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The taxation of bonuses and its effect on executive compensation and risk-taking: Evidence from the UK experience

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Abstract

This paper explores the effects of a bonus tax adopted in the UK in December 2009 on the compensation structure of executives and on risk-taking behavior in the financial sector. Excessive bonuses are blamed for encouraging risk taking and are regarded as one of the pull factors of the financial crisis. The British government attempted to reduce bonuses and accordingly bank risk taking by means of a special tax on cash-based bonuses. Using a comprehensive dataset on executive compensation, we show that the introduction of the bonus tax decreased the net cash bonuses awarded to directors by about 40%, accompanied, however, by a simultaneous increases in other forms of pay leaving total compensation as well as risk levels unaffected.

1 | INTRODUCTION

In the aftermath of the financial crisis that has shaken the economies of many developed countries worldwide, governments have struggled to find ways of dealing with the possible roots of the crisis. Most of the measures regulators have contemplated upon aim at the financial sector in particular. A number of governments adopted policies targeting compensation of financial sector employees that is perceived as excessive and unjustified by the public. Recently, the European Parliament passed a law that will require bonuses of certain bank employees in the EU to be limited to 100% of their salary or twice this amount if shareholders approve to it.

The focus on the financial sectors' pay is not only based on distributional and fairness arguments, but it is also rooted in the view that lavish bonuses have fueled short-termist behavior and risk taking. Many politicians and economists suspect that the rapid increase of variable compensation may have created incentives that contributed to the vulnerability of the financial industry that may justify government intervention. To this purpose, European regulators have made concerted efforts aimed at curbing bankers' pay. The first country to implement such a measure was the United Kingdom. In the tax year 2009/10, the British Treasury introduced a 50% levy on bonuses in excess of GBP 25,000 awarded to employees of certain types of financial institutions. This bank levy represented an experiment which many regard as a step in the right direction:

> *If we want to intervene on pay in addition to (not instead of) reforming capital requirements, the most effective way is a variation of the tax imposed by former British Prime Minister Gordon Brown: a special tax on all compensation above a certain threshold that is not paid in stock. This tax would have two positive effects: it would induce banks to recapitalize, thereby reducing their excessive leverage, while forcing managers to have more skin in the game." Zingales (2010)*

Following the UK's lead, a similar tax was adopted in France on bonuses exceeding Euro 27,500 in 2010.[1]

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Shortly after its introduction, UK government officials reported that financial institutions have not reduced bonus payouts and "the tax has not changed the behavior of big financial institutions" (Financial Times, 2010a). Yet, to be able to correctly infer the consequences of the bonus tax, one should account for a number of additional factors that could bias these findings. First, the tax was introduced immediately after the peak of the financial crisis in 2008 and not surprisingly bonuses may have increased two years later, simply because the economy had recovered to some extent. Second, not all UK financial institutions were affected by the tax, but only those institutions meeting special criteria (see Section 4.1). Accordingly, if we just look at the plain numbers, one would be tempted to jump to the hasty conclusion that the bonus tax did not succeed in curbing bonus payments. Third, to judge the effects of the tax on managers' incentives, the full set of compensation components including shares and options has to be considered. For the tax to matter in terms of managerial risk-taking incentives, the structure of total compensation is decisive. Hence, we also explore in this paper the role of different forms of variable compensation for risk taking in the context of Too Big To Fail (TBTF) banks. On the one hand, in the standard principal agent framework, bonuses typically act as effort incentives or screening mechanisms. On the other hand, in the case of TBTF banks, bonuses can be viewed as incentive alignment devices by inducing risk-taking preferences in managers that match shareholders' preferences. These are interested in encouraging risk taking in order to maximize the value of the implicit guarantee provided to such a TBTF bank by the state. The motivation for government intervention to discourage bonus payouts lies in the adverse systemic effects of risk taking. The bonus tax is one means to achieve this end. If banks had responded to the introduction of the levy by say increasing fixed compensation, the government could have achieved its objective. Hence, even if the tax was borne by the bank instead of the managers, the tax could have been successful in curbing risk-taking incentives. In contrast, if shareholders increase the convexity of compensation by awarding managers more options or shares instead of bonuses, the tax would have failed to meet its objective. Thus, the response of financial institutions to the introduction of the bonus tax is an open question from a theoretical point of view and we seek to address this with our empirical analysis.

In this paper, we draw on a comprehensive dataset covering detailed information on about 11,000 executive directors to identify the causal effect of a bonus tax for compensation practice of executives and address issues related to the effect of the tax on risk taking by banks. Remarkably, the effects of a levy on cash-based variable compensation have not received any attention in the empirical literature thus far, despite its importance for current policy making. Addressing this issue is particularly pertinent when governments disagree about the economic repercussions of different regulatory measures on the financial sector. We choose to focus on the executive directors of the financial institutions affected by the tax instead of considering all employees receiving bonuses because executives provide the authority to manage an institution and are the main decision makers of a company. Hence, their remuneration is key for the performance of the firm they run. Executives who are not properly compensated may not receive the correct incentives to perform in the best interest of shareholders. Our empirical identification strategy draws on variation across countries, firms, directors, and time. We construct different sets of suitable control groups to evaluate the effect of a bonus tax (i) for managerial compensation practice and (ii) bank risk. Our comprehensive data enable us to account for numerous director and firm-specific controls that may confound the estimates. The causal interpretation of our results is supported by equal pretax trends of compensation across treated and control groups. As a sensitivity check, we construct synthetic controls using a data-driven procedure introduced by Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010).

We show that the bonus tax has triggered a significant reduction in net bonuses awarded to employees in the UK financial sector by about 40%. However, our analysis also reveals that the drop in net bonuses was accompanied by a simultaneous increase in other variable pay components such as to keep the executives' overall compensation unchanged. To make up for the decrease in cash-based bonuses, financial institutions indemnified executives by awarding them higher equity-based pay in the form of shares, stock options, or target-contingent equity-based compensation (long-term incentive plans [LTIPs]). The shift in the compensation structure toward equity along with the unchanged total compensation implies that (i) an effect on managerial incentives and in particular risk taking seems unlikely and (ii) the burden of the tax was borne by the banks.

The remainder of the paper is structured as follows. The next section presents an overview of the literature on the role of variable compensation in the banking sector and on the regulation and taxation of managerial pay. Section 3 describes the data we employ before Section 4 presents our analysis of the causal effects of the British bonus tax as well as a sensitivity analysis, whereas Section 5 concludes with a summary of our most important findings.

2 | LITERATURE

In the context of TBTF banks, bonuses represent an incentive alignment device between shareholders and managers risk-taking preferences. This is so, because related to these specific types of financial institutions, shareholders have an incentive to

encourage managerial risk taking in order to maximize the implicit state guarantee provided to the bank. The role of bonuses in TBTF banks versus other types of companies differs fundamentally. In the latter, it is the firms owners who stand to absorb all losses in case of bankruptcy and hence do not have any incentives to encourage excessive managerial risk taking. In this type of framework, bonuses act as a screening and incentive device as in the model of Bannier, Fees, and Peckham (2012).[2] However, Bannier et al. (2012) model is based on a rather strict assumption, namely, that banks face no bankruptcy risk. In the case of TBTF banks that are able to align shareholders and managers incentives, bonus compensation should imply higher risk-taking and worse performance during financial downturns. Fahlenbrach and Stulz's (2011) findings support this idea. They show that those banks performed worse during the crisis that displayed a better alignment of shareholders and CEOs incentives. This poor performance was the result of unforeseen risk and was attributable to the high-risk nature and the extremely negative realization of their trading and investment strategy. Gregg, Jewels, and Tonks (2012) and Adams (2012) share a somewhat different view on corporate governance in the banking sector. Gregg et al. (2012) examine the pay-performance relationship between executive cash compensation and company performance in the context of large UK financial firms. Their findings reveal that the pay-performance sensitivity for the analyzed group of firms is not significantly higher than for companies in other sectors and conclude that one cannot blame the incentive structures of bank executives for inducing them to focus on short-termist behavior. Following a similar line of arguments, but focusing on the more general aspect of governance of financial institutions, Adams (2012) documents that the governance of U.S. financial institutions does not appear to be worse than that of nonfinancial institutions.

