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ABSTRACT

The Consequences of Short-Time Compensation: Evidence from Japan*

There is a growing body of evidence on the efficacy of Short-Time Compensation (STC), a subsidy to promote worksharing in a recession, in achieving its intended goal of curtailing layoffs and preventing a sharp rise in unemployment. However, very little is known about the consequences of STC for firm performance. We apply the Propensity Score Matching (PSM) with difference-in-differences methodology to unique data from Japan, a country known for its extensive use, and find that STC results in improved profitability. The improved profitability is further found to be achieved through sales growth without raising labor costs. We explore possible mechanisms behind the observed positive consequences of STC for sales and profits. Additional evidence tends to favor what the psychology literature calls "shared adversity"- worksharing promoted by STC facilitates supportive interactions among workers in the firm and strengthens commitment of workers to the firm, and thereby enhances goal alignment between workers and the firm as well as between coworkers. Such workers are more open to the firm's effort to increase sales/revenues without raising cost.

JEL Classification: J23, J65, J68, H25

Keywords: short-time work, short-time compensation, worksharing, employment adjustment, firm performance

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The Consequence of Short-Time Compensation: Evidence from Japan

I. Introduction

Short-Time Compensation (STC) is a subsidy to promote worksharing (reduced working hours) in a recession with the intended goal of curtailing layoffs and preventing a sharp rise in unemployment. The STC schemes, which have been offered in many OECD countries, such as Germany, France, and Italy, are often touted as a reason for the aversion of the full-scale labor market crisis in the Great Recession (Rinne and Zimmermann, 2012 and Cahuc, 2014). Naturally the empirical literature focuses on testing the efficacy of STC in reducing working hours and job losses, and provides largely favorable evidence for STC as a policy instrument to promote worksharing and prevent a sharp rise in unemployment during the Recession using cross-country or cross-state data (see, for instance, Lydon, Matha, and Millard, 2018; Cooper, Meyer, and Schott, 2017; Balleer, et al., 2016; Abraham and Houseman, 2014; Hijzen and Martin, 2013; Brenke, Rinne, and Zimmermann, 2013; Arico and Stein, 2013; Boeri and Bruecker, 2011).[1]

In contrast to the growing body of evidence on the effects of STC on workers, however, there is a dearth of evidence on what STC does to the firm. Theoretically, on the one hand, STC may distort the firm's efficient use of inputs, resulting in worsening performance of the firm with STC. Specifically STC may cause the firm to maintain an inefficiently high level of employment, resulting in a delay in necessary restructuring which requires employment reduction. Moreover, STC-induced worksharing may lead to adverse worker sorting, i.e., high-productivity workers leave the firm for a different firm without STC where he/she can work full time (Abraham and Houseman, 2014). Again, such negative worker sorting may lead to deteriorating performance of

[1] However, recent studies using micro-data provide less sanguine evidence on STC as a job saver (Cahuc, Kramarz, and Nevoux, 2018; Arranz, Garcia-Serrano, and Hernanz, 2018; Kambayashi, 2017; and Ariga and Kuo, 2017).

the firm with STC. Finally STC can impede efficiency-enhancing relocation of workers between firms, resulting in an economy-wide efficiency loss (see, for instance, Cooper, Meyer, and Schott, 2017 and Giupponi and Landais, 2018).

On the other hand, as discussed in Abraham and Houseman (2014), STC may end up helping rather than harming firm performance in the long run. First, it may be optimal in the short run to let go workers in a recession. However, some of those downsized workers may find jobs elsewhere and never come back to the firm when a recession is over. As such, in the long run, the firm's past investment in firm-specific human capital of those workers will be wasted. STC will help the firm use worksharing, and minimize such layoffs and hence the waste of human capital investment. Second, letting go workers may have adverse consequences for their remaining colleagues, resulting in the deterioration of workplace morale and unity, and hence productivity (see, for instance, Iverson and Zatzick, 2011; Trevor and Nyberg, 2008; Zatzick and Iverson, 2004; and Mishra and Spreitzer, 1998). Again, STC can lessen such adverse consequences for workplace morale/unity and firm performance.

In addition to those two often-discussed benefits of STC to the firm, we argue that there are two additional possible channels through which STC may benefit the firm. Third, the firm may take advantage of STC and ask workers with reduced working hours to participate in off-the-job training programs, which will result in more productive labor force. STC is sometimes combined with subsidy for training (which is the case in Japan, as explained in the next section). Fourth, instead of asking a few employees to bear the burden of downward adjustment of labor input in a recession, worksharing spreads the burden equally among all employees, and helps them overcome the adversity (or the recession) together. We posit that worksharing which STC promotes can be viewed as shared adversity in the psychology literature, which increases each employee's identity with and commitment to the group to which he/she belongs (the firm) and promotes supportive interactions among coworkers (see, for instance, Bastian, et al., 2018). As such, worksharing can enhance the goal alignment between workers and the firm by providing them with shared experiences of overcoming adversity together. The enhanced goal alignment helps the firm implement performance-enhancing strategic changes with minimum friction.

