AUSTRALIA–JAPAN RESEARCH CENTRE
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TAX CONSOLIDATION AND THE STRUCTURE OF CORPORATE GROUPS: EVIDENCE FROM THE JAPANESE TAX REFORM 2002

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Kazuki Onji

ABSTRACT

A consolidated filing of corporate income tax may induce firms to manipulate ownership interests in subsidiaries but no study has systematically examined such behavioral responses. This paper examines empirically inclusions/exclusions of subsidiaries to/from consolidation groups in a quasi-experiment that utilizes the Japanese tax reform of 2002. The identification of tax effects is based on a difference-in-difference strategy that exploits disincentives to consolidate subsidiaries with losses carried forward. The data consists of 37,000-40,000 subsidiary-time observations spanning biennially over 1988-2006. The result shows that losses carried forward significantly reduced the propensity to include subsidiaries to consolidation groups. No evidence on tax-motivated exclusion is found. This result suggests that the forced consolidation regime is preferable.

Keywords: Tax Avoidance, Corporate Income Tax, Business Restructuring

JEL Classification: G34, H25, K34

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Introduction

The European Union (EU) in 2002 proposed a measure to tax a multinational corporation on the basis of a consolidated income of subsidiaries residing within EU. Mintz (2004) commends such measure as a step towards reducing administration costs and compliance costs in a highly-integrated market. Drawing from the US experience, however, Hellerstein and McLure (2004) raise concern about unintended consequences: Policy makers must draw a line on what constitutes a ‘group’ for tax purposes; Will a tax on group-level income then leads corporate groups to manipulate ownership interests to minimize tax burdens? If so, to what extent do legal ownership demarcations affect the ownership structure in a consolidation regime? Designers of consolidation regimes have asked this question.\(^1\) While Fuest (2008) calls for evidence-based policy on tax consolidation, to my knowledge, no systematic study has provided answer to this common concern.

For corporate tax filers, the key benefits of a consolidation regime are higher expected returns and lower volatility relative to a separate filing regime. Essentially, this system subsidizes risk taking and shares some risks with the government. These benefits create incentives to include subsidiaries in a consolidation group by adjusting ownership interests up. Additionally, in a forced consolidation regime, where all eligible subsidiaries are automatically enrolled in a consolidation group, tax disadvantages create incentives to exclude a subset of subsidiaries from a consolidation group by reducing ownership interests. The extent to which firms respond to those incentives is an empirical question.

This study aims to document the effects of tax consolidation on the structure of corporate groups. To this end, this study focuses on Japan that offers a useful

\(^1\)The minutes of the Japanese Government’s Tax Committee meetings held throughout fiscal 2001 records discussions about possible manipulation of group structures (Hirakawa, 2002).
‘laboratory’ to investigate the behavioral consequences of tax consolidation for several reasons. First, the introduction of a consolidated tax filing in 2002 provides an opportunity to conduct a quasi-experimental analysis. Particularly, Japan adopted a comparatively more stringent treatment of loss carries than institutions in, for example, France or the US. As this rule strongly discourages groups to include subsidiaries with loss carries, the Japanese tax institution gives rise to differences in ‘treatment intensity’ among ‘treated’ subsidiaries. Second, a commercial database on detailed structures of Japanese corporate groups allows us to observe inclusions to and exclusions from consolidation groups at individual subsidiary level. Third, Japan adopted a forced consolidation regime following the US institution. Thus, both inclusions and exclusions behaviors are relevant theoretically in the context of Japan. Fourth, evidence on income shifting among affiliated corporations (Gramlich, Limpaphayom, and Ghon, 2004; Onji and Vera, 2010) leads us to anticipate the importance of tax avoidance consideration in corporate groups’ decision making processes in Japanese groups. Last, this tax reform in one of the world’s largest economies provides a good sample size.

The empirical analysis addresses threats to internal validity arising from the research setting without an experimental control. First is the non-randomness in the filing of a consolidated tax return. Firms decide on whether to opt in to file consolidated tax returns, so that a simple comparison of adopters with non-adopters would be problematic: unobservable characteristics may cause a firm to adopt this new tax system and to have a higher propensity to adjust its structure. Second is the possible endogeneity in the timing of the 2002 reform: A possibility that policy makers responded to an economy-wide increase in group activities by reforming the group tax system. Thus, the reverse causality is a concern. The empirical strategy addresses

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2This database draws from an annually published directory to meet commercial demand (e.g. assessing credit risks of buyers). This directory provides more details than *Who owns whom*, an international directory.
those threats to internal validity by adopting a difference-in-difference estimation that utilizes the differences in the timing of adoption and the feature of the tax law that discourages consolidation of previously unprofitable subsidiaries.

The data source is biennial subsidiary-level information on about 3,000 domestic corporate groups headed by public companies from 1988-2006. Using about 40,000 subsidiary-time observations on ownership changes in partially-owned subsidiaries, this paper asks whether a systematic difference between adopters and non-adopters on the propensity to become wholly-owned exists. Likewise, the analysis of exclusion examines about 36,000 subsidiary-time observations on ownership changes in wholly-owned subsidiaries.

The result indicates nuanced impacts of the 2002 reform: Corporate groups selectively increased ownership levels in partially-owned subsidiaries to 100 percent—losses carried forward, which are not carried into a consolidation groups under the Japanese tax law, affected inclusion decisions; corporate groups however, did not exclude wholly-owned subsidiaries from consolidation groups to reduce tax liabilities. A benchmark regression shows that among subsidiaries in newly consolidated groups, those with losses carried forward were 3.5 percentage points less likely to become wholly-owned subsidiary. Given the unconditional probability of becoming a wholly-owned subsidiary in the sample is 6 percentage points, this magnitude is substantial. The results are robust to a battery of robustness checks.

Cautions are clearly required in extrapolating findings from a single study and evidence should be accumulated before drawing policy recommendations. With this qualification in mind, the forced consolidation system seems preferable to the optional consolidation from governments' view point since no evidence of tax-motivated exclusions is found and the former is able to raise more revenue.

This study adds to the literature on the tax consolidation of corporate income. The EU proposal on tax consolidation first spurred discussions on its merits and demerits (Devereux, 2004; Hellerstein and McLure 2004; Mintz, 2004; So rensen, 2004). Subsequent investigations analytically compared the welfare properties of separate accounting and tax consolidation in a multi-jurisdiction context (Nielsen,
Raimondos-Moller and Schjelderup 2001; Gé rard, 2005; Kind, Midelfart, Schjelderup 2005; Gresik 2007; Eichner and Runkel, 2011). The present study is unique in offering an empirical analysis and in focusing on a specific design element of a tax consolidation regime.

The empirical literature on tax avoidance have documented a wide array of behaviors under the separate accounting regime: Income shifting by multinational corporations (Grubert and Mutti, 1991) and among domestic corporations (Gramlich, Limpaphayom, and Ghon, 2004); the choice of organizational form (Gordon and MacKie-Mason, 1990; MacKie-Mason and Gordon, 1997); corporate splitting (Goolsbee and Maydew, 2002; Onji, 2009). Much is yet to be documented for tax avoidance in the consolidation regime. The understanding of tax avoidance sometimes leads to surprising insights into the nature of tax incentives. This paper extends previous literature by examining a type of behavioral response that has not yet received sufficient attentions in the past.

