Don't Forget the Gravy! Are Bonuses and Time Rates Complements?

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Abstract

The press often depicts bonuses as extra payments to the already well compensated and calls for reform. Yet, these calls typically ignore the efficiency argument that bonuses are potentially risky performance pay that substitute for salary compensation. This paper uses representative UK data to estimate that bonuses appear not to substitute for salary in cross-sectional estimates. Yet, when controlling for time invariant characteristics in panel data, bonuses emerge as substitutes. Each pound of bonus comes at a cost of 40 pence in other earnings. The degree of substitution is far larger at the bottom of the earnings distribution and far smaller at the top of the earnings distribution.

JEL Codes: J31, J33

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1. INTRODUCTION

The payment of bonuses as part of managerial and executive compensation attracts increasing public controversy. Print and other media highlight the size of bonuses paid at financial institutions, often with the application of pejorative terms such as `bonus culture' that suggest the payment of something for nothing.[1] Indeed, the depth of public feeling regarding bonuses has led to pronouncements by both the US president and the UK prime minister on the need to restrain these "inequitable payments." The public perception of something for nothing seems at odds with the basic theory that bonuses, like other forms of performance pay, represent a means to mitigate agency problems in labour contracts. Payment contingent on worker performance stands in lieu of some portion of an otherwise riskless (or at least less risky) salary payment and serves to increases firm profitability, worker utility or both. In fact, the presumption that high performance bonuses substitute for salaries provides the basis for the resistance by both the UK and US financial sector to cap or reduce bonus payments. Advocates for the sector explicitly claim that reducing bonuses will lead to either a necessary compensating increase in salary payments or a loss of talent within the sector.

The basic notion that performance pay elicits additional effort and is associated with increased earnings stands as well engrained in the economics of personnel (Brown 1992, Parent 1999, Lazear 2000 and Shearer 2004). Yet, the combination of the disutility from greater effort and risk has left in doubt the extent to which the higher pay generates higher worker utility from performance pay (Green and Heywood 2008 and Cornellisen et al. 2011). At least part of the answer of whether or not workers benefit from performance pay revolves around the critical issue at the heart of the public debate, the extent to which performance pay substitutes for fixed time rates. As we will detail, previous empirical results often fail to find any substitution showing that higher performance payments tend to be associated with higher fixed time rates. If correct, the performance pay in these studies would represent "gravy" simply poured on top of fixed rates. We provide a unique study focused specifically on bonus payments.

In contributing to this issue, we emphasize that none of the previous studies directly examining substitutability control for worker fixed effects despite routine evidence that performance pay causes worker sorting on characteristics such as ability. Using panel data from the UK, we confirm the importance of accounting for worker fixed effects. We present

pooled cross-sectional evidence suggesting that bonuses are entirely gravy and a compliment to other earnings. Yet, when controlling for worker fixed effects, and the associated sorting, we show that bonuses are imperfect substitutes for other earnings. In particular, we find that about 60 pence of every pound of bonuses is translated into increased earnings. Put differently, each pound of bonus costs 40 pence in lost other earnings. Moreover, when we explore the distributional aspects of this correlation through quantile regression, it emerges as far larger at the top of the earnings distribution. While we provide some speculation on this distributional aspect, our primary contribution is a unique focus on bonus payments, an improvement on previous studies that attempt to measure the degree of substitution between performance pay and time rates and our ability to find such substitution.

In what follows, the next section provides further motivation for our examination and reviews previous empirical studies. The third section provides our data and methodology. Section four presents the critical results and a series of robustness checks as well as our quantile regression estimates. A fifth section concludes.

2. MOTIVATION

Perhaps the most dramatic example of substitution comes from the history of concern over ratchet effects in which fixed rates are replaced by piece rates which are then lowered when workers respond with greater productivity (see Gibbons 1987, Carmichael and MacLeod 2000 and Freeman and Kleiner 2005). Yet, even apart of these dynamic concerns, the two basic static models of performance pay each predict substitution. The agent-principle and sorting, Lazear type, models do differ in the extent to which workers' earnings will increase as a result of performance pay (Cornellisen et al. 2011). The former assumes a reservation utility constraint and argues total earnings increase only enough to compensate for the increased cost of effort and for assuming additional risk. The second argues that they increase by more as workers capture individual rents and the firm faces a zero profit constraint. Thus, as total earnings go up less in the agent-principle model it would predict greater substitution than the sorting model. Despite this difference, neither model suggests that moving from fixed earnings to performance pay should cause the fixed earnings to increase while the performance pay is simply added on top. The very point of the performance pay is to reduce the fixed salary component in order to make earnings depend, if imperfectly, on worker productivity.

This prediction is critical as the, admittedly modest, previous empirical literature often fails to confirm any substitution at all. It finds that greater performance pay is, indeed, often associated with larger fixed pay. Among those who do find some substitution, Kaufman (1998) uses a survey of US firms implementing gain sharing to follow earnings before and after the plans are implemented. He estimates that gain sharing is not "pure gravy" as other compensation falls but not by as much as the gain sharing payment. Barkume (2004) has more detailed data from the US Employment Cost Index on specific jobs (but not workers and their characteristics). He finds that incentive pay (largely piece rates) increases total employer costs for employee compensation but it is associated with reductions in other forms of compensation suggesting substitution. Importantly, both of these papers focus on types of performance pay typically oriented to line production workers. On the other hand, a series of examinations of profit sharing payments fail to find evidence of substitution (Wadhwani and Wall 1990 for the UK; Hart and Huebler 1991 for Germany; Cahuc and Dormont 1997 for France). Indeed, the studies of both France and Germany present evidence that profit shares are positively associated with base wages suggesting complementarity. Mitchell et al. (1990) examine bonus payments showing that they are also positively associated not only with total compensation but with base wages suggesting, again, not substitution but complementarity. Thus, previous evidence presents a surprising number of positive associations between performance pay and base wages when neither of the basic static models would predict such a result.[2]

In addition to the failures to confirm substitution cited above, other literatures might cast doubt on the basic implications of agent-principle and Lazear type models. The separation between ownership and control may allow managers substantial latitude in determining both their own contracts and those of their employees. Bertrand and Mullanaithan (2001) and Albanesi and Olivetti (2008) present evidence that CEOs `skim' rents from firms, especially in favourable conditions where they are less likely to be detected. Indeed, linking these skimmed rents with "performance" may be crucial in reducing their likelihood of detection as it is often difficult to accurately determine the influence of the CEO on performance. Empirical evidence accords with this showing that more severe agency problems are associated with unusually high performance payments such as options and other incentives (Brick et al. 2012 and Bebchuk et al. 2002). This can be relevant to workers beyond the upper management if managers with high powered incentives tend to devise higher powered incentives for their workers (See Heywood et al. 2006). Kruger (1991)

confirms that the earnings of line workers are higher when owners do not manage. Similarly, Groshen and Kruger (1990) show that when earnings of managers are higher so are those of other occupations even holding constant, as best as possible, job content and supervision. Thus, it is not inconceivable that the separation of ownership from control could allow both management and key workers to capture bonuses added on to large fixed compensation as part of portraying a performance oriented workplace to owners with imperfect information.[3]

