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EMPIRICAL EVIDENCE ON THE IMPACT OF RECENT KOREAN TAX REFORMS

Abstract

In 2011, Korea required all firms to report all value added tax (VAT) invoices electronically to tax authorities. This unique law provided a natural experiment to examine the effects of this disclosure on income taxes and firms' related responses. The authors find that this additional required disclosure caused firms to become less aggressive on their income taxes, and that they were unable to pass increased tax burdens forward to consumers or backward to suppliers and labor. To maintain, profitability firms cut research and development (R&D) costs, and this cost cutting was larger for tax aggressive firms. Policy implications of this unintended result are discussed.

Keywords	tax avoidance, investment decisions, tax compliance systems
JEL Classification	M41, H26

INTRODUCTION

Firms generally use research and development (R&D) spending to increase long-term value, not to meet short-term earnings targets (see for example, Almeida & Campello, 2007). Technology firms in particular tend to increase R&D spending each year under most conditions. For example, Apple spent USD 2.5 billion on research and development investment in the third quarter of fiscal year 2016, up to 25% from the prior year, despite the fact that the company continued to face revenue decreases[1]. Such increasing R&D spending is generally also true for Korean firms. However, Samsung Electronics, Apple's largest hardware competitor, reduced the number of its R&D centers from 44 to 41, and reduced its overall R&D spending by USD 45 billion in 2015 (the firm's first decrease since the Asian financial crisis in 1998). Such R&D cuts also occurred for other Korean firms around this period (starting in 2011), despite growth in these firms' product markets. A major purpose of this paper is to explain this unusual phenomenon in Korea as an unexpected by-product of tax legislation.

Firms' R&D investment decisions can be affected by various factors. One of the most important factors is the amount of surplus money the firm has, which affects all of its discretionary investment decisions (Almeida & Campello, 2007; Fazzari et al., 1988; Lamont, 1997; Boyle & Guthrie, 2003). Earnings management can also influence firms' decision making on investment (McNichols & Stubben, 2008). Additionally, prior studies have examined the association between financial distress and investment (Boyle & Guthrie, 2003; Keefe &

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1   "Apple is thinking long-term: R&D spending keeps rising even as revenue dips", Business Insider, Jul. 26, 2016.

Tate, 2013; Hirth & Viswanatha, 2011; Minton & Schrand, 1999; Campello et al., 2010). These studies have generally found that firms facing financial distress are likely to decrease, or at least delay, current investment.

One way in which financially constrained firms have been found to generate additional funds for R&D (and other investments) is through tax avoidance behavior (Blaylock, 2016; Green & Kerr, 2016), despite the risk of being audited by tax authorities (Desai & Dharmapala, 2006; Rego, 2003; Slemrod, 2001; Ayers et al., 2011; Edwards et al., 2013; Brondolo, 2009; Campello et al., 2011, 2012)[2]. Such increased R&D investment in turn may increase the firm's market value (Ayers et al., 2011). The above implies that when firms have less opportunities for aggressive tax avoidance or evasion behavior[3], discretionary funds are lower and R&D investment should drop accordingly. Blouin et al. (2012) suggest that tax uncertainty is due to the inherent incompleteness of the law and its endless legislative, judicial, and administrative modification. Tax policy uncertainty also discourages investment (Niemann, 2011; Hassett & Metcalf, 1999; Croce et al., 2012) and may induce a reduction or delay investment (Stokey, 2013)[4]. A major reason for lowered tax avoidance is due to tax uncertainty. Blouin et al. (2012) found that tax uncertainty decreases aggressive tax avoidance, which in turn decreases firms' investments.

As discussed above, Korean firms exhibited significant R&D reductions starting in 2011, despite strong product growth. At this same time[5], in an effort to curb tax evasion on value added taxes (VAT), the Korean government mandated that all invoices be electronic and that copies of such invoices be filed with the National Tax Service (Korea's equivalent of the US' Internal Revenue Service)[6]. Korea is the first country to have such an innovative system, and the Korean government reported that the result was an unqualified success in increasing VAT compliance. According to research conducted by the Korea Institute of Public Finance in 2011, the system saved about KRW 900 billion (approximately USD 790 million) in compliance costs (Korean NTS Annual Report, 2015). Such electronic VAT invoices were required to be filed by the 10th day of the month following the month of issuance; a penalty tax (1% of the VAT-invoiced amount) was levied on companies that either did not file or were late in filing. The penalty tax was either 0.5% or 1%, depending upon the number of days the filing was delayed. To incentivize use of the system, suppliers receive a tax credit of 100 KRW (slightly under 9 cents US) per issuance, and up to KRW 1 million can be credited per year per taxpayer. The NTS reported that by July 31, 2011, 99% of all eligible corporate taxpayers participated in issuing electronic invoices for VAT, amounting to KRW 1.142 trillion (99.9% of all invoiced amounts)[7].