In the case of TBTF banks, social preferences and shareholders preferences are misaligned given that the government has to step in and rescue the banks in case of default. Accordingly, the state has an incentive to discourage bonus payments that can be achieved, for instance, by means of regulation or a bonus tax. There are a number of theoretical papers that seek to analyze the implications of a bonus tax for compensation components. At the heart of these papers that find arguments for the regulation of incentive pay in the financial sector, there lie different forms of market failure. Hence, Bolton, Mehran, and Shapiro (2011) argue that asymmetric information between bondholders and directors leads to excessive risk taking and recommend to base compensation on the price of debt that can take, for instance, the form of credit default swaps (CDSs) spreads.[3] Furthermore, Besley and Ghatak (2011) explore the implications of the taxation of bonus pay when investors are protected from downside risk by the means of bailouts. They show that the optimal bonus structure can be achieved by a combination of a regulation on the structure of bonuses and a tax on their level. Thanassoulis (2012) suggests that competition for bankers induces a negative externality driving up bankers' compensation and implicitly also the default risk of rival banks. His findings indicate that stringent bonus caps are value destroying, however, there is an optimal financial regulation that limits the share of the balance sheet used for bonuses. Regarding the taxation of bonuses, his analysis implies that such a policy indeed lowers bonus payments; however, the default risk of banks is not affected. Bhagat and Bolton (2014) consider incentives generated by executive compensation programs to be related with excessive risk taking in the banking sector. They study the executive pay structure in 14 of the largest U.S. financial institutions during the time period 2000–2008 and recommend on the basis of their findings that incentive compensation for executives in the banking sector should mainly comprise restricted stock and options that can only be sold two to four years after the executives term in office has expired. Radulescu (2012) as well as Dietl, Grossman, Lang, and Wey (2013) illustrate a trade-off between the effort-based pay component and effort-independent salary as a consequence of a tax on incentive-based pay. In these papers, the authors show that effort-based pay may decrease due to the tax, while the fixed-salary component may increase or vice versa, depending on the parameter constellation of the principal–agent model employed. Still, all of the above-mentioned theoretical papers do not distinguish between different types of performance related pay, that is, between cash bonuses, shares, and options and typically contain only a variable compensation component that is linear. Hence, they cannot depict the income shifting issue between different kinds of variable pay following the taxation or restriction of a particular remuneration class such as cash bonuses.

Whereas only a few empirical papers such as Kaplan and Rauh (2010), Egger, Ehrlich, and Radulescu (2012), and Philippon and Reshef (2012) look at the compensation of financial sector employees in particular, none attempts to empirically evaluate the implications of a bonus tax as we do in the present study.

A different instrument introduced by European countries to curb risk taking in the banking sector is the so-called bank levy that targets bank borrowing. The effects of this measure have been analyzed by Devereux, Johannesen, and Vella (2013) who find that the levies triggered lower borrowing, however, at the same time, banks held more risky assets. Furthermore, they show that the levies were not successful in curbing risk-taking behavior of relatively risky banks.

We should also note that the debate on the high level of executive compensation, in general, has a long standing tradition in the literature.[4] There were previous attempts in other countries to curb CEO pay, even prior to the financial crisis. For instance, in 1993, the Clinton administration introduced a USD 1m deductibility cap of top executives' salaries. Rose and Wolfram (2000, 2002) show that the limit has led firms close to the USD 1m cap of deductibility of expenditures to restrain

salary increases. Rose and Wolfram (2000) also find little evidence of a significant increase in the performance sensitivity of CEO pay. In contrast, Perry and Zenner (2001) do observe that the pay performance sensitivity has increased for firms likely to be affected by the 162(m) Section of the Internal Revenue Code. Regarding the effectiveness of labor income taxes—not specifically aimed at bonus pay—in limiting executive remuneration, the literature has not reached a univocal conclusion yet. The rather limited number of studies do not find significant effects of labor income taxes on the structure and level of executive remuneration.[5] Using data on executives of U.S.-listed companies between 1946 and 2005, Frydman and Molloy (2011) show that the effect of changes in tax rates on the level and structure of CEO pay are largely inexistent. In contrast to the reforms considered in Frydman and Molloy, the UK bank payroll tax (BPT) resulted in a sizeable tax advantage of salary and equity based pay relative to cash bonuses which encourages a reoptimization of compensation schedules. Regarding the total level of executive pay our results are in line with previous estimates as overall compensation did not respond to the BPT. The observed reaction of compensation structure is consistent with a positive assortative matching equilibrium where compensation of heterogeneous firms is set such as to meet the managers' reservation wage at given talent (see Gabaix & Landier, 2008). In such a framework the shift towards a more tax efficient structure of compensation that puts more weight on equity pay allows firms subject to the bonus tax to avoid a loss in management talent they may face if instead executives' overall compensation decreased.

3 | DATA

We focus in the present paper on the effects of the tax on executives of financial institutions to which the bonus tax applied, given their crucial role for the companies they are managing and the fact that they decide on the compensation practice for all subordinate employees. The main dataset we employ is BoardEx, compiled by Management Diagnostics Limited. This dataset is particularly appropriate for dealing with issues related to the compensation of executives.[6] The dataset incorporates detailed information about compensation such as ones on bonuses, salary, shares, and options awarded, and LTIPs. Moreover, the dataset includes biographic information such as education, age, gender, employment duration, and individual role in the company. In addition to the biographic and compensation data, we make use of the information provided about the structure of the board the respective director belongs to. For instance, we know if a director has an executive or supervisory role on board.[7] Overall, the original BoardEx dataset covers 150,879 directors employed in 17,426 companies across 88 countries and for the years 1999–2012. We link the director information with data on various company details from the Compustat North American and Global databases using information about ISIN codes and reporting dates. In the United Kingdom, the fiscal year for personal income taxes lasts from the 6th of April to the 5th of April of the consecutive year. As the BPT applied from 9 December 2009 to 5 April 2010, the treatment period corresponds to the tax year 2009/10. The majority of large corporations, however, have their fiscal year ending in December and bonuses being paid out in the beginning of the year. Hence, virtually for all firms, the bonuses paid out during the taxable period show up as operating expenses for the fiscal year 2010 that are reported in the end of calendar year 2010. Very few of the taxable firms publish their reports on the last day of March. In these cases, the treated period refers to the fiscal year 2009 and the reports published in the beginning of 2010 include the BPT. Accordingly, in our analysis, the time dimension refers to the date of publication of the annual report. This ensures that the treatment period is always correctly specified in the year 2010. Also, note that our results are robust to the exclusion of taxable firms that publish their reports in the beginning of the year.[8]

Given that the coverage in BoardEx is rather incomplete prior to 2002 and for the year 2012, we restrict our sample to the years 2002–2011. Furthermore, we drop companies in the French, Italian, Greek, or Irish financial sector as they face at different points of time similar forms of taxation on variable compensation and we lack a sufficient number of observations to credibly infer the effects of these country-specific measures. In addition, we keep only directors aged between 20 and maximum 85 years old, only those companies with a positive market-to-book ratio, and nonmissing information on bonus, salary, and total compensation. We exclude these observations that may either be prone to measurement error or very specific circumstances because they do not serve as suitable controls. Furthermore, we restrict our dataset to directors and firms which we observe repeatedly in the data enabling us to exploit time variation. Hence, our final sample covers 2,417 companies and 11,248 directors.

The dataset is well suited for analyzing the issue at hand, given that it provides a high coverage of directors of UK companies in the financial sector as well as in all other parts of the economy. Overall, we have compensation data for 7,442 directors and 1,432 companies in the UK that meet the aforementioned criteria. Approximately 3% of these companies were affected by the BPT.

Table I provides descriptive statistics of the main dependent variables (bonuses, total compensation, and equity compensation) and all covariates considered in the empirical analysis. The first four columns report the moments of the distribution for the

TABLE I Descriptive statistics

	Full Sample				Treated Group				Control Group			
	Mean	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Dependent variables												
Bonus ($k.)	482.73	1,329.09	0	76,951	919.51	1,595.19	0	20,463.23	468.96	1,317.5	0	76,951
Equity Comp. ($k)	686.24	3,425.05	0	131,135	27.27	267.28	0	8,292.77	707.63	3,477.76	0	131,135
Total Comp. ($k)	2,423.11	6,135.53	1.51	150,823	2,766.79	3,746.93	12.77	39,303.15	2,412.27	6,195.61	1.51	150,823
Control variables												
ROE	−0.08	3	−179.59	55.86	0.08	0.43	−5.98	0.93	−0.08	3.04	−179.59	55.86
Market/Book	3.23	12.62	0	991.72	2.14	2.87	0.05	42.6	3.27	12.81	0	991.72
MarketCap. (ln($m))	6.57	2.65	−1.03	13.13	7.17	2.59	1.71	12.26	6.55	2.65	−1.03	13.13
Assets (ln($m))	6.95	2.87	−0.47	15.14	8.47	3.28	2.23	15.14	6.91	2.84	−0.47	14.9
Employees (ln(k))	0.74	2.64	−6.21	7.55	0.46	2.59	−5.3	5.75	0.75	2.64	−6.21	7.55
Directors/Employees	0.04	0.12	0	1	0.05	0.13	0	0.86	0.04	0.12	0	1
Gender	0.04	0.2	0	1	0.03	0.17	0	1	0.04	0.2	0	1
Age	51.43	8.23	23	85	50.77	7.01	30	76	51.45	8.26	23	85
YearsRole	4.71	4.93	0	48.2	4.95	5.03	0	32	4.7	4.92	0	48.2
YearsCompany	10.02	9.31	0	61.2	10.17	8.64	0.1	43.2	10.01	9.34	0	61.2
Obs.	38,052	–	–	–	1,163	–	–	–	36,889	–	–	–
Obs. bonus>0	29,085	–	–	–	937	–	–	–	28,148	–	–	–

Note: We drop directors aged below 20 and above 85 years, we keep only firms with a positive market-to-book ratio and nonmissing information on bonus, salary, and total compensation. The sample is confined to directors and firms that are observed repeatedly in the data. The sample covers 2,417 companies and 11,248 directors.

full sample of firms, columns (5)–(8) for the group of firms subject to the UK BPT, and columns (9)–(12) for the remaining companies.

