THE RETENTION CONSEQUENCES OF CAPS ON EXECUTIVE COMPENSATION DURING

design of compensation contracts, resulting in inefficient contracts in which base pay is too low (and the contract through the second period or to fire the CEO and hire a new one. The firm then offers a new contract to either the incumbent CEO (if the firm wishes to retain the CEO) or to a new one. Finally, second-period profit and CEO performance are realized. The firm goes bankrupt at the end of the second period if the sum of first and second-period profits (minus the fixed cost incurred as a result of the financial crisis) is negative. Otherwise the firm survives.

The policy world is the same as the baseline world

We then compare the simulated outcomes from the policy world to those from the baseline world to identify the effect of the policy.

Our simulations reveal the following results. First, the probability that the CEO leaves after the financial crisis hits drops significantly, and the bulk of this effect occurs in the case in which the bailout is taken. This result is counter to the criticism of the pay regulations that is

CEO stays or leaves by increasing the variance of compensation. Given that the policy constrains only base pay and not variable pay, meeting the risk-
constraint requires an increase in the slope of the incentive contract to induce a higher-than-optimal effort level. Thus, we find that the average level of second-period CEO base pay is decreasing in the bailout amount, whereas the average slope of the second-period compensation contract is increasing.

I. Related Literature

Our analysis relates to several areas in the executive compensation literature surveyed in accompanying restrictions on executive pay) that determines whether it is subject to compensation restrictions. Thus, two o

and whether to retain the CEO or not) that are central to our paper are not modeled in the Dittmann *et al*. analysis. Third, that analysis is based on a calibration approach, i.e. all of the parameters in their model were assigned values for each firm in the sample rather than estimated from data in a structural analysis. We see the differences between the two analyses as driven by differences in the research questions addressed. Thus, the papers are complementary and shed light on different aspects of the under-explored research area of executive pay restrictions.

Taylor (2011) is the first to estimate a structural model of CEO turnover, quantifying the potential effects of suboptimal turnover decisions on shareholder value. He estimates parameters via the method of simulated moments using data on firm profitabilit

potential effec moments usemethod of method of method of turnover during a period of financial crisis rather than over the entire business cycle as in Eisfeldt and Rampini (2008).

II. Policy Background (ARRA): Restrictions on Executive Compen

in period t. To simplify the analysis in order to enrich it in other dimensions (e.g. endogenous firm choices of compensation contracts, CEO turnover, and, in the policy world, whether to accept or reject public bailout funds and the accompanying restrictions on pay contracts) we assume that the firm maximizes per-period expected profit. The model is therefore not fully dynamic given that when making first-period choices the firm does not account for the effect of its decisions on second-period profit; the two periods represent different regimes pre and post crisis. Given this approach, the probability of a future financial crisis is not taken into account in the pre-crisis decisions of the firm and workers. The financial crisis is modeled as a non-stochastic, unexpected fixed cost incurred by the firm in the middle of the first period.[13]

At the start of period 1, the firm hires a risk-averse executive by drawing from the , representing a stochastic and time-invariant executive ability. Let U_t denote the -t reservation expected utility. Although the executives are heterogeneous in ability, they have common preferences given by a per- 0 1 345.791 0 0 1 33ET3a future Tm[(wh Tm[( )] TJETB where a_1 (i.e. base salary and other components of compensation that do not and $W_2 = a_S + b_S P_2$ $P_2 =$ $+ u_2 +$ — and $W_2 = a_L + b_L P_2$.[16]

-period profits, $_2$, are realized at the end of period 2 and depend on the choice the firm made at the end of period 1, i.e. $_2 = P_2$ $_2$ W_2, where $_2$ is a mean-zero stochastic shock. The firm closes at the end of the second period if $_1 +$ $_2$ < 0.