This natural experiment provides the opportunity to examine a number of other potential outcomes. Because VAT invoices provide a more transparent (and immediate) trail for income tax audits, the new law may have reduced income tax evasion and avoidance as well[8]. We find that this in fact occurred. We next test whether firms were successful in passing such additional tax burdens onto consumers in the

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2   Such firms are also more likely to use tax avoidance if they are not able to opportunistically achieve earnings targets other than taxes (Dhaliwal, Gleason, & Mills, 2004).

3   Since either avoidance or evasion have the same objective here to increase funds for R&D, we can argue that they are similar.

4   Taxes are a particularly important matter for multinationals' investment decisions, and such firms' tax decisions are based on the average effective tax rate. See "How Taxes Affect Investment Decisions for Multinational Firms?" Forbes, Apr. 14, 2015.

5   This was preceded in January 2001 by a law change whereby suppliers were permitted to issue electronic VAT receipts. Effective July 1, 2007, the self-billing of VAT invoices was encouraged to improve the transparency of VAT transactions when a businessperson receives a supply of goods or services and is not able to take receipt of tax invoices. However, the supplier of goods or services could not issue a tax invoice to avoid exposing the tax base. Self-billing was permitted if the head of a district tax office approved, and as long as the consideration of relevant transactions was more than KRW 100,000 and less than KRW 5,000,000.

6   Earlier law changes allowed such invoices, but there was limited adoption. Effective January 1, 2001, suppliers were permitted to issue electronic VAT receipts. Effective July 1, 2007, the self-billing of VAT invoices was encouraged to improve the transparency of VAT transactions when a businessperson receives a supply of goods or services and is not able to take receipt of tax invoices. However, the supplier of goods or services may not issue a tax invoice to avoid exposing the tax base. Self-billing was performed upon the approval of the head of a district tax office, as long as the consideration of relevant transactions is more than KRW 100,000 and less than KRW 5,000,000.

7   Annual Report 2011, Korean National Tax Service.

8   The main goal of e-invoicing was to reduce tax evasion. We argue that it also reduced tax avoidance.

form of higher prices, or backward to labor (via lower wages) or to vendors (via lower prices). We find that it was not the case, which implies that the increased tax burden may have resulted in lower after-tax profitability. These findings have important policy implications for countries adopting similar systems; with increasing use of ERP systems by companies and the ability to transmit such data real-time over the web, such systems may not only be feasible and cost-effective, but also reduce tax evasion with no "side effects" on other sectors of the economy.

Finally, we find that in order to maintain profit margins, firms reduced R&D expenditures. Such R&D reductions were more concentrated in firms, which were prone to tax avoidance (aggressive tax behavior), implying that such firms were most affected by the policy. This latter finding is consistent with the "flip" of findings in previous studies (e.g., Ayers et al., 2011). and in doing so, adds to the literature in this area; that is, firms, which are more tax aggressive, tend to spend more on R&D. The R&D results have policy implications for all countries insofar as tax increases (resulting from decreased avoidance opportunities) may inadvertently result in decreased innovation by firms. The lower profitability and decreased tax avoidance results have policy implications for other countries considering similar electronic VAT reporting systems. The remainder of the paper is organized as follows. Section 1 provides a literature review and hypothesis development. Section 2 discusses the sample and methodology. Section 3 presents descriptive statistics, correlations, and regression results. Final section discusses the results and related policy implications.

1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

As noted in the previous section, Korean firms significantly cut R&D after the 2011 tax reforms. Before examining the tax law itself, it is instructive to examine the literature on firm discretionary investment, including investments in R&D. Internal funds are significant forecasters of firms' investments (Almeida & Campello, 2007; Fazzari et al., 1988; Lamont, 1997). For example, Boyle and Guthrie (2003) show a positive association between investment and cash flow volatility in financially constrained firms. Relatedly, Minton, and Schrand (1999) show that firms with higher cash flow volatility have financial deficits, which in turn leads to capital rationing and skipping investments. When firms face financial distress, they are likely to decrease investments (Keefe & Tate, 2013; Boyle & Guthrie, 2003), or at least delay current investment (Boyle & Guthrie, 2003; Hirth & Viswanatha, 2011). Keefe and Tate (2013) find that a financially constrained firm experiencing both high volatility and a negative cash flow growth realization cut investment by 5%. As an extreme example, during the 2008 global financial crisis, fi-

nancially constrained firms tended to aggressively decrease investments, technology, marketing, and employment relative to financially unconstrained firms (Campello et al., 2010, 2011).

Financially constrained firms make additional internal funds and/or cut cash outflows through various techniques, one of which is tax avoidance. Such tax avoidance has been shown to be significantly associated with capital management strategies (Desai & Dharmapala, 2006; Rego, 2003; Slemrod, 2001) and financially constrained firms are likely to increase cash through tax avoidance activities as a source of internal funds (Ayers et al., 2011; Edwards et al., 2013). Highly financially distressed firms are likely to engage aggressive tax avoidance activities, even though increasing aggressive activities can increase the risk of being audited by tax authorities (Brondolo, 2009; Campello et al., 2011, 2012)[9].

