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Tax knowledge diffusion via strategic alliances

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Tax Knowledge Diffusion via Strategic Alliances

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Tax Knowledge Diffusion via Strategic Alliances

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Abstract

This study examines strategic alliances as channels for tax knowledge diffusion between firms. Although strategic alliances are primarily expected to foster their main business purposes, we focus on whether tax knowledge potentially diffuses as a second order effect of peer-to-peer cooperation. To tease out diffusion of tax knowledge, we investigate changes in the tax planning behavior of high-tax firms in strategic alliances with low-tax firms in comparison to high-tax firms in strategic alliances with other high-tax firms. Our results suggest an economically meaningful decrease of high-tax firms' cash effective tax rates when cooperating with low-tax firms. Additionally, we find that this adjustment occurs within two years of a strategic alliance's initiation. We apply textual analysis to control for the strategic alliances' main business purposes in our analyses. Because these activities do not appear to drive our findings, we argue to identify tax knowledge diffusion as a second order effect and conjecture that strategic alliances are not intended to be tax planning investments. Finally, we test whether partner characteristics intensify or mitigate the identified effects. Overall, our results provide robust evidence for tax knowledge diffusion via strategic alliances.

Keywords: Corporate Tax Planning/Avoidance, Knowledge Diffusion, Network, Strategic Alliance.

JEL Qualification: C31, G34, H26.

Data: Data are available from public and/or subscription-based sources identified in the paper.

Declarations of Interest: None.

1. Introduction

Do strategic alliances serve as channels for tax knowledge diffusion? In the form of contractual-based cooperation between firms, strategic alliances are one means of striving for optimal corporate institutionalization. Their relevance is emphasized by the observation that firms currently plan to disrupt other industries by entering via cooperation (PwC, 2018). Although strategic alliances are expected to foster their main business purposes, they also facilitate knowledge diffusion in other areas (e.g., Li, Qiu, and Wang (2019)). As a second order effect of peer-to-peer cooperation, our study analyzes the diffusion of tax knowledge. Previous studies, which investigate cross-firm connections and tax knowledge, focus on either intentional transfers (Cen et al., 2018) or the effect of intermediaries (e.g., Brown and Drake (2014)). Our analysis, however, neither requires the existence of an intermediary nor imperatively assumes intentional transfers.

Conceptually, diffusion of tax knowledge comprises gaining access to and being willing and capable of employing relevant information and know-how. An exemplary driver within this process could be a shift in a firm's management preferences and confidence towards implementing a specific tax planning activity when observing unchallenged or successfully defended strategies by other participants in a strategic alliance. As a result of tax knowledge diffusion, one may observe changes in the actual tax planning behavior of a firm. Strategic alliances, which we also refer to as "networks", are, in contrast to equity joint ventures, not subject to corporate taxation. They are regarded as "lying somewhere in between single-firm activity and spot contracting" (Lindsey, 2008), involving mutual commitment not typically found in arm's-length market transactions but having less impact on the partnering firms' operations than equity joint ventures (Chan et al., 1997). This is useful for us since we are not interested in whether firms potentially use joint ventures as vehicles in tax planning activities but in whether peer-to-peer cooperation may serve as a channel through which tax knowledge diffuses between firms. Observing tax consequences at the level of the investing firms allows us to identify tax knowledge diffusion via strategic alliances. This is the key innovation of our study.

We empirically exploit information on strategic alliances that were established between publicly traded US firms from 1994 to 2016. Given that accounting data are available for a network's participants, we reshape the data from the alliance to the participant level (network-firm observations). We measure tax knowledge by observing a firm's nonconforming tax planning behavior (*cash ETR3*) and classify the participants and the network as low-tax and high-tax. To tease out tax knowledge diffusion after network initiation, we analyze changes in the tax planning behavior of high-tax firms in strategic alliances with low-tax firms in comparison to high-tax firms in strategic alliances with high-tax firms. We gain insights into the business purpose of a network by applying textual analysis of the networks' deal descriptions. For our inferences, we apply a multivariate regression design and a difference-in-differences (DiD) model, which both complement a descriptive analysis. We find a substantial increase in the tax planning behavior of high-tax firms in strategic alliances with low-tax firms relative to high-tax firms in high-tax strategic alliances. Our results are also economically meaningful because they lead to expected cash effective tax rate levels for high-tax firms in low-tax networks of approximately 5 percentage points below the cash effective tax rate levels for high-tax firms in high-tax networks. Furthermore, we assess firms to be able to adjust their tax planning behavior on average within two years of network initiation. Finally, we test whether partner characteristics intensify or mitigate the identified effects but find that tax knowledge diffusion via strategic alliances is rather unaffected by such heterogeneity.

Our study refers to the emerging literature that identifies cross-firm connections to determine increases in the tax planning behavior of linked firms. By examining a potential determinant of cross-sectional variation in the tax planning practices among firms, we follow calls for contributions to the understanding of this matter (Cen et al., 2018; Dyreng and Maydew, 2017; Wilson, 2009). By focusing on cross-firm connections via intermediaries and intentional transfers of tax knowledge, recent research has analyzed board ties (Brown, 2011; Brown and Drake, 2014), banks (Gallemore, Gipper, and Maydew, 2018), human capital turnover (Barrios and Gallemore, 2019), auditors (Frey, 2018; Lim et al., 2018) and the supply chain (Cen et al., 2017, 2018). Strategic alliances, which are established on a peer-to-peer basis without an

intermediary, aim to foster a specific business purpose and constitute, per se, no tax planning investment. Budget meetings, monitoring and within-firm reporting, however, could establish opportunities to gain insights into the partnering firms' tax positions. If we observed the actual exploitation of these opportunities, we could shed light on diffusion of tax knowledge during peer-to-peer contracting and contribute to this yet underexplored literature.

Additionally, we contribute to the management literature on identifying knowledge flows via strategic alliances. Empirical inferences in such studies are usually based on the contracting parties' stock price performance (Boone and Ivanov, 2012; Mohanram and Nanda, 1996; Chen, King, and Wen, 2015; Anand and Khanna, 2000), return on equity, (cash flow) return on assets (Chan et al., 1997; Porrini, 2004), post-reorganization performance (Cai and Sevilir, 2012; Higgins and Rodriguez, 2006; Ishii and Xuan, 2014; Porrini, 2004) and patent citations (Gomes-Casseres, Hagedoorn, and Jaffe, 2006; Li, Qiu, and Wang, 2019). Although firms are often found to benefit from what they learn in alliances in other contexts, not all corporate practices diffuse in the same way (Cai et al., 2014). Since tax knowledge characteristics are considered to lie somewhere between being excessively complex (Hoppe et al., 2019) and serving as mass-market ideas (Lisowsky, 2010), ambiguity arises when analyzing the diffusion of tax knowledge. To the best of our knowledge, we are the first to measure knowledge diffusion via strategic alliances based on a firm's tax planning behavior. Our study therefore combines accounting and management research.

In the next section, we review the related literature to discuss whether tax knowledge could diffuse between firms via strategic alliances. Subsequently, we explain our data exploitation and identification strategy. We discuss an appropriate research design and then present and discuss the results of our study. Before this paper closes with a brief conclusion, we provide several sensitivity analyses.

2. Conceptual Framework & Prior Literature

2.1. *Cross-Firm Connections and Tax Knowledge*

The extensive research that considers within-firm determinants of tax planning by firms underlines the perceived importance of corporate taxes in economic theory, politics and society (for comprehensive reviews, see Hanlon and Heitzman (2010) and Wilde and Wilson (2018)). Given the substantial economic impact of tax planning activities (Clausing, 2016; Tørsløv, Wier, and Zucman, 2018; Blouin and Robinson, 2019), tax advisors are intuitively linked to observations of tax planning. However, by investigating “tax planning ecosystem[s]” (Dyreng and Maydew, 2017) between firms, recent research suggests the existence of further channels. The findings indicate that cross-firm connections impact tax planning behavior of linked firms. Brown (2011) pioneered this strand of literature by examining the spread of a specific tax planning tool, the corporate-owned life insurance shelter. Although she finds that board interlocks and (to some extent) geographical proximity increase the probability that a firm adopts the shelter from a prior user, she does not find significant shelter adoption via shared audit firms. This result, although it is theoretically convincing due to independence regulations on audit services, is somewhat surprising given the literature on auditors who transgress their limited scope of function (Aobdia, 2015; Cai et al., 2016; Dhaliwal et al., 2016; McGuire, Omer, and Wang, 2012). By calibrating from the audit firm level to the individual audit engagement partner, Frey (2018) suggests that the engagement of a German tax certified auditor, who signals high competency in taxes, is associated with higher effective tax rates at client firms. In contrast, Lim et al. (2018) find that Chinese firms with stronger connections to low-tax firms through individual audit partners show lower effective tax rates. Further disentangling the role of intermediaries, Barrios and Gallemore (2019) document that firms exhibit increasing tax planning when they hire tax staff from sophisticated tax planners. This finding is consistent with the inferences from analyzing board ties to low-tax firms (Brown and Drake, 2014). Gallemore, Gipper, and Maydew (2018) show that firms experience meaningful tax reductions when they start a relationship with a bank whose existing clients engage in tax planning.

[Figure 1]

These studies are conceptually aligned by the presence of intermediaries who implement tax planning expertise in their set of contracts and intentionally transfer the tax knowledge gained to other parties that they are contracting with. Consistently, intermediaries are found to play a key role in the acquisition and dissemination of information in many research fields (e.g., see Di Maggio et al. (2019)). Figure 1 aligns institutional settings with identified channels of prior research on transfers and diffusion of tax knowledge. The research focuses on the role of intermediaries, whereas Cen et al. (2017) and Cen et al. (2018) analyze peer-to-peer contracting between firms. Specifically, they focus on transfers of tax knowledge via the supply chain and document that both customers and suppliers increase their tax planning activities once their relationship is considered to be dependent. Cen et al. (2018) suggest that customers and suppliers share tax planning benefits through lower product prices. Although evidence for the intended sharing of tax benefits is scarce (for instance, see Erickson (1998) and Erickson and Wang (1999)), an intentional transfer of tax knowledge aligns the “supply chain channel” with research on intermediaries.

2.2. Strategic Alliances and Tax Knowledge Diffusion

In contrast to previous research, we ease the studies’ assumptions of existing intermediaries and intentional transfers of tax knowledge and focus on tax knowledge diffusion between firms when peer-to-peer contracting. For this purpose, we not only need to identify tax knowledge characteristics but also must resolve whether strategic alliances conceptually allow for (tax) knowledge diffusion.