While the performance shocks (u_1 and u_2) are independent across periods, the presence of P_1 on the right-hand side of (5) implies persistence of first-period shocks, capturing the idea that the stochastic part of performance reflects a blend of persistent and idiosyncratic components. However, note that b_1 $_1$ (which also appears in (5)). Thus, persistence in performance is modeled via stochastic shocks rather than via effort choices.[17] Note also that the recursive structure of performance, with P_1 being observed by the firm and appearing on the right-hand side of P_2, eliminates the need for Bayesian updating about when making second-period compensation and retention decisions, because is embedded in the observed P_1. Thus, the retention decision requires only a comparison of the observed P_1 with

Let $E(\ \ _S|P_1)^*$ and $E(\ \ _L)^*$ denote expected period-2 profits evaluated at the optimal contracts (a_1,b_1), (a_S,b_S), and (a_L,b_L), given defined as follows:

$$E(\ \ _S|P_1)^* = (1 \quad b_S)(1 + \quad)(P_1 + — \quad —) \quad a_S + \quad _S \tag{6}$$

$$E(\ \ _L)^* = (1 \quad b_L)(\mu + —) \quad a_L + \quad _L \tag{7}$$

The firm makes the choice that yields the highest of $E(\ \ _S|P_1)^*$ and $E(\ \ _L)^*$. We now describe the -period compensation .

In the S case, the firm chooses (a_S,b_S) to maximize

$$E(\ \ _S|P_1) = (1 \quad b_S)(1 + \quad)(P_1 + — \quad —) \quad a_S \tag{8}$$

subject to $E[\ \exp(\qquad _2 \quad C(e_2)))|P_1] \qquad _2$ and $E(\ \ _S|P_1)$

Given the expression for second-period contracts, we compute realized profits and whether the firm survives or closes. The following algorithm describes our approach, which provides the basis for the estimation routine described in the next section:

1. As , , , $_1$, and U_2.

2. Compute a_1 and b_1.

3. ′, u_1, u_2 $_1$ $_2$ $_S$, $_L$).

4. Compute P_1, W_1, and $_1$.

5. Solve for the second-period compensation contracts, i.e. (a_S, b_S) and

-period profits are as before, with

the addit [20] The timing for period 2 is the same as in the baseline world, and the timing for period 1 in the policy world is as follows:

Period 1 Timing

Firm offers linear compensation contract (a_1, b_1) to a new, risk-averse executive.

Firm observes executive performance, P_1, and firm profit, $_1$.

Financial crisis occurs, and f acing it in financial distress.

Government offers the option of a bailout, B, combined with future restrictions on executive pay (capping base pay at k).

Firm decides whether to take bailout and whether to retain the executive.

Firm makes second-period compensation offer to second-period executive.

Second-period contracts for the cases of NS and NL are the same as those for cases S and L, respectively, in the baseline world. In the BS case, assuming first that the regulation does not bind, then $b_{BS} = b_{NS}$. Assuming next that the regulation binds, the firm offers $a_{BS} = k$ and chooses 00125 -0.1213

In the BL case, assuming the regulation does not bind, then the standard result of b_{BL} =

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hours worked in labor supply models involving the econometrics of piecewise linear budget constraints (e.g. MaCurdy, Green, and Paarsch 1990, Blundell and MaCurdy 1999). In that literature, progressive taxes create piece-wise linear, convex budget constraints, with kinks occurring at particular hours of work that correspond

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Empirically, however, it is not unusual (even in datasets of thousands of worker hours choices) for few or even no observed hours choices to occur exactly at these kink points. In MaCurdy, Green, and Paarsch (1990), only a single observed hours choice occurred at a kink point. The authors note that in the absence of assumed measurement error in hours worked, such evidence would be the basis for immediate rejection of the theoret

10. Change a parameter value in step 1, and then repeat steps 2-9, to conduct comparative statics analysis.

Note that the policy reduces base pay below what the firm would optimally offer. What happens to the contract slope depends on parameter values. More precisely, in the BL case, if

