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Do Broad-Based Stock Options Promote Organization Capital?

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Abstract

There is a growing body of empirical literature that provides evidence that stock option usage is associated with greater firm-level output. Little is known, however, about the mechanisms associated with this result. Focusing on broad-based employee stock options, we hypothesize organization capital as one mechanism underlying the positive impact of stock options. The evidence we provide here shows a positive relationship between stock options and organization capital.

1. Introduction

During the last 30 years, the majority of the value of firms has become intangible capital (Lev 2001). Starting in the early 1980s, the market value of the firm started to diverge from book value. Corresponding closely to this proportional increase in intangible capital has been the rise of equity compensation (Blasi *et al*. 2003). It may be that the two are interrelated, and we explore this possible connection in the following article.

Since 1980, the use of stock options programmes are growing and becoming more widespread (Weeden *et al*. 1998). Stock options are typically given to the top executives and increasingly to a broader set of employees. According to Hall and Murphy (2003), 90 per cent of the options granted in 2002 were to non-executives. This work will address the consequence of the adoption of broad-based stock options programmes.

In virtually every industry, some firms systematically outperform others such as Intel in semiconductors and DuPont in chemicals. Such outstanding performance cannot be entirely attributed to highly advanced physical capital investments or competition-constraining regulations, but rather are the consequence of special characteristics or assets of the firms. These special assets are generally referred to as organization capital (Atkeson and Kehoe

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2005; Prescott and Visscher 1980), which is defined as a type of unmeasured capital that is distinct from the concepts of physical or human capital in the standard growth model.

Lev and Radhakrishnan (2003: 4–5) state that 'A sufficient definition of organization capital is provided by Evenson and Westphal (1995): Organization capital is the knowledge used to combine human skills and physical capital into systems for producing and delivering want-satisfying products. It relates but is not limited to the following: (a) operating capabilities; (b) investment capabilities; and (c) innovation capabilities'. Some writers on organization capital view this resource as embodied in employees (e.g. Jovanovic 1979). Others (e.g. Rosen 1972) view organization capital as 'a firm-specific capital good jointly produced with output and embodied in the organization itself'.

All of these definitions recognize the key contribution human capital makes to organization capital. In the following article, we explore the relationship between stock option adoption and organization capital. The structure of this study is as follows: Section 2 covers literature review and hypothesis. Section 3 demonstrates the dataset and results. Section 4 is the discussion and conclusion.

2. Literature review and hypothesis

Productivity and Broad-Based Stock Options

There is a growing body of empirical work identifying positive performance associated with the use of broad-based stock options. The work by Black and Lynch (2004) shows that stock options are associated with increased productivity by using a unique nationally representative sample of US establishments surveyed in 1993 and 1996. Using a sample of 200 large NASDAQ firms, Kedia and Mozumdar (2002) find that firms grant options to retain key employees and that firms' use of options to retain key employees creates value and is associated with positive abnormal returns. Sesil *et al.* (2002) document that the adoption of stock options programmes results in higher levels of value added per employee. Sesil and Lin (2010) show a significant impact of employee stock options on employee productivity.

With few exceptions, a problem with much of this research is it relies mostly on cross-sectional data. The positive impact identified by previous studies may be a result of firm-specific factors such as better management. Second, the current literature mostly is unable to distinguish the effects of broad-based programmes from executive programmes because of the absence of proper data. In particular, if the adoption and the maintenance decision of executive and broad-based programmes are correlated, the observed impact is seriously biased. Third, the positive association may be due to a general upward trend experienced by a majority of firms, and broad-based stock options may not carry a true effect. Finally, while the literature provides evidence besides motivation (Oyer and Schaefer 2005), it remains mostly

TABLE 1
Top Reasons for Stock Option Plans

Retaining valued employees	94%
Competing for top talent (attracting)	84%
Promoting shareholder ownership	69%
Hiring	36%
Building corporate culture/identity	33%
Wealth accumulation	32%

By PricewaterhouseCoopers and the National Association of Stock Plan Professionals (1998).

silent on the mechanisms associated with broad-based programmes impacting productivity. We offer a line of reasoning and provide evidence on an alternative channel in the following sections.