Alternatively, bonuses may simply not be linked intimately to productivity and performance. In this view calling something a bonus in a survey or even within a firm's compensation scheme does not make it "performance pay" of the sort in the traditional models. Critically, there may be large elements of subjectivity in the determination of bonuses (MacLeod 2003). This subjectivity increases the latitude for managers who set bonuses. As a consequence, managers may follow objective functions other than simple rent skimming. Freibel and Raith (2004) describe a hierarchy in which supervisors at each level reward unproductive subordinates as a way of protecting themselves.[4] Heywood (1991) presents a model in which managers "overpay" workers to reduce managerial effort associated with monitoring and job turnover. In addition, performance pay has been associated with greater racial earnings gaps (Heywood and Parent 2012). To the extent that bonuses reflect industrial politics, effort avoidance or attempts to discriminate they need not be linked to productivity and there becomes far less reason to think they necessarily substitute for fixed salary.

Indeed, theorists have explicitly questioned the traditional models. Zaharieva (2010) constructs a model that relies on heterogeneous jobs, incomplete information and equilibrium job search to introduce frictions that can explain the "stylized fact" of complementarity. Yet, before abandoning the more straightforward agent-principle and Lazear type models, we think the estimation should be revisited.

Crucially, findings that bonuses are complements could spuriously result from more productive workers sorting into performance pay jobs and the inability to control for this in typical cross-section results. Indeed, none of the previous empirical examinations described above has exploited comprehensive individual panel data to construct tests of substitution. They use either firm level data or individual level data in relatively small cross-sections. We use multiple waves of a representative UK individual level data set, the British Household Panel Survey (BHPS) for the period 1998-2008. The BHPS uniquely provides the pound

value of bonuses, a type of performance pay attracting great attention, to examine the association between bonuses and non-bonus earnings. Critically, we control for individual worker effects as part of holding constant otherwise unmeasured ability that might be associated with both bonus size and fixed time rates. This makes a substantial difference as we find that bonus size and non-bonus earnings are positively associated in the BHPS.

Previous research demonstrates that bonus payments are highly concentrated in the upper levels of the income distribution (Bell and Van Reenen 2010). While the size of bonuses for financial service workers garners substantial press attention, Lemieux et al. (2009) demonstrate that the growing incidence of performance pay in the US is associated with a large share of the growth in earnings inequality over the 1980s and 1990s and virtually all of the growth of earnings inequality in the upper quintile of the distribution. Our UK examination is timely in light of OECD research that earnings inequality is growing more quickly in the UK than in any other developed country (OECD 2011), and the evidence that this growth is uniquely tied to the financial services industry with its use of performance bonuses (Stewart 2011). Part of evaluating this trend, and perhaps an even more pointed equity examination, is determining the extent to which performance pay and other compensation substitute across the earnings distribution. The examination is not one of the extent to which bonuses are associated with inequality but rather of the extent to which bonuses appear to be part of a reward structure in which pay is at risk because fixed salaries are lower.

To examine the relative tradeoff we estimate quantile regressions to show the pattern of the substitution at different places in the earnings distribution. We find that while there is extremely high substitution between bonus amounts and earnings at the bottom of the distribution, there exists little or no substitution at the top of the distribution. At the risk of stretching the metaphor, the gravy appears thicker at the top. We show this remains in quantile regression estimates that control for individual fixed effects. We provide some data driven explanations but also recognize this might be consistent with rent skimming being concentrated among those at the top of the internal hierarchy and this being associated with constructing performance pay schemes.

3. EMPIRICAL APPROACH AND DATA

The data we use are drawn from the British Household Panel Survey (BHPS). The BHPS is a nationally representative longitudinal sample that annually interviews approximately 10,000 individuals from roughly 5,500 households. We use the 1998 to 2008 period as prior to 1998 information on bonus amounts was simply not collected. We also limit our sample to private sector employees.

The BHPS contains a range of information on earnings. We follow Bell and Van Reenen (2010) focusing on the measure of annual labour income. This derived variable generated by the BHPS staff is constructed from weekly and monthly wages accounting for job changes and other potential variation in earnings.[5] In addition to this derived annual earnings measure, respondents are asked to report whether they received a bonus or profit share within the last year. If they answer yes, they are then asked for the amount of the bonus payment. Bell and Van Reenen (2010) demonstrate that these two figures, total labour income and the additional bonus payment, are generally comparable to those reported in the UK ASHE data that are based on verified payment details.[6]

INSERT TABLE 1

While we observe bonus amounts we do not observe when workers are subject to a bonus scheme but fail to meet the requirements for receiving a bonus in a given year. To examine this, we follow the method outlined in Lemieux et al. (2009) to identify "bonus jobs." In this method job matches which at any point paid a bonus are classified as bonus scheme jobs for all periods. Again, we demonstrate the robustness of the key results to this variation in the empirical section.

INSERT FIGURE 1

Table 1 presents key descriptive statistics divided by bonus receipt. Note that those receiving bonuses are more likely to receive other types of performance pay and that their annual labor income is substantially larger. This difference in means is not, by itself, surprising as those receiving bonus payments might be expected to be those with higher earnings capacity. The size of the average bonus among recipients is £3,180. All of these figures have been averaged across years but deflated by the consumer price index to a base year of 2005. Figure 1 shows that the real value of bonuses among recipients has increased substantially over the decade we examine. It reaches a high of £5,400 in 2007, but declines

substantially the next year coinciding with the financial crisis. Figure 2 confirms that each year the annual income is larger for those that receive bonuses than for those who do not.

INSERT FIGURE 2

Bonus amount as a share of derived annual earnings shows the anticipated variation across the earnings distribution. As Figure 3a shows, the bonus share generally increases with earnings. It shoots up dramatically in the top five percent of the distribution. Figure 3b concentrates on the upper decile showing that the share reaches its maximum in the single highest percentile in the distribution. Approximately eleven percent of all earnings in the top five percent are in the form of bonuses and this share increases to more than fifteen percent at the top percentage point. It is critical to recognize that the majority of workers even in the top five percent do not receive a bonus so that conditional upon receiving a bonus, the shares in the top five percent are substantially higher. This pattern suggests the importance of distributional considerations when estimating the extent of substitution and will motivate one vein of our empirical testing.