$+ \quad)b_{BL} < -b_{BL} + \mu$ then reductions in a_{BL} imply increases in b_{BL} (i.e. base pay and the contract slope are substitutes), whereas if the inequality is reversed the opposite is true (i.e. base pay and the contract slope are complements). Similarly, in the BS case, if

$b_{BS} < -[b_{BS} \quad b_1] + P_1$ we have substitutes, and if the inequality is reversed we have complements.[22] In the BL case, if the product $\quad + \quad)$ is sufficiently small, then the case of substitutes occurs, whereas if it is sufficiently large the case of complements occurs. In contrast, in the BS case, the magnitude of $\ _u^2$ is insufficient for determining whether the case of substitutes or complements prevails. The reason is that the BS case conditions on first-period performance, so P_1 appears in the resulting inequality. This means that, for example, even if $\quad =$ 0, base pay and variable pay can be complements if $P_1 \quad -$ ochastic ability plus the first-period performance shock) is sufficiently negative. In both the BL and BS cases, a higher product of the coefficient of absolute risk aversion and the variance of second-period performance implies a greater likelihood that base pay and the piece rate are complements.

when this product is large. Thus, if base pay is reduced (as it is by the ARRA) then to maintain second-period expec -period participation constraint) a reduction in the slope of the contract is needed. In expected utility terms, decreasing the variance of total compensation is more appealing to the executive than raising its mean, hence a drop in the slope accompanies a drop in the base pay. Whereas the theoretical model allows for both complements and substitutes, the data must determine which case is empirically relevant. As we discuss later, the empirically relevant case in our data is substitutes.

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[22] Both conditions are found by solving the relevant participation constraint (for the BL case or the BS case) for the contract intercept and then differentiating its right-hand side with respect to the contract slope. Note that in the BS case the condition

nstruct the moments for post-crisis variables. Following stud -score as a model for predicting computing Z-scores for each observation and defining those firms with Z-scores below 1.81 as distressed.[24] The Altman Z-score model is not recommended for use with financial companies, due to the opacity of their balance sheets and their frequent use of off-balance sheet items. For this reason we restrict our analysis sample to non-financial companies, though we note that our model should also be applicable to financials, particularly given that the restrictions imposed by ARRA are similar for both types of companies.[25] The subsample of 2108 firm-year observations, and the subsample of non- contains 11,655 firm-year observations.

B. Identification

The identification problem is to infer the joint distribution of the stochastic components of the model (except for the optimization errors), the degree of firm-specific human capital ( ), and

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V. Policy Analysis (ARRA)

In this section, we use the parameter estimates from Section IV to analyze the effect of the cap on base pay for firms accepting bailout assistance. Given the values for , ^{2} $_{u}^{2}$ ^{2}, ^{2} $_{1}$, and U_2 from Section IV, we set values for the two policy parameters (B and k) and simulate various outcomes of interest in the policy world, including the probability the CEO stays in the second period, the probability of accepting a bailout, the probability of firm closure, and the structure of second-period compensation contracts. A comparison of the simulated outcomes from the policy world to those from the baseline world the regulations will make it difficult for firms to retain top executive talent. As we noted earlier, this argument is problematic because the cap exempts a component of compensation that can be adjusted n constraint and prevent a quit. Simulated executive retention rates are actually higher when the firm takes a bailout than in the baseline world.

Second, the bankruptcy probability is relatively insensitive to the policy; however it is slightly higher when the firm does not take the bailout than when the firm does, given that the CEO stays.[30] A higher first-period performance increases the likelihood that the bailout is taken and that the CEO is retained. If the firm has a lower chance of second-period closure anyway (even absent the bailout) it finds the bailout more appealing. To understand why this happens, recall that a high first-period performance increases the likelihood of a high second-period performance due to persistence in the performance shocks. The increased likelihood of a high second-period performance is more valuable in the case of a bailed-out firm with a retained CEO because of the firm-specific human capital parameter, δ, which enters multiplicatively, raising the marginal return to second-period CEO performance.