Hypothesis: Organizational Capital as an Underlying Mechanism

The stated objectives of company stock option plans are used as a means to motivate, attract and retain valuable employees.[1] Employee retention is one of the most often cited objectives for offering a broad-based stock option plan. A survey conducted by PricewaterhouseCoopers and the National Association of Stock Plan Professionals in 1998, which is shown in Table 1, documents the top reasons for stock option plan adoption, and retention is noted as one of the primary reasons. Lazear (2004) concludes that the prevalence of stock option programmes is more consistent with selection than with an incentive effect.

Oyer and Schaefer (2003, 2005) gather data from three distinct sources and seek to determine which explanation is most consistent with the option grants observed. They reject an incentive-based explanation for broad-based stock option plans and conclude that selection and retention explanations appear to be consistent with the data. Blasi *et al.* (2003) argue that one way stock options help to create extra value for firms is attracting and retaining employees with experience, talent, and drive (i.e. key employees).

Running through these academic discussions has been one major unanswered question. How is the selection and/or retention of human capital associated with the impact of broad-based programmes on employee productivity? One factor that we believe to be important in the programme–productivity relationship, and on which data are available, is organization capital. Strengthened selection and retention may result in lower turnover, longer tenure, and the formation of more firm-specific human capital and, in turn, lead to better firm performance (Freeman 1976).

Typically, in economic theory, wages equal marginal product, and because wages and marginal product are assumed to be the same in many firms, there are no benefits or losses associated with employee turnover. It does not matter whether a firm's labour force always contains the same individuals or constantly changing individuals. Consequently, turnover is almost always

ignored in economic and organizational theory (Becker 1993). However, within organization capital, turnover becomes important because costs are imposed on firms. Such costs may take various forms, such as the costs associated with specific training (Becker 1993) and the loss of the contributions towards organization capital.

Increasingly, because of multi-skilling and team-based production processes, employee productivity is not always easily identified at the individual level and, hence, the marginal product is not readily observable. Thus, compensation schemes based on individual performance might not be optimal. According to Black and Lynch (2005, p. 208) '. . . while incentive-based pay is not organizational capital per se, it is an important glue that holds organizational capital together and keeps it within the firm'. We hypothesize that broad-based employee stock option programmes reduces employee turnover (Balsam *et al*. 2007), resulting in organization capital accumulation, which leads to better employee productivity.

One can examine this hypothesis by testing whether organization capital acts as the intermediate variable in the association between broad-based stock option programmes and employee productivity. This is the task we embark upon in the following section.

3. Empirical strategy, data and results

As discussed in Section 2, the association between broad-based stock option programmes and employee productivity is unclear because of unobserved firm-specific effects or a general upward trend experienced by both adopting and non-adopting firms. Consequently, broad-based programmes may not carry a true significant impact, and this is what we initially examine. We evaluate the impact and test the underlying channels on the following data.

Using its own resources and knowledge of the field, as well as information obtained from the media and consultants, the National Center for Employee Ownership[2] (NCEO) identified that a total of 563 public and private companies from different industry sectors reported as sponsoring some form of stock option plans. From this list, the NCEO had information on the start dates of both executive and broad-based stock option plans for 193 firms. Using the original list of 563 firms, the start dates for another 98 firms was confirmed. This was accomplished through survey data collected in 2001 and early 2002[3] and by examining SEC 8-K forms between the years 1983 and 2002.

The New York Stock Exchange classifies as broad based those plans that offer options to 20 per cent or more of a company's employees. However, to be more conservative, we follow the NCEO's definition of broad-based stock option plans as plan where at least 50 per cent of non-management employees receive stock options. Information on the plans' start dates was then combined with Standard and Poors COMPUSTAT full coverage firm-level data for the years 1966–2006. After eliminating missing variables on such items as sales and employment, we arrived at an unbalanced panel containing 150 adopting firms with 2,908 observations.