The remainder of this paper is organized as follows. Section I describes the Japanese-style Consolidated Filing System in a comparative perspective. Section II develops a model of managerial decision making with an aim to articulate the mechanics of tax incentives. Section III discusses data used in analysis. Section VI presents an empirical analysis of inclusion and exclusion decisions. Section V concludes.

A tax consolidation in a multi-jurisdictional context requires the formula apportionment, which is a mechanism to allocate tax revenues to different jurisdictions. These theoretical studies chiefly examine the distortion in real activities arising from formula apportionment in the tradition of Gordon and Wilson (1986).

Cullen and Gordon (2007) predict a rise in personal income tax rates increases entrepreneurial risk taking. The income shifting between personal and corporate tax bases is central to their theory.
I Institutional details

In June 2002, the Japanese legislature passed the law on the consolidated filing (CF) of national corporate income tax (CIT). The law introduced an option to file a consolidated tax return from the financial year ending in March 2003. When the Japanese Government's Tax Commission first considered CF in 1996, the advice was against the adoption of CF. Then, other fields of corporate laws, such as the Commercial Law, lacked the notion of a group as a unitary entity, and the Commission preferred to maintain the consistency of tax law with other areas of law. By 2001, the legal environment had become conducive to tax consolidation: the consolidated financial report became mandatory; an amendment to the Commercial Law enforced in 2002 facilitated corporate splitting; amendments to the Anti-Monopoly Law were being considered. The reminder of this section compares the Japanese-style Consolidated Taxation System with institutions adopted in other countries (Table I).

A The types of group tax regimes

An alternative to CF is a system to transfer group losses. In UK, for instance, a loss made by one corporation offsets a taxable income made by another corporation belonging to a 75-percent-owned group. The group loss-transfer system would had been an extension to the pre-2002 Japanese Corporate Income Tax, which already had implicit allowance for group loss transfer. This old system was preserved in the

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7A subsidized loan, for example, from one group-company to another was treated as charitable donation for tax purposes, and charitable donation is deductible up to a limit under the Japanese CIT.
2002 reform, allowing non-consolidation groups to continue offsetting losses in this way, unlike Australia where lawmakers repealed a loss transfer system at the introduction of a consolidated return in July 2002. Ting (2010) argues that the repealing of loss transfer system is responsible for a high adoption rate of CF in Australia. The Japanese adoption rate remains low: By the 2008 tax year, only 772 corporations, or 0.028 percent of all corporate tax filers, had adopted CF. Adopters do account for a large segment of the economy; together those 772 corporations paid 3.6 percent of the total amount of corporate income tax in that year.

B Group demarcation

Typically, consolidation regimes are optional (Table I). Corporate groups that do not elect to be taxed under a CF regime file separate tax returns for each member. The ownership thresholds above which a group consolidate incomes (or transfer losses) vary, ranging from 50 percent in Germany to 100 percent in Japan and Australia. Concerns about putting minority shareholders at disadvantage led to the policy choice of 100 percent in Japan. Japan and Australia, both of which are relatively late introducers, followed the US model of forced consolidation. The forced consolidation regime automatically consolidates all domestic subsidiaries with ownership exceeding a statutory threshold, once a group elects for consolidation. The French system in contrast gives an option to select subsidiaries to consolidate. A potential disadvantage of the forced consolidation regime is the distortion in ownership levels for corporate groups that artificially exclude subsidiaries from a consolidation group. Such behavioral response is not a concern in the French system that gives flexibility over the choice of consolidation groups.

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C The treatment of losses carried forward

The key tax disadvantage of the Japanese CF had been the treatment of previous losses until the 2010 amendment to the tax law. Prior to the 2010 amendment, the Japanese tax law allows separately filing corporations to carry forward losses for 5 years under SA, but cancels the losses of subsidiaries from pre-consolidation periods under CF. A parent company can carry forward its own losses under CF. This provision is relatively stricter than other countries which allows group to carry pre-consolidation losses up to limit. Japanese policy at the time of designing CF were evidently concerned with the fact that roughly half of joint-stock companies in Japan reported tax losses, and the anti-avoidance consideration led to this strict policy choice (Hirakawa, 2002). This measure was unpopular among businesses: Ohkura (2004) reports that 86 percent of traded companies he surveyed found this limit on loss carry to be a discouragement in adopting CF. The flagship change in the 2010 amendment brought in the treatment of losses in line with the French system.
II Theoretical Analysis

How does an option to file a consolidated tax return affect the structure of corporate groups? How does the firm’s decision on the ownership level compare to the choice under a separate accounting regime? This section aims to develop a simple model of a corporate group to analyze the tax motive in adjusting an ownership stake a company holds in another company. The scope is to articulate the mechanics of tax incentives generated by CF in a single jurisdiction and to illustrate the key trade-off involved in the decision to adjust ownership for tax purposes.

The primary tax benefits of CF relative to separate accounting (SA) arise when the return to investment is uncertain. The model thus considers the choice of ownership under uncertainty, and here, I focus on the decision to undertake a risky joint venture. A wide array of economics and non-economic considerations potentially affect an ownership stake a company holds in another company: Ensuring incentives among parties involved in a joint venture; business history of owner-managed company; bargaining power between joint venture partners; legislative restriction on cross holding, to name some. These considerations would be important in practice, but the scope here is to highlight tax incentives generated by CF.

Why do firms operate a wholly-owned subsidiary rather than internalizing production by directly owning production assets? By internalizing a wholly-owned subsidiary, firms avoid the issue with SA while not incurring compliance costs under CF. One reason is negative synergy; a wedding services business is better operated as a separate entity from a gas company, for example. The discussion below assumes economic reasons for maintaining a separate legal entities.
A  The manager’s decision

The model assumes a corporate manager, whose interest is in limiting risk exposure, decides on the amount of ownership interests, \( s \in [0,1] \), in a risky venture. S/he also chooses a method of filing a tax return: a separate accounting regime \((R = 0)\) or a consolidated filing regime \((R = 1)\). The objective function is,

\[
\max_{\{s, R\}} E[\pi^a(x_1, x_2, s, R)] - \frac{\theta}{2} \text{Var}[\pi^a(x_1, x_2, s, R)].
\]  

(1)

where \( \pi^a(.) = x_1 + sx_2 - T(x_1, x_2, s, R) \) is a random before-tax profit of a parent with a mean \( \mu_1 \) and a variance \( \sigma_1 \). Likewise, \( x_2 \) represents a random before-tax profit of a subsidiary with a mean \( \mu_2 \) and a variance \( \sigma_2 \). This two-entity model implicitly allows for multiple subsidiaries, since the model captures a piecewise decision to adjust ownership under a forced consolidation regime. \( \pi^a(.) \) represents an after-tax group-profit, which is the sum of a parent profit and a subsidiary profit, weighted by a ownership stake, minus the tax.\(^9\)

\( T(.) \) represents a tax function. Under CF with forced consolidation of wholly-owned subsidiaries, this function takes the following form.

\[
T(x_1, x_2, s, R = 1) = \begin{cases} 
\tau \max(x_1 + x_2, 0) + c & \text{if } s = 1 \\
\tau [\max(x_1, 0) + \max(sx_2, 0)] & \text{if } s < 1 
\end{cases}
\]

(2)

If the parent company opts in to file a consolidated return and if its subsidiary is wholly-owned, a tax liability is based on a combined group income, which is the

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\(^9\)In this formulation the parent company bails out large losses incurred by the subsidiary in proportion to the degree of its ownership stake so that owners’ liability is not limited to the initial investment even if the subsidiary is a limited liability corporation. This assumption of an implicit guarantee is sensible in the Japanese context where a parent company and its ‘child companies’ typically share a corporate identity.
sum of profits/losses generated by the parent and its wholly-owned subsidiary. \( \tau \) is the corporate tax rate. If the ownership interests in the subsidiary are less than 100 percent, the separate accounting applies, and a tax liability is based on entity-level incomes.