There is another mechanism, also relating to firm-specific human capital, that explains why when the firm takes a bailout it tends to retain the CEO. This mechanism concerns incentives. Recall that our empirical results imply that base pay and the contract slope are substitutes, so that the second-period contract slope is higher when the bailout is taken than when it is not. The steeper slope induces incremental CEO effort, and the marginal effect of this effort on performance is particularly valuable in the presence of multiplicative firm-specific human capital. In other words, the distortion in the structure of compensation that the policy creates (i.e. requiring the firm to offer a higher slope than desirable) is not as costly to the firm in the presence of firm-specific human capital, given that the marginal return to the firm of CEO effort is higher in the presence of firm-specific human capital than in its absence.

Third, second-period total CEO compensation does not change much as a result of the policy, though it is slightly higher than in the baseline world given that it is higher when the bailout is accepted. Note that this is despite the cap on executive base pay; the firm is able to make up the difference by paying CEOs more variable pay to compensate for reduced based pay, as discussed in the next point. An increase in second-period total compensation is expected, since

[30] is case should be discounted since it happens so rarely (i.e. as seen in column 3, given that a bailout occurs, the CEO leaves only 0.269% of the time).

payments they receive. These effects are displayed for all observations in Table V, for the

ons (cases BL and BS) in Table VI

(cases NL and NS) in Table VII. The rationale for looking at the effects of increases in B on the

) is that when B in

-- Insert Tables V, VI, and VII here --

Although Table V reveals that the probability the CEO is retained is increasing in B, Tables VI and VII reveal that the same probability is decreasing in B when the firm takes the bailout and when it does not. To understand why this happens, first notice that as we move from column 1 to column 5 in Table V, the likelihood that the employer takes the bailout increases, because the bailout is becoming more generous. Second, notice that the CEO retention rate is significantly higher for the bailout firms (Table VI), in every column, than for

firms (Table VII). It is the combination of these two facts that explains why the retention rate that combines both groups (Table V) is increasing in B. The reason why Prob(S) is a decreasing function of B in Tables VI and VII can be explained as follows. First, as noted earlier, a higher first-period performance increases the likelihood of a bailout. Second, as B increases in columns 6 and 7, the firm is naturally more likely to take the bailout; in the context of simulations this means

to accepting the bailout when B is higher. This lowers the average first-period performance both in the case of the bailout being accepted (i.e. Table VI) and in the case of it being rejected (i.e. Table VII) which in turn implies an increased probability of separation in both cases, given that lower first-period performance implies a greater likelihood of lower second-period performance, due to persistence in CEO performance.

Table V reveals that probabilities of firm closure are decreasing in B, as expected. Within the categories of stayers and leavers, however, the closure probabilities are non-monotonic in B. Similarly, both Table VI (for bailout firms) and Table VII

closure probability is non-monotonic in B, both overall and within the categories of stayers and leavers. These results are not surprising given the small magnitude of B relative to the large estimated variance of the stochastic shocks to per-period profit. The closure probability is

Prob($_1$ + $_2$, and it must decrease in B, *ceteris paribus*, given that the expression for $_2$

Table V reveals that total second

restrictions on severance pay). The model could also be extended to incorporate competing firms so that th   determined in each period.[31]

We conclude by noting that although we have focused on the ARRA, our approach to the

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Table I. Structural Estimation Results

Results from estimation of parameters in the baseline world by method of simulated moments (n = 100,000 stochastic draws

$_1 = U_2$

	Parameter Estimates	Standard Errors
δ	0.035	0.005
λ	64.141	1014.126
	4805.011	333.515
$_u$	1.006	7.962
	0.004	0.001
U_1	-0.012	0.003
μ	44.482	2.747

Table II. Observed and

Table VI. Comparative Statics for B (Bai