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## Tax loss carryforwards and corporate behavior

Masanori Orihara

*Policy Research Institute, Ministry of Finance, Japan*

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Research Department Policy Research Institute, MOF  
3-1-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8940, Japan  
TEL 03-3581-4111

# **Tax loss carryforwards and corporate behavior**

Masanori Orihara \*

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## **Abstract**

Tax losses are prevalent in the corporate sector of many countries. Firms with tax losses can deduct these losses from current or future taxable income. This deduction reduces corporate marginal tax rates and in turn can affect managerial incentives. Using industry-year level tax return data and accounting data, we show that tax loss carryforwards decrease leverage. We also show that tax loss carryforwards increase investments when the effective tax rates among the industry-year observations are considerably affected by tax loss carryforwards. Our findings suggest that the incentive effects of tax loss carryforwards on corporate behavior need to be considered in tax reforms in addition to other factors in public finance.

JEL classifications: G31, G32, H25, H34

Key words: tax loss carryforward, leverage, investment

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\* Economist, Policy Research Institute, Ministry of Finance, Japan; University of Illinois at Urbana-Champaign. I am grateful to Makoto Hasegawa and seminar participants at the Ministry of Finance for helpful comments and suggestions. I am also indebted to Hisashi Ishimoto and Kenji Tominaga for excellent research assistance. The views expressed herein are those of the author and do not necessarily reflect the views of the Ministry of Finance or the Policy Research Institute. E-mail: masanori.orihara@mof.go.jp

# 1. Introduction

A considerable proportion of firms report tax losses in many countries. For example, 68.2% of corporations reported tax losses in 2013 in Japan according to recent tax statistics (Corporate Sample Survey). As a result, the corporate sector has accumulated tax loss carryforwards (TLCs). Corporations can claim a tax deduction for TLCs. The Japanese corporate sector owned 68.6 trillion yen of TLCs at the end of 2013 fiscal year. This amount corresponds to 14.3% of the Japanese GDP of the year (480 trillion yen). OECD (2011) reports that the size of TLCs in 17 OECD countries in the 2000s is typically 10-20% of individual countries' GDP as well.

This large amount of TLCs lowers effective corporate tax rates of individual corporations. The tax statistics in Japan report that 9.8 trillion yen was offset with corporate taxable income in 2013 as a deduction for TLCs. This observation has two implications. First, given that the statutory national corporate income tax rate in 2013 was 28.05%, 2.75 trillion yen was shifted from the government to corporations, relative to a tax system that does not allow a deduction for TLCs. This amount of reduced tax liabilities is 26% of the year's national corporate tax revenues (10.5 trillion yen). Since the magnitude of TLCs as a percent of GDP is comparable in other OECD countries, TLCs considerably affect public finance in various countries. Second, TLCs can create large heterogeneity in marginal tax rates among individual corporations. This argument comes from the observation that the amount deducted for TLCs is enormous. Thus, it is relatively likely that those firms that claim a deduction for TLCs have zero taxable income, and therefore face zero marginal tax rates. We use this variation in marginal tax rates to examine how taxes affect corporate behavior.

More specifically, we examine the impacts of TLCs on two types of fundamental corporate decisions in line with Auerbach and Poterba (1987): capital structure (or leverage) and corporate investments. Theory in public economics as well as in financial economics provides

predictions about the impacts of taxes on them.<sup>1</sup> The tradeoff theory of capital structure emphasizes the role of debt tax shields. Since interest payments are deductible from taxable income, firms facing high marginal tax rates have incentive to issue debts. Since TLCs reduce taxable income and in turn marginal tax rates, we predict that TLCs decrease leverage. Extensive theoretical studies since Hall and Jorgenson (1967) demonstrate that tax rates are negatively associated with corporate investments. In contrast, Auerbach and Poterba (1987) show that TLCs can lead to a lower level of investments when the tax benefits from a deduction for TLCs are relatively small. Thus, the impacts of TLCs on corporate investments are not clear a priori.

One challenge in the literature is the limited availability of tax return data. Many studies in the literature have access to information on the amount of TLCs owned by firms, but they do not observe the amount of TLCs claimed by corporations. In contrast, our industry-year level tax return data, the Corporation Sample Survey collected by the National Tax Agency, include information on TLCs in terms of both stock and flow. Thus, we can quantify the impacts of TLCs actually claimed on corporate behavior. In other words, our data allow us to divide cash flow (or profitability) into two parts: TLC factor and non-TLC factors. Access to this flow information regarding TLCs is a critical difference between our paper and related papers. We also use the Financial Statements Statistics collected by the Ministry of Finance as a source of accounting data.