Research by Ayers et al. (2011) also indicates that cash generated from tax avoidance may ultimately increase firm value by funding investment opportunities. Since cash tax planning is unlikely to adversely affect the firm's long-term performance, financially constrained firms are anticipated to have a preference for reducing taxes rather than using oth-

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9   Firms also use tax avoidance to achieve financial earnings targets (Dhaliwal, Gleason, & Mills, 2004).

er cost saving techniques such as reducing research and development, advertising, capital expenditures, etc. (Edwards et al., 2013). If firms cannot decrease taxes, firms may be forced to generate additional cash through cost cuts in investment despite undesirable effects on the firm's long-term performance.

Since the 2011 Korean tax law changes essentially reduced firms' opportunities for tax avoidance, it is instructive to examine the tax avoidance literature. By utilizing tax avoidance, firms generate new sources of internal funds (Edwards et al., 2013). A number of studies show the positive association between tax avoidance and investment (Blaylock, 2016). Blanchard et al. (1994) find that firms are likely to overinvest funds from cash tax savings based on volatile tax avoidance. Using multinational data, Green and Kerr (2016) show that firms' tax avoidance activities affect firms' decisions such as investment and dividend payout. They examine how cash tax savings are associated with cash investments and dividend payouts and find that the firms with greater cash tax avoidance are more likely to fund investment rather than paying out them in the form of dividends.

A number of recent studies suggest that many firms appear to be inefficient at investing cash tax savings. For example, Hanlon et al. (2015) and Edwards et al. (2016) found that U.S. multinational firms located in countries with worldwide tax systems tend to invest cash tax savings inefficiently. One source of inefficiency is uncertainty, Blouin et al. (2012) show that tax uncertainty from aggressive tax avoidance reduces firms' investments. Following the definitions of Niemann (2011), Blouin et al. (2012) suggest two sources of tax uncertainty: (1) the inherent incompleteness of the law and its endless legislative, judicial, and administrative modifications; and (2) intentional tax avoidance that requires the exploiting of unclear or ambiguous law. Other studies show that uncertainty over changing tax policy on investments discourages investment (Niemann, 2011; Hassett & Metcalf, 1999; Croce et al., 2012). Similarly, Stokey (2013) analyzes whether uncertainty about future tax policy leads to a temporary reduction in investment and finds that firms delay projects until the uncertainty is resolved.

The conclusions from the above literature are that investments in R&D are a function of cash flows, and that such cash flows are in part generated by aggressive tax behavior (tax avoidance). But such tax avoidance (and therefore investments) are reduced where there is uncertainty. In the case of the Korean tax law changes in 2011, tax avoidance opportunities are decreased, since firms must fully disclose all transactions to the government. Additionally, there is uncertainty related to government audit likelihoods from the new law due to the law's "newness". Both of these reductions in tax avoidance reduce cash flows and, accordingly, reduce investments in R&D.

Based on the aforementioned literature, we posit:

H1: *Firms' R&D investments are positively associated with firms' tax avoidance[10].*

H2: *Firms' R&D investments are negatively associated with firms' tax avoidance after tax compliance systems are implemented.*

We additionally test if companies were able to shift taxes. Since the effects of the law were economy-wide, it is conceivable that this caused shifts in demand and supply curves in numerous markets. The general equilibrium effects of this are described in Harberger (1962) and a plethora of subsequent papers (see Gravelle, 2010 for a survey of the related tax incidence literature). The net effects could conceivably be that corporations shift some of the extra taxes forward to consumers in the form of higher prices, and/or backward to labor in the form of lower wages or to vendors in the form of lower prices paid. Any taxes not absorbed would result in lower after-tax profits, which is essentially a tax on capital. The magnitudes of such shifting depend on elasticities in all markets and are essentially an empirical question. It is also conceivable that because all firms (corporate and non-corporate) were affected by the law, opposing pressures on prices between vendors and buyers could have been offsetting. Similarly, it may be there were no effects in labor markets since there could have been equal shifting supply and demand between sectors.

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10   Tax avoidance is the reduction in taxes via legitimate (legal) methods. Tax evasion is reduction in taxes by illegal methods. We argue that
      since the e-invoice system made evasion very difficult, reduced tax avoidance is of more interest here.

2. RESEARCH DESIGN

2.1. Sample selection

This study uses financial data made available by KIS-DATA, a database developed by Korea Investors Service, Inc., for the years 1998 to 2014. The sample includes publicly traded nonfinancial firms on the Korean Stock Exchange (KSE, KOSPI[11]) that have a fiscal year-end of December 31 and have unimpaired capital. The top and bottom 1% of all continuous variables are minorized to moderate the influence of outliers. Thus, the final sample includes 9.178 listed firm-year observations. Table 1 shows the industry distribution of the sample.