On our reading of the literature, there is no rigorous econometric evidence on the consequence of STC for performance of the firm with STC, especially middle- and long-term. We are aimed at filling this important gap in the literature by providing the first evidence on the consequences of STC for firm performance. The data are from Japan, a country known for its generous STC. As detailed in the next section, STC has been used extensively in Japan, in particular during the global Great Recession following the financial meltdown of 2008.

In the next section we provide some institutional details of STC in Japan. In section III, we describe the data we use and provide our empirical strategy. Section IV presents the results, followed by concluding remarks.

II. STC in Japan

STC in Japan, called Koyo Chosei Joseikin, was established in 1975. It was introduced as a policy response to exogenous and temporary recessions such as oil shocks under the premise that hoarding workforce is more efficient than reducing and reemploying workers for temporary shock. Although it was available to establishments only in the government-designated industries whose business conditions did not worsen more than 2 years, STC was provided for structural recession industries, such as steel industry or petrochemical industry.[2] Between 1990 and 2002,

[2] Once designated, establishments in the government-designated industries could receive the subsidy relatively easily.

approximately 94% and 40% of the total amount of STC subsidy went to the manufacturing sector and the iron and steel industry respectively (Griffin, 2010). However, in 1990s, STC was criticized to be just life-prolonging system for depressed industries. In 2000, the government designation of the qualifying industries was eliminated, and any establishment regardless of its industry became eligible for STC, provided it meets a set of conditions, which were stricter than before.

In response to the global Great Recession following the financial crisis in the U.S. in the fall of 2008, the eligibility conditions for STC were significantly relaxed, and eligible establishments were able to receive STC for a longer time period. Specifically, the eligibility conditions were reduced to a single condition---production in the last three months was at least five-percent lower than in the preceding three months (or in the same three-month period of the previous year), and the employment requirement was abolished. Once approved by the government, the establishment uses its STC subsidy from the government to compensate each employee under worksharing for 2/3 of his/her lost pay due to reduced working hours (4/5 in the case of small to medium-size firms). In Japanese STC, establishments could receive an additional subsidy when their STC employees participate in training program. The STC program can last up to 3 years and 300 days. As the result of the relaxation of the requirements, according to a recent research report by JILPT (Japan Institute of Labor Policy and Training), the use of STC among Japanese firms was unprecedentedly high in 2009. There were only 250,000 employees receiving STC in 2008 (amounting to about 68 million dollars in total). In 2009, the number of employees receiving STC rose to over 21 million people and the total amount of STC reached 6.5 billion dollars (JILPT, 2017).

III. Empirical Strategy and Data

The objective of our empirical analysis is to estimate the consequences of STC for firm outcomes----if the firm receives the subsidy in a recession, what will happen to its firm outcomes such as profitability in the subsequent recovery period. More formally, we estimate the following treatment effect on firm outcome:

$$\tau_i = \mathrm{Y}_i(1) - \mathrm{Y}_i(0) \qquad (1)$$

where $\mathrm{Y}_i(\mathrm{D}_i)$ for *i* (=1,…,N) is outcome of firm i and D_i equals one if firm *i* receives treatment (STC) and zero otherwise. For each firm, we observe only $\mathrm{Y}_i(1)$ or $\mathrm{Y}_i(0)$ but not both. Thus, τ_i cannot be observed directly. Instead we estimate the average treatment effect on the treated (ATT):

$$\tau_{ATT} = \mathrm{E}(\mathrm{Y}(1) - \mathrm{Y}(0)|STC = 1) = \mathrm{E}(\mathrm{Y}(1)|STC = 1) - \mathrm{E}(\mathrm{Y}(0)|STC = 1) \qquad (2)$$

As the counterfactual, $\mathrm{E}(\mathrm{Y}(0)|STC = 1)$, cannot be observed directly, we need to estimate the counterfactual. More specifically, to estimate ATT, we have to predict what their performance of the subsidized company would have been had they not received STC. The mean outcome of untreated firms, $\mathrm{E}(\mathrm{Y}(0)|STC = 0)$, is observed directly, however. Thus we may find it tempting to use it as a substitute for the counterfactual. Unfortunately some observed firm characteristics, X, may well be correlated with whether the firm receives STC as well as subsequent firm outcomes, Y. Thus, we estimate ATT, conditional on X:

$$\begin{aligned}\tau_{ATT} &= \mathrm{E}(\mathrm{Y}(1)|STC = 1, X) - \mathrm{E}(\mathrm{Y}(0)|STC = 1, X) \\ &= \{\mathrm{E}(\mathrm{Y}(1)|STC = 1, X) - \mathrm{E}(\mathrm{Y}(0)|STC = 0, X)\} \\ &\qquad - \{\mathrm{E}(\mathrm{Y}(0)|STC = 1, X) - \mathrm{E}(\mathrm{Y}(0)|STC = 0, X)\} \qquad (3)\end{aligned}$$