TABLE 2
Variable Definitions and Means

Variable	*Definitions*	*Mean (standard error)*
Executive stock option plan (*EX*)	Firms where at least one of the top five executives receives stock option grants (dummy variable)	0.36 (0.48)
Broad-based stock option plan (*BB*)	Firms where 50% or greater of the non-management employees have been granted stock options (dummy variable)	0.25 (0.43)
Total employment (*L*)	Total company employment (number of employees) (thousands)	15.15 (36.14)
Capital intensity (*K*/*L*)	Total property, plant and equipment per employee adjusted to current market value using GDP deflator (thousands)	47.91 (75.22)
Research and development (*R&D*/*L*)	Research and development expenses per employee deflated by GDP deflator (thousands)	19.29 (25.34)
Sales, general and administrative expenditures (*SGA*/*L*)	Sales, General, and Administrative expenditures per employee (thousands)	64.99 (53.36)
Productivity (*Q*/*L*)	Output per employee (total sales adjusted for inventory changes and inflation divided by the number of employees) (thousands)	193.08 (164.73)

Moreover, we assume that firms similar in size and within the same four-digit industry classification are similar in other important ways. Such firms may tap the same labour market and employ human capital of similar quality, or they may use similar human resource management practices. In order to construct our control group, we took the original NCEO list of 563 firms that were identified as having stock option programmes and excluded them from the entire COMPUSTAT population of firms creating our control group. Next, we construct a group of control peers by identifying, for every broad-based stock option company, the next largest or the next smallest (in terms of total employment) or both (if available) non-stock option company within the same industry (identified as the four-digit SIC code) *at the adoption year*.

An advantage of constructing a control group in this fashion is that it helps to control for industry-specific factors. Finally, we arrive at 263 firms with 3,885 observations as the non-stock option peer group. Therefore, in total, we have 413 firms with 6,793 observations and with an average of 16 years of observations per firm. In order to convert nominal numbers into real terms, we deflate all the variables to 1997 dollars using the GDP deflator. Table 2 shows the variable definitions and the means for the entire sample. Worth noting is that the overall sample means of the programme dummies (i.e. BB and EX) suggest that 36 per cent of the total observations (firm-year) had executive programmes while 25 per cent had broad-based programmes. As firms generally adopted executive programmes in the 1980s and broad-based programmes in the 1990s, the percentage of

TABLE 3
Pre-Post Comparisons — Adopters vs Control Firms

Variable	*Adopters*		*Control Firms*	
	Pre	*Post*	*Pre*	*Post*
Total employment	28.59 (56.47)	16.86 (40.61)	9.41 (19.84)	10.79 (23.45)
Capital intensity	51.24 (75.92)	57.77 (72.44)	39.85 (85.17)	45.11 (65.86)
Research and development	12.60 (14.44)	34.30 (36.87)	9.14 (11.80)	20.25 (21.63)
Sales, general and administrative expenditures	49.45 (40.14)	94.76 (60.75)	42.02 (34.08)	70.84 (55.24)
Productivity	166.05 (155.10)	261.14 (192.70)	149.24 (149.30)	193.48 (138.78)
No. of observations	1238	1670	1847	2038

Standard deviations are in parentheses.

TABLE 4
Productivity Comparison between Adopting and Non-Adopting Firms

			Significance Level		
			Pre versus post	*Adopting Firms versus Non-Adopting Firms*	
	Pre	*Post*		*Pre*	*Post*
Adopting firms	166.05 (155.10)	261.14 (192.70)	***	*	***
Non-adopting firms	149.24 (149.30)	193.48 (138.78)	***		

Standard deviations are in parentheses.
* Significant at 10%; ** Significant at 5%; *** Significant at 1%.

observations for executive programmes is naturally higher than broad-based programmes.

With few exceptions, most stock option studies are cross-sectional and are so hampered by the multitude of unobserved idiosyncratic factors that influence firm performance. Cross-sectional data make it difficult to disentangle the causes for adopting broad-based stock option programmes from these unobserved effects. Other studies compare the performance of a single firm over time but cannot control for intervening firm changes that may also affect performance. Resolving these limitations generally requires a comparison of performance improvements across similar firms over time; our dataset serves this purpose.

Table 3 contains preliminary pre- and post-adoption statistics on all variables in the two groups of firms. Table 4 specifically compares productivity for different groups of sample firms. As we match each adopting firm to its non-adopting peers in the same industry, we are able to assign a 'virtual' adoption year to the control firms corresponding to their adopting peers.