Bonus compensation refers to the value of cash bonuses. We define equity compensation in the following way. It includes the sum of the value of shares and options awarded to executives as well as the value of target-contingent equity-based compensation (LTIP).[9] The value of awarded shares is computed at the latest closing stock price before the company's annual report was published. The value of options is calculated by BoardEX based on the latest closing stock price and using the Black–Scholes option pricing model where volatility is measured using a 100 day historic volatility. Total compensation hence refers to the value of the sum of all three compensation categories: salary, bonuses, and equity compensation. All monetary values are measured in nominal terms and are expressed in USD.

On average, the annual bonuses paid to directors amounted to USD 482.73k, while the total compensation was USD 2,423.11k and total equity compensation (including shares and stock options) amounted to USD 686.24k. In terms of total compensation, bonuses represent about 21.4% on average. Bonus, equity, and total compensation vary considerably over the time dimension as well as over the company director dimension. Note that we measure all compensation components net of the bonus tax. Concerning the selection into bonus-tax treatment, we regard the following firm specific variables as relevant: the return on equity *ROE*, the market-to-book ratio *Market/Book*, the market capitalization *MarketCap*, the value of total assets *Assets*, the number of employees *Employees*, and the number of directors per employee *Directors/Employees*. These variables should reflect the firm performance measured in accounting terms and from a capital markets perspective as well as the size of the firm in terms of their physical and human capital stock. Due to the focus on publicly traded firms, our dataset comprises rather large companies with an average market capitalization of USD 713m and mean assets of USD 1,043m. The firms we cover employ on average around 2,096 employees; however, employment varies substantially and can even reach 1.9m employees.[10] On the director level, we account for the individuals' *Age*, *Gender*, as well as for the number of years the director has been hired in the respective firm and role denoted by *YearsRole* and *YearsCompany*, respectively. The age of the directors spans from 23 up to 85 years with a mean of about 51 years. Typically, these individuals tend to be employed for many years in the company they are managing. On average, they have worked around 10 years in the company and have spent almost five years in the same role. Whereas the numbers in Table I pertain to the full sample of firms, we also report in Table AI in the Appendix the corresponding values for three alternative control groups that comprise UK firms only, financial sector companies, or just firms belonging to the UK financial sector. The summary statistics for the aforementioned variables for the pre- and postreform period, respectively, are presented in Table AII.

4 | BONUS TAXATION AND EXECUTIVE COMPENSATION

Figure 1 depicts the evolution of bonuses expressed in logarithmic terms in the subset of treated UK financial firms vis-à-vis suitable control groups. Panel A includes as a control group all companies worldwide except the treated UK financial firms. In panels B, C, and D, we restrict our sample to more homogeneous control groups. Thus, in panel B, we focus on worldwide financial sector firms, and in panel C, we limit the control group to UK firms (all sectors), whereas the control group in panel D shows the evolution of bonuses exclusively for nontreated firms in the UK financial sector.[11] The latter group qualifies as a proper control because it includes among others UK asset managers or traders that follow similar compensation practices as banks. An unconditional comparison between the change of bonuses from years 2009 to 2010 in the subset of treated UK financial firms and other firm types reveals that bonuses have declined in the treatment group compared to our control groups. In all four panels, the upper blue line shows a dip in the year 2010 followed by a recovery afterward. In the following, we use a range of observable information on firm performance and director characteristics to infer whether this preliminary finding can be attributed to the introduction of the bonus tax. Moreover, we allow for different time trends across treated and control units and capture unobservable firm-specific information by fixed effects.

4.1 | Identification strategy

For the identification of the causal effect of the UK bonus tax on compensation components of executives, our treatment group is defined in the following way: In broad terms, the BPT was levied on UK resident banks, UK investment banks, and UK building societies that represent financial institutions owned by their members as mutual organizations. More precisely, taxable banks included those companies that are authorized under the UK regulatory regime to carry out activities such as deposit taking, dealing in investments as principal, dealing in investments as an agent, arranging deals in investments, safeguarding and administering investments, and entering into regulated mortgage contracts (see HMRC, 2009). Thus, the law excluded numerous

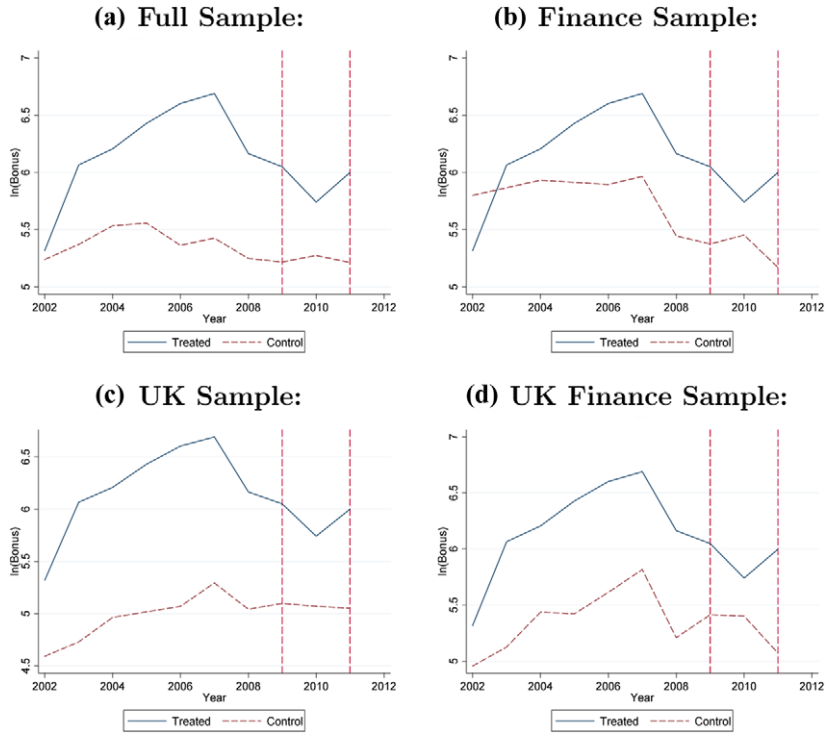

FIGURE 1 Bonus payments 2002–2011

Notes: The control group for panel A includes all companies worldwide except the treated UK financial firms. In panel B, the control group is limited to financial sector firms, in panel C, we restrict the control group to UK firms, and in panel D, the control group consists only of UK financial firms not subjected to the tax. Note that these figures show only the intensive margin and therefore reflect only partly the drop in bonuses during the financial crisis (*ln* of a zero bonus drops out due to a missing value).

[Color figure can be viewed at wileyonlinelibrary.com]

financial firms such as insurance companies, asset managers that do not arrange investments, or credit unions that were tax exempt.[12] Accordingly, we do not regard the treatment as sector specific but rather inspect for each firm in the UK financial sector whether it meets the criteria for taxation. The levy of 50% was implemented on all cash bonuses above GBP 25,000. Hence, the BPT was not applicable to regular salary, regular wages, regular benefits, and shares awarded under an approved share incentive plan and share options. From the perspective of an individual director or an individual firm, the introduction of the bonus tax as such was exogenous. Essentially, the definition of taxable activities was so broad, that an affected firm had no other viable option than either paying the tax or changing compensation practices.