2.2.1. Tax Knowledge

Generally, repeated business transactions are found to enable knowledge spillovers (Isaksson, Simeth, and Seifert, 2016). However, not all corporate practices diffuse in the same way (Cai et al., 2014), as major barriers to knowledge spillovers are shown to be knowledge-related factors (Szulanski, 1996). Explicit knowledge can easily be codified and is systematically transferable, whereas tacit knowledge is difficult to formulate and communicate because it “is deeply rooted in action, commitment, and involvement in a

specific context” (Nonaka, 1994). Consequently, when (tax) knowledge qualifies as more explicit, it should be more easily transferable (Meier, 2011). One might reflexively refer to tax knowledge as tacit given the substantial complexity of corporate taxes (Hoppe et al., 2019) and the increased uncertainty (Dyreg, Hanlon, and Maydew, 2019; Guenther, Matsunaga, and Williams, 2017) and costs (Hundsdoerfer and Jacob, 2018) of tax planning. One also has to consider that know-how is somewhat sticky, difficult to codify and, therefore, more tacit than pure information (Kale, Singh, and Perlmutter, 2000). However, anecdotal evidence suggests that tax shelters, such as the German family office shelter for limited partnerships, are repetitive among firms and not limited to a particular industry. Recent findings suggest tax knowledge to be of an explicit nature, given the inferences on corporate-owned life insurance shelters (Brown, 2011) or lease-in, lease-out transactions (Wilson, 2009). Lisowsky (2010) further argues that a significant portion of tax shelters serve as mass-market tax-saving ideas for advisors.

2.2.2. Diffusion of (Tax) Knowledge

Knowledge diffusion requires communication through channels over time among members of a social system (Rogers, 2003). In accomplishing a common goal, the contracting parties of a strategic alliance are engaged in joint problem solving via a social system. Consistent with this, cooperation is found to mitigate problems that ensue from cultural differences (Kogut and Singh, 1988). Spillovers are also more likely to occur in cases of a high frequency of interactions between firms (Isaksson, Simeth, and Seifert, 2016) and with increasing partner trustworthiness (Jiang et al., 2016). Regarded as “lying somewhere in between single-firm activity and spot contracting” (Lindsey, 2008) and presenting increased mutual commitment compared to arm’s-length market transactions (Chan et al., 1997), strategic alliances further comply with the diffusion requirements proposed by Rogers. Empirical inferences about knowledge diffusion via strategic alliances are usually based on the contracting parties’ stock price performance (Boone and Ivanov, 2012; Mohanram and Nanda, 1996; Chen, King, and Wen, 2015; Anand and Khanna, 2000), return on equity, (cash flow) return on assets (Chan et al., 1997; Porrini, 2004), post-reorganization performance (Cai and Sevilir, 2012; Higgins and Rodriguez, 2006; Ishii and Xuan, 2014; Porrini, 2004) and patent citations

(Gomes-Casseres, Hagedoorn, and Jaffe, 2006; Li, Qiu, and Wang, 2019). Other scholars apply exploratory approaches by conducting surveys (Dyer and Hatch, 2006) or interviews (Inkpen, 2008). Firms are often found to benefit from what they learn in alliances in other contexts (Porrini, 2004).

Based on these findings and combining them with the characteristics of tax knowledge, one could expect strategic alliances to serve as channels for tax knowledge diffusion between firms. Tension, however, arises from various aspects. Basically, the business purpose of a strategic alliance itself does not aim at immediate tax consequences. Furthermore, limits to a recipient's absorptive capacity create a barrier to knowledge diffusion (Dyer and Hatch, 2006; Szulanski, 1996), and joint operations could induce complexity in the contracting parties' organizations that reduces the ability to fine-tune the tax sheltering of their affiliates (Desai, Foley, and Hines, 2004). Additionally, both cooperation (Chen, King, and Wen, 2015) and tax planning are found to increase a firm's uncertainty (Dyreg, Hanlon, and Maydew, 2019). Even prudent managers could expect the marginal disutility of uncertainty to exceed the benefits of received tax knowledge. Furthermore, firms need to trade off deriving know-how from their alliance partners with protecting themselves from losing their own core capabilities (Kale, Singh, and Perlmutter, 2000). Khanna, Gulati, and Nohria (1998) frame this in the context of earning private benefits in an alliance. Earning private benefits permit a firm to apply what it learns to its business outside the scope of the alliance but harm the network by inducing underinvestment in shared learning.

2.2.3. Mechanisms

Inkpen (2000) describes learning through networks as a multi-stage process that consists of forming a network, gaining access to knowledge and adopting the knowledge. However, there is little evidence on the mechanisms behind knowledge diffusion. Chan et al. (1997) identify optimal decision making authority, organizational flexibility and control of opportunistic behavior as major drivers. Khanna, Gulati, and Nohria (1998) argue that although contracting parties must invest in learning, both parties need not earn private

benefits. They argue that a firm [with poor tax knowledge]¹ would not have an incentive to continue the alliance once it had earned private benefits [tax knowledge] if its private benefits exceeded the common benefits. The other party [with sophisticated tax knowledge] would then “race” to earn benefits itself before termination of the alliance. As such racing behaviors appear to be mutually reinforcing, common benefits would still be attainable (Khanna, Gulati, and Nohria, 1998). Furthermore, strategic alliances enhance managerial flexibility because the contracting parties are not fully committed to the investment (Chen, King, and Wen, 2015). Fiol and Lyles (1985) contemplate that the probability of learning increases with an organizational structure that allows innovativeness and new insights.

Seconded employees to a strategic alliance not only are involved in the alliance’s business as such but also monitor the network and the partner. Within-firm reporting thus creates opportunities for experience-sharing. Additionally, observing effectively implemented tax planning strategies by participants in a network could increase a firm’s management confidence in also implementing the respective tax planning activity. This would be consistent with knowledge diffusion being a gradual process of dissemination (Szulanski, 1996) and with increasing probability of uniformity of actions in networks over time (Gale and Kariv, 2003) while also aligning with anecdotal evidence on tax advisors who heavily pitch tax planning ideas across the population of firms with only partial success from the spot. Gained confidence could also overcome the fear of reputational costs from engaging in tax planning (Gallemore, Maydew, and Thornock, 2014; Hanlon and Slemrod, 2009).

Regarding supply chains, Cen et al. (2018) suggest that intentional tax knowledge transfers enhance and maintain a supply chain’s stability. Strategic alliances are also exposed to instability that is inherent in their institutionalization and specific to cooperation. Cultural differences, product market competition, availability of new technology, cost differences, market entry barriers, deadlocks, or an imitation of a partner cause this instability. However, whether the participants in a strategic alliance follow the intuition

¹ The content in square brackets is added by the authors.

of Cen et al. (2018) and share tax knowledge to establish bonding mechanisms is not decisive for our study since we do not have to imperatively assume intentional transfers of tax knowledge.

Given the variety of potential mechanisms, we do not expect that tax knowledge diffusion via strategic alliances is exposed in (one) specific accounting measure(s). Instead, the experiences of other firms and the communication structure between parties explain information flows (Acemoglu et al., 2011; Blonski, 1999). Consequently, tax knowledge diffusion via strategic alliances should be driven by complex elements such as trust, confidence and skills. If we observed actual exploitation of opportunities for tax knowledge diffusion, we could shed light on diffusion of knowledge when peer-to-peer contracting. Overall, it thus remains an empirical question whether strategic alliances actually serve as channels for tax knowledge diffusion between firms.

3. Data

[Table 1]

3.1. Sample Construction

We exploit data on strategic alliances from the Securities Data Company (SDC) Platinum database on strategic alliances over the 1994–2016 period.² SDC is widely used in relevant research on corporate cooperation (Anand and Khanna, 2000; Boone and Ivanov, 2012; Cai and Sevilir, 2012; Chen, King, and Wen, 2015; Ishii and Xuan, 2014), and its accuracy is generally perceived to be very high for most items (Anand and Khanna, 2000). SDC issues data at the strategic alliance level. We reshape data from the alliance to the participant level because accounting data are available for the (publicly traded) contracting parties. For instance, a strategic alliance between two participants translates to a network-firm observation for each of the two firms. Compustat provides us with firm-year-level accounting information, and we merge SDC and Compustat data by using a firm's six-digit CUSIP number (at the level of the ultimate

² A list of the requested data items is available from the authors upon request.

parent of the participant) as an identifier. Although SDC provides reliable network observations from the beginning of 1990 onwards, we start our sample in 1994 due to changes in reporting requirements on cash taxes paid (Cen et al., 2017). We end our sample in 2016 to exclude any inferences from the 2017 US tax reform. Furthermore, we respectively consider strategic alliances between publicly traded firms incorporated and headquartered in the US and in which all contracting parties are identified in Compustat (Table 1 Panel A). Our base sample contains 4,159 network-firm observations, which translate to 2,064 strategic alliances by 1,603 unique firms and 19,447 overall firm-year observations.

3.2. Identification Strategy

3.2.1. Measuring Tax Knowledge

We measure tax knowledge by observing a firm's nonconforming tax planning behavior. The lingua franca in determining the degree to which a firm succeeds in this attempt is the effective tax rate, which puts tax expenses and pre-tax book income into perspective. The interpretation of effective tax rates is fairly straightforward, and an advantage is that although it is conceptually incorrect, effective tax rates are widely used as input for corporate decisions on new investment (Graham et al., 2017). We base our inferences on the cash effective tax rate (*cash ETR*) because *cash ETR* also captures tax deferral strategies (Hanlon and Heitzman, 2010). Furthermore, we apply a multi-period (3-year) form of *cash ETR* (Brown and Drake, 2014; Barrios and Gallemore, 2019; Gallemore, Gipper, and Maydew, 2018) because we expect the likelihood of tax knowledge diffusion to increase over time.

$$cash\ ETR3_{i,t=1} = \frac{\sum_{t=1}^3 (txpd_{i,t})}{\sum_{t=1}^3 (pi_{i,t} - spi_{i,t})} \quad (1)$$

The terms *txpd*, *pi* and *spi* correspond to their Compustat data item equivalents of cash taxes paid, pretax income and special items. Missing *spi* are reset to 0, while any *cash ETR3* with a negative denominator is reset to missing. Non-missing *cash ETR3* are winsorized at 0 and 1. By nature of this approach, *cash ETR3* would always be missing for the final (penultimate) firm-year of a firm in our panel. For the final

(penultimate) firm-year, we therefore substitute *cash ETR3* with *cash ETR(2)*.³ Applying a forward-looking *cash ETR3* has the advantage that potential tax knowledge diffusion via strategic alliances can be directly linked to the year of network initiation.