The unit of observations of the second data set is firm-year, while that of the first data set is industry-year. Therefore, we aggregate observations in the Financial Statements Statistics at the industry-year level. We classify firm-year observations in each industry-year class of the Financial Statements Statistics into four groups according to two conditions. The first condition

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<sup>1</sup> The literature investigating how taxes affect corporate behavior is summarized in Auerbach (2002), Graham (2003), and Hanlon and Heitzman (2010).

concerns whether the observations have past accumulated losses, and the second condition concerns whether the observations' current profits are positive. Only observations in one of the four groups, which have past accumulated losses and whose current profits are positive, can utilize TLCs. We merge the reduced Financial Statements Statistics data with the Corporation Sample Survey. The data periods are from 1998 to 2001. The final sample consists of 253 industry-year observations.

We regress either leverage or investments on TLCs. We include an industry-year dummy to use an industry-year level variation in effective tax rates, which are defined by tax liabilities divided by before-tax profits. We also divide the total industry-year observations into industry-years with high effective tax rates and those with low effective tax rates. This specification helps us evaluate whether TLCs affect corporate behavior when TLCs effectively reduce marginal tax rates to zero. For example, if some non-TLC factors have major impacts on marginal tax rates, not many firm-years in this industry-year can face zero marginal tax rates. We predict that the impacts of TLCs on corporate behavior are observed more clearly when the effective tax rates are low.

Estimation results are as follows. First, we show that TLCs reduce leverage. This finding is consistent with the tradeoff theory of capital structure. Second, the impacts of TLCs on investments are not statistically significant on average. This insignificance can be attributable to non-TLC factors that affect marginal tax rates. We show that TLCs increase investments when the effective tax rates are low, compared to the case when the effective tax rates are high. This result implies that TLCs increase investments as long as the TLCs effectively reduce marginal tax rates.

Our findings have several policy implications. First, we show that TLCs reduce leverage. Since firms that claim a deduction for TLCs are currently profitable but unprofitable during the previous years, TLCs can help firms reduce risks of financial distress. Second, our findings

suggest that tax reforms that provide generous treatments on past losses can stimulate investments. Although OECD (2011) emphasize that tax laws regarding TLCs can be used for tax planning, they do not necessarily consider the incentive effects of TLCs on corporate behavior. Our paper highlights that these incentive effects of TLCs are a consideration in tax policy discussions in addition to various factors in public finance.

Empirical studies on TLCs are relatively scarce in spite of their relevance in public finance. TLCs are discussed as a factor that affects marginal tax rates in the capital structure literature (Graham (1996)) or as a factor that affects user cost of capital in the investment literature (Devereux, Keen, and Schiantarelli (1994)). Although the author is not aware of studies that investigate direct impacts of TLCs on capital structure, several empirical papers investigate these impacts on investments. Dreßler and Overesch (2013) show that generous tax loss treatments encourage investments, using data of German multinationals. Edgerton (2010) examines the impacts of tax incentives on investments as a function of the firms' tax position. Edgerton (2010) shows that non-taxable firms are more responsive to the tax incentives, but the statistical significance disappears when the interaction term of tax incentives and cash flow is included in regression. An important difference of our paper from related papers is that we use information on the amount of TLCs claimed by corporations, while related papers use information on the amount of TLCs owned by corporations. In other words, we use flow information of TLCs and related papers use stock information of TLCs.<sup>2</sup>

The rest of this paper is organized as follows. Section 2 presents the hypothesis and explains the estimation procedures. Section 3 describes the data. Section 4 shows the estimation results. Section 5 concludes.

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<sup>2</sup> Our paper is also related to the literature that investigates TLCs themselves. Cooper and Knittel (2006, 2010) use corporate tax return data in the U.S. to examine various aspects of TLCs. For instance, they show that there exists a considerable variation in TLCs across industries.

## **2. Hypothesis and empirical specification**

### **2.1. Background information**

The corporate tax law in Japan treats gains and losses asymmetrically like that in many other countries (OECD (2011)). Under the asymmetric tax law, corporations that have positive taxable income need to pay corporate taxes. On the other hand, corporations that report losses cannot receive tax refunds from the government in the same year. Instead, these corporations can offset past losses with current taxable income by claiming a deduction for tax loss carryforwards (TLCs). The periods during which firms can carry losses forward are currently ten years, and they were five years before a tax reform in 2004. Our data cover year periods before 2004, and therefore the effective time span for TLCs is five years in this paper. Firms were able to claim a deduction for TLCs up to the amount of their current taxable income before 2004.<sup>3</sup>

Tax systems with a deduction for TLCs help corporations increase their current after-tax profits through a reduction in firms' tax liabilities, compared to a tax system that does not allow a deduction for TLCs. In other words, claiming TLCs has a common characteristic with increased profitability from an economic perspective.

From a tax perspective, however, there are two differences between TLCs and after-tax profits. First, an increase in TLCs reduces firms' taxable income because TLCs are a tax deduction. When firms have sufficient TLCs relative to their taxable income, these firms are not taxed and therefore they face zero marginal tax rates. On the other hand, an increase in profitability does not reduce taxable income. In a circumstance where tax saving opportunities are limited, high profitability tends to increase the level of taxable income. Second, firms need current positive income to utilize TLCs. Thus, only a certain group of firms can claim TLCs.