INSERT FIGURE 3A, 3B

We present a series of estimates examining the extent of substitution. Our initial test merely examines if those receiving bonuses have higher annual earnings. We estimate the following equation:

$$w_{it} = \beta_0 + \beta_1 Bonus_{it} + \beta_2 PRP_{it} + \gamma X_{it} + \varepsilon_{it} \quad (1)$$

Where *w* is annual labour income earned by individual *i* in year *t*, *Bonus* indicates that they received a bonus (of any size) in that year, *PRP* indicates other performance related pay receipt and *X* is a vector of controls including age, union membership, temporary contract, firm size along with year, region, hours of work, industry and occupational dummies.

We extend this estimate using the information on the amount of bonus receipt available in the BHPS. We estimate:

$$w_{it} = \alpha_0 + \alpha_1 BonusAmount_{it} + \alpha_2 PRP_{it} + \gamma X_{it} + \epsilon_{it} \quad (2)$$

where *BonusAmount* is the pound value of the annual bonuses. Substitution should imply that an additional pound of bonus should be reflected in less than a pound increase in annual earnings ($0 \leq \alpha_1 < 1$) while a pure gravy result would indicate annual earnings increasing

by at least the amount of the bonus ($\alpha_1 \geq 1$). Thus, to aid in interpreting the pound to pound relationship between bonuses and other labour income, we estimate this and subsequent variations in linear rather than log-linear specifications. We hasten to add that re-estimating log-linear or log-log specifications do not alter the tenor of the results.

A number of empirical challenges exist in properly identifying α_1. A fundamental difficulty not dealt with in previous empirical work is that unobserved worker productivity (ability) influences both bonus payment and wages. Thus, unmeasured ability might bias the coefficients toward complementarity as ability would be anticipated to simultaneously influence multiple dimensions of compensation. More specifically, it is well established that the presence of performance pay schemes leads to ability sorting across jobs in which the more able sort into such schemes. Our main approach will control for worker specific fixed effects which remove first order bias in the estimates of α_1 and β_1 due to time invariant worker characteristics. While attractive, this approach restricts the identification of our key parameters to those who we observe both with and without receipt or those for whom we observe some variation in the bonus payment amount. In the results section we spend considerable time examining the stability of the FE estimates and the sources of identification.

The concentration of bonus payments at the top of the earnings distribution leads to concerns regarding the role of bonus receipt in generating inequality (Bell and Van Reenen, 2010). Yet, this concern may be more or less pronounced depending on how the relationship between bonus payments and salary varies across the wage distribution. Thus, if one found that the high bonuses come at the cost of reduced salaries, the concern in the popular press that these bonuses are unjustified (represent rents) may be over-stated. We seek to examine this by estimating quantile regression analogues of (2) above, where for each quantile τ:

$$Q_\tau(w_{it}) = \alpha_{\tau 0} + \alpha_{\tau 1} Bonus_{it} + \alpha_{\tau 2} PRP_{it} + \gamma_\tau X_{it} + \varepsilon_{\tau it} \quad (3)$$

Again, the key parameters of interest will suffer from ability bias in simple cross-sectional estimates. A larger, more positive, relationship between bonus payment and salaries at higher salaries may just reflect the sorting of talent towards highly paid jobs. Fixed effect estimation again seems the most natural approach to addressing this. However, this is complicated in the

quantile regression setting. One analogue to the fixed effects approach in linear regression is to include a worker specific shift for each individual for every τth quantile. This might be termed a conditional (on the quantile) fixed effects quantile regression model. However, as discussed by Koenker (2004) including this type of this τ-dependent distributional worker effect is difficult in practice in a setting such as ours where there a large number of cross-sectional units but the number of time observations per unit is not so large. Instead he suggests the inclusion of a single individual specific effect across the τ quantiles. To do this requires the joint estimation of all τ quantile regressions simultaneously. This is termed an unconditional fixed effects quantile regression and takes the form:

$$Q_\tau(w_{it}) = \alpha_i + \alpha_{\tau 0} + \alpha_{\tau 1} Bonus_{it} + \alpha_{\tau 2} PRP_{it} + \gamma_\tau X_{it} + \varepsilon_{\tau it} \qquad (4)$$

This is estimated and essentially assumes that, in our setting, individual ability has a uniform effect on wages across the distribution.

4. RESULTS

Table 2 presents estimates of the association between bonus receipt and annual earnings. The OLS estimates reveal that workers who receive a bonus earn £2,556 higher in annual labour earnings. The corresponding figure for PRP jobs is approximately £1,870. As emphasized, the large difference associated with a bonus may reflect unobserved worker characteristics. More able workers are likely to sort into jobs paying bonuses and earn higher compensation of all types. The next column reports fixed effects estimates that seek to control for these characteristics. As expected the bonus premium falls markedly, to £930 but remains statistically different from zero. The PRP figure falls to £465 and is now significant at the five percent level instead of the one percent level.

INSERT TABLE 2

Ultimately we want to include the pound value of bonuses to examine the extent of substitution but we recognize that it is both common and closer to theoretical derivations to present log earnings equations. We show these in columns 3 and 4 to confirm the same general pattern. The OLS estimation suggests that those receiving bonuses earn 12.0 percent more than those on times rates while the return to PRP is 6.3 percent. The fixed effect estimates again shrink markedly with those receiving bonuses earning 4.8 percent more but

the return to PRP now insignificantly different from zero. These estimates for the return to receiving a bonus are remarkably close to those estimated in the US. Lemieux et al. (2012) present returns of 8.5 percent in an OLS estimate using the Panel Study of Income Dynamics and 4.1 percent in the associated fixed effect estimate.

As discussed, our bonus receipt indicator fails to capture years where workers are eligible for a bonus but did not meet the requirements for bonus receipt within that year. While we do not have any way of directly observing this from the data, we follow Lemieux et al (2009) in creating a broader measure. From the BHPS we know job changes and we classify a worker as in a bonus job if they ever received a bonus in their current job. Thus, if the original measure fails to capture years on a bonus scheme where there was no payout, this runs the opposite risk of counting years as on a bonus scheme when the scheme was removed. Column five of Table 2 reports fixed effects estimates using this alternative measure of bonus receipt. This reveals a modestly smaller estimate as anticipated but also shows that non-receipt in a given year while eligible does not appear to be generating our estimates.