The model incorporates composite costs, \( c \), of filing a consolidated return. CF can increase compliance costs of tax filing since the system is complex. CF in practice may add documentation requirements: the Japanese corporations pay local income taxes separately on individual entity-level income even if they belong to consolidated groups for the national CIT, so a consolidated return is an additional paperwork to what corporations would have completed under SA. This said, disregarding intra-group transactions for tax purposes would save effort selecting appropriate transfer pricing (Mintz, 2004).\(^{10}\) Tax disadvantages may arise from differences in tax bases between SA and CF. One important determinant of a tax base is the treatment of accumulated losses as discussed. Since a consolidation erases any losses carried forward in subsidiaries, \( c \) includes the amount of losses carried forward. Another determinant is the preferential treatment of small corporations such as the progressivity in corporate tax schedule, a larger deductibility of entertainment expenses, and small business tax credits, to name some. \( c \) also captures any losses of those tax advantages.

If the parent company does not opt in for tax consolidation, then SA applies regardless of the ownership level.

\[
T(x_1, x_2, s, R = 0) = \tau [\max(x_1, 0) + \max(sx_2, 0)] \quad \text{for } \forall s \tag{3}
\]

\(^{10}\)However, under the Japanese tax regime, consolidated groups must apply the arm’s length principle in their intra-group transactions. Further, intra-group contributions, such as subsidized loans, are not deductible for tax purposes under the CF regime. These restrictions add to the composite costs of filing a consolidated return.
SA also applies if the consolidation regime is not available. This formulation abstracts from group loss offsets and the possibility of income shifting between entities for simplicity. The same tax rate applies for SA and CF as usually practiced.\textsuperscript{11}

I use a mean-variance utility function for mathematical convenience, adopted from a model of entrepreneurial risk taking considered by Cullen and Gordon (2007). $\theta$ represents the manager’s degree of risk aversion.

\section{The properties of tax consolidation}

As is well understood by practitioners, the key advantage of CF over SA, from a tax filer’s point of view, is smaller tax bases in case some group members are making losses while other members are making profits. Analytically, consider the difference in expected after-tax profit under CF and SA when $c = 0$. For comparability, the subsidiary is wholly owned by its parent under the two regimes. An appendix derives the difference, expressed as the below, to be non-negative.

\begin{equation}
E(\pi^{CA}) - E(\pi^{SA}) = E(T^{CA}) - E(T^{CF}) = \tau \left\{ \int_{-\infty}^{0} [x_1 F_2(-x_1) - F_1(x_1) dx_1] f_1(x_1) dx_1 \right. \\
+ \int_{-\infty}^{0} [x_1 F_2(-x_1) - x_1 - \int_{0}^{x_2} f_2(x_2) dx_2] f_1(x_1) dx_1 \right\} \geq 0 \tag{4}
\end{equation}

$f_i(x_i)$ and $F_i(\cdot)$ represent $x_i$’s probability density function and cumulative density function respectively. The first integral in the curly brackets represents tax savings

\textsuperscript{11}The tax rate on CF was higher for two years following the introduction of the CF in Japan to allow for possible budget shortfalls.
from adopting CF in events where \( x_1 \) takes positive values, weighted by the probabilities of these events. The second integral likewise represents savings in events where \( x_1 \) takes negative values. Notice that the tax bases are the same under two regimes if both entities are always profitable or unprofitable. Intuitively, because the tax base is no larger under CF, the expected profit is higher under CF.

A Monte Carlo simulation illustrates the properties of CF. Panel A in Figure 1 examines the expected return as a function of \( \sigma \). The simulation assumes that \( x_1 \) and \( x_2 \) are independent and identically distributed as a normal distribution with mean 50 and an equal standard deviations shown on the x-axis. The tax rate is 40 percent and the compliance cost is zero: \( \{\tau, c\} = \{0.4, 0\} \). The y-axis shows after-tax group-wide returns under CF and SA averaged over 1 million Monte Carlo sample for each \( \sigma \). The expected return under CF is no smaller than those under SA. The differential is larger, the higher is \( \sigma \), since the volatility increases the probability that either entities is making a loss. Thus, the first property of CF is to increase expected profit when returns are sufficiently volatile. Put differently in the language of Cullen and Gordon (2007), CF provides a tax subsidy to undertake risky ventures relative to SA.\textsuperscript{12}

Panel B examines the variance of group returns under the two tax regimes from the same sample. The variance under CF is no larger than those under SA.\textsuperscript{13} The

\textsuperscript{12}The degree of a tax subsidy also depends on the covariance of returns. A stronger negative covariance reinforces the tax subsidy since the chance of income offset across affiliates is higher. The tax subsidy of CF is zero when returns of a parent and its subsidiary are perfectly correlated.

\textsuperscript{13}One can construct a counterexample in which the variance of return is higher under CF than SA. Suppose that a set of possible outcomes for two entities is \( \{10, -10\} \) with corresponding probabilities of \( \{0.5, 0.5\} \). With a tax rate of 40 percent, the variance or after-tax return is 3.1 percent higher under CF. In a simulation with a realistic distribution of returns, I found that the variance of return to be lower for CF. I approximated an empirical distribution of accounting profit with a lognormal distribution using the data on the mid ninety percentile of the 2006 sample (with an appropriate adjustment in the support
government thus shares more risk with the firm under CF. The reduction in variance represents risk sharing that Cullen and Gordon (2007) refer to in the context of taxes faced by entrepreneurs.

Within-group correlations in returns affect the relative advantage of CF. Panel C shows a Monte Carlo simulation that generated before-tax returns of two group companies from a bivariate normal distribution with an equal mean of 50, an equal standard deviation of 50, and correlation coefficients shown on the x-axis. The y-axis shows average after-tax group-wide returns under CF and SA. The relative advantage of CF is high (low) with negatively (positively) correlated returns. Intuitively, a negative correlation in returns implies that one company is more likely to be making a loss when the other is making a profit, so that the CF has a smaller tax base than the SA. With a perfectly positive correlation, tax liabilities are the same under the two tax regimes.

