman*Residual		0.0115					-0.201					-0.266			
		[0.9648]					[0.4745]					[0.4082]			
CompMem			0.0595					0.0426					0.0646		
			[0.4411]					[0.6831]					[0.5807]		
CompMem*Residual			0.000589					-0.0925					-0.0598		
			[0.9963]					[0.3658]					[0.5952]		
SmallBoard				-0.00319					0.061					0.0599	
				[0.9652]					[0.4891]					[0.5355]	
SmallBoard*Residual				0.108					0.175					0.234	
				[0.6183]					[0.4779]					[0.2492]	
AnyPos					0.000786					-0.114					-0.17
					[0.9954]					[0.4895]					[0.3872]
AnyPos*Residual					0.12					0.0257					0.0562
					[0.6269]					[0.9197]					[0.8404]
Constant	0.0999	0.0507	0.0781	0.0974	0.108	0.0732	0.0697	0.0524	0.0508	0.151	0.0735	0.0808	0.0472	0.0455	0.195
	[0.2043]	[0.5168]	[0.3797]	[0.2291]	[0.4491]	[0.3886]	[0.4436]	[0.6152]	[0.5229]	[0.3969]	[0.4633]	[0.4454]	[0.7056]	[0.6301]	[0.3597]
Observations	162	162	162	162	162	142	142	142	142	142	130	130	130	130	130
R-squared	0.1626	0.1751	0.1647	0.1654	0.1668	0.1507	0.1622	0.1558	0.16	0.1581	0.0957	0.1113	0.0998	0.1094	0.1097

TABLE 8. CONTROLLING FOR CHAIRMANSHIP AND COMPENSATION COMMITTEE MEMBERSHIP, AVERAGES OVER THE ENTIRE SAMPLE PERIOD

This table shows effects and cross effects of the board member in a tit-for-tat pair being the chairman of the board (*Chairman*), on the compensation committee (*CompCom*), serving on a board with less than seven members (*SmallBoard*) or being any position of influence (*Any*). Apart from the board chairmanship and compensation committee membership, the board vice chairmanship and membership on the governance committee counts as a position of influence. The regression uses averages over the entire time period, i.e. corresponding to columns ten to twelve of Table 6. Standard errors are clustered on pairs. p-values are given in brackets.

Specification	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3
Residual	0.472***	0.409***	0.513***	0.348***	0.432**	0.424***	0.412**	0.469***	0.365***	0.425**	0.398***	0.406**	0.420***	0.361**	0.355*
	[0.0000]	[0.0027]	[0.0002]	[0.0073]	[0.0105]	[0.0002]	[0.0100]	[0.0011]	[0.0044]	[0.0219]	[0.0019]	[0.0248]	[0.0081]	[0.0103]	[0.0977]
Chairman		0.163					0.0656					0.0412			
		[0.2162]					[0.6443]					[0.8012]			
Chairman*Residual		0.105					0.0125					-0.0207			
		[0.6122]					[0.9542]					[0.9337]			
CompMem			-0.14					-0.12					-0.0755		
			[0.3184]					[0.4122]					[0.6753]		
CompMem*Residual			-0.162					-0.186					-0.121		
			[0.4485]					[0.4255]					[0.6791]		
SmallBoard				0.0559					0.0706					0.0293	
				[0.6619]					[0.5956]					[0.8456]	
SmallBoard*Residual				0.215					0.102					0.0654	
				[0.2144]					[0.6172]					[0.7683]	
AnyPos					0.00311					-0.136					-0.197
					[0.9837]					[0.4387]					[0.3145]
AnyPos*Residual					0.0646					-0.00974					0.0439
					[0.7567]					[0.9654]					[0.8659]
Constant	0.0579	-0.0365	0.0988	0.0235	0.0571	0.0553	0.015	0.0879	0.0166	0.165	0.0735	0.048	0.0891	0.0525	0.232
	[0.3696]	[0.7098]	[0.2250]	[0.8031]	[0.6668]	[0.4140]	[0.8925]	[0.3197]	[0.8522]	[0.2974]	[0.3426]	[0.7116]	[0.3745]	[0.6290]	[0.1867]
Observations	54	54	54	54	54	48	48	48	48	48	45	45	45	45	45
R-squared	0.3043	0.3272	0.322	0.3207	0.3056	0.2604	0.264	0.2784	0.2678	0.2705	0.2032	0.2048	0.2083	0.205	0.2233