INSERT TABLE 3

In Table 3 we present the estimated relationship between bonus amounts and usual earnings. These estimates show the pound to pound conditional relationship between bonus amount and annual earnings. Column 1 presents the OLS estimates demonstrating that for every additional dollar of bonus, the total earnings are approximately 1.24 pounds larger. Taken at face value, this implies that bonuses and time rate earnings are compliments. The estimate holds constant earnings from PRP and implies that total earnings go up by more than the bonus amount. Specifically time rates go up by approximately 25 percent of the bonus amount as well. This would be gravy indeed and is similar to findings in previous studies.

Yet, this fails to account for unmeasured ability that likely causes both bonuses and time rates to be larger as the more able sort into bonus jobs. Column 2 presents the equivalent estimate controlling for worker fixed effects. As expected, this causes the estimated coefficient on the bonus amount to fall markedly. However, it remains positive, statistically significant and of an economically important magnitude. Each pound of bonus is associated with earnings that are 0.6 pounds higher. This suggests clear substitution rather than the complentarity suggested by the OLS estimate. Thus, substantially less than the full value of

bonuses is observed in total earnings. Each pound of bonus is associated with a 40 pence reduction in time rate earnings. This clearly differs from the flavour of the earlier empirical research that failed to control for worker fixed effects and it implies that bonuses are not simply gravy added on top. We recognize that our variation comes from both sorting into jobs that provide bonuses (the bonus going from zero to positive) and changes in the bonus amount (among positive amounts). This leads to a series of robustness checks.

4.1 Robustness Checks

We undertake a series of robustness checks that assess the source of the identification, the stability of our estimate over a number of subsamples and the influence of functional form and model specification.

First we examine who identifies our fixed effects model and the stability of our key estimate across sources of identification. Specifically, the critical pound value of bonuses can vary and identify the fixed effect estimate in three ways. First, workers can move into bonuses (receiving when not previously receiving). Second, they can move out of bonuses (no longer receiving when previously receiving). Third, they can remain in bonuses in adjacent periods but experience a change in the amount of receipt (and in income). We separately examine each source of variation and stress that our results tend to be broadly similar for each source of variation. The overall observations associated with each source of variation allow reasonable inference: 4,055 observations moving in, 4,024 moving out and 7,200 changing within. Table 4 shows our fixed effects estimate for those moving in is a 0.39 pound increase in annual earnings for each pound increase in bonus amount. The size is smaller but sill positive for those moving out with a 0.27 increase in earnings for each pound increase in bonus amount. Finally, the within estimate is virtually identical to the original estimate at a 0.58 increase in earnings for each pound increase in bonus amount. Each estimate is significantly different from zero. Thus, our general result of a meaningful positive association between bonus and non-bonus earnings that indicates substitution is not driven by asymmetries making only one source of identification meaningful. For instance, there may have simply been increasing bonus receipts in general across our sample period in which non-bonus earnings may also be increasing. Our decomposition suggests that such underlying patterns do not drive the nature of our empirical result.

INSERT TABLE 4

Like all panels, the BHPS suffers attrition, and our focus on workers makes it more acute. We worried that attrition might be associated with earnings in a way that might lead to a biased estimate of the relationship between bonus and non-bonus earnings. We re-estimated our model on only those workers who we observe at least 10 times and the point estimate was of the same general magnitude (0.552 [s.e. =0.048]). A related concern is that one-off bonuses may reflect some idiosyncratic payment rather than the income routinely being at risk. We re-estimated our models including only those workers who received bonus payments at least twice. These estimates were essentially the same as our main estimates (0.584 [s.e.=0.018]). In further unreported estimates we continued to increase the number of minimum bonus payments (at least 3 payments, 4 payments etc), and again the estimates did not vary markedly. In sum, these estimates suggest that the positive correlation is not driven by any particular pattern of the frequency of bonus receipt.

The bonus to salary relationship may not be stationary across the years for which we have data. To investigate this, we split the sample in half and report the both sets of estimates. There is only modest variation across period: from 0.41 for 1997-2002 and 0.38 for 2003 onwards but both are highly significant. In unreported results we estimate our fixed effects model across a range of different sub-samples of years of the survey; in all cases the coefficient on bonuses remained positive, statistically significant and indicative of substitution. Related to potential changes over time, we also explored using deflated wages only without year dummies, or year dummies using nominal wage values. Neither modification materially changes our results.

We estimated the specification in a series of further sub-samples in an effort to avoid a spurious relationship between bonuses and non-bonus earnings. First, PRP receipt may be problematic as it is incorporated into the derived annual labour income, our dependent variable. We re-estimate our model for workers who do not receive PRP generating a fixed effects estimate of bonus amount of 0.638 [s.e.=0.023]. Second, bonus receipt and salaries for workers with longer tenure may reflect a variety of factors including deferred compensation. Hence, any trade-off between salaries and bonuses may be more acute early in a job when the compensation scheme reflects a salary – bonus trade-off that is potentially driven more by the external market than by internal labour market negotiations. We re-estimate our OLS model for those workers with less than 2 years of tenure[7]. These reveal a point estimate of 1.201 [s.e. =0.150] suggesting that our positive bonus coefficient is not being driven by internal

labour market institutions such as deferred compensation. Third, we re-estimate the fixed effect models split by gender. For both males and females the bonus coefficient remains positive and significant at the 1% level.

As mentioned earlier, we examine the robustness of our estimates to choice of functional form and model specification. We re-estimate our model as both log linear and as log-log with bonus amount also in logs. While this obviously changes the point estimates, they remain positive and significant. In the second case, the estimate is (0.043 [s.e=0.008]).

We also recognize that while typical of many in the literature our specification contains a fairly parsimonious set of industry and occupation controls. This could hide occupation and industry variation at a more disaggregated level. We examine this by saturating the model with 77 occupational controls (SOC 2 digit) and 84 industry controls (SIC 2 digit). The resultant fixed effect estimate is essentially unchanged by this degree of detail (0.561 [0.021]). We next re-estimate our model separately for white and blue collar workers. These return surprisingly similar estimates. To focus on the broad group subject to the greatest press scrutiny, we limit the sample to those in the managerial and professional occupation groups. This returns only a modestly smaller fixed effect estimate than found for the entire sample (0.544 [.030]).

Perhaps the confounding issue is not the occupation but an effort level of the workers which is unobserved and varies with bonus amounts. While difficult to examine, we undertook several checks with the hours of work measure. We limited ourselves to those who reported working full time. We also added to the control for usual hours a control for usual overtime hours. Neither check produced meaningful differences from the original estimates.

Finally, we were concerned that smaller profit sharing payments or routine Christmas bonuses may be included in our measure. These may be routinely given for reasons other than individual performance and may be causing our estimates to understate the level of substitutability. We re-estimate our results excluding observations where the worker received a bonus but it was less than £1,000. The fixed effect estimate is 0.579 [s.e. = 0.023].