This procedure, Propensity Score Matching (PSM), will be valid only if conditional on observable covariates, X, the treated firms with STC and the control firms without STC would exhibit a similar performance under the same circumstances, X. The assumption leads the second term on the right hand side in equation (3) zero. The validity of the procedure will be threatened if there are unobserved firm characteristics. This is a strong assumption and justified by only the qualified data. For instance, some firms may have an unusually gifted team of managers who are capable of taking advantage of various government subsidy programs, including STC (e.g., knowing how to prepare successful applications for such subsidy programs and networking with relevant government employees). It is plausible that such managers are also capable of improving their firm performance. Alternatively, some firms in Japan use the Japanese high-performance work system, while some do not (for the Japanese high-performance work system, see, for instance, Kato, 2014, and Kambayashi and Kato, 2017). Conceivably those firms with the well-established Japanese management system are more likely to apply for STC and succeed in getting it in order to maintain its practice of long-term employment. The literature on the Japanese high-performance work system provides evidence pointing to the positive performance effects of such a system (see, for instance, Kato and Morishima, 2002). If we fail to control for the use of such a system, our PSM procedure will be still subject to selection bias.

To this end, we are fortunate that the data allow us to include a rich set of covariates. Thus, in addition to a standard set of firm characteristics, we are able to include R&D subsidy=1 if the firm has applied and succeeded in getting R&D subsidy from the government in the past three years, 0 otherwise; and training/development subsidy=1 if the firm has applied and succeeded in getting training and development subsidy from the government, 0 otherwise. [3] The firm with a recent experience of applying for R&D subsidy and succeeding in getting it may well have the aforementioned unusually gifted team of managers who are capable of taking advantage

[3] According to Chuma et al. (2002), well-established and large firms with complete personnel records are likely to apply for STC, considering cumbersome procedures of paperwork.

of various government subsidy programs, including STC. We can make a similar argument to a recent experience of applying for training/development and succeeding in getting it. As such, one major threat to our approach can be eliminated or at least reduced by including R&D subsidy (=1 if the firm has a recent experience of getting R&D subsidy successfully, 0 otherwise) and Training/development subsidy (=1 if the firm has a recent experience of getting Training/development subsidy successfully, 0 otherwise) in X.

Likewise, our data contain unusual information on the use of Employee Stock Ownership (ESO) plans, which is one of the Three Pillars of Japan's high-performance work system (Jones and Kato, 1995, and Kato and Morishima, 2002). Furthermore, the data also allow us to identify which firms operate under Japan's keiretsu (main-bank) system, which is considered a complementary corporate governance system to Japan's high-performance work system (see, for instance, Aoki, 1990 and Abe and Hoshi, 2007). Controlling for ESO and Keiretsu, we can again eliminate or at least diminish the threat to our approach. In the end, we estimate the ATT, conditional on a rich set of covariates, X, which are likely to minimize selection on unobservables in PSM.

In sum, the second term in Eq. (3), $\{\mathrm{E}(\mathrm{Y}(0)|STC=1,X)-\mathrm{E}(\mathrm{Y}(0)|STC=0,X)\}$ represents bias caused by selection. When a set of covariates, X, are inadequate, leaving some important firm characteristics unaccounted for, this term is not zero. It follows that the first term in Eq. (3), $\{\mathrm{E}(\mathrm{Y}(1)|STC=1,X)-\mathrm{E}(\mathrm{Y}(0)|STC=0,X)\}$ will be a biased estimate of the ATT. As discussed above, we are reasonably confident that our set of covariates, X, include proxies for usual suspects for the sources of selection bias, and that our PSM estimates on the ATT are less subject to selection bias.

The propensity score is the predicted odds of treatment, which in our case is the probability that firm *i* applies for and succeeds in getting STC in year *t*, conditional on firm i not receiving STC in year *t-1*[4]. To yield the propensity score, we estimate a probit model of the odds of getting STC in year t conditional on not getting STC in year *t-1* as a function of X (R&D subsidy, training/development subsidy, a change in performance of a company from *t*-1 (i.e., the year prior to subsidy) to *t*, and time invariant dummy variables indicating whether or not firm *i* is a listed company; whether or not firm *i* is an owner company; whether or not firm *i* is unionized; whether or not firm *i* has been exposed to global competition; whether or not firm *i* has a main-bank; whether or not firm *i* is under the influence of a main-bank; whether or not firm *i* has an employee stock ownership plan; and whether or not firm *i* has performance related pay as well as firm size and industry.