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<sup>3</sup> Under the current tax law, firms can claim a deduction for TLCs up to 65% of their current taxable income.

For this group of firms, after-tax profitability consists of two factors: after-tax profits from TLCs and those from non-TLCs such as those from regular business activities.<sup>4</sup> Our paper examines how these tax effects of TLCs affect corporate behavior.

## **2.2. Hypothesis**

The first prediction concerns the impacts of TLCs on capital structure (or leverage). Leverage is defined by liabilities divided by lagged assets in percentage. A key feature of typical tax systems including the Japanese tax system is that interest payments are tax deductible. Therefore, corporations have incentive to issue more debts when facing higher marginal tax rates. Because TLCs reduce taxable income, TLCs can lower marginal tax rates. Thus, we predict that TLCs reduce leverage.

The second prediction concerns the impacts of TLCs on investments. Auerbach (1986) theoretically shows that TLCs can increase investment levels. This is because TLCs reduce the tax burden of profitable firms. In the extreme case, corporations with large TLCs can become tax-free entities. In addition, theoretical studies since Hall and Jorgenson (1967) show a negative association between tax rates and investments. These arguments lead us to the prediction that TLCs increase investments. In contrast, Auerbach and Poterba (1987) suggest a possibility that TLCs reduce investments. This can happen when the costs of postponed depreciation benefits exceed the benefits from reduced tax liabilities through a deduction for TLCs. Thus, the impacts of TLCs on investments are not clear a priori. We further discuss our predictions regarding investments in the following subsection.

## **2.3. Variable definition and empirical specification**

We estimate a standard leverage equation (Rajan and Zingales (1995)) and a standard investment equation (Fazzari, Hubbard, and Petersen (1988)). The former equation includes

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<sup>4</sup> Another difference between TLCs and after-tax profits is that only TLCs expire if unused for a certain period of time.

profitability and the latter equation includes cash flow as a control variable for the reasons explained below. To isolate the TLC element from profitability or cash flow, we subtract the monetary value of a deduction for TLCs from these variables. We then include the monetary value of TLCs as another dependent variable in each equation. Note that, since TLCs are a tax deduction, we multiply the TLC variable by the statutory tax rates to evaluate the monetary impact of TLCs. The statutory tax rates were 46.36% in 1998 and they were 40.87% between 1999 and 2001. These tax rates reflect both national taxes and local taxes. Note that these tax rates are higher than the tax rate mentioned in the introduction (28.05%), because this tax rate includes only national corporate taxes.

The standard leverage equation includes profitability, tangibility, firm size, and market to book ratio as control variables. Leverage is negatively related to profitability because internal funding is less expensive than external funding. Leverage is positively correlated with tangibility that is measured by fixed tangible assets. This is because tangible assets have higher collateral value, and therefore borrowing costs of firms with a higher level of tangibility are less expensive. Leverage is positively correlated with firm size that is commonly measured by the size of assets or sales. This is because larger firms are less likely to be involved in financial distress, and therefore they have access to a less expensive source of external funding. Since our data cover unlisted firms, we do not include market to book ratio as a control variable, which needs stock prices for its definition. The standard investment equation includes two variables: market to book ratio and cash flow. Cash flow is positively related to investments because of the cash flow sensitivity of investments documented in the literature. We do not include market to book ratio in the investment equation, either. We also include an industry-year dummy in each of the equations to use a within-industry-year variation for estimation. This dummy variable controls for any industry-year level shock that is common across firms in the same industry-year.

A potential source of bias in OLS estimates is represented by two conditions that firms need to satisfy to claim a deduction for TLCs: current positive profitability and the existence of past accumulated losses. For example, firms with accumulated losses might hesitate to engage in high-risk activities to avoid a further drop in profitability. As a consequence, these firms might invest less. Estimates of TLC coefficients can exhibit a downward bias for the investment equation in this case. Thus, we include two dummy variables: a positive current profit dummy variable and a past accumulated loss dummy variable. The positive current profit dummy variable takes one when the firms' current profits are positive. The past accumulated loss dummy variable takes one when the before-tax profits aggregated across previous five years are negative, where five-year corresponds to the time span for TLCs during our data periods. All variables other than log of assets are normalized by lagged assets to eliminate potential size effects. These normalized variables are multiplied by 100 to interpret them in percentages.

Our discussion has presumed that TLCs lead to lower marginal tax rates. However, the data presented in the next section show that effective tax rates are relatively high in some industry-year observations. To examine the impacts of TLCs through a reduction in marginal tax rates by claiming TLCs, we interact TLCs with a low tax rate dummy variable. The low tax rate dummy variable takes one if the effective tax rates of the TLC group 1 observation of the industry-year are lower than the median value of the effective tax rates. This framework helps us evaluate the impacts of TLCs on corporate behavior when TLCs actually reduce the effective tax rates of the firm-years.