In summary, despite a variety of robustness tests and specifications, each of our estimates shows a positive relationship between bonus levels and earnings but one that

suggests substitution between bonuses and time rates. It may be the case that more finely drawn data within a single occupation or with more homogenous workers would reveal different results but we cannot find them with our data. As an attempt to further investigate this, we now consider how this relationship varies across the wage distribution.

4.2 Distribution of Bonus Payments

The bonuses observed at the top of the earnings distribution may be fundamentally different in type from those at the bottom of the distribution. Much of the recent concern with bonuses for bankers has been that they may be able to manipulate a system in which others have imperfect information and, as a consequence, the size of bonuses may have little relationship to true productivity. At the extreme the "performance" measure may have been simply short-term sales of a "toxic" product. While not passing judgement on this claim, currently the focus of a federal inquiry in the United States, it remains possible that there is more transparency and less ability to manipulate performance measures at the bottom of the earnings distribution than at the top. This could suggest that substitution may be more obvious at the bottom of the distribution. Moreover, as performance pay has been intimately tied to growing inequality (Lemieux et al. 2009), there is good reason to explore distributional aspects of substitution.

INSERT TABLE 5

We first pool the data and run simple quantile regressions. As shown in Table 5, these indicate large coefficients across the distribution but a clear pattern that the positive values increase moving up the distribution. At the bottom of the distribution (0.10) the estimates suggest a pound of bonus is associated with .84 pence of labour earnings. At the top of the distribution, the estimates suggest and enormous 1.9 pounds of earnings associated with every pound of bonus income. Taken literally this would suggest very strong complements. In unreported estimates, we further extended the estimates out to the 95^{th} and 99^{th} percentile. This follows a similar increasing pattern, 2.418 [0.008] for the 95^{th} percentile and 2.785 [0.019] for the 99^{th} percentile.

Yet, like the earlier estimates, these quantile estimates surely suffer from unmeasured ability influencing the earnings measures. Thus, we implement Koenker's (2004) unconditional fixed effect estimator using the public domain package R and Koenker's

program. The results are shown in the bottom of Table 5 and while much smaller in absolute magnitude, they show the same or even greater percentage growth across the distribution. In the lowest quantile at 0.10, the coefficient is only .39. There is substantial substitution with workers giving up 61 pence for every pound earned in bonuses. The estimated coefficient steadily increases so that at the top quantile, 0.90, it is a 0.97. This says in essence that there is no cost in lost time rates for increased bonus payments at the top of the distribution. Again we explore estimates at the extremes of the distribution. First, we estimate a model with bonus coefficient evaluated at the 5^{th} and 95^{th} percentile. The estimates for these two points are 0.048 [s.e.= 0.061] and 0.934[s.e.= 0.114], respectively; with the 5^{th} percentile estimate not statistically different from zero. Second, we estimate the 1^{st} and 99^{th} percentile in addition to those points listed in Table 5. This reveals -0.211 [s.e. = 0.118] at the 1^{st} percentile and 1.231 [s.e. = 0.173] at the 99^{th} percentile. These estimates suggest that, once holding unmeasured time invariant ability constant, there is evidence of gravy at the upper most part of the wage distribution but substantial evidence of substitution at the lowest point.

The critical point from this distributional exercise has been that we typically find evidence of substitution throughout most of the earnings distribution but only after controlling for sorting. The basic implication of the agency model seems supported at all but perhaps the very top of the earnings distribution where the evidence of substitution fades.

5. CONCLUSION

The frequently inability to past research to find substitution between performance pay and time rates stood as the starting point for this paper. This is a critical point from a policy perspective as the efficiency of bonus payments rely on a degree of substitution with fixed pay. Indeed, we initially confirmed this finding in simple earnings equations that show higher bonus amounts go together with higher time rate amounts. Yet, such estimates fail to control for the ability sorting that is inherent especially in Lazear type models. This led to fixed effect estimates that showed the important such of sorting and that evidence of substitution only emerges when accounting for this sorting. This was followed by a series of robustness checks designed to improve the focus of the estimates. We focused only on large bonuses, bonuses that were regular and also focused on the distributional aspects of the estimates. These efforts served only to reinforce the early estimates. We found no evidence of complimentarity in the fixed effect estimates. Nonetheless, we found strong distributional

aspects suggesting that the extent of substitution is very large at the bottom of the earnings distribution and vanishingly small at the top of the earnings distribution. The BHPS data on bonuses payments is imperfect and we readily admit that a general representative survey of workers may not provide the detail and sample size needed to uncover the implications of a firm deciding to pay such bonuses. Nonetheless, it is striking that our evidence shows substitution between base pay and bonuses only when accounting for worker fixed effects.

There exists room for further testing. First, data sources from other countries that itemize the size of bonuses may be worth investigating. Second, it could also be worth examining other forms of performance pay beyond bonuses and controlling for worker fixed effects. The trade-off between piece rate earnings (or commissions) and fixed wage payments stand as obvious examples but the BHPS does not itemize these earnings. While these other forms of performance pay could inform agency models, the current public scrutiny is aimed at bonuses. It remains the case that our best efforts to examine bonuses and other earnings have found that they appear to be substitutes but only when looking at within worker estimates generated by the fixed effect estimate.

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TABLE 1 Summary Statistics, Male Private Sector Employees, 1997-2008

	Bonus	*No Bonus*
Annual Labour Income	27,031.20	21,327.24
Bonus Amount	3,180.37	
Performance Pay	0.278	0.091
Normal Hours	39.977	39.985
Age	40.069	41.693
A Level	0.263	0.222
Diploma	0.099	0.089
Degree or Higher	0.198	0.128
Union	0.232	0.219
Temporary Job	0.006	0.034
Large Firm	0.473	0.387
Manager/Supervisory Duties	0.593	0.393
Observations	9,482	12,376

Source: BHPS

TABLE 2 Bonus Receipt Wage Premium on (non-bonus) Annual Incomes (£2005), Male Private Sector Employees, 1997-2008.