Even though the introduction of the BPT was officially announced on the 9th of December 2009, some discussions or ideas about the implementation of special surcharges levied on the financial sector in the UK were already brought up during the course of the year 2009. Accordingly, in March 2009, after the G20 summit in London, Alistair Darling, the former British Chancellor addressed for the first time the issue of taxation of the banking sector in general. In August 2009, Adair Turner, chairman of the Financial Services Authority of the time, stated that new taxes might be necessary to curb excessive profits and pay in the financial sector. In October 2009, following a speech of the then Shadow Chancellor, George Osborne, in which he indicated that an incoming conservative administration might introduce a new levy for the banking sector, considerable speculation that the Treasury was actively planning a windfall tax on bonuses arose (Blakemore & Iliffe, 2010). Still, the political climate, the strong reactions, and oppositions of important bank representatives as well as the risk that such a tax would threaten London's position as a major financial hub did not seem to favor the introduction of such a levy. However, on the 9th of December 2009, the tax was officially announced and the draft legislation was published. The tax applied immediately after the Chancellor publicized the measure (at press conference on 9 December 2009, 12:30) and ended on the 5th of April 2010 (that is, the end of the tax year). Yet, in his prebudget statement of December 2009, Alistair Darling stated that "the Government will consider extending the period of the charge [...]. Where there is evidence of avoidance schemes being put in place, the Government will take action to close those schemes." This discussion shows that indeed, the introduction of a tax for the financial sector was a topic raised in different public debates and interviews. Nevertheless, it was not a matter of course during the year that—if at all the tax would be implemented, given the possible negative implications for London as a financial center. On top of it, even though it

was first announced as a one off levy, the declarations of the Chancellor reveal that there was no guarantee that the validity period of this special levy would not be extended. Hence, it is safe to assume that neither was the BPT quite anticipated nor that it would be only temporary in nature. Furthermore, the draft law specified a number of antiavoidance rules warranting that firms could not easily defer compensation to a later point in time when the tax did not apply anymore.[13] The tax was payable by the company to the British Revenue and Customs Department. The data we observe are collected from the companies annual reports or remuneration reports and refers to the cash bonuses that were actually paid to the directors, that is, the bonuses net of the BPT.[14] As to other policies and regulations that may confound our results, we should mention here that most changes to the British Tax Code came into force after our treatment period. For instance, the increase of the marginal income tax rate from 40% to 50% for earnings in excess of GBP 150,000, though announced already in April 2009 applied only from April 2010 onward. The bank levy on UK bank balance sheets was introduced by the subsequent government and applied as of January 2011.

The cross-sectional units of observation in our compensation regressions are executive directors $i = 1, \dots, N$ at a certain company $s = 1, \dots, S$. We observe the outcomes of interest $\ln(y_{ist})$ for $T = 10$ consecutive years $t = 2002, \dots, 2011$. In the following, we will consider four alternative outcomes, that is y_{ist} denotes either the bonus of director i in year t at company s, her equity pay (including the value of shares, options, and equity-contingent LTIPs awarded), the volume of shares awarded under different schemes, and her total compensation. Formally, the log-linear version of the generic differences-in-differences model we estimate can be stated as

$$\ln(y_{ist}) = \alpha + \beta d_s + \gamma Tax_t + \delta \left(d_s * Tax_t\right) + \epsilon_{ist}, \tag{1}$$

where d_s represents an indicator variable that is unity for financial firms that are affected by the UK BPT and zero otherwise. Hence, β captures the treatment group-specific effect. The dummy variable Tax_t is unity for the treatment year 2010 and thus captures aggregate changes that occur in that year. The coefficient of interest, δ, measures the treatment effect of the bonus tax.

This baseline specification may be augmented by adding fixed effects, covariates, and different time trends for the treatment and control groups that should improve the causal interpretation of our results. Hence, the augmented model is given by

$$\ln(y_{ist}) = \alpha + \eta_s + \lambda_t + \mathbf{X}'_{ist}\boldsymbol{\beta} + \gamma_{d0}t + \gamma_{d1}t + \delta \left(d_s * Tax_t\right) + \epsilon_{ist}, \tag{2}$$

where $d_s * Tax_t$ is unity for taxable companies according to the law described above and in the year 2010. The interaction is zero for all other firms and all other years. For identifying the causal effect of the bonus tax, we need to ensure unconfoundedness in the sense that the assignment probability to treatment with the bonus tax is independent of the potential outcomes. We control for all possibly relevant time-invariant firm-specific effects η_s (for example, such as being a firm in the financial sector, the location of the firm, the legal form, etc.) and time-specific effects that are common for all cross-sectional units λ_t (for example, the business cycle). Certainly, these fixed effects will capture a substantial amount of the variation in the outcomes and reduce the effects of unobserved information that may confound the estimates obtained in the generic differences-in-differences model in (1). The $K \times 1$ vector $\mathbf{X}_{ist}$ summarizes the covariates introduced in Table I where K indicates the number of covariates employed in the respective specification and the columns of $\boldsymbol{\beta}$ reflect the corresponding coefficients. Note that the fixed effects impede a direct interpretation of $\boldsymbol{\beta}$ and accordingly, we are not reporting the estimated $\boldsymbol{\beta}$ in the main tables. The rows of vector $\mathbf{X}$ contain time variant covariates that determine the compensation level and may at the same time be related to the treatment probability of the company: *ROE*, *Market/Book*, *MarketCap*, *Assets*, *Employees*, *Directors/Employees* as well as the corresponding one year lags. On the director level, we account for *Age*, *Gender*, as well as for *YearsRole* and *YearsCompany*. Finally, we control for a group-specific linear time trend where the coefficient γ_{d1} refers to observations that belong in 2010 to the treatment group and is zero for all observations with $d_s = 0$. Conversely, γ_{d0} refers to the time trend of the control group and is zero for observations with $d_s = 1$.

Hence, specification (2) is very comprehensive and goes beyond a traditional difference-in-difference approach. Even though the historical development of log bonuses tends to be quite similar across treated and control units as illustrated in Figure 1, we relax the common-trend assumption of conventional difference-in-difference identification by fitting in separate time trends.[15]

The parameter of interest is δ which captures the average treatment effect on executive directors of introducing the bonus tax in the UK financial sector in the year 2010. Due to our log-linear specification, $\delta \times 100$ measures our estimate for the percentage change of bonuses and total compensation due to the introduction of the bonus tax. If assignment to treatment is random conditional on the covariates we control for, we can estimate the parameter δ consistently. In spite of our comprehensive specification, there might still be unobservable factors confounding our results. To address this issue, we present in the subsequent section results for different control groups based on variants of the model in equation (2). Among others, we exploit within country as well as within sector variation and apply a synthetic control approach to show that our findings are very robust.

Since we use panel data with potentially serially correlated outcomes, conventional difference-in-difference standard errors may be inconsistent. Bertrand, Duflo, and Mullainathan, (2004) suggest to compute consistent standard errors by block bootstrapping where the cross-sectional units are resampled with its entire time-series attached. The block bootstrap also eliminates the issue of clustered data that arise because our variable of interest—the bonus tax treatment—varies only on the *firm* level, while we observe the outcomes on *director* level. Bonuses of directors within the same firm are unlikely to be independent from each other just as directors' bonuses are correlated over time. Therefore, consistent standard errors are constructed by resampling with replacement on the firm level *s* (see Cameron, Gelbach, & Miller, 2008 and Efron & Tibshirani, 1994).

For the effects of the bonus tax on risk taking, we substitute the dependent variable in equation (2) by *st*-specific information and exclude all director-specific covariates. We keep all firm-specific covariates as we expect the determinants for firm performance and variable pay to matter as well for the amount of profits distributed to shareholders. Again, we compute standard errors from a block bootstrapping routine to address the issue of serially correlated outcomes.

4.2 | Empirical results

4.2.1 | Compensation

In this section, we present the results for the effects of the bonus tax on director compensation. In Table II, we report the parameter estimates for the generic differences-in-differences model where the control group includes all firms in our dataset apart from those affected by the tax, counting between 19,940 and 38,052 observations depending on which outcome of interest we focus on. In Panels A, B, C, and D, we employ four alternative dependent variables, namely, log bonuses, log total compensation, log equity compensation (which includes the value of shares, options, and equity-based LTIPs awarded to directors), or log number of shares granted under different schemes. The results of these estimations are presented in column (1) of Table II. We then extend this baseline specification in columns (2)–(5). In the interest of readability, we now report only the coefficients of the main variable of interest together with *F*-statistics about the joint significance of director and firm covariates. The augmented specifications considerably relax the standard differences-in-differences assumptions and can account for numerous factors that potentially confound the results: column (2) controls for all time-invariant firm-specific factors as well as year-specific factors; column (3) reflects the concern that the bonus tax was systematically targeted at certain firm characteristics which we hold constant in the respective specification (*ROE*, *Market/Book*, *MarketCap*, *Assets*, *Employees*, *Directors/Employees*); column (4) addresses selection issues due to observable director characteristics (*Age*, *Gender*, *YearsRole*, *YearsCompany*); column (5) relaxes the common trend assumption as it allows for different (linear) time trends of treated and control units. As is evident from Table II, the overall explanatory power of our specification is markedly increased in the specifications with firm- and year-fixed effects and also the director and firm covariates add clearly to the overall fit of the model. Importantly, the estimates of the coefficient of interest *BonusTax* remain very similar across all these specifications.