Table 1. Industry distribution of the sample

Industry	Number of firms	%
Agriculture/Forestry/Mining/Fishing	87	0.95%
Manufacturing	5,923	64.53%
Electricity/Water supply/Environment	165	1.80%
Construction	506	5.51%
Wholesale/Retail	586	6.38%
Transportation/Warehousing	250	2.72%
Lodging/Restaurants	20	0.22%
Publication/Broadcasting/Communication	210	2.29%
Medical/Computer/Information	696	7.58%
Real Estate/Renting/Leasing	735	8.01%
Total	9,178	100%

2.2. Regression model and measurement of variables

2.2.1. Direct effects on firms

Although the intent of the law change was explicitly to reduce VAT evasion, the additional disclosure of all transactions to tax authorities may also have reduced income tax evasion and avoidance[12]. This could occur in a number of ways. For example, firms previously wishing to avoid tax could

avoid issuing some receipts, but this was no longer feasible under the new law. Firms wishing to accelerate deductions or delay receipts could no longer do so. Additionally, since inter-company receipts were also to be reported, firms utilizing tax aggressive transfer pricing schemes would now have the prices completely exposed to tax authorities[13]. Conceivably, this could make firms less prone to utilize such methods. To test whether tax avoidance decreased, we examine book-tax differences before and after the law change in the following regression model:

$$TAvoid_{i,t} = \alpha + \beta_1 TaxSystem_{i,t} + \\ + \sum \alpha_j X_j + \sum \alpha_k IND_k + \sum \alpha_l YEAR_l + \varepsilon_{i,t}, \quad (1)$$

where $TAvoid_{i,t}$ is tax avoidance (discussed below), $TaxSystem_{i,t}$ is a dummy variable for the tax compliance system, $X_{i,t}$ are other factors affecting tax avoidance (explained below), IND are industry indicator variables (defined by the one-digit Korea Standard Industry Code), and $YEAR$ are annual indicator variables. Tax avoidance measurements are based on book-tax differences, or BTDs. The BTD is the difference between the accounting income before tax and TI is the taxable income, and it is scaled by total assets. Taxable income is calculated as Income Tax Expense + {(Deferred Tax Assets$_t$ – Deferred Tax Assets$_{t-1}$) – (Deferred Tax Liabilities$_t$ – Deferred Tax Liabilities$_{t-1}$)}. Thereafter, it is divided by the tax rate. Following the method developed by Desai and Dharmapala (2006), an OLS regression model is used to account for the component of the book-tax gap, which is attributable to earnings management, as follows:

$$BTD_{i,t} = \beta_1 TA_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where TA is total accruals calculated by subtracting operating cash flows from net income using the measure of total accruals developed by Hribar and Collins (2002), which is divided by the begin-

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11 The Korea Composite Stock Price Index or KOSPI is the index of all common stocks traded on the Stock Market Division – previously, Korea Stock Exchange – of the Korea Exchange. It is the representative stock market index of South Korea, like the Dow Jones Industrial Average or S&P 500 in the United States.

12 As noted previously, tax evasion is the illegal underpayment of tax. The e-invoice system was designed to reduce VAT tax evasion, but because al transaction were now disclosed to authorities, income tax evasion would become very difficult. Similarly income tax avoidance would be more difficult to the extent firms misstated transactions prices, since all such transactions were now on a transparent basis.

13 Unfortunately, the KIS data does not report any information, which would indicate the degree to which firms have multinational sales and for whom such aggressive transfer pricing schemes would be most salient. However, most of these firms do have such international sales and in fact most Korean manufacturers have exports larger than domestic sales.

ning of year assets. The residual is then BTD after accruals, and it is our measure of $TAvoid$ in equation (1).

The model in equation (1) includes control variables that can affect tax avoidance. These variables include leverage, size, operating cash flow, return on assets, deferred tax, loss in the prior year, sales growth, investment, foreign shareholders, and auditors (Big 4 vs. non-Big 4). Leverage is the total liabilities divided by total assets. Leverage may have a positive association with tax avoidance due to tax-deductible interest payments. Size, which is measured as the natural log of total assets, is included to control for size effects. Size may have a positive association based on political cost theory (Watts & Zimmerman, 1986) or negative association based on political power theory (Siegfried, 1974) with tax avoidance. Since tax payments are a significant cash outflows, operating cash flow is included. Return on assets, which is measured as net income divided by total assets, is included to control for firm profitability[14].

Deferred tax is included to control for future variable tax expenses. It is expected that the data will show that firms that reported losses in one year are more likely to be tax avoidant in the subsequent year. Thus, a LOSS dummy variable is included. Growth firms are more likely to purchase tax-favored assets (Chen et al., 2010), so sales growth is included to control for growth. Since firm's investment decisions might have an effect on tax planning, investment is used as a control variable. Foreign shareholders and auditors (Big 4 vs. non-Big 4) are also included, since they may have an impact on reducing tax avoidance through monitoring and oversight.