We estimate two equations defined below: equation (L) that is the leverage equation and equation (I) that is the investment equation. Individual variables depend on indexes for industry  $i$  and year  $t$ . In addition, individual variables depend on the "TLC group" indexed by  $j = 1, \dots, 4$ . For example, TLC group 1 consists of firms that have current positive profits and past accumulated losses. Only firms in this TLC group 1 can claim a deduction for TLCs. We define

TLC groups 2, 3, and 4 in the next section. We use robust standard errors clustered at the industry-year level. Our argument is summarized in the following equations (L) and (I).

$$\begin{aligned} \frac{\text{liab}_{ijt}}{\text{ast}_{ijt-1}} = & \beta_1 \frac{\text{TLC}_{ijt}}{\text{ast}_{ijt-1}} + \beta_2 \frac{\text{TLC}_{ijt}}{\text{ast}_{ijt-1}} \times \text{LTD}_{it} + \beta_3 \frac{\text{prf}_{ijt}}{\text{ast}_{ijt-1}} + \beta_4 \frac{\text{fta}_{ijt}}{\text{ast}_{ijt-1}} + \beta_5 \ln(\text{ast}_{ijt-1}) \\ & + \beta_6 \text{a\_loss}_{ijt} + \beta_7 \text{p\_prf}_{ijt} + \alpha_{it} + \epsilon_{ijt} \quad (\text{L}) \end{aligned}$$

$$\begin{aligned} \frac{\text{inv}_{ijt}}{\text{ast}_{ijt-1}} = & \gamma_1 \frac{\text{TLC}_{ijt}}{\text{ast}_{ijt-1}} + \gamma_2 \frac{\text{TLC}_{ijt}}{\text{ast}_{ijt-1}} \times \text{LTD}_{it} + \gamma_3 \frac{\text{cf}_{ijt}}{\text{ast}_{ijt-1}} \\ & + \gamma_4 \text{a\_loss}_{ijt} + \gamma_5 \text{p\_prf}_{ijt} + \alpha_{it} + \epsilon_{ijt} \quad (\text{I}) \end{aligned}$$

subscript i - industry; subscript j - TLC group; subscript t - year

liab - liabilities; ast - assets; TLC - tax loss carryforwards claimed by firms multiplied by the statutory corporate tax rates; LTD - low tax rate dummy variable that takes one when the effective tax rates of the TLC group 1 observation of the industry-year are lower than the medium value of the effective tax rates; prf - after-tax profits; fta - fixed tangible assets; a\_loss - accumulated loss dummy that takes one when the before-tax profits aggregated across previous five years are negative; p\_prf - positive profitability dummy that takes one when the firms' current profits are positive;  $\alpha$  - industry-year dummy;  $\epsilon$  - error term; inv - capital expenditures in fixed tangible assets and in intangible assets; cf - cash flow that is after-tax profits plus depreciation

Our main interests of coefficients are  $\beta_2$  and  $\gamma_2$ . They measure differences in the impacts of TLCs on each of corporate behavior between the high effective tax rate observations and the

low effective tax rate observations. We expect the estimates of  $\beta_2$  are negative and those of  $\gamma_2$  are positive.

### **3. Data**

#### **3.1. Description of the data**

We use two data sets of Japanese corporations. The first data set is the Corporation Sample Survey collected by the National Tax Agency. This data set covers industry-year level tax return data. This data set contains two types of information about TLCs: the amount of TLC deductions which corporation claimed and the amount of TLC deductions corporations own, which can be used as a deduction for TLCs in the future. Thus, this data set covers information on TLCs in terms of both flow information and stock information. The second data set is the Financial Statements Statistics by Corporations collected by the Ministry of Finance. This data set covers firm-year level standard accounting data. This data set also covers information on tax liabilities. More specifically, the data cover corporate income taxes paid in 1998, and they cover corporate income tax expenses, which reflect temporary differences, between 1999 and 2001. These two data sets cover unlisted companies as well as listed companies.

A difference between these two data sets is the unit of observations. The observation is at the industry-year level in the Corporation Sample Survey, and it is at the firm-year level in the Financial Statements Statistics. Therefore, we first classify the firm-year observations in the Financial Statements Statistics into the industry-year level. We next classify individual firm-year observations of one industry-year class into four groups based on the following two criteria. The first criterion is whether the current before-tax profits are positive. The second criterion is the existence of past losses. We define that the firms have past losses when the aggregated before-tax profits across past five years are negative.

As a result of this procedure, firm-years in one industry-year class in the Financial Statements Statistics are divided into four groups. We name each of these four groups as follows. TLC group 1 consists of firms that have positive before-tax income in the current year and have past accumulated losses. The rest of TLC groups are defined as in Table 1.