We then employ a k-Nearest (k=5) matching procedure to estimate ATT.[5]

$$\mathrm{ATT} = \frac{1}{N_{treated}} \sum_{i=1}^{N_{treated}} \left(Y_{i,T+s}^{treated} - Y_{i,T-1}^{treated} \right) - \frac{1}{N_{control}} \sum_{i=1}^{N_{control}} \left(Y_{i,T+s}^{control} - Y_{i,T-1}^{control} \right) \quad (eq.1)$$

We estimate ATT by using unique data from Japan for the time period covering the Great Recession following the financial crisis in the fall of 2008 and the subsequent recovery phase. First, we use unique firm IDs and link Basic Survey of Japanese Business Structure and Activities (BSJBSA) to Survey of Corporate Management and Economic Policy (SCMEP). The BSJBSA is conducted annually by the Ministry of Economy, Trade and Industry as part of the governmental statistics. It includes approximately 30,000 firms per year, which have 50 or more employees and the value of capital of at least 30 million yen. It covers all manufacturing, trade

[4] The control group is firms which never receive STC during the entire time period under study. Once firm i receives STC in year t, firm i drops from the sample for the rest of the time period.

[5] We also use kernel matching procedure for robustness check, and find no discernible change in our results.

companies and parts of service companies except for finance, real estate sectors and non-profit service sector (e.g., hospitals and schools) from 1995 to 2014. The BSJBSA data contain information on the total number of employees (full-time and part-time workers), sales, investment, fixed-assets, and R&D intensity.

The SCMEP was conducted by the Research Institute of Economy, Trade and Industry (RIETI) from December 2011 to February 2012.[6] The questionnaire was sent to15,500 Japanese companies in manufacturing and service sectors, and a total of 3,444 companies responded to the survey. The SCMEP provides us with data on whether the company received STC, R&D subsidies, and training/development subsidy, ESO, keiretsu, performance-related pay, and exposure to global competition as well as data on ownership characteristics (publicly traded or owner-managed) and union presence. The dataset we use in this analysis contains 10,621 firm-year observations for the Great Recession and subsequent recovery period of 2008-2014, which are satisfied with common support condition.

For Y, the data allow us to consider firm profitability measured by ROA and profit margin. In addition, to explore some possible channels through which STC affects firm performance, we also consider log(sales), log(total payroll costs), log(number of total employees), log(average wage), log(TFP), and log(labor productivity).[7] T is the year of receiving STC, T-1 pertains to the previous year and T+s where s=0, 1, 2, 3, or 4 pertains to the subsequent years. We present bootstrapped standard errors.

VI. Results

Summary statistics are shown in Table 1. Firm *i* in year *t* is considered "treated" if STC_{it-1}

[6] See Morikawa (2019) for more detail.

[7] Unfortunately the data do not contain information on working hours, and do not allow us to consider working hours as the dependent variable.

= 0 and STC_{it} = 1. The incidence of applying for and succeeding in getting R&D subsidy and training/development subsidy is 6.3% and 3.3% respectively. 5.7% of all observations come from listed firms; 54.7% from owner companies; and 30.2% from unionized firms; 86.4% from firms with a main bank; 36.8% from firms that are under the influence of the main bank; 29.8% from firms with ESO plans; and 51.0% from firms with performance related pay.

The probit estimates of our propensity score equation are presented in Table 2. Firms with R&D subsidy and training/development subsidy; unionized firms; owner-managed firms; and firms with exposure to globalization are significantly more likely to apply for STC and succeed in getting it from the government. In addition, firms with lower sales growth are more likely to apply for STC and succeed in getting it. Having a main-bank, having being under the influence of the main-bank, having an employee stock ownership plan, and performance related pay prove to be inconsequential.

The balancing test is passed. Table 3 compares the extent of balancing between the treatment and control samples before and after propensity score matching. There is no significant difference in covariates between treated and untreated after matching.

Our key results are presented in Tables 4-1 and 4-2. ATT on ROA in the year of receiving the subsidy is positive but not statistically significant at the 10 percent level, suggesting that STC has no immediate significant effect on ROA. Likewise, even a year later there is still no significant effect of STC on ROA. However, two years later STC has a significant positive effect on ROA. Considering that mean ROA is about 4 percent, the magnitude of the effect of STC on ROA is sizable (If the firm has STC, its ROA will be about 1 percentage-point higher in four years after the use of STC than otherwise). Table 4-2 shows the robustness of the above result to the use of profit margin as an alternative measure of profitability.