2.2.2. Collateral effects: R&D expenditures

The following regression allows for tests for both firms' post-law change cuts in R&D, and for the incrementally higher effect of this for firms with higher tax avoidance:

$$R\&Dintensity_{i,t} = \alpha + \beta_1 TaxAvoidance_{i,t} +$$
$$+ \beta_2 TaxAvoidance_{i,t} \cdot TaxSystem + \qquad (3)$$
$$+ \sum \alpha_j X_j + \sum \alpha_k IND_k + \sum \alpha_l YEAR_l + \varepsilon_{i,t},$$

where $R\&Dintensity$ is the ratio of R&D expenditures to firm sales (e.g., Greve, 2003; Lee & O'Neill, 2003), $TaxAvoidance_{i,t}$ is tax avoidance as defined previously, $TaxSystem$ is a dummy variable for the tax compliance system, (also defined previously), X_j, i, t are other factors and control variables affecting R&D investment (explained below), and IND and $YEAR$ are industry indicator and year indicator variables, respectively.

The other factors and control variables include size, financial distress, operating cash flow, return on equity, Tobin's q, market-to-book ratio, sales growth, foreign shareholders, operating cycle. Size, which is measured as the natural log of total assets, is included to control for size effects on R&D investment (Shehata, 1991). Size may have a positive association with R&D investment. Financial distress is measured following the modified Altman Z-score (Graham et al., 1998). This model is calculated as $Z = 1.2$ (working capital divided by total assets) + 1.4 (retained earnings divided by total assets) + 3.3 (earnings before interest and taxes divided by total assets) + 0.999 (sales divided by total assets). Financial distress may have a positive association with R&D investment, as firms facing financial distress have less funds for discretionary investment. Since firms with greater cash flows are more likely to invest (Stein, 2003), operating cash flow is included. Return on equity, which is measured as net income divided by equity, is included to control for firm profitability. More profitable firms are likely to have funds available for investment, we thus expect positive sign. We also include Tobin's q (1969) and market-to-book ratio to control for investment opportunities. Tobin's q is calculated as the market value of equity plus liabilities, divided by total assets.

Sales growth is included to control for growth and to capture changes in demand that would require additional investment (Bond et al., 2007). We expect a positive association of sales growth with R&D investment. Foreign shareholders are also included, since they may have an impact on controlling R&D investment through monitoring and oversight. We also include a control for operating cycles (opcycle), as firms may have different investment needs depending on their life cycle

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14   Gupta and Newberry (1997) and Rice (1992) found a positive association between firm profitability and tax avoidance.

(Dechow, 1994; Dechow, Kothari, & Watts 1998; Dechow & Dichev, 2002). Opcycle is calculated as the natural log of the sum of receivables turnover (RECT/SALE) and inventory turnover (COGS/INVT) multiplied by 360.

3. EMPIRICAL RESULTS

3.1. Descriptive statistics and correlations

Table 2 shows the descriptive statistics for the main variables. The variables include all variables used in subsequent regressions[15]. The mean (median) for *TAvoid* is –0.0628 (–0.0704). The mean (median) for *RD* is 0.0482 (0.0023). The mean (median) for *Post2011* is 0.2101 (0), implying that the period from 2011 onward accounted for 21% of the

samples. The mean (median) values for the control variables *LEV*, *FD*, *SIZE*, *OCF*, *ROA*, *ROE*, and *DT* are 0.4806 (0.4556), 2.1492 (2.0539), 19.7114 (19.4395), 0.0718 (0.0604), 0.0637 (0.0468), 1.7702 (1.7702) and –0.0081 (–0.0025), respectively. The mean (median) values for the control variables *LOSS*, *TQ*, *MTB*, *FSH*, *GROW*, *INV* and *OPcycle* are 0.0904 (0), 2.6453 (0.5988), 1.2069 (0.9085), 11.5518 (4), 9.5993 (0.0550), 0.1896 (0.1648) and 13857.7 (2773.947), respectively. The mean (median) for *BIG4* is 0.6730(1), implying that 67% of the samples are audited by Big 4 auditors.