We then merge the industry-year-TLC group level data constructed from the Financial Statements Statistics with the Corporation Sample Survey. The year periods we are using in this paper are between 1998 and 2001.<sup>5</sup> Like many other studies, we exclude firms in the financial industry since their financial policy and investment policy is different from firms in other industries. The resulting number of industries is 16. In the Financial Statements Statistics, we include only firms whose capital is over one billion yen. This is because, although the data are a sampling survey, these firms are always a target of the Financial Statements Statistics. In addition, these firms are always a target of the Corporation Sample Survey as well. Therefore, these two data sets can cover exactly the same firms.

However, the actual coverage of these two data sets does not coincide. For example, total legal capital across the entire data periods is 230 trillion yen in the Corporation Sample Survey, and it is 177 trillion yen in the Financial Statements Statistics. In this sense, the match ratio of these two data sets is 77.0%. There are two reasons behind this discrepancy. First, we keep firm-years in the Financial Statements Statistics only when they exist for five consecutive years. This restriction is necessary to calculate past accumulated losses. Second, the response rate of the Financial Statements Statistics is not 100%. It is about 95% among corporations with legal capital over one billion yen. To mitigate the concern in the data merging process, we check the

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<sup>5</sup> The reason that the year periods are relatively short is that the Japanese government introduced a consolidated taxation system in 2002. This tax system allows firms in business groups to share TLCs among member companies of the same business group in the same fiscal year. The Corporation Sample Survey excludes firms that have adopted the consolidated taxation system from their regular industry classification. Since the Financial Statements Statistics does not tell whether the firms have adopted the consolidated taxation system, we cannot accurately merge these two data sets after 2002. Therefore, we are not using data periods after 2002.

robustness of the estimation results when excluding two industries whose data coverage ratio is less than 50%: the hotel-and-food industry (the coverage ratio is 38.5%) and the service industry (the coverage ratio is 47.3%).<sup>6</sup>

### **3.2. Summary statistics**

Table 2 presents the number of firm-year observations recorded in the Financial Statements Statistics by TLC group. This table shows that 1967 firm-years (12.0%) can use TLCs (TLC group 1). Thus, tax benefits from TLCs are not distributed uniformly across firm-years. This table also shows that over a half of firm-years (58.6%) do not have accumulated losses, and the current profits are positive (TLC group 2). This observation seems plausible given that the sample consists of relatively large firms, which are more likely to be steadily profitable. TLC groups 3 and 4 each involve slightly less than 15% of firm-years.

Table 3 reports descriptive statistics of the merged sample of the Financial Statements Statistics and the Corporate Sample Survey. This is the sample we use for regression. Although there can exist 256 observations (16 industries, 4 TLC groups, and 4 years), our data have three observations that do not have any firm-years in them. Thus, the final number of observations is 253.

The first column presents the average monetary value of TLCs claimed by each of the TLC groups. Since TLCs are available only for TLC group 1, this variable takes zero for other TLC groups. Table 3 shows that cash flow excluding TLCs for the group 1 is considerably lower (0.76) than that for the group 2 (5.42). However, cash flow with TLCs for the group 1 (4.63) is close to that of TLC group 2 (5.42). Similar comparison between the group 1 and group 2

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<sup>6</sup> Admittedly, there remains a concern that the data merging process might cause a bias in estimation. However, it is highly difficult to obtain confidential tax return data especially in terms of the amount of TLCs actually used. As a consequence, most previous studies rely only on accounting data, which can be subject to measurement errors because of differences between financial accounting and tax accounting. Alternatively, related studies use only the amount of TLCs owned by firms, and they do not have access to information on the flow aspect of TLCs. We expect this study with tax return data on claimed TLCs to be complementary to the existing studies on TLCs.

applies to profitability. Thus, this table demonstrates that TLCs are an important factor to determine after-tax profitability among corporations that claim a deduction for TLCs.

Table 3 shows that effective tax rates for the group 1 are almost half of those for the group 2. Although firm-years in TLC group 2 are eligible for other types of deduction, the average effective tax rate for the group 2 is close to the statutory corporate tax rates that were effective between 1998 and 2001. This observation suggests that a deduction for TLCs is a dominant factor in tax payments. We winsorize effective tax rates at 0 and 100, but we obtain similar statistics without this winsorization. Since firm-years in TLC groups 3 or 4 do not have positive before-tax profits, we put zero in the corresponding cells of the effective tax rates.

To further examine the difference in effective tax rates between these two TLC groups, we use non-aggregated, firm-year level observations of the Financial Statements Statistics in Figure 1. The left panel and the right panel respectively depict the distribution of the effective tax rates for TLC group 1 firms-years and TLC group 2 firm-years. The left panel shows that the mode is around zero. In contrast, the right panel shows that the mode is around 45, which is almost identical to statutory corporate tax rates of the data periods. Although the winsorization in effective tax rates contributes to the mass at 0 and 100, we observe a distribution with a similar shape when we drop observations whose corporate taxes are recorded as negative values or whose effective tax rates are over 100.