Depending on the specification, bonuses in the treatment group went down by between 36% and 61% relative to the control group in 2010.[16] Accordingly, our preferred specification with firm covariates (and firm-fixed effects) suggests that the introduction of the tax *ceteris paribus* reduced bonuses by about 40%. To investigate whether financial institutions rewarded executives for the decrease in bonuses with higher alternative forms of pay, we employ as dependent variables log total compensation and log equity compensation in panels B and C, respectively. For instance, if a bank desired to maintain the same incentive structure, it may have reacted by increasing target-contingent equity compensation as a substitute for lower cash bonuses. Equity compensation is thereby defined as the sum of the value of shares and options awarded to executives as well as the value of target-contingent equity-based compensation (LTIP). Total compensation hence refers to the value of the sum of all compensation categories such as salary, bonuses, and equity compensation. All monetary values are measured in nominal terms. The coefficients on equity pay are positive and significant at the 1%, 10%, or 15% level depending on the specification considered. While the results with regard to equity compensation are less stable and significant than the ones for bonuses, the estimated coefficients indicate a positive response of equity pay across all specifications. Since the value of equity-based compensation may be influenced by the stock price, we use as an alternative dependent variable log number of shares awarded under different schemes and additionally control for the number of shares outstanding. The coefficients of the bonus tax indicator are positive and significant. Moreover, the magnitude of the effect is very stable across specifications. Hence, once again, the results suggest that the reduction in bonuses was accompanied by an increase in the volume of shares awarded under different schemes. At the same time, overall compensation remained unaffected as is evident from the insignificant coefficients in all columns of panel B.

In Table III, we restrict our estimates to more homogeneous control groups that should allow us to reject the hypothesis that our treatment indicator measures a country-time or sector-time specific shock. Thus, in columns (1) and (2) of Table III, we limit our sample to financial sector firms, columns (3) and (4) focus on the UK, and the last two columns in Table III consider the most homogeneous set that is the financial sector in the United Kingdom. In all samples, we find a highly significant reduction

TABLE II Compensation effects of the bonus tax

A. Log(bonus)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
BonusTax	−0.361**	−0.426***	−0.396***	−0.404***	−0.612***
	(0.175)	(0.118)	(0.121)	(0.120)	(0.197)
Obs.	29,085	29,085	29,085	29,085	29,085
No firms.		2,045	2,045	2,045	2,045
F-stat. firm covar.			223.791	186.730	188.190
F-stat. director covar.				19.082	19.094
R^2	0.009	0.593	0.625	0.638	0.638
B. Log(total compensation)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
BonusTax	0.029	−0.062	−0.033	−0.037	−0.002
	(0.130)	(0.079)	(0.080)	(0.081)	(0.091)
Obs.	38,052	38,052	38,052	38,052	38,052
No firms.		2,417	2,417	2,417	2,417
F-stat. firm covar.			169.389	118.666	119.884
F-stat. director covar.				24.756	24.757
R^2	0.008	0.679	0.713	0.725	0.725
C. Log(equity compensation)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
BonusTax	1.513***	0.685♯	0.748*	0.752*	0.318
	(0.377)	(0.445)	(0.436)	(0.435)	(0.415)
Obs.	27,839	27,839	27,839	27,839	27,839
No firms.		2,042	2,042	2,042	2,042
F-stat. firm covar.			62.122	73.819	72.604
F-stat. director covar.				7.938	7.939
R^2	0.014	0.639	0.651	0.652	0.652
D. Log(No. Shares)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
BonusTax	0.722**	0.476*	0.398	0.400	0.496 *
	(0.290)	(0.288)	(0.258)	(0.256)	(0.259)
Log(Shares outstanding)	0.347***	0.455***	0.567***	0.560***	0.560***
	(0.026)	(0.017)	(0.022)	(0.023)	(0.023)
Obs.	19,940	19,940	19,940	19,940	19,940
No firms.		1,905	1,905	1,905	1,905
F-stat. firm covar.			14.17	12.93	13.00
F-stat. director covar.				6.19	6.20
R^2	0.116	0.588	0.592	0.594	0.594
Firm-fixed effects	no	yes	yes	yes	yes
Year-fixed effects	no	yes	yes	yes	yes
Firm covariates	no	no	yes	yes	yes
Director covariates	no	no	no	yes	yes
Separate time trends	no	no	no	no	yes

Notes: ***, **, *, and ♯ indicate statistical significance at 1%, 5%, 10%, and 15%, respectively (using two-tailed test statistics). Standard errors are reported in parenthesis. We report clustered bootstrapped standard errors where we resample on company level for all specifications. The control group consists of all firms in the dataset apart from those affected by the tax. The firm covariates are *ROE*, *Market/Book*, *MarketCap*, *Assets*, *Employees*, and *Directors/Employees*. The director covariates are *Age*, *Gender*, *Years Role*, and *Years Company*.

TABLE III Compensation effects of the bonus tax—subsamples

	Finance		UK		Finance UK	
A. Log(bonus)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
BonusTax	−0.189	−0.470**	−0.489***	−0.537***	−0.398***	−0.427**
	(0.164)	(0.231)	(0.118)	(0.191)	(0.142)	(0.201)
Includes year-, firm-fixed effects, and director-, firm-level covariates						
Separate time trends	no	yes	no	yes	no	yes
Obs.	5,909	5,909	16,579	16,579	3,441	3,441
F-stat. firm covar.	56.994	60.413	91.403	91.560	5.883	6.322
F-stat. director covar.	4.938	4.950	20.826	20.808	4.344	4.355
R^2	0.666	0.667	0.685	0.685	0.703	0.703
B. Log(total compensation)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
BonusTax	−0.019	−0.024	−0.048	0.026	−0.089	−0.008
	(0.104)	(0.127)	(0.076)	(0.092)	(0.095)	(0.109)
Includes year-, firm-fixed effects, and director-, firm-level covariates						
Separate time trends	no	yes	no	yes	no	yes
Obs.	7,213	7,213	25,344	25,344	4,704	4,704
F-stat. firm covar.	84.902	83.871	156.902	161.129	27.811	27.197
F-stat. director covar.	8.202	8.198	32.574	32.605	14.425	14.283
R^2	0.744	0.744	0.725	0.725	0.768	0.768
C. Log(equity compensation)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
BonusTax	0.712♯	0.205	0.617	0.366	0.712♯	0.482
	(0.445)	(0.423)	(0.440)	(0.429)	(0.438)	(0.434)
Includes year-, firm-fixed effects, and director-, firm-level covariates						
Separate time trends	no	yes	no	yes	no	yes
Obs.	5,688	5,688	15,959	15,959	3,340	3,340
F-stat. firm covar.	45.149	49.717	3.419	3.374	4.305	3.966
F-stat. director covar.	1.983	2.029	5.325	5.342	3.757	3.766
R^2	0.683	0.684	0.348	0.348	0.290	0.292

Notes: ***, **, and ♯ indicate statistical significance at 1%, 5%, and 15%, respectively (using two-tailed test statistics). Standard errors are reported in parenthesis. We report clustered bootstrapped standard errors where we resample on company level for all specifications. Control groups in columns (1) and (2) are confined to financial firms, to UK firms in columns (3) and (4), and to financial firms in the UK in columns (5) and (6). The firm covariates are *ROE*, *Market/Book*, *MarketCap*, *Assets*, *Employees*, and *Directors/Employees*. The director covariates are *Age*, *Gender*, *YearsRole*, and *YearsCompany*.

in the log of bonuses awarded to executives due to the tax treatment. The magnitude ranges between a 20% reduction in the financial sector sample using a specification without separate time trends and a 50% reduction in the sample for UK firms using a specification with separate time trends. In none of the samples is total compensation affected at conventional levels of statistical significance. Moreover, the point estimates are all close to zero. In contrast, all subsamples feature positive point estimates on equity compensation. While the standard errors increase compared to Table II due to less variation in the subsamples, the magnitude of the effects remains very similar as in the benchmark.

These findings suggest the following conclusion: the bonus tax indeed triggered a considerable reduction of bonuses that is significant independent of the specification and control group we choose. However, executives were compensated by means of higher other forms of pay leaving their overall total compensation unaffected. Still, we should note here that a substitute of one pound of cash compensation for one pound of equity compensation may change managerial welfare even though total compensation is unchanged. This may happen because, as pointed out by Murphy (2002), because of risk aversion and under-diversification, the manager's valuation of equity compensation is likely to be much lower than its market value. Our estimates seem to point toward an increase in equity based pay that includes shares, options, and target-contingent equity-based LTIPs awarded. Choosing the regression coefficients based on the UK financial sector sample or the overall financial sector sample as our *preferred point estimates*, we conclude that the bonus tax reduced the level of bonuses awarded to executives by about 43–47% relative to the control group in 2010, whereas equity compensation increased by about 20–48% relative to the control group.

TABLE IV Risk

	Full		UK		Finance		Finance UK	
	TotRisk	IdioRisk	TotRisk	IdioRisk	TotRisk	IdioRisk	TotRisk	IdioRisk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BonusTax	0.004	−0.140	−0.004	−0.234	−0.0009	−0.211	−0.004	−0.061
	(0.010)	(0.131)	(0.012)	(0.148)	(0.011)	(0.134)	(0.016)	(0.133)
Obs.	31,064	31,150	7,512	7,546	5,277	5,289	1,202	1,209
R^2	0.584	0.484	0.573	0.493	0.56	0.477	0.507	0.522

Notes: Standard errors are reported in parenthesis. We also include company fixed effects as well as the following firm-level covariates ROE, ROE_{t-1}, $Market/Book$, $Market/Book_{t-1}$, $MarketCap$, $MarketCap_{t-1}$, $Assets$, $Employees$, $Employees^2$, and $Directors/Employees$. The dependent variables are two market-based risk measures, namely, total risk *TotRisk*, computed as the standard deviation of monthly stock returns, idiosyncratic risk *IdioRisk*, computed as the standard deviation of residuals from a market regression where the share return is regressed on the return of the market index (for the United States, the market index is represented by S&P 500, for the UK by FTSE100, for Canada by S&P 500 Canada, and for the rest of the world by MSCI EAFE excluding UK) and on the the risk-free interest rate (for the United States, the risk-free rate of return is the return on three-month T-bills, for Canada, the return on three-month Canadian T-bills, for the UK, the return on three-month UK treasury bills, and for the rest of the world, the return on three month U.S. T-bills). Both measures of risk are computed using monthly returns over 12 month for each firm in our dataset.