To explore possible mechanisms behind the positive consequences of STC for firm profitability, we repeat the same analysis, using log of sales as an alternative outcome variable. Table 4-3 summarizes the results. The estimated effect of STC on sales mirrors the estimated effect of STC on profitability---we find no significant effect for the year of STC and a year later but significant positive effects for the second year onwards. Sales growth does not translate to rising profit if STC causes labor cost to increase more rapidly. To this end, we estimate the effect of STC on total labor cost. As shown in Table 4-4 and 4-5, we find no evidence that STC causes total labor cost and average wage to rise.

In sum, STC is found to result in increased sales without raising labor cost, and thereby improved firm profitability. The positive effect of STC on firm profitability is, however, not felt immediately. The gestation period is found to be two years. Note that we report the results with k-nearest matching but our results are not sensitive to alternative PSM options such as Kernel matching.

As discussed in the introduction, there are four major mechanisms behind the positive effect of STC on firm performance. The first two mechanisms, the preservation of firm-specific human capital and the avoidance of negative morale effect of layoffs, are based on the assertion that STC makes the firm less prone to lay off workers and reduce employment thanks to the use of worksharing. Table 4-6 summarizes our estimates on ATT with log of the number of all employees as the dependent variable. STC is found to have no significant employment effect, suggesting that in the pervasiveness of the practice of “long-term employment” among Japanese firms, even without STC, Japanese firms are reluctant to lay off workers, making the employment effect of STC negligible.[8] In light of the salient segmentation of the labor market in

[8]For evidence on the enduring practice of long-term employment in Japan, see Kambayashi and Kato (2017).

Japan, we repeated the same analysis by using the number of standard employees (who are termed "seishain" in the workplace) instead of all employees including both standard and non-standard employees.[9] Reassuringly we found no discernible change in the results (these and all other unreported results are available upon request from the corresponding author). Our finding of the lack of the employment effect of SCT is consistent with prior studies (Kambayashi, 2017; and Ariga and Kuo, 2017). In sum, it is unlikely in the context of the Japanese employment system that STC leads to improved firm performance as a result of preserved firm-specific human capital and the avoidance of negative morale effect of layoffs.

If the third mechanism, skill-enhancing off-the-job training programs afforded by STC, is a primary driver of the positive effect of STC on profitability, we should observe some productivity gains from STC. To this end, we consider two additional productivity measures, TFP and labor productivity as the dependent variables. The results are summarized in Tables 4-7 and 4-8. We find no evidence on such productivity gains from STC, casting doubt on the third mechanism.

The fourth mechanism, the enhanced goal alignment through shared adversity, can still operate to boost firm profitability even if there is no productivity gain from STC. Workers who become more strongly identified with and committed to the firm through overcoming adversity together are more receptive to the firm's effort to boost sales/revenues without incurring higher cost. While our data do not contain any information which we can use to test the importance of this mechanism directly, there is some supporting evidence albeit indirect and only suggestive. According to Small and Medium Enterprise Agency (2010), a survey of small to medium size firms with STC reveals that the firm's enhanced ability to revise business plans was among the

[9] For Japan's labor market segmentation between standard and non-standard employment, see Kambayashi and Kato (2016).

top three benefits of STC during the Great Recession. A significant impediment to the firm's ability to revise business plans is employee resistance (Krügel and Traub, 2018). Through shared adversity, employees are more strongly identified with the firm, and such committed employees are more likely to be receptive to the firm's effort to revise business plans.

V. Placebo tests

It is still possible that our estimated ATT is confounded by pre-treatment differences between the treatment and control groups that are not accounted for by a set of control variables. To account for such pre-treatment differences, we conduct the following Placebo test---we follow the same PSM procedure and estimate ATT with one exception---instead of using the actual year of STC introduction, we make a false assumption that STC were introduced seven years earlier than the actual year of introduction. The starting year of the Placebo test (seven years earlier than the actual year of STC) was chosen so that we have the same time frame (the reference year and following five years) and avoid any overlap between the Placebo test time frame (t-7 to t-2) and the actual time frame (t-1 to t+4).

The Placebo test works as follows: if under the false assumption of the Placebo test we still obtain the positive and significant effect of STC on firm profitability (ROA and profit margin) and sales as we did under the correct assumption on the year of STC, we will not be able to rule out the possibility of our ATT estimates being confounded by the pre-treatment differences.