3.2.2. Networks between Low-Tax and High-Tax Firms

[Figure 2]

For tax knowledge diffusion to occur, at least one network participant must possess sophisticated tax knowledge. Therefore, we classify the strategic alliances' participants into low-tax and high-tax firms. Applying a forward-looking *cash ETR3* for our output analysis has the advantage of aligning any influence on the *cash ETR3* directly with the year of network initiation. However, identifying low-tax firms based on a forward-looking measurement would come with the disadvantage of concluding the type of input based on the output. For the identification of sophisticated tax planners, we therefore consider the *pre cash ETR3*, which is constructed over a three-year preceding period:

$$pre\ cash\ ETR3_{i,t=0} = \frac{\sum_{t=-2}^0 (txpd_{i,t})}{\sum_{t=-2}^0 (pi_{i,t} - spi_{i,t})} \quad (2)$$

For every $t = 1$ in which a new network is initiated, we consider the participants' initial *pre cash ETR3*, which is constructed from $t = -2$ to $t = 0$. For the first (second) firm-year of a firm in our panel, we substitute *pre cash ETR3* with *pre cash ETR(2)*. To increase the accuracy of our analysis, we require to observe *cash ETR3* and *pre cash ETR3* of all participants for a network to be considered in our analysis (Table 1 Panel B). Figure 2 provides additional information regarding how we identify low-tax and high-tax observations. We classify low-tax firms based on their industry-adjusted *pre cash ETR3* and allocate firm-year observations into 4 bins (*pre taxrank*) according to the quartiles of the distribution of the industry-adjusted *pre cash ETR3*. Industry adjustment (Brown and Drake, 2014) and a multi-period

³ For example, given our overall sample period, *cash ETR3* would always be missing for fiscal year 2015. In this case, we construct the numerator and denominator over two years, respectively.

measure (Dyreng, Hanlon, and Maydew, 2008) help us to validate identification of sophisticated tax planners. A network participant that is aligned with the first *pre taxrank* is treated as a low-tax firm in a network. Consequently, a strategic alliance in which at least one participant qualifies as a low-tax firm is treated as a low-tax network. Firms that do not qualify as low-tax firms are treated as high-tax firms, and networks in which none of the participants is a low-tax firm qualify as high-tax networks. We focus on high-tax firms in our analyses and thereby distinguish between high-tax firms that invest in low-tax networks and high-tax firms that invest in high-tax networks (Table 1 Panel C). Tax knowledge diffusion can occur for high-tax firms in low-tax networks (*hightolow*). However, high-tax firms in high-tax networks are in a very similar situation except for potentially experiencing tax knowledge diffusion. Finally, we exclude multiple network initiations of one firm in a single year to rule out the overweighing of a firm in the sample.⁴ Our identification strategy leads us to 197 observations of high-tax firms in networks with low-tax firms and 540 network-firm observations solely among high-tax firms.

3.3. Information on Networks and Firms

[Table 2]

Panel A of Table 2 contains information on the distribution of *pre cash ETR3* by *pre taxrank*, which is used to identify low-tax networks. Although the mean *pre cash ETR3* in the first bin of *pre taxrank* equals 7.08%, the average rises to 63.91% in the top *pre taxrank*. The overall mean of 30.66% for *pre cash ETR3* is relatively close to but below the federal corporate income tax rate of 35%, which is consistent with prior research on multi-period cash effective tax rates (e.g., Dyreng, Hanlon, and Maydew (2008)). Furthermore, Panel B of Table 2 contains descriptive statistics for firm-level characteristics separated by the classification of firms as low-tax or high-tax and by the network type for high-tax firms. Panel B includes measures of firm-level accounting information (*firm controls*), which are included in our regression analyses. Following Dyreng, Hanlon, and Maydew (2010), we show information on

⁴ The variable definitions in the Appendix contain detailed descriptions of the steps taken.

EBITDA3, *RnDExp3*, *AdExp3*, *SGA3*, *CapEx3*, *ChangeSale3*, *Leverage3*, *Cash3*, *MNE3*, *NOL3*, *Intangibles3*, *PPE3*, and *Size3*.⁵ Consistently with *cash ETR3*, these measures are constructed over rolling three-year periods. In Panel C of Table 2, we present information regarding the industry affiliation of networks and firms. Industry affiliation is determined on a two-digit SIC-code basis. It can be observed that the majority of networks operate in business services, while the investing firms are predominantly manufacturers and business service providers. Additionally, Panel D of Table 2 contains a correlation matrix of all independent variables included in our analyses.

4. Methodology

4.1. Regression Analysis

If engaging in low-tax strategic alliances is associated with tax knowledge diffusion, one should be able to identify increasing levels of tax planning at high-tax firms. Nevertheless, if the influence of a network on a firm's tax planning behavior as such were omitted, no inferences could be drawn. Consequently, our main variable of interest *hightolow* is constructed as an indicator variable to distinguish between high-tax firms that enter into high-tax networks (*hightolow* = 0) and high-tax firms that engage in low-tax networks (*hightolow* = 1). By running our regression among high-tax firms, *hightolow* isolates the incremental effect a low-tax network exerts on the high-tax firm's *Tax Knowledge*:

$$\begin{aligned}
 \textit{Tax Knowledge}_{i,t=1} &= \beta_0 + \beta_1 \textit{hightolow}_{i,t=1} + \sum_n \beta_n \textit{partner controls}_{i,t=1}^n \\
 &+ \sum_l \beta_l \textit{network controls}_{i,t=1}^l + \sum_k \beta_k \textit{firm controls}_{i,t=1}^k \\
 &+ \delta_{ind} + \tau_t + \varepsilon_{i,t}.
 \end{aligned} \tag{3}$$

⁵ All variables are defined in detail in the Appendix. There is a large variety of control variables in the tax planning research. For instance, Kubick et al. (2015) suggest considering a firm's price cost margin to control for market power. In untabulated robustness checks, we include several vectors of firm controls but do not find our results to be driven by them. Therefore, we apply the basic approach by Dyreng, Hanlon, and Maydew (2010).

By using indicator notation (*hightolow*), the coefficient estimate describes the effect from moving from one condition to another condition. As we use a three-year rolling specification of a firm's cash effective tax rate (*pre cash ETR3*) for identification purposes, we primarily measure *Tax Knowledge* by *cash ETR3*. Consistently, Kim et al. (2019) suggest that firms are generally able to adjust their tax planning behavior within three years. Consequently, the coefficient estimate for *hightolow* would load negatively if strategic alliances served as channels for tax knowledge diffusion. To alleviate concerns about interpreting a level-based dependent variable, we also construct the change-indicating variable *delta cash ETR3*, which is *cash ETR3* [$t_1; t_3$] scaled by *pre cash ETR3* [$t_{-2}; t_0$]. Given a suggested average lifespan for strategic alliances of five years (Chan et al., 1997), we also measure *Tax Knowledge* as *cash ETR5* and *delta cash ETR5*.

Because strategic alliances go beyond bringing together high-tax and low-tax firms, we include vectors of variables on *partner & network controls* in our main regression model. From Compustat data, we can infer whether network participants share an audit firm in the year of network initiation (*SameAuditor*). Furthermore, we manually collect the geographical distance (as the crow flies) between the zip codes of the network participants' headquarters to control for the potential impact of geographical proximity in tax knowledge diffusion (*Proximity*). We normalize *Proximity* between 1 for the closest and 0 for the farthest distance, which allows us to interpret the sign of the coefficient in agreement with the sign of a potential indicator variable for a geographical linkage (as, for instance, in Brown (2011)). In our main regression, we do not include an indicator for firms belonging to the same industry (*SameInd*), as we include industry fixed effects (δ_{ind}).

[Figure 3]

Generally, business activities in a strategic alliance are in no way limited and could thus exert an influence on the options of tax planning that are available for a network participant. Therefore, we are interested in the main business purposes of the strategic alliances (*network controls*). To derive these, we apply textual

analysis. For illustration purposes, the word cloud depicted in Figure 3 shows the 50 most common words used in SDC’s deal descriptions of the networks in our regression sample. By systematically searching through the deal descriptions, we identify *PurposeWholesale*, *PurposeRnD*, *PurposeLicensing*, *PurposeService*, *PurposeMarketing*, *PurposeSupply*, and *PurposeManufacturing* as network activities, create respective indicator variables at the individual network level, and include these *network controls* in equation (3). Furthermore, we control for within-firm determinants of tax planning by including a vector of *firm controls*. We follow Dyreng, Hanlon, and Maydew (2010) and include *EBITDA3*, *RnDExp3*, *AdExp3*, *SGA3*, *CapEx3*, *ChangeSale3*, *Leverage3*, *Cash3*, *MNE3*, *NOL3*, *Intangibles3*, *PPE3*, and *Size3*. Consistent with *cash ETR3*, these measures are constructed over rolling three-year periods. The Appendix includes a complete list of the variable definitions. In addition to industry fixed effects (δ_{ind}), we include year fixed effects (τ_t) and cluster standard errors at the firm level (Petersen, 2009).⁶

4.2. Difference-in-Differences (DiD)

The regression model in equation (3) allows us to observe actual tax knowledge diffusion, which should occur over time, in the year of network initiation. This approach allows us to account for *partner & network controls*, although it condenses our panel to a cross-section. An alternative approach for measuring tax knowledge diffusion is to maintain the panel structure of our data and apply a DiD methodology. In this model, treatment is in alignment with *hightolow*. We create an embargo period of eight years around a *hightolow* observation during which no further network may occur, which reduces the number of observations in the sample. The embargo period contains the three years preceding and five years subsequent to network initiation. Our sample allows firms to enter into a network at any point in time of their discretion. We therefore compose a matched panel by matching control observations (*hightolow* = 0) to treatment observations (*hightolow* = 1) based on year and industry affiliation. As we no longer

⁶ The sign and overall significance of our main variable of interest are not sensitive to the design choices regarding fixed effects or the clustering of standard errors.

exploit cross-sectional but panel data, we adjust dependent and control variables from multi-period measures to their single-year versions:

$$\begin{aligned} \text{cash ETR}_{i,t} = & \beta_0 + \beta_1 \text{treated}_i + \beta_2 \text{post}_t + \beta_3 \text{treated} * \text{post}_{i,t} \\ & + \sum_k \beta_k \text{firm controls}_{i,t}^k + \delta_{ind} + \varepsilon_{i,t}. \end{aligned} \tag{4}$$

In this model, *treated* measures the baseline difference in *cash ETR* that is not due to the presence of the treatment. The parameter *post* captures changes in *cash ETR* from before to after treatment. The parameter of interest is the interaction *treated * post*. It measures the effect on *cash ETR* that is due to the treatment (i.e., low-tax network of high-tax firm). We include industry fixed effects and the annual measures of *firm controls* as defined in the Appendix. We base our inferences on standard errors clustered at the firm level (Petersen, 2009).

4.3. Endogeneity

A firm's decision to engage in a network is intentional and not random, which could lead to biased sample selection. Nevertheless, it is important to note that our study does not compare network firms to non-network firms but instead focuses on a within-comparison of network firms. Nevertheless, once a firm experiences knowledge diffusion via a low-tax network, engaging in subsequent networks could, to some extent, also depend on an expected learning effect. Our sample could thus be nonrandomly selected, which leads to concerns about endogenous treatment assignment (regarding scholars on strategic alliances, see Carpenter, Li, and Jiang (2012)). One may account for this empirically by constructing a two-stage estimator (Heckman, 1979). However, identifying valid covariates that predict treatment assignment while having no direct impact on the dependent variable is difficult (Bodnaruk, Massa, and Simonov, 2013; Chan et al., 1997; McGuire, Omer, and Wang, 2012). Following the recommendation by Lennox, Francis, and Wang (2012), we emphasize that our study potentially has an endogeneity problem that could affect the inferences from OLS regressions. However, if tax planning was an endogenous choice based on having high effective tax rates prior to engaging in tax planning (Dyreg, Hanlon, and Maydew, 2008), tax planning

research would generally face endogeneity concerns. Additionally, research indicates that firms could accept expected high taxation when establishing an [international] network (Owen and Yawson, 2013). If a network’s primary aim was facilitating tax planning, we would further expect firms to cover their tracks by not disclosing the partner. These cases, however, are excluded from our sample since we require the identification of all participants in a network.