Figure 1 has two implications. First, we confirm that TLCs considerably reduce effective tax rates for TLC group 1 firm-years. Second, the left panel of this figure suggests there remains a variation in effective tax rates among TLC group 1 firm-years. This implies that a deduction for TLCs does not necessarily allow firm-years to face zero marginal tax rates. Therefore, we divide our industry-year level final sample into two classes: high effective tax rate industry-years and low effective tax rate industry-years. The median effective tax rate across all TLC group 1 observations is 24.0%, and we divide industry-years into these two

classes based on this median value. The average effective tax rate for TLC group 1 is 37.2% among the high effective tax rate industry-years, and it is 12.3% among the low effective tax rate industry-years. Therefore, it is likely that more firms in the latter industry-years face zero marginal tax rates than the former industry-years. We use this variation in the effective tax rates to approximate a variation in the marginal tax rates.

## **4. Results**

### **4.1. Tax loss carryforwards and capital structure**

Table 4 reports the estimation results when the dependent variable is leverage. The odd numbered columns use all industry-year observations, and the even numbered columns use observations other than the two industries whose data matching ratio is relatively low. Columns (1) – (2) do not include the interaction term of TLCs with the low tax rate dummy. Columns (3) – (4) include this interaction term. These two columns are the main models in this subsection.

TLC coefficients in columns (1) and (2) are negative and significant at the 1% level. Thus, TLCs reduce leverage. This is consistent with our prediction. The magnitude of the estimates is similar in these two models. This finding from column (2) suggests that the potential data matching problem does not cause a bias in estimates. We can interpret the TLC coefficients in a simple way because we normalize both leverage and TLCs by the same variable of lagged assets. The TLC coefficient in column (1) of -1.7 implies that one yen worth of an increase in TLCs leads to a 1.7 yen decrease in liabilities. Note that this result does not mean that a deduction of one yen for TLCs leads to a 1.7 yen decrease in liabilities because we multiply TLCs by the statutory corporate tax rates. If we use TLCs themselves in regression, the coefficients are around 0.7. Therefore, a one yen deduction for TLCs leads to a 0.7 yen decrease in liabilities. This result is consistent with our prediction based on the tax incentives of debt financing. An implication of this finding is that TLCs help firms reduce risks in facing financial

distress. This implication is important because firms that claim a deduction for TLCs were unprofitable for a certain period of time before claiming a deduction, and thus they can have strong incentives to repay debt.

Columns (3) and (4) show that TLC\*LTD coefficients are negative and significant. Therefore, TLCs reduce leverage among the low tax rate observations compared to among the high tax rate observations. It is noteworthy that the TLC coefficients are not statistically significant. This implies that TLCs do not have impacts on leverage among high tax rate observations, possibly because TLCs are not a dominant factor to reduce marginal tax rates. Another finding is that the TLC coefficients are larger in columns (3) and (4) than in columns (1) and (2). This result is consistent with our argument that more firms face zero marginal tax rates among firms that face lower effective tax rates, and thus leverage is more likely to be reduced among these observations. The sign of the coefficients on other variables are consistent with our prediction; we obtain a negative sign on profitability and positive signs on tangibility and firm size.

## **4.2. Tax loss carryforwards and investments**

Table 5 reports the estimation results when the dependent variable is investments. We number each column according to the same order as that in Table 4. Columns (1) and (2) show that TLCs do not affect investments when we do not consider the heterogeneity of the effective tax rates. Instead, these two models show that cash flow is a determinant to increase investments. This finding is common in the literature of financial constraints since Fazzari, Hubbard, and Petersen (1988).

One reason for having obtained results that are not consistent with our prediction can be that TLCs do not necessarily decrease effective tax rates. Therefore, we examine the impacts of TLCs on investments as a function of the effective tax rates for the TLC group 1 firm-years. Columns (3) and (4) show that TLC\*LTD coefficients are positive and significant. Therefore,

these two models support that TLCs increase investments when the effective tax rates are low, relative to the case when the effective tax rates are high.<sup>7</sup> In other words, TLCs can provide investment incentives as long as TLCs can reduce effective tax rates. This finding is in line with Auerbach (1986).

## 5. Conclusion

This paper has examined the impacts of tax loss carryforwards (TLCs) on corporate leverage and corporate investments. We use unique industry-year level tax return data that cover flow information of TLCs as well as accounting data of Japanese corporations between 1998 and 2001. The availability of flow information on TLCs is an important difference with related studies that use only stock information of TLCs. Those firms that can use TLCs and thus face low effective tax rates are more likely to face low marginal tax rates. We use this variation to show that the tax effects of TLCs decrease leverage and increase investments.