In contrast to the British government's view, our results suggest that the BPT was an instrument to change the way firms reward their executives, however, not of the sort expected by the British government, given that financial institutions did reduce bonus compensation but simultaneously increased stocks and options that also affect risk-taking incentives.

4.2.2 | Risk

In this section, we turn to the central issue related to the purpose of the bonus tax, namely, its effect on risk-taking behavior. Executive compensation typically builds on variable cash and equity compensation in order to align directors' incentives with maximizing shareholder value. In leveraged firms with bondholders not observing the true risk profile, marginally increasing risk does not result in a higher price of debt. Accordingly, shareholders have an incentive to increase risk beyond the social optimal level. With separation of ownership and control, this is achieved by writing director contracts with significant shares of performance-related pay (see Bolton et al., 2011). In the following, we attempt to analyze the link between risk taking and the bonus tax given that our results presented above seem to imply that bonuses were replaced with other forms of pay such as stocks and option grants that also favor short-termist behavior. To shed light on this risk aspect, we follow closely the literature[17] and employ two market-based risk measures, namely, total risk (*TotRisk*) and idiosyncratic risk (*IdioRisk*). Total risk is defined as the volatility of stock returns and is computed as the standard deviation of monthly returns, whereas idiosyncratic risk is computed as the standard deviation of the residuals $\sigma_{st} = sd(u_{st})$ derived from the following market regression:[18]

$$R_{s\tau} = \alpha_{s\tau} + \beta_{s\tau} R^m_{s\tau} + \gamma_{s\tau} R^f_{\tau} + u_{s\tau}. \tag{3}$$

Both measures of risk are computed using monthly returns $R_{s\tau}$ over 12 months for each firm s in our dataset. Note that the subscript τ represents the respective month and the subscript t the respective year. $R^m_{s\tau}$ denotes the return of the market index, R^f_{τ} the risk-free interest rate, and $u_{s\tau}$ the error term.[19] These variables are all derived from the Compustat database.

To address the question on whether the BPT affected risk-taking behavior, we estimate the following model: we substitute the dependent variable in equation (2) by st-specific information and keep all firm-specific covariates such as ROE, ROE_{t-1}, $Market/Book$, $Market/Book_{t-1}$, $MarketCap$, $MarketCap_{t-1}$, $Assets$, $Employees$, $Employees^2$, and $Directors/Employees$. Once again, we control for all possibly time-invariant firm-specific effects as well as time-specific effects. As the results in Table IV show, *BonusTax* the coefficient of our main variable of interest, is not significant at conventional levels in any of the presented cases and risk taking proxied by our two different risk measures is constant. The columns of Table IV refer to the full sample as well as the four subsamples and present for each sample the result for both risk measures. Hence, our results seem to point to the fact that the tax was not successful in changing risk-taking behavior. This is in line with our findings presented above that suggest the reduction in bonuses was accompanied by a simultaneous increase in equity pay.

4.3 | Sensitivity analysis

In this subsection, we present the results of a host of sensitivity checks about our main results. Estimating equation (2) with log bonuses as outcome may yield biased estimates as we lose all observations with zero bonuses paid. This renders the sample inconsistent because not only the level but also the provision of bonuses as such may be affected by the tax.[20] Hence, we follow

TABLE V Sensitivity analysis

	Sample Selection	No Supervisory Directors	Low Bonus before Tax	Country Year Fixed Effects	Symmetric Time Frame	Balanced Panel
	(1)	(2)	(3)	(4)	(5)	(6)
BonusTax	−0.359***	−0.422***	−0.563***	−0.496***	−0.359***	−0.404***
	(0.118)	(0.117)	(0.169)	(0.119)	(0.137)	(0.142)
$LowBonus_{2007-2009}$			0.404*			
			(0.212)			
Obs.	29,085	25,879	29,085	29,085	10,911	7,583
No. firms	2,418	2,035	2,045	2,045	1,451	684
F-stat. firm covar.	38.433	316.870	178.842	181.442	7.759	5.889
F-stat. director covar.	19.086	42.243	19.957	8.447	14.712	12.125
R^2	0.641	0.724	0.631	0.656	0.690	0.661

Notes: ***, and * indicate statistical significance at 1%, 5 and 10%, respectively (using two-tailed test statistics). Standard errors are reported in parenthesis. The control group consists of all firms besides those affected by the tax.

the approach introduced by Wooldridge (1995) to correct for selection bias with panel data. In order to identify the selection equation, we impose an exclusion restriction on an indicator stating whether a director is a supervisor or an executive. With only few exceptions, supervisory directors do not receive cash bonuses such that our indicator *ED* is highly relevant for the selection stage, while it should not have a partial effect on the level of bonuses.[21] The approach introduced by Wooldridge for sample selection with panel data requires estimating first-stage probits for each period separately such that the inverse Mills' ratio is calculated as a time-varying variable that is plugged into the second-stage regressions. We do not report the first-stage regressions but note that the indicator on whether an individual is an executive or supervisory director—our exclusion restriction—tends to be highly significant in the majority of first-stage regressions. Even when we control for sample selection, the log bonuses and the main control variable *BonusTax* feature the expected negative and highly significant relationship (see column (1) in Table V).

Given that almost all supervisory directors do not receive cash bonuses, we consider in column (2) of Table V a specification based on a sample that excludes supervisory directors. Our main result remains robust when using this alternative sample and is similar in magnitude and significance to its counterpart in Table II. To support our argument that the reduction in bonuses can indeed be attributed to the bonus tax, we also investigate whether financial firms that paid lower bonuses prior to the bonus tax reform display no or a weaker bonus reduction. Hence, we include an additional variable labeled $LowBonus_{2007-2009}$. This indicator variable is unity for those companies that featured below average bonus payments between 2007 and 2009 and that were treated by the BPT in 2010. It is zero for all control companies and for treated companies with an above average bonus level in 2007–2009. When adding this additional control to the difference-in-difference specification, we find that the negative effect of the tax on bonus payments continues to prevail and is driven by the firms that paid above average bonuses in the years prior to the tax.

One may argue that the postbonus tax period is related to overall market conditions, and hence these negative economic environments could have systematically different effects on financial institutions in countries that were more affected by the crisis than others. We have addressed this issue as follows: we perform a robustness check that includes country-time specific fixed effects that capture the country-specific degree of recovery from the crisis. The results of this alternative scenario are presented in column (4) of Table V. The coefficient on *BonusTax* remains negative and highly significant, which mitigates the concern that general economic conditions drive the temporary reduction on bonuses we identify. Since our baseline results are based on an unbalanced panel where the prebonus time period is longer than the posttreatment period, we perform a sensitivity check in which we consider a symmetric time window ranging between 2008 and 2011. The results of this robustness check are presented in Table V, column (5). Once again, the coefficient on *BonusTax* continues to be negative and highly significant. The last check presented in column (6) of Table V examines whether the composition effect due to an unbalanced sample may affect the results. In this alternative specification, we restrict the estimation to firms and directors that are observed in every year. Using this balanced sample, which somewhat reduces the number of firms, does not qualitatively affect our results. The main variable of interest *BonusTax* remains negative, highly significant, and at similar magnitude as in the benchmark specification.