The number of group members also affect the overall level of tax saving from CF. A simulation in Panel D generated before tax returns from multivariate normal distribution with an equal mean of 50, an equal standard deviation of 50, zero correlation, and the number of group members shown on the x-axis. The y-axis shows the average across a given Monte Carlo sample of an after-tax return per member under CF and SA. The sample size is one thousand. On average two lines are parallel to each other, indicating that total tax savings under CF being roughly in proportion to group sizes. The sample averages exhibit ‘noises’ for smaller group sizes. This higher variability for smaller groups reflects a stronger influence of abnormal returns on sample average in small groups.

so that all values are positive). I then randomly generated two sets of 10,000 observations, representing $x_1$ and $x_2$, with the mean and variance of the approximated lognormal distribution, and computed after-tax returns. Compared to SA, CF had a 4-percent larger mean return and a 1.6-percent smaller variance.
C The optimal ownership

To obtain the solution to the manager's optimization problem, consider first the sub-problem for the range of ownership interests \( s \in [0,1] \). As shown in the appendix the first order condition simplifies to,

\[
\hat{s} = \frac{\mathbb{E}(\pi_2^{SA}) - \theta \text{Cov}(\pi_2^{SA}, \pi_1^{SA})}{\theta \text{Var}(\pi_2^{SA})},
\]

for an interior solution. If \( x_1 \perp x_2 \), then \( \text{Cov}(.) = 0 \) and the optimal ownership stake is simply the ratio of the subsidiary's expected after-tax return and its variance of after-tax return, weighted by the coefficient of risk aversion (\( \theta \)). All else constant, the optimal ownership interest is higher, the higher is the expected profit of the subsidiary. The ownership interest is lower, the higher is the volatility of subsidiary profits. A positive (negative) covariance of \( x_1 \) and \( x_2 \) decreases (increases) \( \hat{s} \), since the volatility of group profits increases (decreases) for a given level of \( s \).

Denote the objective function as \( EU(s) \). The global optimum of \( s \) is

\[
\sigma^* = \begin{cases} 
1 & \text{if } EU(1) > EU(\hat{s}) \& EU(1) > EU(0) \\
\hat{s} & \text{if } EU(\hat{s}) > EU(1) \& EU(\hat{s}) > EU(0) \\
0 & \text{if } EU(0) > EU(\hat{s}) \& EU(0) > EU(1) 
\end{cases}
\]

To evaluate the effects of a regime shift from SA to CF on the ownership pattern, Panel A of Figure 2 shows the optimal ownership stakes as a function of \( \sigma \), assuming \( x_1 \perp x_2 \), \( X_i \sim \mathcal{N}(10, \sigma) \) and \( \{\tau, c, \theta\} = \{0.4, 0.0.2\} \). For the ease of interpretation, the x-axis shows the probability of negative entity-level returns for a given level of \( \sigma \). As a benchmark, the dotted line shows the case without tax. For a probability of losses below 8 percent, a manager takes on the full ownership while
preferring joint ventures beyond that point. The full ownership range is greater under SA compared to the no-tax benchmark: a smaller variance in after-tax profit led to more risk being taken. The tolerance for risk increases further under CF due to the risk sharing and risk subsidy mechanism. Thus, in the absence of composite costs, the theory predicts that medium risk ventures will have ownership stake increased to 100-percent when CF becomes available.

The advantage of CF over SA is lost if the composite costs are sufficiently high and outweigh benefits arising from the risk sharing and risk subsidy mechanisms. In this case, wholly-owned subsidiaries may have ownership stakes reduced so that they are excluded from a consolidation group. Panel B examines the amounts of composite costs that make the manager indifferent between CF and SA. The costs are presented in terms of percent of pretax group return. The break-even costs is nonzero and initially increasing in $\sigma$, peaking at 4.6 percent when the probability of losses is about 13 percent, and declines subsequently to zero beyond the loss probability of 19 percent. When the loss probability is 2.3 percent, the break-even costs are only 0.4 percent of the pre-tax return at the group level. That is, CF has little advantage if return is consistently positive. Some volatility in outcome increase the break-even costs since CF provides a tax subsidy. With large volatility, no costs are tolerable since the venture is too risky to warrant investment. Without knowing the amount of composite costs, the behavioral impacts of an introduction of CF are an empirical question. For a moderately high composite costs, we would expect a firm to remain SA in case when the return is not volatile. The model focused on a two-entity case but if a firm opted in for CF the ownership of low-risk subsidiaries may be reduced so as to exclude them from a consolidated group.
III Data

A Data sources

I constructed data from three sources. First is a list of CF adopters compiled by a consulting company, Partners Inc., based on their review of securities report filers.\textsuperscript{14} Securities reports contain notes indicating the adoption of a consolidated filing for the reporting year (and also the previous year). All traded corporations, and some large non-traded corporations, must file securities reports. 243 companies filed CF as at the financial year ending between May 2008 and April 2009, according to Partners' list. Since this list does not contain information on the timing of CF adoption, I focused on 234 traded companies, and searched past securities reports for the first years from which those companies adopted consolidated return. I located exact information for 221 companies and narrowed the adoption years down to two years for 4 companies.

Second, I matched the adopter list to information on subsidiaries obtained from the Affiliated Company Data (ACD) published annually by Toyo Keizai. ACD is a directory of corporate groups, containing information on domestic affiliated companies of traded and large non-traded companies. Biennial data covering FY1988-2006 is available for this research. Third, financial information on parent companies was drawn from unconsolidated financial statements contained in Nikkei's NEEDS-DVD. The appendix describes the protocol for matching companies across ACD surveys.

\textsuperscript{14} http://www.shinnihon.or.jp/knowledge/account_co/account/opinion/35/story/01.html, accessed April 19, 2010.
B A description of key variables

Table II reports the timings of adoption by calendar years. The number of adoption is the highest in 2002, halves in 2003, and temporarily increases in 2004 and 2005. The 2004/5 hike is attributable to the end of a 2-percent surcharge on consolidated filers on the two years following the 2002 reform and to a change in the treatment of experiment and research expenses.

Table III reports summary statistics for FY2006, the last sample year, comparing adopters to non-adopters. A systematic difference between groups emerges from Table III. First, the group of adopters is substantially larger by various metric: the number of subsidiaries in a group, total paid-in capital of subsidiaries, total number of workers at subsidiaries, total sales volume of subsidiaries, parent's asset, parent's sale, or parent's gross profit. This size differential could have arisen from fixed costs of learning tax codes. Second, the adopters tend to be more diverse by various metric. HHI is the Herfindahl–Hirschman Index (HHI) constructed for industry classification of group companies. If all group companies belong to the same industry, HHI equals 1, which is the maximum value for the index.\(^{15}\) HHI for an average adopter is lower, indicating that an average adopter is less 'concentrated,' or operates in a larger numbers of industries.\(^{16}\) Subsidiaries of the adopters are also less likely to share industry codes, to headquarter in the same prefecture, or to share the same area code as their parents. Last, the adopters' subsidiaries tend to share the same cycle of fiscal years as parents, probably reflecting the requirement of CF.

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\(^{15}\) The industry classification in ACD is close to the SIC 1-digit for all industries except Manufacturing, Finance, and Services (in the 2-digit level).