The Pearson correlation results are reported in Panels A and B of Table 3. Significant correlations are observed between tax avoidance and the period dummy (Period 2011) ($p < 0.01$). Significant positive correlations are also seen between tax avoidance and some control variables (*SIZE*,

Table 2. Descriptive statistics

Variables	Mean	Std. Dev.	Median	Q1	Q3
TAvoid	–0.0628	0.1203	–0.0704	–0.1128	–0.0283
RD	0.0482	0.2004	0.0023	0	0.0235
Post2011	0.2101	0.4074	0	0	0
LEV	0.4806	0.3180	0.4556	0.2893	0.6126
FD	2.1492	1.0262	2.0539	1.4140	2.7536
SIZE	19.7114	1.5005	19.4395	18.6567	20.5436
OCF	0.0718	0.0937	0.0604	0.0169	0.1135
ROA	0.0637	0.2994	0.0468	0.0232	0.0803
ROE	1.7702	4.0959	1.7702	0.2560	1.3189
DT	–0.0081	0.0252	–0.0025	–0.0193	0.0045
LOSS	0.0904	0.2867	0	0	0
TQ	2.6453	7.3118	0.5988	0.2351	1.6460
MTB	1.2069	0.9275	0.9085	0.5545	1.5270
FSH	11.5518	15.7319	4	0	17
GROW	9.5993	35.3367	0.0550	–0.7303	3.4931
INV	0.1896	0.1344	0.1648	0.0904	0.2608
OPcycle	13857.7	50478.29	2773.947	1553.815	5631.133
BIG4	0.6730	0.4691	1	0	1

Notes: TAvoid: book-tax gap residual calculated using the method developed by Desai and Dharmapala (2006), *RD*: total R&D investment divided by sales, *Post2011*: coded 1 for the period after 2011, otherwise 0, *LEV*: total liabilities divided by total assets, *FD*: financial distress measured following modified Altman *Z*-score, *SIZE*: the natural logarithm of total assets, *OCF*: operating cash flow divided by total assets, *ROA*: net income divided by total assets, *ROE*: net income divided by owners' equity, *DT*: deferred taxes divided by total assets, *LOSS*: coded 1 if the firm has incurred a loss in the previous year, and 0 otherwise, *TQ*: Tobin's *q*, calculated as the market value of equity plus liabilities, all divided by total assets, *MTB*: market to book ratio, market value of equity divided by book value of equity, *FSH*: foreign investor ownership, *GROW*: sales growth, *INV*: plant, property, and equipment (except land and construction in progress) divided by total assets, *OPcycle*: the natural log of the sum of receivables turnover and inventory turnover multiplied by 360, *BIG4*: coded 1 if the auditor is a Big 4 auditor, and 0 otherwise.

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15   During the time periods we examine, the Korean corporate tax rate was decreasing as follows: 1998–2001: 28% (+ 10% residents' tax: 30.8%); 2002–2004: 27% (+ 10% residents' tax: 29.7%); 2005~2008: 25% (+ 10% residents' tax: 27.5%); 2009–???: 22% (+ 10% residents' tax: 24.2%). We take these rate changes into account in all subsequent analyses. Because we found that firms' taxes increased after the VAT reporting law change, this suggests a strong effect from the law change.

Table 3. Correlations

Panel A. Correlations for tax avoidance analysis

Variables	TAvoid	Post2011	LEV	SIZE	OCF	ROA	DT	LOSS	FSH	GROW	INV	BIG4
TAvoid	1	–	–	–	–	–	–	–	–	–	–	–
Post2011	–0.0640*	1	–	–	–	–	–	–	–	–	–	–
LEV	–0.0848*	–0.0555*	1	–	–	–	–	–	–	–	–	–
SIZE	0.0794*	0.0689*	–0.0126	1	–	–	–	–	–	–	–	–
OCF	0.3719*	–0.0574*	0.1936*	0.0082	1	–	–	–	–	–	–	–
ROA	0.0745*	–0.0209*	–0.0167	–0.0240*	0.0310*	1	–	–	–	–	–	–
DT	0.1793*	–0.1068*	0.1442*	–0.0667*	0.1136*	0.0029	1	–	–	–	–	–
LOSS	0.0831*	0.0094	0.0955*	–0.0679*	–0.0554*	0.0379*	0.0893*	1	–	–	–	–
FSH	0.0094	0.0003	–0.0687*	0.4619*	0.2243*	0.0286*	–0.0011	–0.1273*	1	–	–	–
GROW	–0.0016	0.0229*	0.0999*	0.4426*	0.0688*	–0.0007	–0.0074	–0.0343*	0.2551*	1	–	–
INV	0.1840*	–0.0983*	0.1858*	0.1562*	0.2185*	–0.0242*	0.1990*	0.0428*	0.0668*	0.0926*	1	–
BIG4	–0.0959*	0.0752*	–0.0252*	0.3243*	0.0415*	–0.0129	–0.0388*	–0.1045*	0.2483*	0.1320*	0.0148	1