For further mitigation purposes, we conduct a thorough descriptive analysis. We analyze changes in the tax planning behavior of high-tax firms in strategic alliances with low-tax firms in comparison to high-tax firms in strategic alliances with high-tax firms. First, we compare *pre cash ETR3* [$t_{-2}; t_0$] between the two groups. Subsequently, we focus on our primary measure of *Tax Knowledge* after network initiation, *cash ETR3* [$t_1; t_3$], and test the significance of the differences between the groups and within-group change by applying a z test following Paternoster et al. (1998):

$$z = \frac{b_1 - b_2}{\sqrt{SEb_1^2 + SEb_2^2}} \quad (5)$$

5. Results & Discussion

5.1. Descriptive Insights

[Table 3]

The results of our descriptive analysis are depicted in Table 3. In Panel A, we compare changes in *Tax Knowledge* between and within groups. Interestingly, the mean of *pre cash ETR3* is very similar for high-tax firms in the period before investing in low-tax or high-tax networks, with 38.96% and 39.35%, respectively (p-value of difference 0.8613). This alleviates concerns about analyzing level measures of *Tax Knowledge* in equation (3). It also indicates that low-tax firms do not tend to stay among themselves by engaging in strategic alliances with sophisticated tax planners. For periods subsequent to the initiation of a network by high-tax firms, the distribution of *cash ETR3* points towards a completely different direction. While observations of *hightolow* = 1 are accompanied with a mean *cash ETR3* of 27.55%,

networks solely among high-tax firms (*hightolow* = 0) are aligned to an average *cash ETR3* of 32.82%. The respective difference of 5.27% is also highly significant (p-value 0.0065). Generally, we observe substantial reductions in cash effective tax rates for both groups (within-group change), each being highly significant (p-values < 0.0000). These decreases could comprise reversion to the mean. However, this would not explain differences in the development between the groups. We therefore test whether the difference in the within-group change of 4.88 percentage points is significant and find it to be so (z-statistic -1.6994). In Panel B, we compare the development of *cash ETR3* for high-tax firms' involvement in low-tax and high-tax networks with a growing number of networks. In this test, we again observe lower levels of *cash ETR3* for high-tax firms in low-tax networks, with differences increasing in intensified networking. Although our descriptive analysis does not allow us to include further covariates, we interpret our findings to be consistent with strategic alliances serving as channels for tax knowledge diffusion. Therefore, we are interested in whether the multivariate regression results further support this notion.

5.2. Regression Results

[Table 4]

5.2.1. Multivariate Regression

The main variable of interest in our regression analysis is *hightolow* because it isolates the incremental effect a low-tax network exerts on a high-tax firm's *Tax Knowledge*. In Panel A of Table 4, we show multi-period specifications of *Tax Knowledge* for equation (3) with *cash ETR3*, *delta cash ETR3*, *cash ETR5* and *delta cash ETR5*. By observing multi-period measures, we can link our inferences to the period of network initiation. For brevity, we report only the coefficient estimates for *hightolow* and *partner controls*. Throughout all specifications, the estimate for *hightolow* is negative and highly significant. In the specification with *cash ETR3* as the dependent variable, the estimate for *hightolow* has a magnitude of -0.0480 (p-value 0.0103), which is consistent with our descriptive inferences in terms of direction and magnitude. Because an overall network effect is absorbed by including high-tax firms in our

regression and because the covariates of *partner, network & firm controls* account for a broad range of alternative explanations, we find it plausible to associate the (relative) increase in tax planning practices for high-tax firms in low-tax networks to be induced by the presence of a low-tax firm in the network. Extending equation (3) to a change-indicating variable, *delta cash ETR3*, yields the same implications (p-value 0.0061). Furthermore, we extend our model to *cash ETR5* and *delta cash ETR5*, which are constructed identically to *cash ETR3* and *delta cash ETR3*, respectively, but over five years subsequent to and including the year of network initiation as the dependent variables. The results for these specifications imply a slightly smaller magnitude (coefficient estimate for *(delta) cash ETR5* is -0.0376 (-0.1229)) in effects but are both negative and highly significant. Interestingly, the estimates for the *partner controls*, namely, *Proximity* and *SameAuditor*, do not surpass the usual levels of significance. In several additional analyses (see Section 6), we focus on the interactions of *hightolow* and *partner controls* to align our findings with prior research. Furthermore, we do not observe that the business purposes of the strategic alliances (*network controls*) drive our findings, which supports the notion that strategic alliances are not intended to be tax planning investments. Overall, our findings in Panel A convey that decreases in cash taxes paid are driven by the partner firm's tax planning behavior.

5.2.2. Difference-in-Differences

[Figure 4]

Panel B of Table 4 shows the results for our DiD analysis from equation (4). Any DiD specification relies on the parallel trend assumption. Otherwise, one could not empirically identify the posttreatment outcome absent the treatment. Usually, the parallel trend assumption is graphically examined by observing pretreatment trends of the dependent variable among the treatment and control groups. Accordingly, Panel A of Figure 4 provides visual evidence that the trends of *cash ETR* are parallel for treatment and control firms prior to the treatment (*hightolow* = 1). Consistent with our analysis on the full sample, it can also be observed that the pretreatment levels of *cash ETR* are very similar for the treated and untreated

firms in the matched panel. Although a direct empirical test for the parallel trend assumption is not possible, Patel and Seegert (2015) developed an approach to alleviate concerns about potential confounding factors. They suggest regressing the treatment indicator, time fixed effects and the interaction of the treatment indicator and time fixed effects on the dependent variable:

$$cash\ ETR_{i,t} = \alpha + treated_i + \tau_t + \tau_t * treated_i + \varepsilon_{i,t}. \quad (6)$$

They argue that failure to reject that the coefficient estimates for the interaction terms for $\tau_t * treated_i$ are jointly zero in the pretreatment period supports the parallel trend assumption. In Panel B of Figure 4, we therefore present the coefficient and the 95% confidence interval of the interaction of the treatment indicator and time fixed effects from equation (6) for the pretreatment years. First, none of the individual coefficients are significantly different from zero. More importantly, however, the p-value of the parallel trend test (the coefficients of $\tau_t * treated_i$ are jointly zero during pretreatment) is far beyond the usual levels of significance ($p = 0.7427$). Consequently, we are able to provide visual and statistical evidence for the parallel trend assumption.

In Panel B of Table 4, we depict several specifications of equation (4) with varying levels of including *firm controls* and industry fixed effects (δ_{ind}). The estimate for the interaction of *treated * post* is negative and significant throughout all these specifications. Consequently, we find a negative *cash ETR* response to low-tax networks in comparison to high-tax networks for high-tax firms. Taken together, the results from our descriptive and regression analyses are consistent with strategic alliances serving as channels through which tax knowledge diffuses between firms. For the purpose of interpreting the economic significance of our findings, we computed the margins of response of *cash ETR* for all specifications of equation (4). High-tax firms show an approximately 5-percentage point lower *cash ETR* when in networks with low-tax firms than when high-tax firms are in high-tax networks. Although this difference is economically meaningful (and statistically significant), the predicted levels of *cash ETR* are also reasonable with approximately 26.5%.

5.2.3. Adjustment Speed

We are further interested in how fast high-tax firms can adjust their tax planning behavior when cooperating with low-tax firms. Therefore, we estimate five specifications of equation (4). We extend the posttreatment period by one year with each specification. Thus, we notate $post = 1$ only for the year of network initiation $[t_1]$ first and finish with $post$ equaling one for the entire posttreatment embargo period $[t_1; t_5]$. The coefficient estimates of $treatment * post$ thus present the cumulative adjustment of a high-tax firm's tax planning behavior with progressing time (t_1 to t_5) when cooperating with low-tax firms (i.e., adjustment speed). The results of this analysis are presented in Panel C of Table 4. In accordance with the theory that suggests that diffusion of (tax) knowledge increases in probability over time, the coefficient estimate of $treatment * post$ is not significant when the posttreatment period is limited to the year of network initiation. This finding is consistent with our notion that strategic alliances, per se, do not aim at facilitating tax planning. Otherwise, one would expect to find an immediate adjustment. The coefficient estimate of the interaction, however, turns significant when $post$ equals one for t_1 and t_2 . Furthermore, the estimated effect continues to be significant when extending the posttreatment period to t_3 , t_4 and t_5 . Consequently, we assess high-tax firms on average to be able to adjust their tax planning behavior within two years of network initiation. These findings are consistent with recent research by Kim et al. (2019) who suggest that firms generally are able to adjust their tax planning behavior within three years and that high-tax firms may increase their tax planning behavior even faster. Additionally, our results suggest that a firm's adjustment of its tax planning behavior, once implemented, stays constant over subsequent years.

6. Additional Analyses

[Table 5]

Thus far, we have considered the overall implications of low-tax networks for high-tax firms. We are also interested in partnering firms' characteristics, which could intensify or mitigate the identified effects. Thereby, we focus on geographical proximity, identical industry affiliation and shared audit firms.

In Panel A of Table 5, we compare two subsamples of networks by following the identification strategy of Brown (2011). One group consists of firms with their headquarters located in the same region as defined by the Bureau of Economic Analysis (BEA; *SameBEARegion* = 1).⁷ The other group consists of firms with headquarters located in different BEA regions in the year of network initiation (*SameBEARegion* = 0).⁸ The intuition behind this approach is that shared membership in a geographical region could allow higher levels of interfirm interaction. We run specifications of equation (3) with (*delta*) *cash ETR3* as the dependent variable and are interested in the interaction of *hightolow* * *SameBEARegion* because the coefficient estimates comprise the incremental influence of geographical proximity on tax knowledge diffusion via low-tax networks. We observe a significant coefficient estimate of the main effect of *hightolow*. Neither *SameBEARegion* nor the interaction of the two variables are significantly different from zero. Although this finding is generally consistent with the inferences by Brown (2011) on geographical proximity, Cen et al. (2018) report that the correlation of effective tax rates is stronger for the members of a supply chain that are located within the same geographical region.

In their hypothesis development, Brown and Drake (2014) argue that firms with the same industry affiliation share the same operating environment and suggest that this should enhance the identified effect. However, the results from comparing intra- and interindustry board ties fall short of their expectation. To test the potential effect of shared industry affiliation in our setting, we construct two subsamples, which coincides with our approach in Panel A. One group consists of network participants who share industry affiliation (*SameInd* = 1), and the other group consists of firms with different industry affiliations (*SameInd* = 0). Consistent with Brown and Drake (2014) and in line with our inferences on geographical proximity, we cannot reject that the interactions of *hightolow* and *SameInd* are significantly different

⁷ The respective BEA regions are Far West, Great Lakes, Mideast, New England, Plains, Rocky Mountains, Southeast and Southwest.

⁸ Our findings are not conditional on choosing either a state-level indicator, a region-level indicator or continuous distance.

from zero. This finding supports the notion that tax shelters are repetitive among firms, are not limited by industry barriers and serve as mass-market tax-saving ideas (Lisowsky, 2010).

Finally, we examine the role of shared audit firms and identify whether the firms in a network share an audit firm in the year of network initiation. We construct an indicator variable (*SameAuditor*) and interact it with *hightolow*. In specifications of equation (3) with *cash ETR3* and *delta cash ETR3* as dependent variables, the interaction terms for *hightolow * SameAuditor* approach common levels of statistical significance. Our inferences take their place alongside a range of mixed inferences concerning auditors' impact on firms' tax planning behavior. Brown (2011) does not find significant tax shelter adoption via shared audit firms and Klassen, Lisowsky, and Mescall (2016) show that less tax aggressiveness in the past is associated with the auditor preparing a firm's tax return. In contrast, Lim et al. (2018) and Cen et al. (2018) suggest that common auditors facilitate tax planning. Consistent with the mixed evidence from prior literature, Nesbitt, Persson, and Shaw (2019) suggest that there are limits to the relation between auditor-provided tax services and clients' tax aggressiveness.