\(^{16}\) This observation holds when HHI is re-defined as the sum of squared shares of total paid-in capital in an industry. I have tried including and excluding parent companies in constructing this paid-in-capital-weighted HHI to assess sensitivity, since parents are disproportional large compared to their subsidiaries.
Panel A, Table IV shows a comparison of the incidence of ownership changes at the commencement of tax consolidation with `all others.' In addition to non-adopters, the `all others' category includes (eventual) adopters in years prior to the commencement, and years after the initial filing year. Thus the focus here is on behavioral responses just prior to filing a consolidated return. The first row shows the fraction of partially-owned subsidiaries at time \( t - 1 \) that had ownership stake increased to 100 percent by time \( t \). The adopter group has a higher incidence (12 percent) than the non-adopter group (6 percent). The difference is significant at the 1-percent level. The second row shows the fraction of wholly-owned subsidiaries at time \( t - 1 \) that had ownership stake reduced by time \( t \). The adopter group has a higher incidence (3 percent) than the non-adopter group (2 percent). The difference is not as salient as above but is statistically significant. Panel B focuses on the ownership change subsequent to the initial adoption. Here, the `all others' category excludes subsidiaries of newly adopted groups. The pattern is similar, except the difference in the incidence of inclusion is smaller.

These patterns may indicate behavioral responses, but may reflect the different characteristics of adopters and non-adopters: Larger groups, which tend to adopt CF, may in general engage more actively on restructuring.

C Sample selection

The rest of the analysis examines samples constructed by dropping following types of observations. First is the financial groups that undergo substantial structural changes during the sample period. Second is the groups headed by non-traded parent companies which lack sufficient information for analysis. Third is subsidiaries with no prior-year data on holding levels which are necessary to observe changes in holding levels. This category includes the entire observations from the first sample year. Fourth is suspected cases of identity mismatch uncovered through a procedure described in the Appendix. Last is those with missing information on any of explanatory variables. This process trimmed the data size to about 40 percent of the original sample size.
IV  Empirical Analysis

A  Inclusion behavior

The theory predicts that, when CF is adopted, the optimal ownership increases to 100 percent for subsidiaries with sufficiently low costs of consolidation. This section examines whether CF affected the decision to increase ownership stake in partially-owned subsidiaries to 100 percent. The empirical approach takes advantage of the differences in the timing of adoption with the following empirical model. The sample consists of partially-owned subsidiaries in \( t - 1 \).

\[
E(UP_{ijt} | X_{ijt}) = F(NEWLYADOPTED_{jt}, PREVLOSS_{it}, \quad (7) \\
PREVLOSS \times NEWLYADOPTED_{jt}, ADOPTERS_{jt}, \text{YEAR}_{it}, \text{Z}_{ijt})
\]

Subscripts \( i, t \) and \( j \) indicate subsidiary, time, and group respectively. \( UP_{ijt} \) is an indicator for an increase in the ownership share to 100 percent between \( t - 1 \) and \( t \) for subsidiary \( i \) belonging to group \( j \). If a subsidiary is wholly-owned in \( t \), this variable takes on the value of 1. The probability of becoming a wholly-owned subsidiary is a function, \( F(.) \), of a vector of covariates \( X \). \( F(.) \) is a cumulative distribution function of the normal distribution.\(^{17}\)

\( NEWLYADOPTED_{jt}\) is an indicator for group \( j \)'s initial year of adopting a CF. This variable has two sources of variation: the tax reform of 2002 and the firm's decision on whether and when to adopt CF. First, the 2002 reform is exogenous to individual firms' decision to adjust ownership interests. However, other areas of corporate laws were changing at the time. If those other policy changes spurred restructuring activities, the coefficient on this variable will confound these non-tax influences. Similarly, the Japanese financial crisis of 1998 might also have affected restructuring activities. To address these concerns, a vector of year dummies,

\(^{17}\)The results were very similar with the logit model.
\( \text{YEAR}_t \), is included to absorb economy-wide shocks. The year dummies absorb any common effects of the CF introduction, so any common effects are not identified in this approach. The identification of tax effects relies on the variation in the timing of adoption by different corporate groups. The omitted category in year dummy is 1990.

Second, the adoption decisions are not random. Firms would introduce CF by weighing tax savings with other considerations. If, for example, larger groups tended to adopt CF due to the scale economies, and also inclined to restructure more frequently, the coefficient on \( \text{NEWLYADOPTED}_{jt} \) will be biased upward. To account for this selection effects, \( \text{ADOPTERS}_j \), an indicator for group \( j \) that adopted CF at any stage, is included to absorb any time-invariant tendency for the group of CF adopters to increase ownership levels to 100 percent. A remaining concern is that some time-variant tendencies influencing the timing of adoption and restructuring decisions. The model thus include a vector of time-varying control variables, \( Z_{ijt} \), to account for those influences.

The key discouragement for adopting CF had been the restriction on loss carry as discussed. We thus expect CF groups are less likely to consolidate for tax purposes subsidiaries with tax credits from previous year losses. If we view the adoption of CF as a `treatment,' in the language of quasi-experimental analysis, the treatment intensity varies by the presence of losses carried forward. To capture this element \( \text{NEWLYADOPTED}_{jt} \) is interacted with \( \text{PREVLOSS}_it \), which is a proxy indicator for the presence of losses carried forward. This variable takes on the value of 1 if the accounting profit from the previous sample year is at or less than zero.

A negative value on interaction effects based on the cross-partial derivative of (7) with respect to \( \text{NEWLYADOPTED}_{jt} \) and \( \text{PREVLOSS}_it \) supports an interpretation that the tax incentives affected the choice of ownership level. Note that the standard procedure in econometric software typically computes marginal effects based on the first derivatives with respect to interaction terms even in non-linear models. As Ai and Norton (2003) have shown, a cross-partial derivative
and a first derivative with respect to an interaction term are analytically different in non-linear models. I report estimates of interaction effects from the procedure developed by Ai and Norton (2003) and from the standard procedure. Since the interacted variables are both indicator variables, the interaction effect is computed as the discrete double difference from the base in both procedures.

A vector of control variables, $Z_{ijt}$, includes the following: $AGE_{it}$ is years since the founding of subsidiary $i$ till the end of financial year. $INITIALCAP_{it}$ is a natural log of paid-in capital of subsidiary $i$. $NETPROFIT\_POS_{it}$ is an after-tax profit of subsidiary $i$. This variable is included to capture the correlation of corporate performances across years, which may confound the interpretation of the coefficient on $PREVIOUSLOSS_{it}$. $NETPROFIT\_NEG_{it}$ is an interaction between $NETPROFIT\_POS_{it}$ and an indicator for an after-tax profit of subsidiary $i$ at $t$ being at or less than zero, and is included to capture possible non-linear effects of current profits.\(^{18}\) Group-level variables control for any systematic differences in restructuring pattern by the size of corporate group: $NUMSUB_{jt}$ is the number of subsidiaries in group $j$; $PARENTASSET_{jt}$ is a natural log of stand-alone assets of group $j$ ’s parent; $PARENTSALES_{jt}$ is a natural log of sales of group $j$ ’s parent. $PARENTGPROFIT_{jt}$ is the gross profit of group $j$ ’s parent.

Control variables include industry and geographical location of subsidiaries and parents. I amalgamated industry classifications of subsidiary $i$ and a parent of group $j$ into 5 categories from underlying data available at the 2-digit level to avoid perfect predictions. Likewise, I amalgamated headquarter locations of subsidiary $i$ and a parent of group $j$ into 6 geographical regions.