This enables us to do a preliminary comparison between adopters and control firms on pre- and post-adoption periods. Table 3 suggests that the adopting firms are generally larger, more R&D intensive and more productive relative to their non-adopting peers. Please note that in the preliminary analysis in Table 3, there is a 40 per cent pre–post decline in employment for adopters but remains relatively flat for non-adopters. It may be that because adopting firms have an average of 11 post-adoption years of observations and non-adopters only 7, the longer time span may expose adopting firms to more recession-related reductions in employment levels.

Adopters are, on average, larger than their non-adopting peers both in pre- and post-adoption periods; however, we do not expect declines in employment levels to significantly alter the mechanisms underlying the programme–productivity relationship. While it is true that the drop in employment may cloud the results in our simple comparison statistics (Tables 3 and 4), note that in our subsequent multivariate analysis (Tables 5–7), we normalize all variables by total employment consequently controlling for the change in employment.

The evidence in Table 4 allows us to draw the following preliminary conclusions. First, while compared with the period before adoption, all groups, including adopting firms and non-adopting peers, have significantly higher productivity in the post-adoption period. However, within the group of firms that eventually adopt broad-based stock option programmes, productivity is on the average 57 per cent higher in the periods after adoption, as compared with the periods before adoption; it is on average 30 per cent higher in the controlling peers. One can immediately observe that adopting firms capture a greater productivity premium than non-adopting peers. Again, please note that the higher productivity premium experienced by the adopting firms may be inflated by the decline in employment levels. However, it seems true that both groups experience an upward movement in productivity. It is this observation that leads us to utilize the difference-in-differences (DID) method as one of our estimation frameworks in the following section.

Second, focusing on the post-adoption period, the difference between adopting firms and non-adopting peers is significant. This implies that although all firms in our sample experience an increase in productivity, adopting firms enjoy a significantly higher productivity premium. Third, although adopting firms' productivity is higher than their non-adopting peers in the pre-adoption periods, it is weakly significant. This allows us to preliminarily reject the hypothesis of reverse causality, according to which stock options are simply a reward for better firm performance. Overall, these preliminary comparisons strongly suggest a positive impact of broad-based stock option programme adoption.

In what follows, we present, first, the evidence of the productivity impact of broad-based stock option programmes by utilizing two estimation techniques — fixed effects model and DID estimation. Second, we offer evidence supporting organization capital as the intermediate mechanism through which the impact takes place.

The Impact of Broad-Based Stock Options Programmes

In order to examine the impact of stock options on productivity, we use an augmented Cobb–Douglas production function. This approach is commonly used in the literature associated with employee ownership (Jones and Kato 1995). Our estimation equation is of the general form:

$$Q/L = F(L, K/L, R\&D/L, EX, BB, Z) \tag{1}$$

We have provided additional controls for firm size by normalizing selected firm characteristics by total employment. Consequently, the changes in the employment level are now being entirely attributed for. Q/L is employee productivity, L and K/L are measures of employment and capital intensity, respectively, $R\&D/L$ denotes a measure of research and development expenses per employee, controlling for intangible inputs, EX and BB represent executive and broad-based stock options, respectively, and Z is a vector of year dummies. We adopt sales per employee as the measure of employee productivity.[4]

We examine the programmes' impact by two techniques — fixed effect estimation and DID estimation. The baseline specification, which is the fixed effect framework, is as follows:

$$\begin{aligned} LN(Q/L)_{it} = {} & \alpha + \beta_1 LNL_{it} + \beta_2 LN(K/L)_{it} + \beta_3 LN(R\&D/L)_{it} \\ & + \beta_4 BB_{it} + \beta_5 EX_{it} + \beta_y Year\ Dummies + \mu_i + \varepsilon_{it} \end{aligned} \tag{2}$$

where i = firms, t = time; $LN(.)$ = natural logarithm; $(Q/L)_{it}$ = sales/employee of firm i at year t; as a measure of productivity; L_{it} = the total number of employees of firm i at year t excluding temporary ones; $(K/L)_{it}$ = capital/labour ratio of firm i at year t; physical assets per employee; $(R\&D/L)_{it}$ = research and development expenses per employee of firm i at year t; BB_{it} (dummy variable) = the presence of broad-based stock options programme of firm i in year t; EX_{it} (dummy variable) = the presence of executive stock options programme of firm i in year t; *Year Dummies* = year dummy variables; controlling for the general year effect; μ_i = time-invariant firm-specific effects; and ε_{it} = error term.