The results presented in Table 5 might easily be subject to misinterpretation. We do not posit that industry affiliation, auditor ties or geographical proximity have no impact on firms' tax planning behavior. We are interested solely in whether partner heterogeneity accelerates or alleviates tax knowledge diffusion for high-tax firms that invest in low-tax networks. It appears that tax knowledge diffusion via strategic alliances is rather unaffected by such heterogeneity.

7. Robustness Checks

In this section, we examine the robustness of our primary findings regarding alternative explanations and potential concerns about our identification strategy. We rule out the possibility that our findings are unrelated to tax knowledge diffusion.

7.1. Alternative Explanations

[Table 6]

Applying three-year rolling measures of cash effective tax rates would systematically exclude from our sample network-firm observations that occur at the first, second, penultimate and final firm-years of a network participant. For identification purposes, we substitute *[pre] cash ETR3* with *[pre] cash ETR(2)*. However, it is possible that strategic alliances serve as preliminary ties between successive acquirers and targets (Ishii and Xuan, 2014; Porrini, 2004). Survivorship bias could thus exert an influence on our inferences. Consequently, we present a specification of equation (3) in Panel A of Table 6 in which we exclude from the analysis nonsurvivors (i.e., firms with network-firm observations within the last two years of their presence in our panel). In this model, we still find the loading of *hightolow* to be significant (p-value 0.0571) and the economic magnitude to be consistent with our primary findings. This result indicates that our inferences are robust to survivorship bias.

Another alternative explanation of our findings could be that the difference in the levels of *Tax Knowledge* between the two groups in our sample is not induced by tax knowledge diffusion from low-tax firms to high-tax firms but by increases in *cash ETR3* for high-tax firms in high-tax networks.

[Figure 5]

Figure 5 depicts a kernel density plot of the distribution of *delta cash ETR3* for all high-tax firms. The dotted line at $x = 1$ indicates the threshold between a decrease and an increase for *cash ETR3* relative to *pre cash ETR3*. It can be observed that some parts of the high-tax firm population experience increases in *cash ETR3*, which would, to some extent, not be consistent with knowledge diffusion. In Panel B of Table 6, we provide a specification of equation (3) in which we control for increases in *cash ETR3* by excluding observations of *delta cash ETR3* that are above the threshold of one. Again, our results indicate a negative and significant coefficient estimate for *hightolow*. Consequently, we are confident that our

inferences are based on tax knowledge diffusion via low-tax networks rather than on increases in *cash ETR3* in the control group.

Although we identify tax knowledge diffusion for high-tax firms via low-tax networks, we have not considered the tax position of low-tax firms. Like high-tax firms, low-tax firms can be bound to either high-tax firms or low-tax firms. Intuitively, there is little reason to expect incremental, “negative” tax knowledge spillovers for low-tax firms bound to high-tax firms. To empirically control for this notion, we construct *lowtohigh*, which is an indicator that equals one for low-tax firms in networks with high-tax firms and zero for low-tax firms in low-tax networks. The results for this specification of equation (3) are presented in Panel C of Table 6. The coefficient estimate for *lowtohigh* is far beyond common levels of significance, with a p-value of 0.9961. This finding further supports our inferences of tax knowledge diffusion occurring among high-tax firms.

Since effective tax rates are mechanically influenced by taxes paid and profitability, changes in *cash ETR3* could be solely income induced. This would to some extent speak against identifying tax knowledge diffusion. To account for this concern, we construct *ChangeEBITDA3*, which is the annual average growth rate in *EBITDA* from t_1 to t_3 (geometric mean). We then run equation (3) with *ChangeEBITDA3* as the dependent variable and find the coefficient estimate for *hightolow* to be nonsignificant (p-value 0.6569) and of small economic magnitude (Panel D of Table 6). From this, it follows that the identified effects are not linked to profitability.

7.2. Alternative Identification Strategy

[Table 7]

There are some judgment calls involved in classifying strategic alliances as high-tax- and low-tax networks and including an indicator variable in the respective regression. Therefore, we provide a modified model in which we regress the industry-adjusted *pre cash ETR3* [$t_{-2}; t_0$] of a firm and of its partner on the firm’s *cash ETR3* [$t_1; t_3$]:

$$\begin{aligned}
cash\ ETR3_{i,t=1} &= \beta_0 + \beta_1 Own_ind_adj_pre_cash_ETR3_{i,t=0} \\
&+ \beta_2 Partner_ind_adj_pre_cash_ETR3_{i,t=0} \\
&+ \sum_n \beta_n partner\ controls_{i,t=1}^n \\
&+ \sum_l \beta_l network\ controls_{i,t=1}^l \\
&+ \sum_k \beta_k firm\ controls_{i,t=1}^k + \varepsilon_{i,t}.
\end{aligned} \tag{7}$$

Since we use industry-adjusted measures of *cash ETR3* in this model, we do not insert industry fixed effects. However, we include the indicator *SameInd* in addition to the *partner controls* (*SameAuditor*, *Proximity*). If the partner firm's tax position is correlated with the firm's own levels of tax planning, one would find a positive coefficient estimate of *Partner_ind_adj_pre_cash_ETR3*. In a first specification of equation (7), we include network-firm observations of low-tax firms and high-tax firms. The results are depicted in Panel A of Table 7. While we observe a positive and highly significant coefficient estimate of *Own_ind_adj_pre_cash_ETR3*, *Partner_ind_adj_pre_cash_ETR3* is not significant. The latter finding is, however, little surprising given the inference that low-tax firms are rather unaffected by their partner firms' tax positions (Table 6 Panel C). Therefore, we include network-firm observations of high-tax firms in a second specification of equation (7). In this model, the coefficient estimate of *Partner_ind_adj_pre_cash_ETR3* is significant (p-value 0.0936). Consistent with the findings from our main analysis and with the notion of tax knowledge diffusion via strategic alliances, we find a positive association between partner firms' cash effective tax rates.

8. Conclusion

The purpose of this study is to shed light on channels through which tax knowledge diffuses between firms. Despite solid insights on the within-firm determinants of corporate tax planning, research on cross-firm connections in this field is still developing. We contribute to the emerging literature by being the first to identify strategic alliances as channels of tax knowledge diffusion between firms. With our study, we also

ease prior studies' assumptions of existing intermediaries and intentional transfers of tax knowledge. By using data on strategic alliances between publicly traded US firms, we can distinguish between networks that bring together high-tax and low-tax firms and networks that are established among high-tax firms. Conditional on the level of the tax planning of their strategic alliance partner, we find a substantial and economically meaningful increase in the tax planning behavior of high-tax firms. Our results also suggest that this adjustment occurs within two years of a strategic alliance's initiation. Based on textual analysis, we find that the business purposes of the strategic alliances do not drive our results. Overall, our results are consistent with diffusion of tax knowledge via strategic alliances. We think that the results of our study are of interest to corporate executives, regulators, and researchers because the perception and valuation of this examination's inferences likely depend on the respective position taken.

Although prior research has dedicated substantial attention to corporate cooperation and firms' tax planning, there are a number of unanswered questions regarding the interplay of the two. Primarily, we encourage research on the actual mechanisms of (tax) knowledge diffusion. Furthermore, it remains unclear whether the tax position of a potential network partner influences the decision of a firm to invest in a specific strategic alliance. Our hope is that our study enhances interdisciplinary research in accounting and management.

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Appendix: Variable Definitions

Variable	Definition (Compustat/SDC equivalent)
Network Characteristics	
<i>high-tax network</i>	Equals 1 for networks with solely high-tax firms as participants.
<i>hightolow</i>	Indicator variable; equals 1 for high-tax firms in low-tax networks; equals 0 for high-tax firms in high-tax networks; if a firm enters into multiple networks in one year, only one observation of this firm enters our sample in this year. In these cases, network selection is primarily done on a randomized basis. However, if a firm entered as high-tax firm into a low-tax network and into (a) high-tax network(s) in one year, we keep the low-tax network observation.
<i>low-tax network</i>	Equals 1 for networks involving at least one low-tax firm.
<i>lowtohigh</i>	Indicator variable; equals 1 for low-tax firms in high-tax networks; equals 0 for low-tax firms in low-tax networks.
\sum <i>network controls</i>	Indicator variables for the main business purpose of a network, which is derived from a network's deal description (DealText) in SDC; comprises PurposeWholesale, PurposeRnD, PurposeLicense, PurposeService, PurposeMarketing, PurposeSupply and PurposeManufacture; information is systematically extracted with R: dofile available upon request.
Partner Controls	
<i>Proximity</i>	Distance (as the crow flies) between the participants of a network according to the zip code of the participants' headquarters (addzip); collected from freemaptools.com; normalized between 1 and 0 for closest (same addzip) and farthest distance.
<i>SameAuditor</i>	Indicator variable; equals 1 when all participants of a network share the same auditor firm (au) in the year of network initiation; 0 otherwise; by nature of construction missing for non-network-firm observations.
<i>SameInd</i>	Constructed as SameAuditor but for industry affiliation; industry is classified using two-digit SIC codes (sic); see also Table 2.
<i>SameBEARegion</i>	Constructed as SameAuditor; equals 1 when all network participants are located in the same BEA region in the year of network initiation; 0 otherwise; the respective regions, as defined by the Bureau of Economic Analysis, are Far West, Great Lakes, Mideast, New England, Plains, Rocky Mountains, Southeast and Southwest.
\sum <i>partner controls</i>	See Proximity and SameAuditor for main analysis (equation (3)).