TABLE 9. LAGGED RESIDUALS REGRESSIONS

This table presents the results of including lagged pair residuals in the previously estimated regressions. Each regression is first estimated yearly (with no residuals among the independent variables). The regressions are then re-estimated using various lags of the residuals tit-for-tat partners as independent variables. $Residual_{t-1}$ is the one year lagged residual of each individual's tit-for-tat partner (if any). For individuals that are not part of a tit-for-tat pair at time *t-1*, the variable takes the value zero. $Residual_{t-1:t-2}$ is the sum of the one and two years lagged residuals. $Residual_{t-1:t-5}$ is the sum of the one to five years lagged residuals. The specifications one to three correspond to the specifications in Table 4. Standard errors are clustered on tit-for-tat pairs, years, companies and individuals. Robust p-values are given in brackets.

Specification	1	1	1	2	2	2	3	3	3
$Residual_{t-1}$	0.500			0.562			0.463		
	[0.00021]***			[0.00000]***			[0.00079]***		
$Residual_{t-1:t-2}$		0.355			0.402			0.373	
		[0.00000]***			[0.00000]***			[0.00003]***	
$Residual_{t-1:t-5}$			0.226			0.285			0.257
			[0.00000]***			[0.00000]***			[0.00001]***

TABLE 10. RESIDUAL REGRESSIONS FOR NON-CEO EXECUTIVES

This table shows the results of regressing the residual of the first player in a tit-for-tat pair on that of the other player. *Specification* refers to the set of controls used to generate the residuals as shown in Table 4. *Window length* refers to the window over which residuals are averaged, e.g. one for contemporaneous observations only and eleven for the entire sample. Standard errors are clustered on pair and year where applicable. p-values are given in brackets. This table corresponds to Table 6 but the sample is top non-CEO executives rather than CEOs.

Specification	1	1	1	1	2	2	2	2	3	3	3	3
Window length	1	3	7	11	1	3	7	11	1	3	7	11
Average residual	-0.137	-0.0740	-0.100	-0.100	-0.219	-0.231	-0.169	-0.169	0.239	0.430	0.366	0.366
	[0.4212]	[0.6467]	[0.4217]	[0.4776]	[0.3647]	[0.2846]	[0.3379]	[0.3997]	[0.6279]	[0.2110]	[0.1681]	[0.2416]
Constant	0.406**	0.336**	0.385***	0.385***	0.405**	0.285*	0.337**	0.337**	0.592**	0.473**	0.398**	0.398**
	[0.0183]	[0.0292]	[0.0008]	[0.0043]	[0.0344]	[0.0971]	[0.0167]	[0.0396]	[0.0193]	[0.0184]	[0.0101]	[0.0364]
Observations	105	247	295	59	77	184	215	43	44	81	95	19
R-squared	0.0096	0.0029	0.0065	0.0065	0.0223	0.0227	0.0144	0.0144	0.0149	0.0795	0.0620	0.0620

TABLE 11. LAGGED RESIDUALS REGRESSIONS FOR NON-CEO EXECUTIVES

This table presents the results of including lagged pair residuals in the previously estimated regressions. Each regression is first estimated yearly (with no residuals among the independent variables). The regressions are then re-estimated using various lags of the residuals tit-for-tat partners as independent variables. *Residual*$_{t-1}$ is the one year lagged residual of each individual's tit-for-tat partner (if any). For individuals that are not part of a tit-for-tat pair at time *t-1*, the variable takes the value zero. *Residual*$_{t-1:t-2}$ is the sum of the one and two years lagged residuals. *Residual* $_{t-1:t-5}$ is the sum of the one to five years lagged residuals. The specifications one to three correspond to the specifications in Table 4. Standard errors are clustered on tit-for-tat pairs, years, companies and individuals. Robust p-values are given in brackets. This table corresponds to Table 9 but the sample is top non-CEO executives rather than CEOs.

Specification	1	1	1	2	2	2	3	3	3
Residual$_{t-1}$	-0.023			-0.010			-0.031		
	[0.83260]			[0.94030]			[0.75340]		
Residual$_{t-1:t-2}$		-0.044			-0.016			-0.017	
		[0.33955]			[0.72222]			[0.69249]	
Residual$_{t-1:t-5}$			0.007			0.039			0.051
			[0.89646]			[0.53898]			[0.57679]