As mentioned above, the causal interpretation of our results rests on the suitability of the control groups. The financial sector certainly experienced a unique development since 2007. However, this has been a global development with executive directors

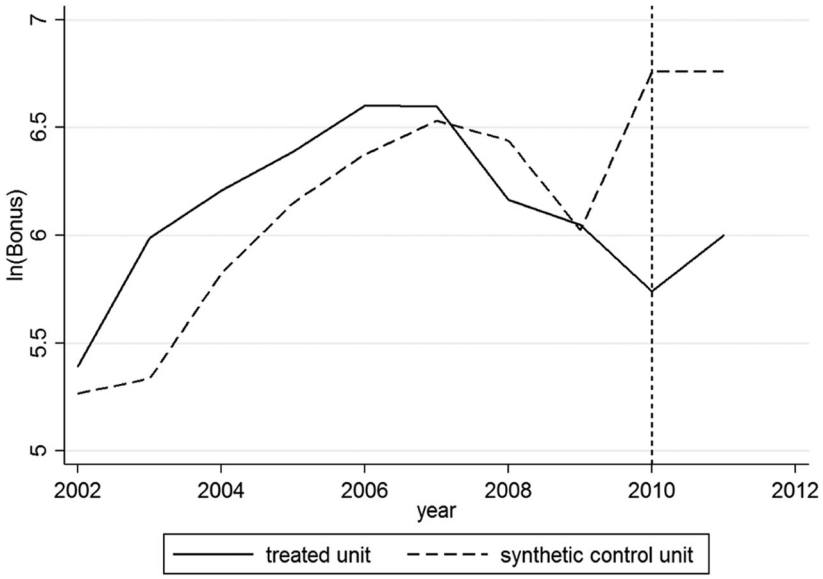

FIGURE 2 Synthetic control approach

Notes: The synthetic control group is constructed on the basis of all UK firms. In order to ensure a most suitable synthetic control, we drop firms in all other countries. The figure bases on the algorithm provided by Abadie et al. (2010) where we combine individual firms for the synthetic control. We use the same pretreatment variables as described in Table I and add lagged values of the dependent variable as suggested by Abadie et al. (2010).

who are highly mobile across borders such that the compensation determinants of financial firms in different countries are sufficiently homogeneous. The observation that the coefficients of interest remains almost identical when using only financial firms within the UK that were exempted from the levy builds further confidence in our results (see Table III). Yet, we choose aggregate sets of companies as controls and there might be some firms among the controls that do not fulfil the requirements for an adequate counterfactual. Of course, one could refine the selection of controls among countries and sectors, for instance, by using a finer classification of sectors or by limiting the controls to specific countries. Still, such a selection may be subjective in the sense that it depends on the choice of observables for which we require balance between treated and control units. A data-driven approach that addresses this issue was introduced by Abadie and Gardeazabal (2003) in the context of regional controls. The idea is to use a combination of potential control units and construct a weighted average that serves as a synthetic control. The weights are chosen so as to minimize the differences in pretreatment outcomes of the synthetic control and the treated units. We present the formal details of the approach in the Appendix. For the pretreatment characteristics, we use the covariates $\mathbf{X}_{ist}$ summarized in Table I and add a lagged value of the outcome as suggested by Abadie et al. (2010). We use all individual firms as potential control units that are then combined for the construction of the synthetic control. In Figure 2, we depict the log bonuses for the treated and the synthetic control. Before the introduction of the bonus tax, we observe a close fit between the bonuses for treated and the ones predicted for our synthetic control. In the year 2010, the dashed and solid lines substantially diverge with the synthetic control predicting a log bonus of about 6.75, whereas the treatment group was paid on average a log bonus of about 5.75. This is consistent with our findings above even if it suggests a somewhat lower effect of about 15% due to the bonus tax.

5 | CONCLUSIONS

Following the recent financial crisis, governments worldwide have envisaged a number of measures to address the structural issues behind the financial crisis. In this context, policymakers have tried to find ways to curb the excessive bonus compensation that has been considered to fuel short-termist behavior and excessive risk taking. One popular instrument is the so-called bonus tax.

In light of these discussions, this paper identifies the effects of a bonus tax on banks' risk-taking behavior and the structure of compensation. We account for detailed firm and director-specific information and contrast the development of bonuses awarded to directors employed in institutions subject to the BPT, to a number of suitable control groups. Our results show that the tax induced a significant decrease in cash bonuses by about 43–47%. This reduction has been accompanied, however, by an

increase in other forms of pay such that overall compensation of the directors targeted by the tax did not significantly change. In particular, our results suggest that the value of equity-linked compensation increased by about 20–48. We provide evidence that this increase can be attributed to a higher volume of shares awarded to executives as a consequence of the bonus tax. Yet, we would not like to overemphasize the latter effect as the coefficients with regard to the response of equity are less stable and only weakly significant. The evidence also shows that the tax had no effect on banks' risk-taking behavior as measured by total and idiosyncratic risk. This latter result is consistent with the observation that the affected financial institutions substituted cash-based bonuses by equity-based pay that rather increases the convexity of compensation.

NOTES

[1] Several other governments also introduced such levies in the aftermath of the financial crisis. Accordingly, in 2011, the Irish government adopted a 90% bonus surcharge for financial institutions that received government support, Italy approved in May 2010 a 10% bonus tax for the banking sector if variable compensation exceeds three times the fixed salary component. Greece levies a tax on bank executives' bonuses ranging between 50% and 90% since April 2010.

[2] Building on a model of competition for managerial talent, Bannier et al. (2012) find that the bonus component can be employed as a screening device because the low ability type's marginal rate of substitution between fixed and variable compensation is lower than that of the high ability type, since she generates a lower return. In this framework, the authors show that the bonuses offered induce risk taking that is excessive both from the society's and the banks' perspective. Therefore, their model suggests that legal restrictions on bonuses would simultaneously increase profits and welfare, assigning accordingly a positive role to interventions by regulators.

[3] CDSs represent contracts that provide protection against the risk of a default event by a company or country. In a CDS, the protection seller agrees to pay to the protection buyer in case default occurs prior to maturity of the contract, the default payment. With no default before maturity, the seller pays nothing.

[4] See Murphy (2013) and the references therein.

[5] See Goolsbee (2000), Hall and Liebman (2000), and Frydman and Molloy (2011).

[6] The BPT did not only apply to the executives of the FSA-regulated institutions that were subject to the tax but to all these firms' employees earning bonuses in excess of GBP 25,000. Evaluating the effect of the tax on all employees is prohibited by data restrictions. Since the tax did not apply to the overall financial sector but only to a number of particular companies, we need data that match employees' compensation—and in particular bonuses—to firms. This is not possible with the available dataset in the UK as, for instance, the Annual Survey on Households and Earnings (ASHE) used by Bell and van Reenen (2013). Using industry breakdowns as to comply with the Office for National Statistics (ONS) confidentiality requirements would not be instrumental in our case because the tax applied only to companies meeting special criteria as explained in Section 4.1, and not to the overall UK financial sector. Furthermore, as opposed to BoardEX, other datasets do not contain data on equity-based remuneration or other forms of pay apart from bonuses and salaries. These different compensation components are nevertheless crucial for assessing the impact of the BPT on total compensation.

[7] Note that supervisory directors are defined as members of the company's board who are not employed at the company but have a financial relationship, for example, own stocks, while independent directors are board members that have no financial relationship to the company and receive only sitting fees.

[8] As the definition of a firm's fiscal year remains constant over time, this variation is also fully absorbed by the firm-level fixed effects.

[9] See also Conyon, Peck, Read, and Sadler (2000) for the definition of equity compensation for UK firms.

[10] This is Wal-Mart.

[11] We should note here that in the United States, financial institutions that received TARP funds were allowed to have only base salaries and restricted shares, and were precluded from receiving bonus payments, which could potentially bias our results when focusing on the worldwide financial sector only. However, our results still hold when we consider UK companies only, or institutions in the UK financial sector solely, such that the compensation structure of U.S. companies does not affect our results.

[12] The law did not distinguish between investment and retail banking operations. In the original draft legislation the term bank, included prime brokerage firms, pension fund managers, and independent fund managers such as private equity and hedge fund managers. During the course of December 2009, however, a revised proposal was published. The new document envisaged, for instance, that a nondeposit taker (such as a fund manager) would only be subject to the BPT under special circumstances and not in general. These proposed changes should leave the scope of the tax applicable to larger proprietary trading investment firms and at the same time exclude most independent fund managers. Nonetheless, some ambiguities remain, as the definition of taxable companies is not straightforward. Furthermore, the tax also applied to so-called relevant foreign banks that carry on a trade in the UK through a permanent establishment. Institutions that are not operating as companies, such as investment managers established as partnerships, are not considered to be taxable companies and are outside the scope of BPT. The list of excluded companies in the original draft legislation included insurance companies, investment trusts, and open-ended investment companies. The extended list of exclusions now also features prime brokers, corporate managers of a pension scheme, or corporate operators of a collective investment scheme. Industry representatives and the HMRC discussed to exclude also other institutions that might be inadvertently subject to the BPT. For instance, the HMRC decided to exclude companies that conduct a banking activity within a predominantly nonbanking financial services group (Blakemore & Iliffe, 2010).

[13] For instance, paragraph 13 ruled out that the firm provides an interest-free loan during the period relevant for taxation and waives the loan in 2011. The act also targets relevant "arrangements" that are intended to shift remuneration outside the chargeable period (see paragraph 13). Note also that the expected increase of the top marginal income tax as of April 2010 rendered shifting to future periods less profitable compared to other options.

[14] In their financial statements, companies typically refer to the BPT as operating expenses.

[15] We performed sensitivity checks with higher order polynomials of t: the treatment effect remains significant and similar in magnitude at least up to a quadratic specification of the time trends that support the causal interpretation of our estimates.

[16] In 2010, the total reduction in bonuses for the treated firms compared to the average over the years 2002–2011 was 47% as we estimate a coefficient of -0.11 on the time indicator Tax_t.