Variable	Definition (Compustat/SDC equivalent)
Firm Characteristics	
<i>cash ETR</i>	Cash effective tax rate; defined as cash taxes paid (txpd) divided by pre-tax income (pi) before special items (spi); special items are reset to 0 when missing; cash ETR observations with negative denominator are reset to missing; winsorized at 0 and 1.
<i>cash ETR3</i>	Cash effective tax rate; defined as cash taxes paid (txpd) divided by pre-tax income (pi) before special items (spi); special items are reset to 0 when missing; numerator and denominator are constructed as the sum of the current and two subsequent years; observations with negative denominator are reset to missing; for the final (penultimate) firm-year of a firm substituted by cash ETR(2); winsorized at 0 and 1.
<i>cash ETR5</i>	Cash effective tax rate; constructed as cash ETR3, but for five years.
<i>ChangeEBITDA3</i>	Three-year annual average growth rate (geometric mean) of EBITDA (ebitda) ($\sqrt[3]{ebitda_{t3}/ebitda_{t1}} - 1$); reset to 0 when missing.
<i>delta cash ETR3</i>	Cash ETR3 [t ₁ ; t ₃] scaled by pre cash ETR3 [t ₋₂ ; t ₀]: $\frac{cash\ ETR3_{[t_1;t_3]}}{pre\ cash\ ETR_{[t_{-2};t_0]}}$
<i>delta cash ETR5</i>	Cash ETR5 [t ₁ ; t ₅] scaled by pre cash ETR3 [t ₋₂ ; t ₀].
<i>high-tax firm</i>	Indicator variable; equals 1 when a firm's industry adjusted pre cash ETR3[t ₋₂ ; t ₀] is aligned to pre taxrank [2; 4] (if pre taxrank[t ₀] is missing, replaced by pre taxrank[t ₋₁]); 0 otherwise.
<i>low-tax firm</i>	Indicator variable; equals 1 when a firm's industry adjusted pre cash ETR3[t ₋₂ ; t ₀] is aligned to pre taxrank = 1 (if pre taxrank[t ₀] is missing, replaced by pre taxrank[t ₋₁]); 0 otherwise.
<i>post</i>	Indicator variable; equals 0 for a period of three years before network initiation and 1 for a period of five years subsequent to initiation and includes treatment/control observations. post constitutes an embargo period during which no other hightolow observation may occur.
<i>pre cash ETR3</i>	Constructed as cash ETR3 but with numerator and denominator constructed as the sum of the current and two preceding periods; for first (second) firm-year of a firm substituted by pre cash ETR(2).
<i>pre taxrank</i>	Allocates ranks (1-4) according to the quartiles of the distribution of industry adjusted pre cash ETR3; 1 for the bottom end, 4 for the top end of the distribution.
<i>treated</i>	Treatment is in alignment with hightolow (see post for embargo period) and extended to pre- and post-periods.

Variable	Definition (Compustat/SDC equivalent)
<i>treated * post</i>	Interaction of treated and post; main variable of interest in the difference-in-differences model.
Firm Controls*	
<i>AdExp3</i>	Advertising expense (xad) divided by net sales (sale); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.
<i>CapEx3</i>	Reported capital expenditures (capx) divided by gross property, plant, and equipment (ppeg); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.
<i>Cash3</i>	Cash and cash equivalents (che) divided by total assets (at); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.
<i>ChangeSale3</i>	Three-year annual average growth rate (geometric mean) of net sales (sale) ($\sqrt[3]{sale_{t3}/sale_{t1}} - 1$); when missing reset to annual change, thereafter reset to 0.
<i>EBITDA3</i>	Earnings before interest, taxes, depreciation and amortization (ebitda) scaled by total assets (at); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.
<i>Intangibles3</i>	The ratio of intangible assets (intan) to total assets (at); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.
<i>Leverage3</i>	The sum of long-term debt (dltt) and long-term debt in current liabilities (dlc) divided by total assets (at); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.
<i>MNE3</i>	Indicator variable; equals 1 if pifo > 0 (non-missing, non-zero value for pre-tax income from foreign operations), 0 otherwise; measured as the sum over three years.
<i>NOL3</i>	Indicator variable equals 1 if tlcf > 0 (non-missing, non-zero value of tax loss carry forward), 0 otherwise; measured as the sum over three years.
<i>PPE3</i>	Gross property, plant, and equipment (ppeg) divided by total assets (at); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.

Variable	Definition (Compustat/SDC equivalent)
<i>RnDExp3</i>	Research and development expenses (xrd) scaled by net sales (sale); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.
<i>SGA3</i>	Selling, general, and administrative expense (xsga); divided by net sales (sale); numerator and denominator are constructed as the sum of the current and two subsequent years; when missing reset to annual measure, thereafter reset to 0.
<i>Size3</i>	The natural log of total assets (at) for the respective and two subsequent periods; when missing reset to annual measure, thereafter reset to 0.

*Continuous *firm controls* are winsorized at p1 and p99 and not mean-centered.

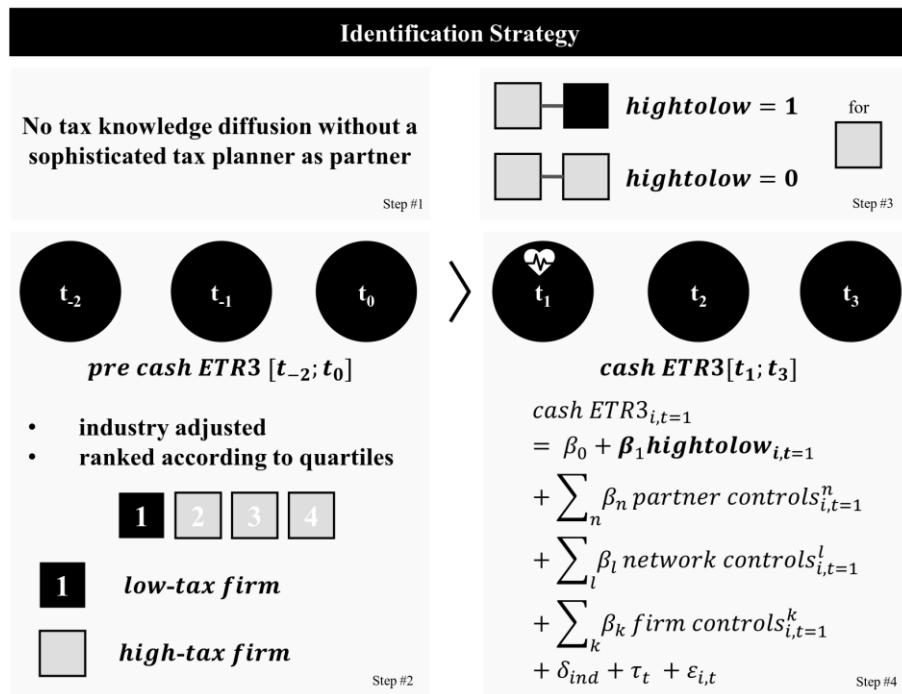
Figures

Figure 1

Cross-Firm Connections and Tax Knowledge		
Framework	① Intermediary	② Peer-to-Peer
Major Channel	A Intentional Transfer	B Diffusion
① — A	<ul style="list-style-type: none"> • Auditors (Frey (2018); Lim et al. (2018)) • Banks (Gallemore, Gipper, Maydew (2018)) • Board Ties (Brown (2011); Brown, Drake (2014)) • Human Capital Turnover (Barrios, Gallemore (2018)) 	
② — A	<ul style="list-style-type: none"> • Supply Chains (Cen et al. (2017); Cen et al. (2018)) 	
② — B	<ul style="list-style-type: none"> • Strategic Alliances 	

This figure categorizes prior research regarding transfers and diffusion of tax knowledge via cross-firm connections. It aligns the framework (i.e., institutional setting) with identified channels.

Figure 2



This figure summarizes our identification strategy. For simplification purposes, we show the strategic alliances of two participants in the upper right corner. The heartbeat pictogram at t_1 indicates the year of initiation of a strategic alliance. We also show a specification of equation (3), where *Tax Knowledge* is measured as *cash ETR3*.

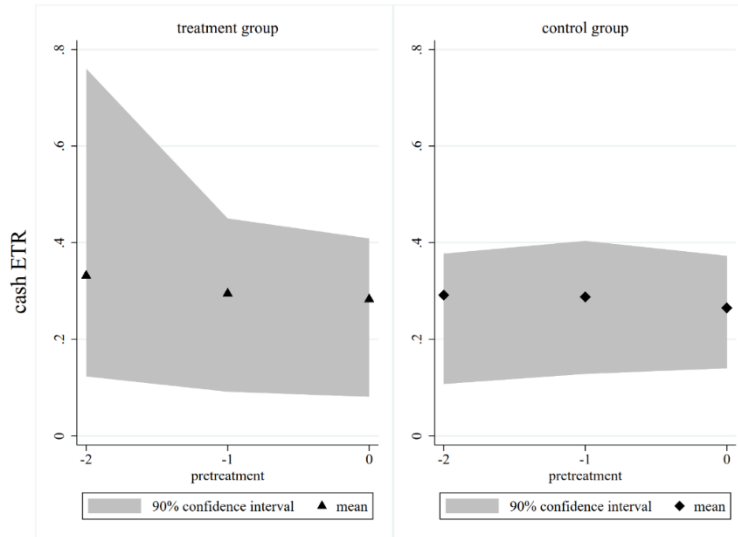
Figure 3



The word cloud depicted in Figure 3 shows the 50 most common words used in SDC's deal description of the networks in our regression sample. By systematically searching through the deal descriptions, we identify *wholesale*, *licensing*, *marketing* and *manufacturing* activities as well as *research and development*, providing *services* and engaging in *supply functions* as major business purposes of the networks in our sample. The respective indicator variables are included in equation (3). All variables are defined in detail in the Appendix.

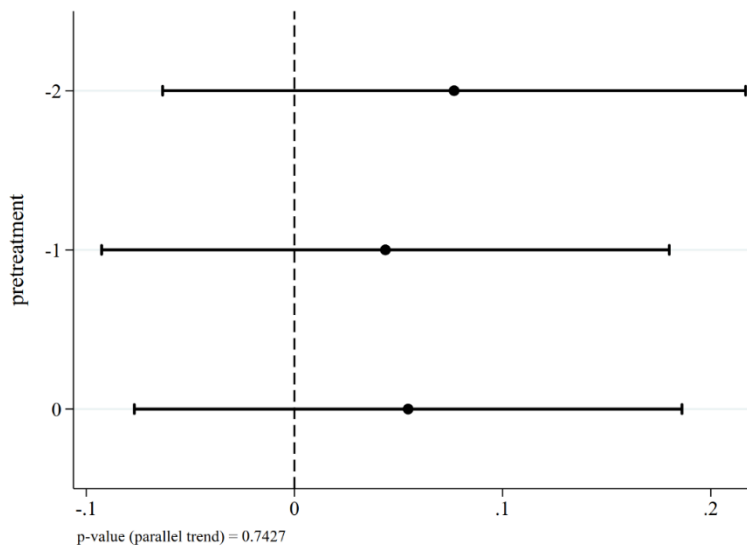
Figure 4

Panel A



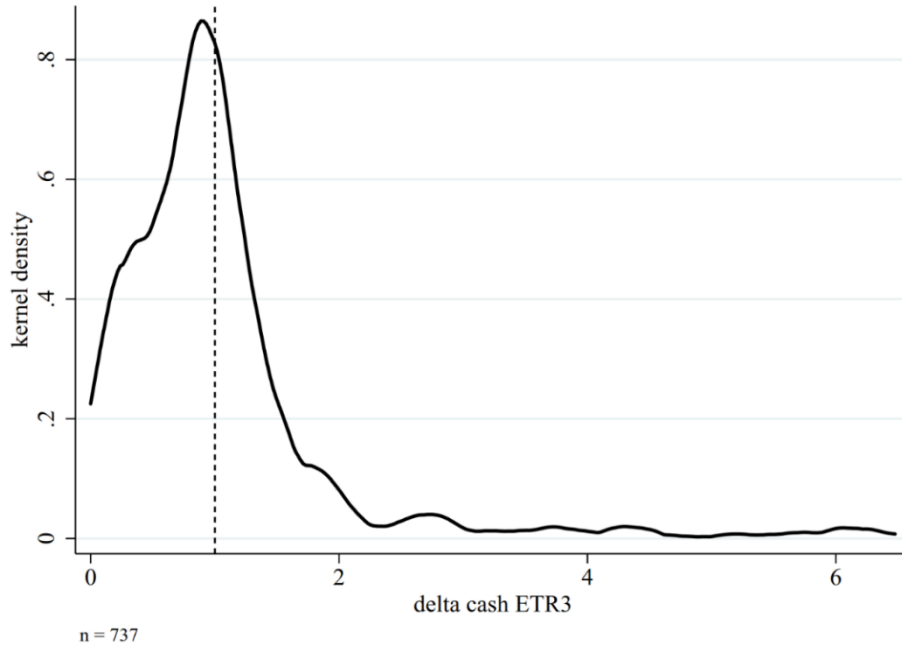
Panel A of this figure provides visual evidence that the trend of cash ETR is similar for the treatment and control firms prior to the treatment.