	(1) OLS	(2) FE	(3) ln(income) OLS	(4) ln(income) FE	(5) ln(income) Bonus Job FE
VARIABLES					
Bonus/Profit Share	2,585***	952.8***	0.115***	0.0487***	0.0403***
	(286.4)	(168.2)	(0.008)	(0.005)	(0.009)
Performance Pay	1,868***	471.7**	0.0614***	0.00780	0.0143**
	(465.7)	(211.6)	(0.011)	(0.007)	(0.007)
Age	1,326***	1,419***	0.0648***	0.0725***	0.0699***
	(88.54)	(265.7)	(0.003)	(0.008)	(0.008)
Age^2	-14.07***	-24.32***	-0.000711***	-0.000947***	-0.000948***
	(1.097)	(1.195)	(4.00e-05)	(3.73e-05)	(3.74e-05)
A Level	2,558***	-777.7	0.102***	-0.0811**	-0.0774**
	(360.6)	(1,215)	(0.013)	(0.0379)	(0.038)
Diploma	5,329***	-2,686	0.186***	-0.124**	-0.110**
	(893.3)	(1,770)	(0.021)	(0.0552)	(0.055)
Degree or Higher	8,898***	809.8	0.282***	0.00501	0.00849
	(693.7)	(1,393)	(0.019)	(0.0435)	(0.044)
Union Member	840.5**	2,038***	0.0992***	0.108***	0.110***
	(345.4)	(313.1)	(0.012)	(0.010)	(0.010)
Temporary Job	-2,651***	-941.8*	-0.214***	-0.107***	-0.110***
	(715.2)	(557.4)	(0.035)	(0.017)	(0.018)
Large Firm	2,992***	739.0***	0.127***	0.0448***	0.0454***
	(332.5)	(215.3)	(0.010)	(0.007)	(0.007
Manager/Supervisor	4,955***	799.4***	0.209***	0.0565***	0.0564***
	(288.0)	(213.8)	(0.010)	(0.007)	(0.007)
Constant	-27,368***	-6,036	7.503***	8.089***	8.174***
	(1,998)	(9,044)	(0.0774)	(0.282)	(0.283)
Observations	21,868	21,868	21,868	21,868	21,868
R-squared	0.331	0.118	0.435	0.193	0.188
Number of pid		5,419		5,419	5,419

Robust standard errors in parentheses Controls included but not reported are hours worked, occupation, industry, region and year dummies.*** p<0.01, ** p<0.05, * p<0.1

TABLE 3: Bonus Amount and Non-Bonus Labour Income, Private Sector Workers, 1997-2008

	OLS	FE
Bonus Amount(£2005)	1.170***	0.580***
	(0.0613)	(0.0209)
Performance Pay	1,182***	412.8**
	(396.6)	(208.1)
Constant	-23,055***	-1,994
	(1,744)	(8,953)
Observations	21,868	21,868
R-squared	0.419	0.153
Number of pid		5,419

Standard errors in parentheses and clustered by worker in the OLS. *, ** and *** indicate statistical significance at the 10%, 5% and 1% respectively. All other controls as per Table 2.

TABLE 4: Sub Sample Estimates: Bonus Amount and Non-Bonus Labour Income, Private Sector Workers, 1997-2008

	(1) moved into bonus payment	(2) moved out of bonus payment	(3) moved within bonus payment	(4) 1997-2002	(5) 2003-2008
Bonus Amount(£2005)	0.388***	0.271***	0.583***	0.408***	0.379***
	(0.0445)	(0.0549)	(0.0209)	(0.0468)	(0.0214)
Performance Pay	-968.2***	916.7*	-141.3	764.1**	6.712
	(359.8)	(517.4)	(253.2)	(334.9)	(229.7)
Constant	-26,394	24,275	-6,942	6,343	-12,160
	(18,158)	(25,686)	(12,673)	(15,476)	(12,561)
Observations	4,055	4,024	7,250	10,621	11,247
R-squared	0.208	0.087	0.319	0.079	0.105
Number of pid	1,552	1,533	1,730	3,432	4,052

Standard errors in parentheses. ***,** and * indicate statistical significance at the 10%, 5% and 1% respectively. All other controls as per Table 2.

TABLE 5, Quantile Regression Estimates: Male Private Sector Employees, 1997-2008

	(1)	(2)	(3)	(4)	(5)
VARIABLES	10%	25%	median	75%	90%
Bonus Amount(£2005)	0.848***	0.973***	1.217***	1.533***	1.919***
	(0.0277)	(0.0414)	(0.0520)	(0.0506)	(0.0968)
Performance Pay	714.8***	832.3***	970.0***	868.3***	353.1
	(161.7)	(139.1)	(189.4)	(224.8)	(349.4)
Observations	21,868				
	Quantile Fixed Effects				
	10%	25%	median	75%	90%
Bonus Amount(£2005)	0.386***	0.479***	0.605***	0.765***	0.966***
	(0.036)	(0.047)	(0.046)	(0.071)	(0.060)
Performance Pay	167.147	115.703	297.511***	329.916***	358.292***
	(222.843)	(0.00)	(95.814)	(131.541)	(191.385)
Observations	21,868				

Standard errors in parentheses. *,** and *** indicate statistical significance at the 10%, 5% and 1% respectively.
All other controls as per Table 2.