Table 5-1 presents the result of the Placebo test with ROA as the outcome variable. Contrary to the positive ATT estimates we obtained under the correct assumption, the ATT estimates under the false assumption that STC were introduced seven years earlier than the actual year of STC introduction are negative consistently, and the absolute value of the ATT is much smaller. Table 5-2 shows the result of the Placebo test with profit margin, an alternative measure of firm profitability. Again, the ATT estimates are negative (which is the opposite to the ATT estimates under the correct assumption on the year of STC) and much smaller in the absolute value. Finally, the Placebo test result with sales as the outcome variable is provided in Table 5-3. The ATT estimates are of the same sign (positive) as the ATT estimates under the correct assumption yet much smaller and not statistically significant even at the 10 percent level.

In sum, our ATT estimates pass the Placebo tests, suggesting that it is unlikely that our ATT estimates are confounded by pre-treatment differences between the treatment and control groups that are not accounted for by observable controls.

IV. Concluding remarks

In stark contrast to a growing body of research on what STC does to workers (especially job security), there is a paucity of studies on what STC does to the firm. To fill this important gap in the literature, we have begun discussing channels through which STC can result in positive and negative changes in firm performance, and have identified four possible mechanisms behind the positive effect of STC on firm performance and two possible mechanisms behind the negative effect.

We have then applied the Propensity Score Matching (PSM) with Difference-in-differences procedure to unique firm-level micro data on the use of STC by Japanese firms and have estimated the Average Treatment effect on the Treated (ATT). In short, our ATT estimation has yielded the first rigorous econometric evidence on the positive consequences of STC for firm performance measured by ROA and profit margin. Our evidence is less subject to bias due to selection, for the data allow for the use of an unusually rich set of controls in PSM. To be consistent with the observed positive consequences of STC for firm profitability, we have further found that STC leads to sales growth without raising labor cost.

Finally, to explore the validity of the four proposed mechanisms behind the positive effect of STC on firm performance, we have examined the consequence of STC for employment and have found no significant change in employment as a result of the use of STC. The first two proposed channels, the preservation of firm-specific human capital and the avoidance of negative morale effect of layoffs, are based on the positive employment effect of STC. That we have failed to find evidence on the positive effect of STC on employment casts doubt on the relevance of those two channels. The third possible channel, the skill-enhancing off-the-job training programs afforded by STC, points to the positive effect of STC on productivity. To this end, we have also estimated ATT with TFP as well as labor productivity as the outcome variables. We have found no statistically significant ATT, which is not consistent with the skill-enhancing off-the-job training programs afforded by STC.

The fourth mechanism, the enhanced goal alignment through shared adversity, can still function as a firm performance booster even if there is no productivity gain from STC. Workers become more strongly identified with and committed to the firm through overcoming adversity together through STC. Such workers are more open to the firm’s effort to increase sales/revenues without raising cost. While there is no direct evidence, the shared adversity mechanism appears to be a promising line of inquiry.

Finally, Japanese policymakers and regulators are often blamed for keeping “zombie firms” alive with lax regulations and subsidies, ending up turning other “healthy firms” into “zombie firms”, and delaying the recovery (Caballero, Hoshi, and Kashyap, 2008). Our evidence suggests that insofar as STC is concerned, Japanese policymakers' efforts to help firms in the midst of the global Great Recession had positive consequences for their performance in the long run (five years after the financial meltdown in 2008). Improving firm performance in the long run was not the intention of policymakers who promoted STC yet STC is found to have an unintended positive rather than negative consequence.

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Table 1. Summary statistics

Variable	Obs	Mean	Std. Dev.
Treated	10,621	0.037	0.189
Profit Margin	10,568	0.024	0.054
ROA	10,611	0.046	0.127
ln(sales)	10,532	8.532	1.222
ln(total labor costs)	10,616	6.700	1.045
ln(# of total employees)	10,621	5.213	1.029
ln(# of full-time workers)	10,621	4.947	0.947
R&D intensity	10,621	0.005	0.036
HR development investment ratio	3,707	0.000	0.001
Sales growth from (t-1) to (t)	10,621	-0.010	0.169
Listed company	10,621	0.057	0.232
Owner company	10,621	0.547	0.498
ln(total asset)	10,621	8.223	1.246
Having a union	10,621	0.302	0.459
R&D subsidy	10,621	0.063	0.243
Training/development subsidy	10,621	0.033	0.179
Exposure to global competition	10,621	0.669	0.471
Having a main-bank	10,621	0.864	0.343
Having been under the influence of the main-bank	10,621	0.368	0.482
Having an employee stock ownership plan	10,621	0.298	0.457
Performance related pay	10,621	0.510	0.500

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Table 2. Probit estimates of the PSM equation