Panel B



In Panel B, we apply the approach of Patel and Seegert (2015) to provide statistical evidence for the parallel trend assumption. The figure reports the coefficient and 95% confidence interval of the interaction of the treatment indicator and time fixed effects for pretreatment years from the specification $cash\ ETR_{i,t} = \beta_0 + \beta_1 * treated_i + \tau_t + \tau_t * treated_i + \varepsilon_{i,t}$ (with the end of the embargo period as base year of τ_t). We test that the coefficients on $\tau_t * treated_i$ are jointly zero in the pretreatment period and fail to reject the null hypothesis. This supports the parallel trend assumption. The p-value for the parallel trend test is reported at the bottom of Panel B.

Figure 5



This figure depicts a kernel density plot of the distribution of *delta cash ETR3* for high-tax firms. The dotted line at $x = 1$ indicates the threshold between a decrease and an increase in *cash ETR3* relative to *pre cash ETR3*. The Appendix contains detailed definitions of all variables.

Tables

Table 1 Sample Selection & Identification Strategy

Panel A Compustat & SDC Platinum Data

	network-firm observations	networks	firms	firm-years
Compustat and SDC Platinum dataset of firms matched according to year of network initiation (DateEffective), US firms only (loc, fic, curcd), period 1994 - 2016 (fyear)	17798	15387	3570	52914
./ requirement to identify all contracting parties in network	4159	2064	1603	19447

Panel B Identification Strategy: Missing Information

	network-firm observations
all network-firm observations in sample	4159
./ missing pre cash ETR3 [t-2; t0]	2520
./ missing cash ETR3 [t1; t3]	2247
./ requirement to identify pre cash ETR3 and cash ETR3 of all participants in network	1301

Panel C Identification Strategy: Classification of network-firm observations

	low-tax partner	high-tax partner	Σ
low-tax firm [including multiple new networks of a firm in one year]	58 [78]	159 [225]	217 [303]
high-tax firm [including multiple new networks of a firm in one year]	197 [226]	540 [772]	737 [998]
	255 [304]	699 [997]	954 [1301]

All variables are defined in detail in the Appendix. Data items from Compustat and SDC Platinum are in parentheses.

Table 2 Information on Networks and Firms

Panel A pre cash ETR3 by pre taxrank

	N	mean	min	p5	p25	p50	p75	p95	max
pre taxrank = 1	2872	0.0708	0.0000	0.0000	0.0228	0.0699	0.1136	0.1515	0.2213
pre taxrank = 2	2872	0.2104	0.1055	0.1549	0.1836	0.2107	0.2367	0.2643	0.3255
pre taxrank = 3	2872	0.3062	0.2161	0.2577	0.2801	0.3047	0.3316	0.3602	0.4197
pre taxrank = 4	2872	0.6391	0.3094	0.3559	0.3973	0.4979	1.0000	1.0000	1.0000
pre cash ETR3	11488	0.3066	0.0000	0.0141	0.1527	0.2599	0.3574	1.0000	1.0000

Panel B Descriptive Statistics

	low-tax firm in network			high-tax firm in low-tax network (hightolow = 1)			high-tax firm in high-tax network (hightolow = 0)		
	N	mean	p50	N	mean	p50	N	mean	p50
cash ETR	294	0.1396	0.1166	193	0.2708	0.2533	520	0.2918	0.2659
cash ETR3	303	0.2017	0.1544	197	0.2755	0.2516	540	0.3282	0.2715
cash ETR5	231	0.1836	0.1618	162	0.2366	0.2313	434	0.2697	0.2586
EBITDA3	303	0.1387	0.1291	197	0.1527	0.1455	540	0.1582	0.1503
RnDExp3	303	0.1031	0.0959	197	0.0737	0.0489	540	0.0614	0.0296
AdExp3	303	0.0129	0.0000	197	0.0147	0.0000	540	0.0138	0.0000
SGA3	303	0.3471	0.3363	197	0.2702	0.2720	540	0.2599	0.2432
CapEx3	303	0.2082	0.1488	197	0.1536	0.1131	540	0.1598	0.1258
ChangeSale3	303	0.0693	0.0524	197	0.0484	0.0337	540	0.0605	0.0393
Leverage3	303	0.1681	0.1123	197	0.1815	0.1849	540	0.1942	0.1879
Cash3	303	0.2647	0.2180	197	0.1818	0.1254	540	0.1657	0.1040
MNE3	303	0.6931	1.0000	197	0.6041	1.0000	540	0.5444	1.0000
NOL3	303	0.3432	0.0000	197	0.3503	0.0000	540	0.2722	0.0000
Intangibles3	303	0.1556	0.0854	197	0.1844	0.1363	540	0.1585	0.0877
PPE3	303	0.3067	0.2204	197	0.4116	0.3313	540	0.4341	0.3286
Size3	303	9.1756	9.1257	197	9.6259	9.5942	540	9.1201	9.2695

All variables are defined in detail in the Appendix.

Table 2 Information on Networks and Firms (continued)

Panel C Industry Affiliation of Networks and Firms (two-digit SIC-code)

	#	industry of networks												Σ
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Agriculture, Forestry, & Fishing (01-09)	I	0	0	0	1	0	1	0	0	0	0	0	0	2
Mining (10-14)	II	0	6	0	1	2	0	2	0	0	0	1	0	12
Construction (15-17)	III	0	0	0	0	0	3	0	0	0	0	1	0	4
Manufacturing: Chemical & Allied Products (28)	IV	0	0	0	26	15	0	23	0	20	8	35	0	127
Manufacturing (20-39, except 28)	V	0	4	2	11	167	17	41	4	39	131	48	7	471
Transportation & Public Utilities (40-49)	VI	0	3	2	0	7	32	4	0	1	30	10	0	89
Wholesale Trade (50-51)	VII	0	1	0	0	3	2	19	1	3	8	4	0	41
Retail Trade (52-59)	VII I	0	0	0	0	4	3	9	1	4	10	2	2	35
Finance, Insurance, & Real Estate (60-67)	IX	0	0	0	1	1	1	2	1	25	17	6	2	56
Services: Business Services (73)	X	0	0	0	1	31	10	21	3	22	273	22	3	386
Services (70-89, except 73)	XI	0	0	0	0	0	3	2	0	4	8	16	0	33
Nonclassifiable Establishments (99)	XII	0	0	0	3	8	6	1	0	4	15	8	0	45
		0	14	4	44	238	78	124	10	122	500	153	14	1301

All variables are defined in detail in the Appendix.

Table 2 Information on Networks and Firms (continued)

Panel D Pearson's correlation coefficients\Spearman's rank correlations

	hightolow	Proximity	SameAuditor	PurposeWholesale	PurposeRnD	PurposeLicense	PurposeService	PurposeMarketing	PurposeSupply	PurposeManufacture	EBITDA3	RnDExp3	AdExp3	SGA3	CapEx3	ChangeSale3	Leverage3	Cash3	MNE3	NOL3	Intangibles3	PPE3	Size3
hightolow	1.000	-0.008	-0.012	0.093	-0.047	-0.008	0.060	0.082	-0.026	0.090	-0.035	0.087	0.052	0.025	-0.041	-0.025	-0.018	0.060	0.053	0.076	0.088	0.000	0.097
Proximity	-0.034	1.000	0.076	-0.030	0.034	0.060	-0.069	0.034	0.001	0.021	0.028	-0.021	-0.048	-0.068	-0.037	-0.011	0.057	-0.048	-0.050	-0.033	-0.009	0.061	-0.019
SameAuditor	-0.012	0.013	1.000	-0.012	0.023	-0.009	-0.029	-0.040	0.014	0.061	-0.041	0.020	0.019	-0.052	-0.062	-0.153	0.017	-0.034	0.006	-0.019	-0.003	0.053	0.039
PurposeWholesale	0.093	-0.049	-0.012	1.000	-0.143	-0.099	-0.079	-0.031	0.105	0.027	-0.036	-0.061	0.094	0.025	-0.094	-0.008	0.029	-0.024	0.109	0.005	0.119	0.010	-0.016
PurposeRnD	-0.047	0.086	0.023	-0.143	1.000	-0.092	-0.072	-0.093	-0.085	-0.013	0.084	0.267	-0.061	0.124	0.050	-0.041	-0.087	0.157	0.100	0.017	-0.041	-0.055	-0.003
PurposeLicense	-0.008	0.123	-0.009	-0.099	-0.092	1.000	-0.256	-0.071	-0.020	0.163	0.057	0.121	-0.043	0.100	0.153	0.074	-0.005	0.056	-0.088	-0.066	-0.155	-0.003	-0.181
PurposeService	0.060	-0.080	-0.029	-0.079	-0.072	-0.256	1.000	0.222	-0.089	-0.149	-0.037	-0.184	-0.039	-0.150	-0.053	0.009	0.039	-0.030	0.003	0.054	0.094	-0.004	0.155
PurposeMarketing	0.082	0.030	-0.040	-0.031	-0.093	-0.071	0.222	1.000	-0.050	-0.011	0.039	-0.050	0.052	-0.008	-0.051	0.020	0.002	0.001	0.073	0.073	0.011	0.082	-0.015
PurposeSupply	-0.026	-0.057	0.014	0.105	-0.085	-0.020	-0.089	-0.050	1.000	-0.005	-0.056	-0.093	0.009	-0.090	-0.094	-0.044	0.084	-0.096	-0.039	-0.075	0.013	0.042	0.032
PurposeManufacture	0.090	-0.043	0.061	0.027	-0.013	0.163	-0.149	-0.011	-0.005	1.000	0.039	0.065	-0.019	0.035	0.036	0.007	-0.026	0.035	-0.003	-0.035	-0.052	0.093	-0.074
EBITDA3	-0.033	-0.031	-0.039	-0.036	0.099	0.057	-0.041	0.044	-0.041	0.027	1.000	0.077	0.167	0.095	0.061	0.120	-0.118	0.091	0.132	-0.029	-0.046	0.301	0.066
RnDExp3	0.071	0.091	-0.003	-0.070	0.254	0.102	-0.125	-0.033	-0.111	0.034	0.045	1.000	0.124	0.640	0.313	0.066	-0.409	0.617	0.269	0.093	-0.118	-0.183	-0.133
AdExp3	0.013	0.018	-0.023	0.079	-0.056	-0.029	-0.058	0.042	0.031	-0.025	0.174	0.011	1.000	0.325	0.041	-0.075	0.006	0.131	0.168	0.036	0.138	0.023	0.173
SGA3	0.024	0.018	-0.049	0.015	0.120	0.088	-0.150	-0.011	-0.089	0.024	0.059	0.632	0.246	1.000	0.329	0.040	-0.332	0.499	0.186	0.111	0.006	-0.241	-0.269
CapEx3	-0.021	-0.006	-0.046	-0.081	0.042	0.103	-0.062	-0.071	-0.084	0.012	-0.028	0.401	0.039	0.501	1.000	0.308	-0.368	0.401	0.004	-0.008	-0.274	-0.343	-0.301
ChangeSale3	-0.051	-0.005	-0.099	-0.024	-0.010	0.092	0.005	0.005	-0.050	0.002	0.125	0.094	-0.050	0.050	0.253	1.000	-0.146	0.148	0.026	0.003	-0.110	-0.175	-0.099
Leverage3	-0.038	-0.001	0.021	0.015	-0.074	0.015	0.033	-0.003	0.084	-0.023	-0.148	-0.406	0.023	-0.318	-0.302	-0.146	1.000	-0.636	-0.039	0.045	0.316	0.314	0.321
Cash3	0.044	0.019	-0.050	-0.063	0.129	0.084	-0.035	-0.022	-0.096	0.019	0.089	0.612	0.014	0.500	0.488	0.188	-0.563	1.000	0.172	0.095	-0.247	-0.365	-0.241
MNE3	0.053	0.040	0.006	0.109	0.100	-0.088	0.003	0.073	-0.039	-0.003	0.133	0.188	0.150	0.170	0.003	-0.019	-0.054	0.121	1.000	0.324	0.066	-0.034	0.259
NOL3	0.076	-0.008	-0.019	0.005	0.017	-0.066	0.054	0.073	-0.075	-0.035	-0.032	0.086	0.008	0.118	0.047	-0.018	0.018	0.090	0.324	1.000	0.105	-0.079	0.024
Intangibles3	0.064	0.006	-0.009	0.088	-0.014	-0.158	0.066	-0.020	-0.019	-0.074	-0.080	-0.098	0.093	0.024	-0.180	-0.077	0.285	-0.276	0.043	0.140	1.000	-0.139	0.204
PPE3	-0.031	0.012	0.043	-0.002	-0.062	-0.027	0.060	0.083	0.028	0.039	0.246	-0.245	-0.029	-0.293	-0.277	-0.169	0.255	-0.357	-0.046	-0.078	-0.236	1.000	0.138
Size3	0.098	0.018	0.035	-0.017	-0.003	-0.182	0.163	-0.009	0.027	-0.079	0.068	-0.183	0.125	-0.301	-0.339	-0.118	0.311	-0.308	0.267	0.036	0.201	0.162	1.000