Figure 1, Average Bonus Payments UK 1997-2008, Private Sector Employees - BHPS

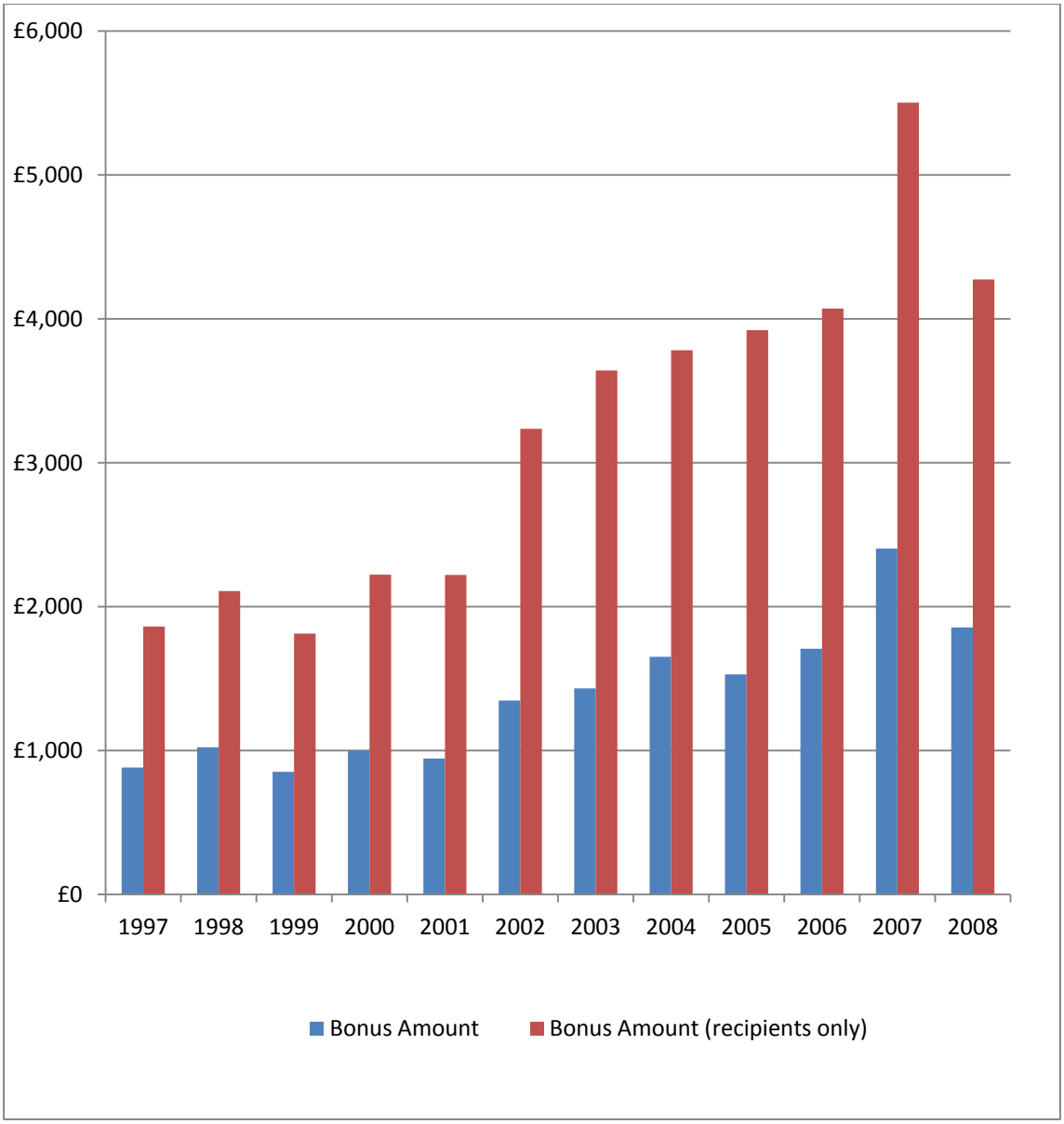


FIGURE 2 Annual Non Bonus Incomes, Bonus versus non-Bonus recipients, 1997-2008, Private Sector Employees

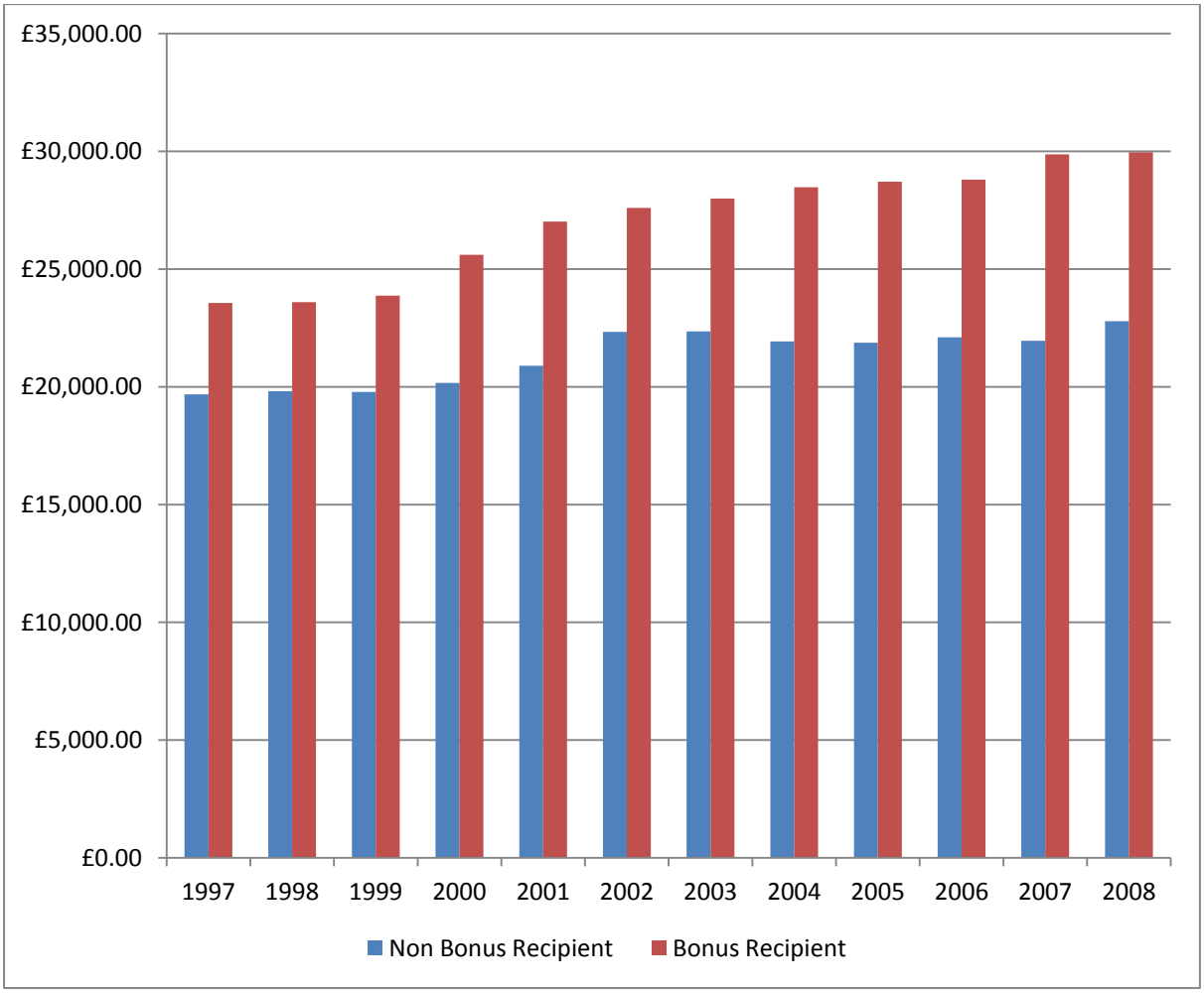


Figure 3a, Bonus Share of Total Annual Income across Income Distribution, 1997-2008, Private Sector Employees, BHPS