	Coef.	Std. Err.	
Sales growth from (t-1) to (t)	-0.612	0.131	***
Listed company	-0.030	0.105	
Owner company	0.087	0.050	*
ln(total asset)	-0.011	0.019	
Having a union	0.134	0.051	***
R&D subsidy	0.254	0.081	***
Training/development subsidy	0.233	0.111	**
Exposure to global competition	0.428	0.059	***
Having a main-bank	-0.020	0.073	
Having been under the influence of the main-bank	0.010	0.051	
Having an employee stock ownership plan	-0.053	0.054	
Performance related pay	0.007	0.047	
constant	-2.175	0.181	***
Industry FE	YES		
N	10621		
LR chi^2	124.930		
Prob > chi^2	0.000		
Pseudo R^2	0.037		

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Table 3. Balancing between the treatment and control groups before and after matching

Variable	Before/After matching	Mean Treated	Mean Control	t-test	p-value
Sales growth from (t-1) to (t)	Before	-0.05	-0.01	-4.89	0.00
	After	-0.05	-0.04	-0.62	0.54
Listed company	Before	0.06	0.06	0.44	0.66
	After	0.06	0.06	0.00	1.00
Owner company	Before	0.58	0.54	1.53	0.13
	After	0.58	0.58	-0.22	0.83
ln(total asset)	Before	8.10	7.74	3.38	0.00
	After	8.19	8.23	-0.45	0.65
Having a union	Before	0.37	0.28	3.83	0.00
	After	0.37	0.39	-0.66	0.51
R&D subsidy	Before	0.14	0.06	6.40	0.00
	After	0.13	0.15	-0.72	0.47
Training/development subsidy	Before	0.06	0.03	3.40	0.00
	After	0.07	0.06	0.14	0.89
Exposure to global competition	Before	0.85	0.67	8.20	0.00
	After	0.85	0.84	0.49	0.62
Having a main-bank	Before	0.87	0.86	0.71	0.48
	After	0.87	0.84	0.91	0.37
Having been under the influence of the main bank	Before	0.38	0.36	0.84	0.40
	After	0.38	0.39	-0.22	0.83
Having an employee stock ownership plan	Before	0.28	0.29	-0.50	0.62
	After	0.29	0.32	-0.92	0.36
Performance related pay	Before	0.52	0.51	0.71	0.48
	After	0.53	0.56	-0.71	0.48

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Table 4-1 The Estimated Effect of STC on ROA (k-Nearest matching)

	Subsidized year	1 year later	2 years later	3 years later	4 years later
Full sample					
ATT	0.006	0.008	0.015***	0.011**	0.013**
	(0.004)	(0.007)	(0.005)	(0.005)	(0.006)
No. of matched pair	394	382	372	365	351
Balanced panel data					
ATT	0.0047	0.006	0.016***	0.011**	0.013**
	(0.003)	(0.006)	(0.006)	(0.005)	(0.006)
No. of matched pair	335	335	335	335	335

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched control firms from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.

Balanced panel data consists of sample size keeping constant from pre-subsidized year to 4 year later.

Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 4-2 The Estimated Effect of STC on profit margin (k-Nearest matching)

	Subsidized year	1 year later	2 years later	3 years later	4 years later
Full sample					
ATT	0.003	0.006	0.012**	0.009***	0.009*
	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)
No. of matched pair	392	378	369	361	347
Balanced panel data					
ATT	0.001	0.003	0.012**	0.008**	0.009
	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
No. of matched pair	332	332	332	332	332

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched control firms from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.

Balanced panel data consists of sample size keeping constant from pre-subsidized year to 4 year later.

Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 4-3 The Estimated Effect of STC on sales (k-Nearest matching)

	Subsidized year	1 year later	2 years later	3 years later	4 years later
Full sample					
ATT	0.001	0.015	0.046**	0.063***	0.083***
	(0.013)	(0.018)	(0.018)	(0.022)	(0.021)
No. of matched pair	391	382	372	365	351
Balanced panel data					
ATT	0.001	0.015	0.046**	0.063***	0.083***
	(0.013)	(0.018)	(0.018)	(0.022)	(0.021)
No. of matched pair	332	332	332	332	332

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched control firms from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.

Balanced panel data consists of sample size keeping constant from pre-subsidized year to 4 year later.

Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 4-4 The Estimated Effect of STC on total labor cost (k-Nearest matching)

	Subsidized year	1 year later	2 years later	3 years later	4 years later
Full sample					
ATT	-0.019	-0.055**	-0.039	0.006	0.023
	(0.023)	(0.026)	(0.027)	(0.028)	(0.027)
No. of matched pair	395	382	372	365	351
Balanced panel data					
ATT	-0.015	-0.056**	-0.033	0.006	0.013
	(0.024)	(0.027)	(0.026)	(0.027)	(0.031)
No. of matched pair	336	336	336	336	336

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched control firms from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.