\(^{18}\)Accounting for non-linear effects marginally improved the model fit but did not make much difference to the estimated coefficients.
Standard errors are adjusted for corporate group level clustering to account for possible within-group correlation in errors.

B Results

The first two columns in Table V shows the summary statistics of the estimation sample. Of about 40 thousand observations, 6 percent of partially-owned subsidiary becomes wholly-owned. Table VI presents estimates of probit regressions. Column 1 is an analogue to the simple comparison discussed above by just including the indicator for the first-time adoption of CF and a constant. The estimated coefficient on $NEWLYADOPTED_{jt}$ is positive and significant. Again, this result is open to at least two interpretations: Tax avoidance and omitted traits of adopters. Column 2 attempts to distinguish between these explanations by including the indicator for groups that adopted CF and the year dummies. The coefficient on $NEWLYADOPTED_{jt}$ in this model thus has an interpretation of a difference-in-difference estimator. The coefficient on $NEWLYADOPTED_{jt}$ turns insignificant, but as we see from an insignificant coefficient on $ADOPTERS_{jt}$, not because of the omitted traits of adopters. Rather, as the significant coefficients on the later-sample-period year dummies show, $NEWLYADOPTED_{jt}$ in the first specification confounded the influence of year effects. The year dummies show a curious pattern: The levels of upward adjustments are indistinguishable from the base period until 1996, increase from 1998, and remain significantly higher from 2000. This could reflect the influence of the 1998 financial crisis or the move towards consolidated financial reporting in 2000: Corporations adjust structure to improve the appearance of financial statements. On average, newly consolidated groups do not exhibit a pattern consistent with tax avoidance.

Column 3 examines the tax provision on loss carry to see if specific tax incentives affected behavior differently among the group of subsidiaries in consolidated groups. The model adds $PREVLOSS_{jt}$ and its interaction term. The coefficient on
PREVLOSS is positive and significant at the 1-percent level, revealing a tendency for parents to resume full control of loss making subsidiaries. This perhaps represents efforts to improve performance or the fleeing of partners in joint ventures that forces majority partners to cover losses.

The interaction term has a coefficient negative and significant at the 10-percent level. This result confirms a prediction that consolidation groups are unlikely to consolidate subsidiaries with loss carried forward due to the tax disadvantage. This result however permits an alternative interpretation: Some time-varying characteristics of subsidiaries, and of groups, that made losses were correlated with the interaction term.

Column 4 considers this alternative explanation by including time-varying characteristics to the model. The estimated coefficient on the interaction term remains very similar, lending support for interpreting the result as causal. The model fit judged from the pseudo R-squared is reasonable for a model of changes.

To interpret the magnitude of the interaction term, Column 4 presents marginal effects computed by two methods near the bottom of the table. A marginal effect computed by a standard computation package is 2.8 percent with an associated p-value of 0.027. A marginal effect computed with the Ai and Norton's (2003) correction is 3.5 percent with an associated p-value of 0.078. That is, among subsidiaries in newly consolidated groups, those with losses carried forward were 3.5 percentage points less likely to become wholly-owned subsidiary. Given the unconditional probability of becoming a wholly-owned subsidiary in the sample is 6 percentage points, this magnitude is substantial. The estimate suggests that the tax motive exerted a substantial influence on the decision to increase the ownership level to 100 percent.
C Exclusion behavior

We now consider exclusions of previously wholly-owned subsidiaries from a consolidation group. Once again, in the absence of composite costs, theory predicts no exclusion from consolidation groups will occur because CF increases after-tax return and reduces volatility. Some exclusion can occur if composite costs outweigh the benefits of CF.

The present analysis employs the same model as above. Here, the sample consists of subsidiaries that are wholly-owned in $t - 1$. If a subsidiary in this sample is partially owned in time $t$, the subsidiary is classified as an exclusion from a group of wholly-owned subsidiaries. The dependent variable, $DOWN_{ijt}$, is an indicator for a reduction in the ownership share from 100 percent over period $t - 1$ to $t$ for subsidiary $i$ belonging to group $j$. If a subsidiary is partially-owned in $t$, this variable takes on the value of 1. The last two columns in Table V show the summary statistics of the estimation sample. Of 37 thousand observations, 1.6 percent of wholly-owned subsidiaries became partially-owned. Table VI, Column 5-8 presents the result as in the preceding analysis. Column 5-6 shows on average new adopters are no more likely to change the ownership level. This is expected since firms would have adopted CF given benefits outweighed costs: Most of subsidiaries of adopters would have had some tax benefits in consolidation.

Column 7-8 shows that the coefficients on the interaction term of $NEWLYADOPTED_{jt}$ between $PREVLOSS_{jt}$ are not significantly different from zero. This result probably reflects that groups own 100 percent subsidiaries for economic reasons that outweighed the tax benefits of exclusion. One can also speculate that the groups might not have excluded some subsidiaries despite tax disadvantage out of fear that such actions may be viewed by the tax authority as aggressive tax avoidance. Type II error, or false negative, is also a concern: Given the low incidences of downward adjustment in the sample, it is possible that the effects were too subtle to be detected.
D Addressing alternative hypotheses

The result so far suggests that the tax consolidation affects the decision to adjust up the ownership level of partially-owned subsidiaries. This section examines concerns in drawing that conclusion based on the proceeding analysis. The first threat to internal validity is the unobserved time-adopter specific effects. The baseline model does control for time-invariant characteristics of adopters, but does not account for time-varying characteristics of adopters that are not captured by the control variables. Some unobservable shock that affected adopters but not the non-adopters can potentially bias the coefficient on the interaction term between the adoption timing and loss carry. To account for this possible bias, an extended model includes interaction terms between an indicator for adopters and year dummies. Notice that this approach additionally accounts for differential time trends between adopters and non-adopters by allowing those dummies to absorb any trend differentials across groups. Column 2, Table VII reports the interaction effects from the extended model, showing that the main result is robust to this concern.

Second concern is an unobserved time-varying industry effect. The banking industry, while excluded from the sample because of this, offers an example of an industry specific effect. Until the mid-1990s, the Japanese Banking Law restricted banks from owning more than a 5-percent stake in other corporations.\textsuperscript{19} A deregulation removed that ownership threshold in the banking industry, and triggered changes to the level of ownership banks hold in bank subsidiaries. The other industries included in the sample might have undergone regulatory reforms or adoption of new business practice that could bias the results. To see if the time-varying industry

\textsuperscript{19}The exception to this rule applied to subsidiaries that conduct core business activities of parent banks, such as personnel stuffing companies that supplies logistical stuffs to parent banks.
effects influenced the finding, the extended model further incorporates interaction terms between parent's industry dummies and time dummies (Column 3). The result on the coefficient of interests is still intact.

Third concern is the unobserved changes in size-specific effects. The baseline model assumes that the effects of group size are time-invariant. More active restructuring of underperforming subsidiaries by larger corporations in the latter sample period, perhaps in reaction to the financial crisis, can bias the coefficient on the interaction term. To address this concern, the extended model in Column 4 adds interaction terms between parent's asset size and year dummies to the above specification. This specification accounts for the time varying size effects by allowing coefficient on that financial variable to have time-varying component. The result is intact and no apparent trend is found.