Panel B. Correlations for R&D investment analysis

Variables	RD	BTD	Post2011	HBTD 2011	SIZE	FD	OCF	ROE	TQ	BTD	GROW	FSH	OPcycle
RD	1	–	–	–	–	–	–	–	–	–	–	–	–
BTD	–0.3155*	1	–	–	–	–	–	–	–	–	–	–	–
Post2011	0.0632*	–0.0820*	1	–	–	–	–	–	–	–	–	–	–
HBTD 2011	–0.0474*	0.2463*	0.6435*	1	–	–	–	–	–	–	–	–	–
SIZE	0.3120*	–0.3626*	0.0971*	–0.0467*	1	–	–	–	–	–	–	–	–
FD	–0.0131	–0.2776*	–0.0271*	–0.1333*	–0.0030	1	–	–	–	–	–	–	–
OCF	0.4996*	–0.4880*	0.0052	–0.0970*	0.3709*	0.0949*	1	–	–	–	–	–	–
ROE	0.5288*	–0.6351*	0.0628*	–0.1139*	0.4241*	0.0226*	0.7776*	1	–	–	–	–	–
TQ	0.5631*	–0.5800*	0.0823*	–0.0944*	0.3997*	0.0883*	0.7697*	0.8651*	1	–	–	–	–
BTD	0.1481*	–0.1460*	0.1175*	0.0524*	0.1337*	0.0704*	0.1577*	0.0884*	0.3165*	1	–	–	–
GROW	0.5277*	–0.5476*	0.0221*	–0.0985*	0.4122*	0.0606*	0.7642*	0.8627*	0.7786*	0.1017*	1	–	–
FSH	0.1356*	–0.2338*	–0.0880*	–0.1397*	0.4372*	0.2257*	0.2386*	0.2132*	0.2616*	0.2320*	0.1755*	1	–
OPcycle	–0.0135	–0.0364*	0.0389*	0.0172	0.0196*	0.0996*	0.0235*	0.0099	0.0223*	0.0393*	0.0364*	0.0059	1

Note: See Table 1 for variable definitions, * significant at 5% level.

OCF, ROA, DT, LOSS, INV) ($p < 0.01$). Significant negative correlations are visible between tax avoidance and some other control variables (*LEV, BIG*) ($p < 0.01$). Significant negative correlations are observed between R&D investment and Period 2011 interaction term with high *BTD* dummy, which is coded as 1 if tax avoidance is greater that the median ($p < 0.01$). Significant positive correlations are also seen between R&D investment and some control variables (*SIZE, OCF, ROA, DT, LOSS, INV*) ($p < 0.01$). Significant negative correlations are visible between tax avoidance and some other control variables (*LEV, BIG*) ($p < 0.01$). Variance Inflation Factors (VIFs) were calculated and indicated that no multi-collinearity problems are evident.

3.2. Regression results

Panel A of Table 4 reports OLS regression results for the association between the enforcement of tax compliance systems and tax avoidance. As can be seen, book-tax differences decreased (significant at 0.01), a result consistent with the prediction that the law had a collateral effect on income tax evasion and avoidance. The regression results are supported by means in Panel B, which show that taxable incomes increased and book-tax differences decreased after the law was enacted (both results significant at 0.001).

Table 5 reports regressions on tax shifting. Panel A examines three regressions for forward shifting to consumers. Results show that when the dependent

Table 4. Change in taxes after law change

Panel A. Regression results

Variables	Expected sign	Dependent variable: *TAvoid*
Constant	?	−0.3513*** (−17.86)
Post2011	−	−0.0077*** (−3.04)
LEV	−	−0.0741*** (−21.01)
SIZE	+/−	0.0148*** (16.57)
OCF	+	0.5382*** (44.58)
ROA	+/−	0.0264*** (7.97)
DT	+/−	0.6346*** (15.21)
LOSS	+	0.0304*** (8.49)
FSH	−	−0.0011*** (−14.44)
GROW	+/−	−0.0002*** (−4.65)
INV	+	0.0677*** (7.61)
BIG4	−	−0.0265*** (−11.45)
Industry dummies		Included
Year dummies		Included
F-value		164.77***
Adjusted R^2		0.2630
N		9,178

Note: See Table 1 and text for variable definitions, *t*-values are shown in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Panel B. Means

Variable	Period	Mean (in Korean Won)	Standard deviation	t
TI	Post 2011	103,000,000,000	895,000,000	2.6979***
	Pre 2011	66,800,000,000	444,000,000	
BTD	Post 2011	0.0015	−0.0086	−3.0965***
	Pre 2011	0.0007	0.0987	

Note: * $p < 0.10$, *** $p < 0.01$.

variable is sales/COGS, there was no increase in prices after 2010. Similarly, when the dependent variable is sales/total assets, there was no indication of forward shifting. On the other hand, when the dependent variable is consumer prices, there is a 22% decrease in consumer prices[16]. The net results suggest that any increases in income taxes were not passed forward to consumers.

Panel B reports regressions looking at tax shifting backward to labor and/or vendors. The regression where the dependent variable is COGS/total assets shows no shifting backward to inventory (and other) vendors, or to labor as part of COGS, after 2010. The regression where the dependent variable is wages/total assets shows that there was no backward shifting of taxes in the form of lower wages after 2010. Finally, the regression having the dependent variable as SG&A expense/total assets shows a statistically significant drop. As discussed below, SG&A includes discretionary expenditures such as advertising and R&D. The potential decrease in R&D is examined next.