We construct BB_{it} as having the value of 1 if firm i has the broad-based programme in year t; 0 otherwise. Similarly, we assign the value of 1 if an executive stock options programme is in place for the entire accounting year; otherwise a 0 is assigned. The EX_{it} is utilized as a control variable for the existence of executive programmes because the adoption of executive and broad-based programmes is likely correlated.

Firm-specific fixed effect (μ_i) controls for any time-invariant heterogeneity of the firms. Other factors with the potential to impact performance include the existence of human resource policies and practices and pension plans (e.g. 401K). Firm-level fixed effects will capture the differences associated with the impact of these other factors assuming they are time invariant (Cole 1989).

Furthermore, we view the inclusion of μ_i as crucial, for otherwise, if it were true that only 'good' managers introduce broad-based stock options programmes, then the postulated effect of the programme on productivity may be only a proxy for the effects of good management.

The simple comparison of the means of the outcomes in treatment and control groups is justified on the grounds that the randomization guarantees they should not have any systematic differences in any other pretreatment variables. However, this is often a very difficult claim to make, especially in non-experimental data. Any observed difference between treatment and control groups may be the result of omitted factors. In our productivity comparison shown in Table 4, it can be seen that both adopting and non-adopting firms experience upward trending productivity. The programme impact we observed may be due to this trend and possibly not caused by the adoption decision. Therefore, in addition to conducting our analysis using conventional fixed effect specification, we subject the programmes' impact to a different test, employing the approach widely used in programme evaluation literature — DID estimation (Wooldridge 2002: 128–32; 283–4). The specification is shown in equation (3).

$$LN(Q/L)_{it} = \alpha + \beta_1 LNL_{it} + \beta_2 LN(K/L)_{it} + \beta_3 LN(R\&D/L)_{it} + \beta_4 BB_{it} + \beta_5 EX_{it} + \beta_6 BByearD_{it} + \beta_y Year\ Dummies + \mu_i + \varepsilon_{it} \quad (3)$$

Please recall that we are able to assign a virtual adopting year to control firms corresponding to their adopting peers. Following the virtual and actual adoption years, we are able to construct one more dummy variable — $BByearD_{it}$ — that is distinguished from BB_{it}. Note that $BByearD_{it}$ is coded with the value of 1 in the post-adoption periods not just for adopting firms but also for control peers. Consider, for instance, firm A adopting a broad-based stock option programme in 1995. Firm AA is identified as firm A's control peer. Firm AA would have a virtual adopting year of 1995. The dummy variable — BB_{it} — is coded for firm A in a way that it is assigned a 0 in all the years before 1995 but a 1 in the years afterward (1995 included). However, for firm AA, because it never adopted a broad-based programme, BB_{it} would be 0s for all available years. Consequently, $BByearD_{it}$ is coded in much the same way as BB_{it} is coded for firm A but now also for firm AA. In other words, firm AA would have $BByearD_{it}$ coded 0 in all the years before 1995 (the virtual adopting year) and 1 afterward. The key idea behind this approach is that $BByearD_{it}$ summarizes the way that both groups are influenced at the time of adoption. Hence, β_6 helps to capture and control the overall time trend for both groups at the actual and virtual adopting years.

Results of specifications (2) and (3) are presented in Table 5. An *F*-test for no fixed effects rejects the hypothesis that there are no firm-specific fixed effects. The Hausman test for random effects rejects the random-effects specification in favour of the fixed effect specification. To avoid the inconsistence of the resulting standard errors due to serially correlated outcomes,

TABLE 5
Broad-Based Stock Options Programme Adoption and Employee Productivity

Variables	*Specification*	
	(2)	*(3)*
BB	0.062	0.070
	(1.80)*	(1.82)***
BByearD	—	–0.013
	—	(–0.54)
LN(*L*)	–0.036	–0.036
	(–2.29)***	(–2.31)***
LN(*K*/*L*)	0.149	0.149
	(7.27)***	(7.28)***
LN(*R&D*/*L*)	0.126	0.126
	(5.44)***	(5.44)***
EX	Yes	Yes
Year dummy	Yes	Yes
Adj. R^2	0.832	0.833
No. of firms	413	413
No. of observations	6793	6793

Note: Firm level clustered *t*-statistics are in parentheses.
* Statistically significant at 10% level; ** 5% level; *** 1% level.

we cluster all standard errors (and hence *t* statistics) by firms. Consequently, all our estimates are calculated in this fashion in order to obtain more robust inferences (Bertrand *et al*. 2004).