We provide evidence that TLCs reduce leverage. This finding is consistent with the tradeoff theory of capital structure. This result implies that TLCs help firms reduce risks in financial distress. Our estimation also shows that TLCs do not necessarily affect investments. We then provide evidence that TLCs increase investments when the effective tax rates of the observations are low, compared to the case when the effective tax rates are high. This result implies that more generous tax rules for TLCs can encourage investments. Given the considerable amount of TLCs in many counties, tax reforms on TLCs can have substantial impacts on public finance. Our paper suggests that the incentive effects are also a consideration in tax reforms.

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<sup>7</sup> The negative coefficients on TLCs in columns (3) – (4), which measure the impacts of TLCs among the high tax rate observations, are difficult to interpret. Since TLCs do not have strong impacts on the effective tax rates among these observations, other factors should be behind this result. However, specific factors cannot be found from our analysis.

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**Table 1**  
**Definition of four TLC groups**

This table reports the definition of the four TLC groups. Current profit is defined based on before-tax profits. Past accumulated loss is calculated based on the before-tax profits aggregated across previous five years.

	With past accumulated loss	Without past accumulated loss
Positive current profit	TLC group 1	TLC group 2
Negative current profit	TLC group 3	TLC group 4

**Table 2**  
**The number of firm-years in Financial Statements Statistics**

This table reports the number of firm-year observations in Financial Statements Statistics by TLC group. TLC group is defined in Table 1. The data periods are between 1998 and 2001.

TLC group 1	TLC group 2	TLC group 3	TLC group 4	Total
1967	9572	2379	2426	16344

**Table 3**  
**Summary statistics**

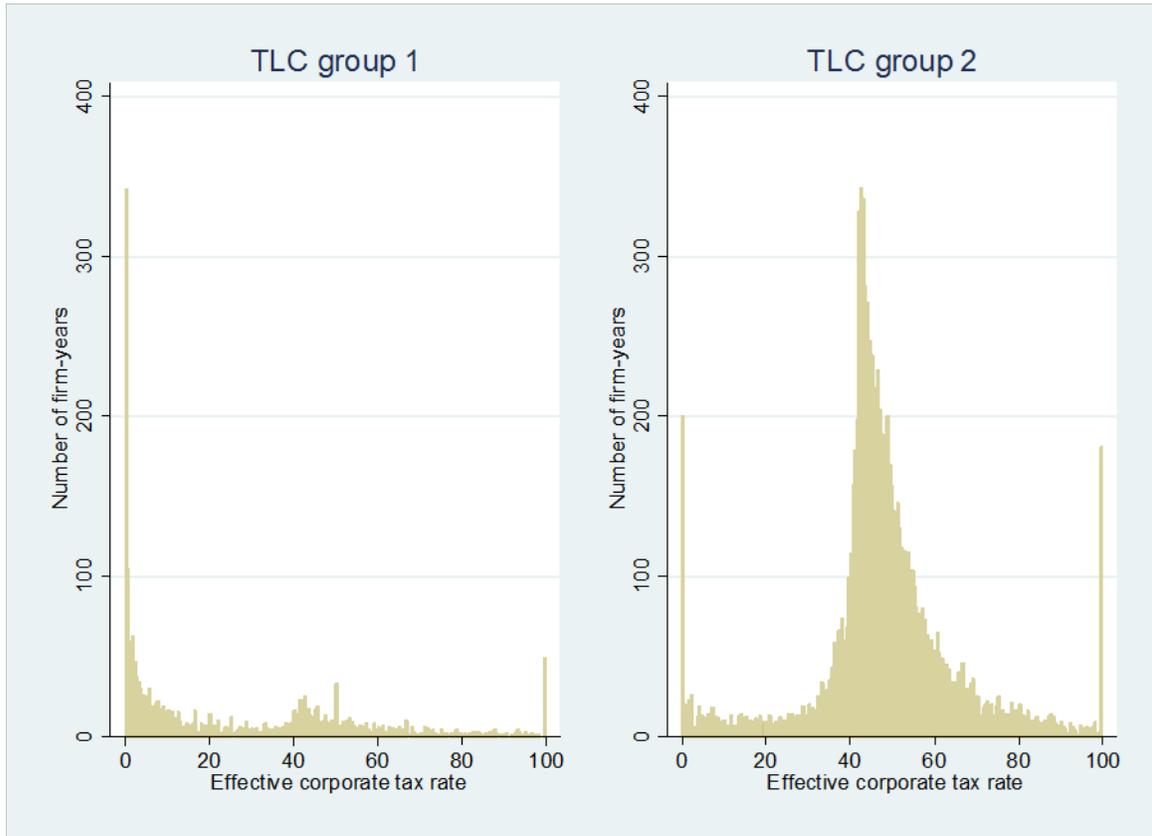
This table reports descriptive statistics by TLC group. TLC group is defined in Table 1. TLC is tax loss carryforwards claimed by corporations multiplied by the statutory corporate tax rates. Leverage is liabilities divided by lagged assets. Investment is capital expenditures in fixed tangible assets and in intangible assets divided by lagged assets. Profit excluding TLCs is after-tax profits minus TLCs divided by lagged assets. Cash flow excluding TLCs is after-tax profits plus depreciation minus TLCs divided by lagged assets. Tangibility is fixed tangible assets divided by lagged assets. Ln(asset) is the natural log of lagged assets. Effective tax rate is tax liabilities divided by before tax profit. All variables other than ln(asset) are multiplied by 100.