A telling finding is shown in the first column in Panel A. Here, the dependent variable is after-tax ROA. Results show no change after the tax law change. Thus, firms were able to maintain their profitability despite tax increases and despite the fact they were unable to shift taxes forward or backward. This suggests that they had to have cut costs somewhere, which is more closely examined in the next section.

Table 6 shows regression results for R&D intensity. The *BTD* variable, which covers all periods, is positive and significant at 0.01, a result consistent with prior research. That is, firms prone to tax avoidance use the resultant cash flows for R&D. The interaction term of *BTD* and post law-change is negative and significant at 0.01. Thus, firms prone to tax avoidance decreased their R&D after the law change. This finding is consistent with the prediction that it was more difficult after 2010 for firms to avoid taxes, and the resultant decrease in funds left less for R&D investment.

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16   The data are from the Consumer Price Index reported by the Economic Statistical System, Bank of Korea (various years).

Table 5. Regression results for tax shifting

Panel A. Forward shifting to consumers

Variable	Return on assets	Sales/cost of goods sold	Sales/total assets	Consumer prices
Constant	−0.00012(−0.01)	−15.8895 (−0.10)	0.7132*** (6.93)	106.5829*** (126.15)
Post2011	−0.0085 (−0.97)	−1.0336 (−0.01)	0.0618 (1.00)	−22.5072*** (−130.97)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	10,540	10,228	10,540	10,385
Adjusted R^2	0.0170	0.0039	0.0509	0.8641
F-value	7.77***	2.49***	21.94***	5503.01***

Note: t-values are shown in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Panel B. Backward shifting to labor and vendors

Variable	Compensation/total assets	Cost of goods sold/total assets	Selling, general and administrative expenses/total assets
Constant	0.0199*** (3.81)	0.6250*** (6.19)	0.0843*** (5.02)
Post2011	−0.0031 (−0.99)	0.0591 (0.97)	−0.0216** (−2.13)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
N	10,540	10,540	10,540
Adjusted R^2	0.0849	0.0490	0.0884
F-value	37.20***	21.12***	38.84***

Note: t-values are shown in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Regression results for R&D investment

Variables	Expected sign	Dependent variable: *RD* intensity
Constant	?	−0.3360*** (−7.18)
BTD	+	0.0208*** (4.65)
Post2011	?	0.0200 (1.13)
HBTD2011	−	−0.0278*** (−2.99)
SIZE	+	0.0161*** (8.19)
FD	−	−0.0118*** (−5.35)
OCF	+	0.0220*** (5.65)
ROE	+	0.0049*** (4.17)
TQ	+	0.0001*** 12.30)
MTB	+	0.0093*** (2.94)
GROW	+/−	0.0039*** (8.88)
FSH	+/−	−0.0066*** (−3.06)
OPcycle	+/−	−0.0001 (−1.10)
Industry dummies		Included
Year dummies		Included
F-value		141.15***
Adjusted R^2		0.3968
N		8,098

Notes: HBTD2011: Period 2011 interaction term with *HBTD* dummy, *HBTD* dummy is coded as 1 if tax avoidance is greater that the median. Otherwise, it is coded as 0. Other variables: see Table 2 for variable definitions, *t*-values are shown in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

CONCLUSION

In 2011, Korea required all firms to report all value added tax (VAT) invoices electronically to tax authorities. This unique law provided a natural experiment to examine the effects of this disclosure on income taxes and firms' related responses. We find that this additional required disclosure caused firms to become less aggressive on their income taxes, and that they were unable to pass increased tax burdens forward to consumers or backward to suppliers and labor. To maintain, profitability firms cut research and development (R&D) costs, and this cost cutting was larger for tax aggressive firms.

There are a number of policy implications of this study. Although the Korean law change is unique, it is conceivable that other countries will follow its lead in order to reduce tax evasion for VAT purposes. With the increasing use of ERPs by firms and the ability to transmit such data real-time over the web, such a system is feasible in many industrialized countries. If other countries follow suit, VAT tax evasion will be dramatically reduced, and there may be minimal collateral effects on market prices throughout the economy (i.e., distortionary effects) since firms will absorb the extra tax costs and not pass them forward to consumers or backward to supplier and/or labor. Countries adopting the Korean system may also be able to reduce income tax evasion/avoidance due to the extra disclosure requirements for transactions, especially those affecting transfer pricing.

On the other hand, a major negative effect could be a reduction in discretionary expenditures such as in R&D, since firms would have less funds from tax avoidance and evasion to invest in R&D. Such decreases in R&D could result in lower innovation and thus be a non-trivial welfare cost to that country's economy to the extent the country is innovation-driven. Other countries adopting such a system should therefor consider the tradeoffs of increased tax revenues versus the potential of slowed economic growth due to decreased investments in R&D.

ACKNOWLEDGEMENT

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