First, column 1 indicates that under fixed effect specification, the adoption of broad-based stock option programmes is accompanied by an increase of 6 per cent in employee productivity. Second, column 2 suggests a 7 per cent increase in productivity upon adoption with DID estimation, which is fairly close to the fixed effect estimation. Most significantly, β_6 is statistically insignificant: as is expected, the adoption of broad-based programmes has no effect for the control firms. Overall, the results suggest that the programme impact is not caused by the general upward trend on productivity but the programme has its own impact. The effect of adopting broad-based stock options remains positive and significant regardless of the model specification, and even the estimated magnitudes of this effect are quite similar.

To further address the concern of possible reverse causality in which companies select stock options programmes because of pre-existing higher productivity or having been on an upward growth path, we use a lead variable in the form of $BB_{i,t+1}$ as an additional right-hand side variable in specifications (2) and (3). The estimated coefficients on $BB_{i,t+1}$ are always insignificant, suggesting no evidence of possible positive causality effect, although they are not very precisely estimated.[5]

Organization Capital as an Underlying Mechanism

The empirical evidence suggests a positive impact of broad-based stock options programmes. The next task we embark upon is examining how

attraction (selection) and retention help to improve employee productivity. The idea that broad-based stock options programmes make firms with employees with specific personal characteristics more productive would be more persuasive if the mechanism by which productivity is improved could be isolated. One channel that we believe to be important is organization capital.

There exist several alternative proxies for organization capital. First, assuming efficient capital markets, firms' share price should fully reflect the value of organization capital. In turn, the difference between a firm's market value and book value (or market-to-book value ratio) could be a viable proxy for organization capital. However, Lev and Radhakrishnan (2003) examine whether capital markets are efficient with respect to organization capital on a sample of approximately 250 firms and find that while investors recognize the importance of organization capital, they do not fully factor its value into equity prices. They ascribe this market inefficiency to poor disclosure of information about intangible capital. Brynjolfsson and Yang (1999) argue that information technology (IT) creates firm value by enabling improvements and innovations in business procedures and processes, namely organization capital. Therefore, one candidate for a proxy of organizational capital is IT-related expenditures; however, this data item is typically not publicly available.

By estimating Solow's residual and correlating the estimated residual output with the sales, general and administrative (SGA) expenses, Lev and Radhakrishnan (2003) document a strong correlation between the estimated residual output and SGA expenses. The SGA expenses (data item 189 in COMPUSTAT) include many outlays related to organization capital, such as information system expenses, employee training, brand promotion and distribution channels. Black and Lynch (2005: 206) state that 'workplace training is a joint decision undertaken by the worker and the firm to invest in additional skills training after an employment relationship has begun. This workforce training . . . raises the productive capacity of a firm'. In this work, we adopt SGA expenses as the proxy variable for organization capital. We normalize SGA expenditures by total employment in an attempt to provide more control for firm size.

The estimation results are shown in Tables 6 and 7. Column 2 in each of the two tables indicates that adopters have levels of organization capital substantially higher than those without broad-based programmes. This result remains even when firm size is held constant. More importantly, the DID estimation (column 2 in Table 7) suggests that the higher level of organization capital is not due to a general upward trend. As organization capital enters the production function, the impact of broad-based programmes is reduced in size as well as in significance level. Columns 3 show that in spite of its statistically significant and fairly sizable effect on output per worker, organization capital reduces the importance of broad-based stock options programme by about 50 per cent.