Balanced panel data consists of sample size keeping constant from pre-subsidized year to 4 year later.

Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 4-5 The Estimated Effect of STC on average wage (k-Nearest matching)

	Subsidized year	1 year later	2 years later	3 years later	4 years later
Full sample					
ATT	-0.029	-0.048**	-0.029	0.009	0.015
	(0.022)	(0.025)	(0.026)	(0.025)	(0.029)
No. of matched pair	395	382	372	365	351
Balanced panel data					
ATT	-0.020	-0.042	-0.023	0.016	0.013
	(0.022)	(0.031)	(0.023)	(0.027)	(0.028)
No. of matched pair	336	336	336	336	336

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched control firms from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.

Balanced panel data consists of sample size keeping constant from pre-subsidized year to 4 year later.

Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 4-6 The Estimated Effect of STC on employment (k-Nearest matching)

	Subsidized year	1 year later	2 years later	3 years later	4 years later
Full sample					
ATT	0.010	-0.007	-0.010	-0.003	0.008
	(0.014)	(0.019)	(0.016)	(0.019)	(0.021)
No. of matched pair	395	382	372	365	351
Balanced panel data					
ATT	0.004	-0.013	-0.010	-0.010	0.000
	(0.014)	(0.020)	(0.017)	(0.018)	(0.020)
No. of matched pair	336	336	336	336	336

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014
Notes: ATTs are changes in a given outcome between the treated firms and the matched control firms from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.
Balanced panel data consists of sample size keeping constant from pre-subsidized year to 4 year later.
Bootstrapped standard errors are presented in parentheses.
***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 4-7 Impact of STC on TFP (k-Nearest matching)

	Subsidized year	1 year later	2 years later	3 years later	4 years later
Full sample					
ATT	-0.007	-0.003	-0.003	0.008	0.010
	(0.006)	(0.008)	(0.007)	(0.007)	(0.008)
No. of matched pair	379	366	358	348	335
Balanced panel data					
ATT	-0.011	-0.010	-0.004	0.006	0.009
	(0.007)	(0.008)	(0.007)	(0.009)	(0.008)
No. of matched pair	312	312	312	312	312

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched control firms from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.

Balanced panel data consists of sample size keeping constant from pre-subsidized year to 4 year later.

Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 4-8 Impact of STC on labor productivity (k-Nearest matching)

	Subsidized year	1 year later	2 years later	3 years later	4 years later
Full sample					
ATT	-0.030	-0.051	0.018	0.008	0.033
	(0.030)	(0.035)	(0.042)	(0.046)	(0.044)
No. of matched pair	383	364	349	343	327
Balanced panel data					
ATT	-0.024	-0.042	0.017	0.024	0.052
	(0.033)	(0.038)	(0.044)	(0.042)	(0.052)
No. of matched pair	308	308	308	308	308

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched control firms from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.

Balanced panel data consists of sample size keeping constant from pre-subsidized year to 4 year later.

Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 5-1 Placebo test for ROA (Growth from t-7)

	t-6	t-5	t-4	t-3	t-2
Full sample					
ATT	-0.0005	-0.0065	-0.0034	-0.0063*	-0.0085*
	(0.0029)	(0.0050)	(0.0038)	(0.0037)	(0.0044)
No. of matched pair	315	302	302	306	317

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014
Notes: ATTs are changes in a given outcome between the treated firms and the matched controls from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4. Bootstrapped standard errors are presented in parentheses.
***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 5-2 Placebo test for profit margin (Growth from t-7)

	t-6	t-5	t-4	t-3	t-2
Full sample					
ATT	-0.0003	-0.0049	-0.0019	-0.0053	-0.0088**
	(0.0023)	(0.0041)	(0.0036)	(0.0035)	(0.0036)
No. of matched pair	315	302	302	306	317

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched controls from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4. Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table 5-3 Placebo test for sales (Growth from t-7)

	t-6	t-5	t-4	t-3	t-2
Full sample					
ATT	0.0045	0.0129	0.0196	0.0076	-0.0178
	(0.0128)	(0.0165)	(0.0192)	(0.0254)	(0.0299)
No. of matched pair	315	303	302	306	317

Data: Firm-level micro data from the Basic Survey of Corporate Management and Economic Policy (SCMEP) linked to firm-level micro data from the Survey of Japanese Business Structure and Activities (BSJBSA), 2008-2014

Notes: ATTs are changes in a given outcome between the treated firms and the matched controls from the previous year (t-1) to (t+s), where s=0, 1, 2, 3, and 4.

Bootstrapped standard errors are presented in parentheses.

***, **, * denote significance at the 1, 5, and 10 percent level, respectively.