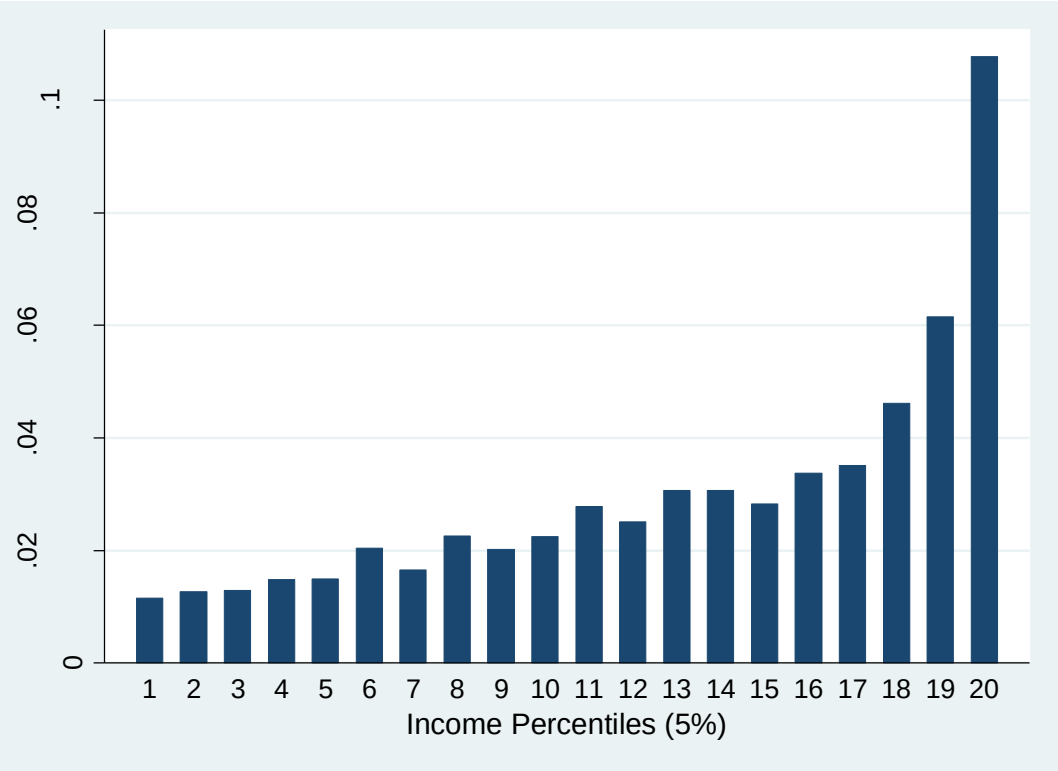
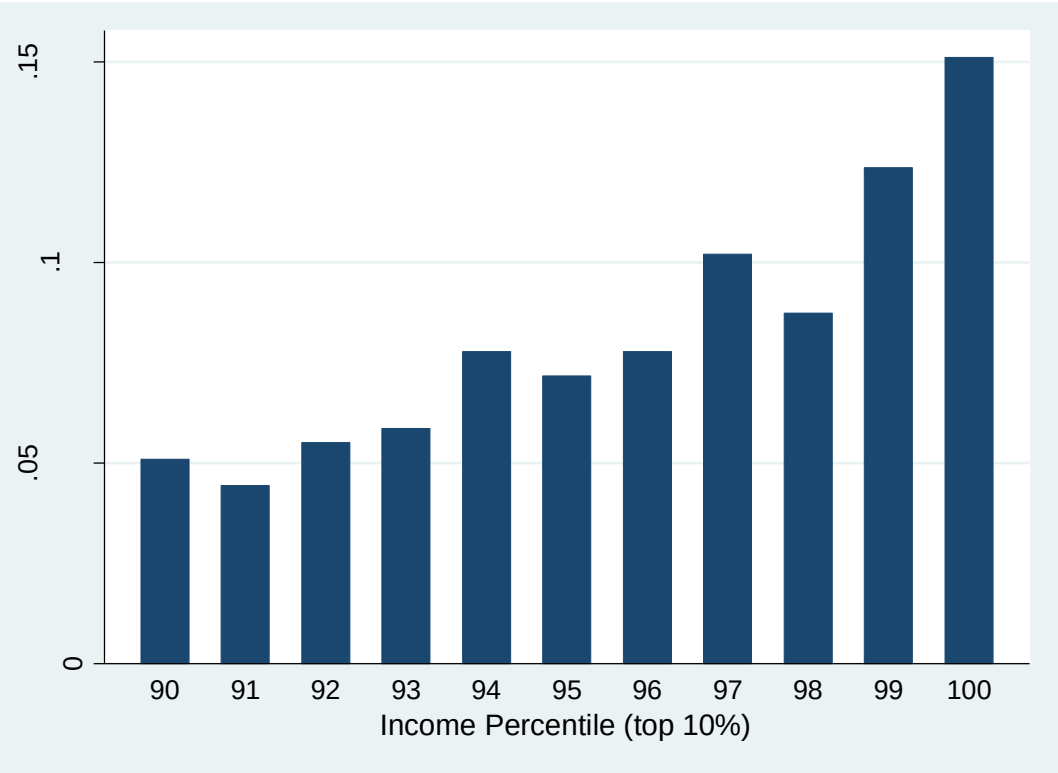


Figure 3b, Bonus Share of Total Annual Income across Income Distribution, Top Decile, 1998-2008, Private Sector Employees



Endnotes

[1] Among the numerous illustrations, we highlight two in the *New York Times*, "Banks Prepare for Big Bonuses, and Public Wrath" (9th Jan 2010) and "A Modest Proposal to End Those Outlandish Bonuses" (16th Sep 2009) and two in *The Times*, "No More Money for Nothing" (25th Jan 2009) and "Bonus Culture Thrives with Payouts of £22bn" (27th May 2011).

[2] Lemeuix et al. (2012) use the PSID to estimate the influence of a dichotomous bonus receipt indicator on an earnings variable that likely includes the value of bonuses. They find a small positive influence. When they include as an alternative a dichotomous indicator of whether the current job has ever paid a bonus, they find no effect. While not in the precise spirit of those estimating the extent of substitution, these results do appear consistent with substantial substitution.

[3] It is important to note that just because bonuses may be based on objective indicators does not mean they reflect market forces. As a potential illustration, despite fear among large US banks to the contrary, government interventions restricting pay and bonuses apparently did not result in an exodus of talent (Dash 2010).

[4] Indeed, both Prendergast and Topel (1993) and Laffont (1990) argue that collusion and hidden gaming within the hierarchy between superiors and subordinates becomes more likely when the superiors are paid in fashions other than simply being residual claimants of their subordinate's output. Surely, bonuses run this risk.

[5] Please refer to Jenkins (2010) for a summary of this information.

[6] The one key difference that they note is that the BHPS appears to under-sample high earners whilst in ASHE response is effectively mandatory. However, we do not use the ASHE data as it lacks a longitudinal component that would allow controlling for worker fixed-effects.

[7] Fixed effects estimation of wages do not make sense in a situation where we are essentially limiting our sample to new hires.