[17] See, for instance, Chen, Steiner, and Whyte (2006), Armstrong and Vashishta (2012), Suntheim (2011), Coles, Daniel, and Naveen (2006), or Low (2009).

[18] See also Chen et al. (2006). We further employ two alternative risk measures, namely, the share of nonperforming loans in total assets and the Tier 1 capital ratio. Data for these variables are, however, only available for banks and this drastically reduces the number of observations in our sample. The bonus tax nevertheless applied to different kinds of financial institutions besides banks. This is why we choose to focus here only on the market-based risk measures. The results for these alternative regressions are available from the authors upon request.

[19] For the United States, the market index is represented by S&P 500, for the UK by FTSE100, for Canada by S&P 500 Canada, and for the rest of the world by MSCI EAFE excluding UK. The risk-free rate of return for the United States is the return on three month T-bills, for Canada, the return on three-month Canadian T-bills, for the UK, the return on three-month UK treasury bills, and for the rest of the world, the return on three-month U.S. T-bills.

[20] Even though the tax was only levied for cash bonuses above GBP 25,000 it may be the case that some companies entirely switched from bonus to salary or equity compensation.

[21] As an alternative way to deal with the problem of zero bonuses we used the level of bonuses in specification (2) and estimated pseudo-poisson-maximum-likelihood (PPML) models as suggested for the log of gravity in empirical trade studies (see Santos Silva, & Tenreyro, 2006). The results turn out qualitatively very similar.

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APPENDIX A: SYNTHETIC CONTROL APPROACH

The synthetic control approach essentially generates a counterfactual path of the outcome variable by assigning weights to the observations in the control group so as to minimize the deviations in bonuses and other observed firm characteristics prior to the intervention. This allows to compute the estimated treatment effect from the simple comparison of the actual level of the outcome variable in the treated year to the counterfactual. In the following, we provide a short summary of the approach introduced by Abadie and Gardeazabal (2003). The set of available control firms is denoted by J (all observations summarized in columns (9)–(12) of Table I) and $\mathbf{W} = (w_1, \ldots, w_J)'$ refers to a $(J \times 1)$ vector of nonnegative weights that are required to sum to one. Each firm j received a weight w_j in the synthetic representation of a firm treated by the bank payroll tax. By altering the weights in vector $\mathbf{W}$, infinitely many different synthetic representations of a taxable company can be generated. Hence, the aim is to choose $\mathbf{W}$ such that the synthetic representation of a firm treated by the bank payroll tax resembles the actually treated firms as closely as possible. The underlying criteria for the similarity are contained in the $\mathrm{K} \times 1$ vector $\mathbf{X_1}$ of observable firm characteristics of the treated observations (see columns (4)–(8) in Table I) that affect the development of bonuses. Likewise, we have a vector of firm characteristics $\mathbf{X_0}$ that predict bonus levels for the J possible control observations. Let $\mathbf{V}$ be a diagonal matrix where the elements reflect the relative importance of the firm characteristics in explaining bonus levels. Then, we choose the vector of optimal weights $\mathbf{W}^*$ so as to minimize $(\mathbf{X_1} - \mathbf{X_0W})'\mathbf{V}(\mathbf{X_1} - \mathbf{X_0W})$ subject to the constraints $w_j \geq 0 \, \forall j$ and $w_1 + w_2 + \ldots + w_j = 1$. Using the optimal weights, we can compute the firm characteristics for the synthetic representation of a firm treated $\widehat{\mathbf{X}}_1 = \mathbf{W}^*\mathbf{X_0}$ and the outcome, that is, bonus levels of the synthetic control $\widehat{\mathbf{Y}}_1 = \mathbf{W}^*\mathbf{Y_0}$. Table AIII shows the actual values in column (1) and the values predicted for the synthetic control in column (2). The comparison shows that our synthetic representation of a taxable company reflects very well the characteristics of the actually treated firms. In the last step, we plot the development of the outcome of the actually treated firms $\mathbf{Y_1}$ against the development of the synthetic control $\widehat{\mathbf{Y}}_1$ to show that they behave similarly until 2010 when they diverge due to the introduction of the bank payroll tax. Unfortunately, the approach itself does not provide standard errors to infer statistical significance of the estimated effects. Abadie and Gardeazabal (2003) suggest to run placebo tests instead. The underlying idea is to draw firms that were actually not treated, assign them to the treatment, and estimate the effect according to the routine described above. If the gap between the actual bonus path and the predicted one is the largest for the true treatment group and nonexistent for the placebo treatments, this speaks in favor of the significance of the results. An alternative would be to bootstrap the synthetic control by drawing from the control group. However, as we employ the synthetic control only as means of robustness, we refrain from such indirect inference tests.

TABLE AI Descriptive statistics—different subsamples

	Finance				UK				Finance UK			
	Mean	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Dependent variables												
Bonus ($k)	811.13	1902.67	0	29,000	199.99	417.96	0	8,101.56	319.32	563.33	0	7,785.12
Equity Comp. ($k)	868.74	4,087.53	0	73,123	42.7	439.67	0	29,480.37	17.86	128.76	0	3,363.07
Total Comp. ($k)	3,251.6	8015.72	1.98	132,409	1,076.79	2,168.22	1.51	86,946.33	1,251.19	1,658.08	1.98	22,205.43
Control variables												
ROE	−0.03	2.84	−123.47	1.35	−0.17	3.71	−179.59	55.86	−0.14	3.71	−123.47	1.35
Market/Book	2.08	2.49	0	69.88	3.08	9.61	0	553.71	1.88	2.57	0	69.88
MarketCap. (ln($m))	7.14	2.54	−0.37	12.52	5.37	2.18	−1.03	12.11	5.9	2.18	−0.37	11.34
Assets (ln($m))	8.39	3.22	0.36	14.9	5.7	2.28	−0.47	14.1	6.85	2.67	0.36	14.1
Employees (ln(k))	0.04	2.72	−6.21	5.96	−0.26	2.31	−6.21	6.44	−1.26	2.32	−6.21	4.45
Directors/Employees	0.08	0.18	0	1	0.06	0.14	0	1	0.13	0.22	0	1
Gender	0.05	0.21	0	1	0.04	0.21	0	1	0.05	0.22	0	1
Age	51.98	8.38	28	85	49.79	7.86	23	84	49.89	8.09	28	80
YearsRole	4.98	5.35	0	45.3	4.8	5.11	0	48.2	5.31	5.84	0	45.3
YearsCompany	10.56	9.66	0	57.8	9.09	8.61	0	54.9	9.8	8.96	0	48.3
Obs.	6,050	–	–	–	24,181	–	–	–	3,541	–	–	–
Obs. bonus>0	4,972	–	–	–	15,642	–	–	–	2,504	–	–	–

TABLE AII Descriptive statistics—before and after tax reform

	Before Reform				After Reform			
	Mean	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Dependent variables								
Bonus ($k)	492.9	1,352.29	0	76,951	394.7	1,090.94	0	27,500
Equity Comp. ($k)	746.45	3,584.57	0	131,135	198.84	1,566.83	0	34,292
Total Comp. ($k)	2,498.05	6,314.45	1.98	150,823	1,830.75	4,458.55	1.51	78,203
Control variables								
ROE	−0.08	3.12	−179.59	55.86	−0.05	1.71	−59.55	5.03
Market/Book	3.19	11.85	0	991.72	3.65	18.95	0.02	553.71
MarketCap. (ln($m))	6.64	2.6	−1.03	13.13	6.08	2.94	−0.15	12.81
Assets (ln($m))	7.02	2.83	−0.47	15.14	6.51	3.09	0.19	14.71
Employees (ln(k))	0.81	2.6	−6.21	7.55	0.23	2.87	−6.21	6.44
Directors/Employees	0.04	0.11	0	1	0.07	0.16	0	1
Gender	0.04	0.19	0	1	0.05	0.23	0	1
Age	51.36	8.24	25	85	52.05	8.13	23	83
YearsRole	4.66	4.9	0	45.3	5.02	5.04	0	48.2
YearsCompany	10.13	9.41	0	61.2	9.04	8.4	0	54.2
Obs.	33,899	–	–	–	3,592	–	–	–
Obs. bonus>0	26,300	–	–	–	2,409	–	–	–

TABLE AIII Synthetic control approach

	Treated	**Synthetic Control**
$\ln(\text{Bonus}_{t-1})$	6.16	5.99
$\ln(\text{TotalComp}_{t-1})$	7.32	7.66
$\ln(\text{Bonus}_{t-2})$	6.11	5.93
$\ln(\text{TotalComp}_{t-2})$	7.30	7.52
ROE	0.07	0.15
ROE_{t-1}	0.07	0.13
Market/Book	1.89	3.36
Market/Book_{t-1}	2.55	3.31
MarketCap	7.47	7.77
MarketCap_{t-1}	7.45	7.62
Assets	8.97	7.67
Employees	0.77	1.52
Employees^2	6.95	6.32