E The effects of small business concessions

Another tax disadvantage of CF is the loss of preferential tax treatment for small subsidiaries. If a head of a consolidation group is a large corporation with paid-in capital above 100 million yen, the tax rules for large corporations apply in computing its consolidation group's tax base. Until the 2010 tax amendment, most of the tax rules under SA are agnostic about group affiliation, so that no distinction is made between a small stand-alone corporation and a subsidiary of a large national corporation (Onji & Vera, 2010). Reductions in tax base, such as a favorable treatment of entertainment expenses, are lost once a small subsidiary joins a consolidation group.

To see if small business concessions influenced inclusion and exclusion decisions, one would augment the empirical model with an interaction term between an indicator for small business and that for adoption. However, computing a proper marginal effects on the additional interaction term is a complex problem. Following Ai and Norton (2003), I replaced the indicator for loss carry with an indicator for paid-in capital at or less than 100 million yen. 100 million yen in paid-in capital is the typical size threshold determining eligibility for various policy concessions.
targeting small businesses. The indicator for loss carry itself is retained in the model. Note that the right-hand-side variables in the baseline model includes log of paid-in capital. Thus, a coefficient on the small-company indicator captures nonlinear effects of subsidiary size. The coefficient on the interaction term between the small-company indicator and the new-adopter indicator captures the effects of the small business concession at the commencement of CF. The effects on inclusion is expected to be negative, while the effects on exclusion is expected to be positive.

Column 5 and 6 in Table VII present the results. For the inclusion regression, the estimate of the interaction effects is negative but insignificant by either ways of evaluating the interaction effects. The two evaluation methods do not agree in the result from the exclusion regression. The estimate is negative and significant at the one-percent level under the conventional evaluation method, but is not significant after correction. A reliance on the conventional method would have led to a misleading conclusion in this case. Thus, preferential treatment for small businesses did not influence the restructuring decisions of adopters. This result suggests that the value of small business concessions is at or less than the benefits from tax consolidation.

F Post-adoption behavior

So far the analysis has focused on the behavior of firms when they have just adopted CF since the adoption decisions are most likely accompanied by adjustments on group structures to minimize tax burdens. Firms may not include or exclude subsidiaries in a similar manner after the adaption decision had been made. Firms may for instance be concern that any ownership adjustments will alert the tax authority during tax audit.

I have separately examined post-adoption decisions on inclusions and exclusions. Table VIII presents estimated marginal effects from the benchmark model. The samples exclude subsidiaries in groups that have just adopted CF, so that the post-adoption dummy captures the effects relative to non adopters. For inclusion decisions, the interaction term with the previous loss indicator is not statistically
significant under both evaluation methods (Column 1). The interaction term with the small corporation indicator is significant under the conventional method but is not significant with the Ai and Norton correction (Column 2). For the exclusion decision, the interaction term with the previous loss indicator and that with the small corporation indicator is not statistically significant under both evaluation methods (Column 3 and 4). These results together indicate that once firms adopted CF they did not alter structure for the purposes of CF.

V Conclusion

The behavioral implication of ownership demarcations in a tax consolidation regime is a recurring policy question: To what extent do corporate groups adjust their group structure to minimize tax burdens? This paper documented for the first time the inclusions of subsidiaries to, and their exclusions from, groups of wholly-owned subsidiaries in response to a consolidated income tax, drawing from the Japanese experience. The result indicated a nuanced impact: Corporate groups selectively increased ownership levels in partially-owned subsidiaries to 100 percent---losses carried forward, which are not carried into a consolidation groups under the Japanese tax law, affected inclusion decisions; corporate groups however did not exclude wholly-owned subsidiaries from consolidation groups.

What is the external validity of this finding based on the Japanese tax system? Aside from any international differences in anti-avoidance rules and their implementations, the fact that selected few Japanese groups opted in for a tax consolidation would limit the direct extrapolation of the results to other countries. The adopters in Japan tend to be larger corporations, and perhaps a fear of attracting penalty, with a collateral damage on corporate reputation, resulted in the lack of exclusions, which would appear as an aggressive tax avoidance. Evidence from other settings would help assess the external validity of the results, especially the conclusion regarding the lack of exclusion. The generalizability of the results in this paper remains an interesting research question.
What are policy implications of the results? With the aforementioned qualifications in mind, the results suggest that the forced consolidation regime may not result in artificial reductions of ownership levels, leaving it equivalent, in terms of behavioral consequences, to the optional consolidation regime under which groups themselves decide on the group demarcation within a restriction on a minimum ownership threshold. If either do not induce any more inefficiency than the other then the forced consolidation system would be a preferred policy option for the purpose of raising more tax revenue.
Appendix

A. The expected profits under CF and SA

This section outlines the derivation of equation (4) which is the expression for the
difference between an expected profit under SA and that under CF. Consider three
ranges of parent's before-tax profit \((x_1): (-\infty, 0), [0], (0, \infty)\). The following
shows the expected tax base under two regimes for these three cases.

A.1. Case 1. The positive parent profit: \(\bar{x}_1 \in (0, \infty)\)

Under SA, all the parent's profit is taxable given positive profit. The subsidiary's
profit is taxable when the profit is positive. By weighing subsidiary's outcomes of
positive profits with probabilities of those outcomes, the expected tax base under SA
in Case 1 is,

\[
\bar{x}_1 + \int_{0}^{\infty} x_2 f(x_2) dx_2. \tag{A1}
\]

Under CF, profits are taxable when \(\bar{x}_1 + x_2 > 0\). Since the tax base on combined
income is 0 if \(x_2 \leq -\bar{x}\), the expected taxable income under CF in Case 1 is,

\[
\int_{-\bar{x}_1}^{\infty} (\bar{x}_1 + x_2) f(x_2) dx_2. \tag{A2}
\]

To obtain the difference between an expected tax base under SA and CF, first
rewrite A2.

\[
\int_{-\bar{x}_1}^{\infty} \bar{x}_1 f(x_2) dx_2 + \int_{-\bar{x}_1}^{\infty} x_2 f(x_2) dx_2
= \bar{x}_1 [1 - \Phi_2(-\bar{x}_1)] + \int_{0}^{\infty} x_2 f(x_2) dx_2 + \int_{-\bar{x}_1}^{0} x_2 f(x_2) dx_2 \tag{A3}
\]
Thus, the difference between A1 and A2 is,

\[ \bar{x}_1 F_2(-\bar{x}_1) - \int_{-\bar{x}_1}^{0} x_2 f(x_2)dx_2 \geq 0. \]  \hspace{1cm} (A4)

The inequality follows since \( 0 \leq F_2(.) \) from the property of a c.d.f. and \( x_2 \) is being integrated over its negative range. Thus, tax bases under SA is no smaller than those under CA for any positive parent profits.