This effect is sizable and suggests that a significant proportion of the impact of the programme on firm productivity is attributable to higher

TABLE 6
Broad-Based Stock Options Programme Adoption and Organization Capital — Fixed Effect

	Dependent Variable		
	LN(Sales/Employee)	*LN(SGA/L)*	*LN(Sales/Employee)*
BB	0.062	0.077	0.039
	(1.80)*	(1.93)*	(1.30)
LN(L)	–0.036	–0.120	0.032
	(–2.29)***	(–6.29)***	(2.05)**
LN(K/L)	0.149	—	0.055
	(7.27)***	—	(2.83)***
LN(R&D/L)	0.126	—	–0.047
	(5.44)***	—	(–2.14)***
LN(SGA/L)	—	—	0.596
	—	—	(13.23)***
EX	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Adj. R^2	0.832	0.894	0.869
No. of firms	413	413	413
No. ob observations	6793	6793	6793

Note: Firm level clustered *t*-statistics are in parentheses.
* Statistically significant at 10% level; ** 5% level; *** 1% level.

TABLE 7
Broad-Based Stock Options Programme Adoption and Organization Capital — DID

	Dependent variable		
	LN(Sales/Employee)	*LN(SGA/L)*	*LN(Sales/Employee)*
BB	0.070	0.097	0.037
	(1.82)*	(2.12)**	(1.09)
BByearD	–0.013	–0.033	0.003
	(–0.54)	(–1.25)	(0.12)
LN(L)	–0.036	–0.121	0.032
	(–2.29)***	(–6.29)***	(2.06)**
LN(K/L)	0.149	—	0.055
	(7.27)***	—	(2.83)***
LN(R&D/L)	0.126	—	–0.047
	(5.44)***	—	(–2.14)***
LN(SGA/L)	—	—	0.596
		—	(13.22)***
EX	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes
Adj. R^2	0.832	0.894	0.869
No. of firms	413	413	413
No. of observations	6793	6793	6793

Note: Firm level clustered *t*-statistics are in parentheses
* Statistically significant at 10% level; ** 5% level; *** 1% level.

levels of organization capital. It should be pointed out that in the current data, broad-based programmes work exclusively by improving organization capital because the programme variable is no longer significant when the organization capital variable is introduced. It is important to note that

there are possible complementarities between organizational capital and other channels (e.g. motivation) which could explain the effect of such programmes on productivity, but they are not measurable in the current work.

4. Conclusion and discussion

By using a unique dataset containing the start year of broad-based stock options programmes, this work indicates that relative to similar control firms, firms adopting broad-based programmes experienced a statistically significant increase in employee productivity following plan adoption. With an appropriate proxy for organization capital, this study sheds light on a possible mechanism underlying the positive impact of broad-based stock options programmes on employee productivity.

The evidence presented here suggests that broad-based programmes and organization capital are positively correlated. We interpret this observation as favourable evidence that retaining key employees through distributing stock options has economic impact on organization capital. The fact that the positive impact of such programmes on firm productivity is lowered when organization capital is entered into the equation suggests the positive impact is attributable to higher levels of organization capital.

In light of our results, two areas of related future research appear worthwhile. First, our analysis should be replicated where establishment-level employee voluntarily turnover data are available. Second, assuming broad-based stock options programmes help attract more able employees, the 'unmeasured labour quality' issue should be studied in greater detail, either with datasets which provide additional measures of labour quality or by using techniques which cast unmeasured quality as an unobservable.

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Notes

1. If the purpose of granting options is simply to convey compensation, then tradable options can be an effective attraction device. Self-selection incentives, on the other hand, require non-tradable options (or other performance-based pay) granted to prospective employees who know better than the firm about their risk aversions and abilities.
2. The NCEO is a private, non-profit membership and research organization that serves as the leading source of accurate, unbiased information on employee stock ownership plans, equity compensation plans such as stock options, and ownership culture. They are the main publisher and research source in the field, hold dozens of Webinars and live meetings annually, and provide services to thousands of members.
3. The Society of Human Resource Management Foundation sponsored the survey of human resource policies and practices.
4. Value added per employee is one viable productivity measure. However, using it reduces sample firms substantially because only 20 per cent of COMPUSTAT firms report labour expenses.
5. The coefficients on $BB_{i,t+1}$ (and t statistics in parentheses) under conventional fixed effect and DID estimations are 0.047 (1.42) and 0.045 (1.33), respectively.

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