	TLC	Leverage	Investment	Profit excluding TLCs	Cash flow excluding TLCs	Tangibility	Ln(asset)	Effective tax rate
TLC group 1	3.87	70.05	3.12	-2.33	0.76	33.33	13.92	24.52
TLC group 2	0	59.79	4.16	1.99	5.42	35.98	15.92	46.00
TLC group 3	0	71.04	2.58	-7.09	-4.42	32.16	13.91	0
TLC group 4	0	68.78	3.43	-5.56	-2.55	33.01	14.4	0

**Figure 1**

**Distribution of effective tax rates**

This figure compares the distribution of the effective tax rates between TLC group 1 and TLC group 2. TLC group is defined in Table 1. The data periods are between 1998 and 2001. Effective tax rate is tax liabilities divided by before-tax profit multiplied by 100. The width of a bin is 0.5.



**Table 4****Tax loss carryforwards and leverage**

This table presents estimation results to examine whether TLCs reduce leverage. The data periods are between 1998 and 2001. We use OLS for estimation. Leverage is liabilities divided by lagged assets. TLC is tax loss carryforwards claimed by corporations multiplied by the statutory corporate tax rates. LTD is a low tax rate dummy variable that takes one when the effective tax rates of the TLC group 1 observation of the industry-year are less than the medium value of the effective tax rates. Effective tax rate is tax liabilities divided by before tax profit. Profit excluding TLCs is after-tax profits minus TLCs divided by lagged assets. Tangibility is fixed tangible assets divided by lagged assets.  $\ln(\text{asset})$  is the natural log of lagged assets.  $a\_loss$  dummy is an accumulated loss dummy that takes one when the before-tax profits aggregated across previous five years are negative.  $p\_prf$  dummy is a positive profitability dummy that takes one when the firms' current profits are positive. All variables normalized by lagged assets are multiplied by 100. Standard errors reported in parentheses are clustered at the industry-year level. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
TLC	-1.716*** (0.264)	-1.777*** (0.261)	0.459 (0.837)	0.707 (0.910)
TLC*LTD			-2.271** (0.870)	-2.598*** (0.927)
Profitability	-1.172** (0.443)	-1.236*** (0.413)	-1.247*** (0.406)	-1.327*** (0.362)
Tangibility	0.412*** (0.148)	0.400** (0.158)	0.421*** (0.146)	0.411** (0.155)
$\ln(\text{asset})$	1.379 (2.553)	1.222 (2.788)	1.821 (2.659)	1.730 (2.889)
$a\_loss$ dummy	8.862** (3.718)	7.271 (4.419)	8.285** (3.624)	6.570 (4.259)
$p\_prf$ dummy	3.924 (3.942)	3.935 (4.025)	3.101 (3.718)	2.939 (3.776)
industry-year dummy	yes	yes	yes	yes
Observations	253	221	253	221

**Table 5****Tax loss carryforwards and investment**

This table presents estimation results to examine whether TLCs increase investments. The data periods are between 1998 and 2001. We use OLS for estimation. Investment is capital expenditures in fixed tangible assets and in intangible assets divided by lagged assets. TLC is tax loss carryforwards claimed by corporations multiplied by the statutory corporate tax rates. LTD is a low tax rate dummy variable that takes one when the effective tax rates of the TLC group 1 observation of the industry-year are less than the medium value of effective tax rates. Effective tax rate is tax liabilities divided by before tax profit. Cash flow excluding TLCs is after-tax profits plus depreciation minus TLCs divided by lagged assets. a\_loss dummy is an accumulated loss dummy that takes one when the before-tax profits aggregated across previous five years are negative. p\_prf dummy is a positive profitability dummy that takes one when the firms' current profits are positive. All the variables normalized by lagged assets are multiplied by 100. Standard errors reported in parentheses are clustered at the industry-year level. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
TLC	0.018 (0.037)	0.015 (0.024)	-0.144** (0.072)	-0.110** (0.047)
TLC*LTD			0.173** (0.081)	0.134** (0.054)
Cash flow	0.089** (0.039)	0.061** (0.025)	0.095** (0.039)	0.066*** (0.023)
a_loss dummy	-0.652** (0.310)	-1.043*** (0.248)	-0.569* (0.326)	-0.969*** (0.259)
p_prf dummy	0.057 (0.356)	-0.000 (0.294)	0.077 (0.351)	0.015 (0.284)
industry-year dummy	yes	yes	yes	yes
Observations	253	221	253	221