**A.2 Case 2. Negative parent profit: \( \bar{x}_1 \in (-\infty, 0) \)**

Under SA, the parent pays no tax when making a loss, but the subsidiary's profit is taxable when the profit is positive as before. The expected tax base under SA in Case 2 is,

\[ \int_{0}^{\infty} x_2 f(x_2)dx_2. \]  \hspace{1cm} (A5)

As above write the tax base under CF as,

\[ \bar{x}_1 [1 - F_2(-\bar{x}_1)] + \int_{-\bar{x}_1}^{\infty} x_2 f(x_2)dx_2. \]  \hspace{1cm} (A6)

Note that \( -\bar{x}_1 > 0 \). Thus, the tax base is positive only when \( x_2 \) is high enough to offset parent's loss. The difference between A4 and A5 is,

\[ -\bar{x}_1 [1 - F_2(-\bar{x}_1)] + \int_{0}^{-\bar{x}_1} x_2 f(x_2)dx_2 \geq 0 \]  \hspace{1cm} (A7)
The first term in A7 is positive since \(-\bar{x}_1 > 0\) by assumption and \(F_2 \leq 1\) by the property of a c.d.f. The second term is positive since \(x_2\) is integrated over its positive range. Thus, tax bases under SA is no smaller than those under CA for any negative parent profits.

A.3 Case 3. Zero parent profit: \(x_1 = 0\)

Clearly the tax base is identical under two regimes: 
\[
\int_0^{\infty} x_2 f(x_2) dx_2.
\]

A.4 Expected difference between SA and CF

The expected difference in the tax bases over the entire range of parent profit is,

\[
\int_0^{\infty} [x_1 F_2(-x_1) - \int_{-\infty}^{x_1} x_2 f(x_2) dx_2] f(x_1) dx_1 + \int_{-\infty}^{0} \{-x_1[1 - F_2(-x_1)] + \int_{0}^{-x_1} x_2 f(x_2) dx_2\} f(x_1) dx_1.
\]

This expression is non-negative given the proceeding discussion.

B The derivation of the first order condition

Denote, for Company \(j\), an expected after-tax profit as \(\bar{\pi}_j\), an expected before tax profit as \(\mu_j\), an expected tax payment as \(\bar{T}_j\). First note that the variance of after-tax group profit is,

\[
\begin{align*}
Var(\bar{\pi}) & = E[(\pi_1 - \bar{\pi}_1 + s\pi_2 - \pi_2)^2] \\
& = E[(\pi_1 - \bar{\pi}_1)^2] + s^2E[(\pi_2 - \bar{\pi}_2)^2] + 2sE[(\pi_1 - \bar{\pi}_1)(\pi_2 - \bar{\pi}_2)].
\end{align*}
\]
A corner solution at $s = 0$ ($s = 1$) arises when, for example, $\mu_2$ is sufficiently small (large). For an ease of exposition, assume for a moment an interior solution to focus on solutions at the intermediate range. The corner cases are dealt within the text.

The first order condition of the firm’s maximization problem with respect to $s$ is,

$$\mu_2 - \frac{\bar{T}_j}{\theta} - \frac{\theta}{2} \left\{ 2sE[(\pi_2^0 - \pi_2^0)^2] + 2E[(\pi_1^0 - \pi_1^0)(\pi_2^0 - \pi_2^0)] \right\} = 0$$

$$\implies E(\pi_2^0) - \frac{\theta}{2}[2s\text{Var}(\pi_2^0) + 2\text{Cov}(\pi_1^0, \pi_2^0)] = 0$$

$$\implies \hat{s} = \frac{E(\pi_2^0) - \theta\text{Cov}(\pi_1^0, \pi_2^0)}{\theta\text{Var}(\pi_2^0)}.$$
The protocol for matching observations across survey

The first step of matching subsidiaries across ACD surveys is matching parent. The main identifier for matching parent companies across ACD surveys is the securities code. The Stock Exchange does not recycle codes of previously listed corporations in principle. The securities code is thus an appropriate matching variable for traded companies. The exception to this Stock Exchange’s rule is for corporations delisted at and before 1993. I found only one mismatch due to this reason and deleted that group. ACD assigns original codes to non-traded companies which do not have securities code. Those original codes are mostly consistent except for insurance companies; the original codes assigned to insurance companies, which were private in earlier surveys but subsequently became public, were matched to securities codes used by other financial companies in the 2000s. To avoid complications, non-traded companies were excluded. Also excluded are all financial companies.

To ensure further accuracy in matching with the securities code, I checked corporate names of companies matched across ACD surveys for any inconsistency in names. Name changes and other innocuous factors (e.g. a change in data entry protocols across years that treat spaces between names differently) can misclassify accurately matched companies as a `mismatch.' To allow for these considerations, those with the same founding date or the same telephone number were classified as a `match.'

The second step uses the information on parents to match subsidiaries. The group company identifier contained in ACD is unique to each subsidiary and is not recycled once subsidiary vanishes from a group. Subsidiaries were matched across years using the securities codes and the group company identifier. To ensure the accuracy in matching, I implemented the procedure outlined above.

Finally, ACD and NEEDS are matched using the Securities Code.
References


Table 2

The Adoption of Consolidated Tax Filings by Public Corporations

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<th>2002</th>
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<th>2004</th>
<th>2005</th>
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<tr>
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<td>28</td>
<td>38</td>
<td>52</td>
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<td>Percentage</td>
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<td>13.3</td>
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<td>7.3</td>
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Notes: Based on author's examination of financial reports. The list of adopters is as reported by Partners Inc.

Table 1

International Comparison of Group Tax Systems

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<th>Type</th>
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<th>Japan</th>
<th>Australia</th>
<th>Germany</th>
<th>England</th>
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<tr>
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<td>Consolidation</td>
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<td>STRY Rule</td>
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<td>Not allowed in</td>
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Notes: Reproduced from Hirschmann (2002: 39). The column for Australia is by this author.
Table 3
Comparison of Adopters and Non-adopters: FY2006 Data

<table>
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<th>Subsidiary Characteristics</th>
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<th>NON-ADOPTERS</th>
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<td>Std. Dev</td>
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Table 4
Simple Comparison of Ownership Adjustments

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<td>0.0202</td>
<td>0.0097 **</td>
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Note: ** indicates significance at the 1-percent level in a two-sample test of difference in proportion.

Table 5
Summary statistics: Estimation Sample

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<td>Wholly Owned in t-1</td>
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N                      | 40,361         |           | 37,496           |                       |          |

Notes: Standard deviations in parentheses.
### Table 6
Probit Regressions of Ownership Changes on CF Adoption

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**Ind. & Region dummies**

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N: 40,361 | 40,361 | 40,361 | 40,361 | 37,496 | 37,496 | 37,496 | 37,496 |
LL: -9108 | -8759 | -8713 | 8538 | -3088 | -3075 | -3033 | -2048 |
Pseudo R squared: 0.0005 | 0.0343 | 0.0438 | 0.0630 | 0.0003 | 0.0046 | 0.0190 | 0.0455 |

Notes: **p<0.01, *p<0.05, +p<0.1. Robust standard errors adjusted for corporate group level clustering in parentheses. P-values are in squared brackets.
Figure 2
The Determinants of Ownership Interests in Risky Ventures

A: The Optimal Ownership Share by the Tax System

B: Break-Even Net Non-tax Costs as a Percentage of the Mean of Pre-Tax Return

Note: Author's computation. The following parameter values were assumed in this simulation: \( \{b, m\} = \{0.1, 10\} \). See text for details.
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