The matrix shows the Pearson's correlation coefficients (Spearman's rank correlations) in the lower triangle (above the diagonal). Casewise deletion is used. All variables are defined in the Appendix.

Table 3 Descriptive Analysis

Panel A Comparison of cash ETR3 change between and within groups

		high-tax firm in low-tax network (hightolow = 1)		high-tax firm in high-tax network (hightolow = 0)		difference	p-value
		N	mean	N	mean		
pre cash ETR3 [t-2; t0]	I	197	0.3896	540	0.3935	- 0.0039	(0.8613)
cash ETR3 [t1; t3]	II	197	0.2755	540	0.3282	- 0.0527 ***	(0.0065)
Within-group change (hightolow = 1)	I to II					- 0.1141 ***	(0.0000)
Within-group change (hightolow = 0)	I to II					- 0.0653 ***	(0.0000)
Difference in within-group change						- 0.0488 *	z-statistic -1.6994

Panel B Comparison of cash ETR3-development for intensified networking

		high-tax firm in low-tax network (hightolow = 1)		high-tax firm in high-tax network (hightolow = 0)		difference	p-value
		N	mean	N	mean		
1 st and 2 nd high-/low-tax network	I	153	0.2922	418	0.3390	- 0.0468 **	(0.0376)
subsequent (≥ 3) high-/low-tax networks	II	44	0.2174	122	0.2915	- 0.0740 **	(0.0455)

All variables are defined in detail in the Appendix.

Table 4 Main Analysis

Panel A Regression Analysis

Dependent variable	cash ETR3		delta cash ETR3		cash ETR5		delta cash ETR5	
	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
hightolow	- 0.0480**	(0.0103)	- 0.2062***	(0.0061)	- 0.0376***	(0.0087)	- 0.1229**	(0.0191)
Proximity	- 0.0877	(0.1171)	- 0.2488	(0.2795)	0.0269	(0.4762)	0.1089	(0.4028)
SameAuditor	- 0.0107	(0.6173)	- 0.0427	(0.6201)	0.0107	(0.5414)	0.0309	(0.6342)
Network controls	Yes		Yes		Yes		Yes	
Firm controls	Yes		Yes		Yes		Yes	
Fixed effects	Industry & Year		Industry & Year		Industry & Year		Industry & Year	
SE cluster	Firm		Firm		Firm		Firm	
Observations	735		735		594		594	
Adjusted R ²	0.1233		0.1047		0.0577		0.1228	

Superscripts ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively, for two-tailed tests. The results for equation (3) are presented in Panel A. Our main variable of interest is *hightolow*, which is an indicator variable set equal to 1 for observations of high-tax firms cooperating with low-tax firms and set equal to 0 for high-tax firms cooperating with high-tax firms. The number of observations is decreased from 737 to 735 (596 to 594) by two singleton observations in the fixed effects. All variables are defined in detail in the Appendix.

Table 4 Main Analysis (continued)

Panel B Matched Panel: Difference-in-Differences

Dependent variable	cash ETR		cash ETR		cash ETR	
	coefficient	p-value	coefficient	p-value	coefficient	p-value
treated	0.0221	(0.3097)	0.0140	(0.5047)	0.0137	(0.5268)
post	0.0364**	(0.0372)	0.0374**	(0.0291)	0.0350*	(0.0536)
treated*post	- 0.0695**	(0.0159)	- 0.0710**	(0.0132)	- 0.0699**	(0.0131)
Firm controls	No		No		Yes (annual measures)	
Fixed effects	No		Industry		Industry	
SE cluster	Firm		Firm		Firm	
Observations	609		609		609	
Adjusted R ²	0.0052		0.0239		0.0431	
Economic significance: margins of responses for cash ETR [SE] (p-value)						
control*post	0.3162 [0.0197]		0.3224 [0.0187]		0.3212 [0.0179]	
treated*post	0.2688 [0.0159]		0.2654 [0.0161]		0.2651 [0.0159]	
Difference	- 0.0474*	(0.0608)	- 0.0570**	(0.0231)	- 0.0561**	(0.0168)

Superscripts ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively, for two-tailed tests. Panel B depicts the results for equation (4). We compose our sample by creating an embargo period of eight years (from -3 to +5 years) around an *hightolow* observation during which no further *hightolow* observations may occur. We match control observations (*hightolow* = 0) according to year and industry to each treatment occurrence (*hightolow* = 1). All variables are defined in detail in the Appendix.

Table 4 Main Analysis (continued)

Panel C Adjustment Speed		
Dependent variable (#) of specification	cash ETR	
	coefficient	p-value
(1) treated*post [t1]	- 0.0555	(0.1946)
(2) treated*post [t1; t2]	- 0.0988 **	(0.0154)
(3) treated*post [t1; t3]	- 0.0697 **	(0.0423)
(4) treated*post [t1; t4]	- 0.0765 **	(0.0118)
(5) treated*post [t1; t5]	- 0.0699 **	(0.0131)
Controls	Firm (annual measures) & treated & post	
Fixed effects	Industry	
SE cluster	Firm	
Observations	331; 405; 479; 545; 609	
Adjusted R ²	0.0403; 0.0505; 0.0359; 0.0420; 0.0431	

Panel C depicts the results for five specifications of equation (4). The posttreatment period is extended by one year for each specification (from $post = 1$ for $[t_1]$ to $post = 1$ for $[t_1; t_5]$). $post$ remains 0 for t_{-2} to t_0 throughout all specifications. The coefficient estimates of $treatment * post$ comprises the cumulative adjustment (i.e., adjustment speed) of a high-tax firm's tax planning behavior with progressing time when cooperating with low-tax firms. Superscripts ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively, for two-tailed tests.

Table 5 Additional Analyses

Panel A Headquarter

Dependent variable	cash ETR3		delta cash ETR3	
	coefficient	p-value	coefficient	p-value
hightolow	- 0.0579 ***	(0.0033)	- 0.1912 **	(0.0107)
SameBEARegion	- 0.0316	(0.1938)	- 0.0474	(0.6590)
hightolow*SameBEARegion	0.0524	(0.2386)	- 0.0486	(0.7772)
Controls	Network & Firm		Network & Firm	
Fixed effects	Industry & Year		Industry & Year	
SE cluster	Firm		Firm	
Observations	735		735	
Adjusted R2	0.1233		0.1040	

Panel B Industry

Dependent variable	cash ETR3		delta cash ETR3	
	coefficient	p-value	coefficient	p-value
hightolow	- 0.0678 ***	(0.0078)	- 0.2505 **	(0.0197)
SameInd	- 0.0403 *	(0.0530)	- 0.1567 *	(0.0735)
hightolow*SameInd	0.0526	(0.1267)	0.1348	(0.3235)
Controls	Network & Firm		Network & Firm	
Fixed effects	Year		Year	
SE cluster	Firm		Firm	
Observations	736		736	
Adjusted R2	0.1215		0.1079	

Table 5 Additional Analyses (continued)

Panel C Auditor				
Dependent variable	cash ETR3		delta cash ETR3	
	coefficient	p-value	coefficient	p-value
<i>hightolow</i>	- 0.0428 **	(0.0367)	- 0.2152 ***	(0.0077)
SameAuditor	- 0.0042	(0.8833)	0.0594	(0.5950)
<i>hightolow</i>*SameAuditor	- 0.0237	(0.5566)	0.0642	(0.6976)
Controls	Network & Firm		Network & Firm	
Fixed effects	Industry & Year		Industry & Year	
SE cluster	Firm		Firm	
Observations	735		735	
Adjusted R2	0.1213		0.1037	

Superscripts ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively, for two-tailed tests. In Panel A, we test for the impact of geographical distance between the headquarters of cooperating firms. Distance is measured by an indicator variable that is set equal to one if network participants are headquartered in the same region, as defined by the Bureau of Economic Analysis, at network initiation. Panel B follows the approach of Panel A for the industry affiliation of network participants. We interact *hightolow* with an indicator for changes to a shared audit firm within three years of the network initiation in Panel C. All variables are defined in detail in the Appendix.

Table 6 Robustness Checks: Alternative Explanations

Panel A Survivorship Bias

Dependent variable	cash ETR3	
Specification	exclude nonsurvivors	
	coefficient	p-value
hightolow	- 0.0279*	(0.0571)
Proximity	- 0.0663	(0.1718)
SameAuditor	- 0.0109	(0.5264)
Network controls	No	
Firm controls	Yes	
Fixed effects	Industry & Year	
SE cluster	Firm	
Observations	638	
Adjusted R2	0.0966	

Panel B Increases in cash ETR3

Dependent variable	delta cash ETR3	
Specification	only if delta cash ETR ≤ 1	
	coefficient	p-value
hightolow	- 0.0543*	(0.0950)
Proximity	- 0.0398	(0.7199)
SameAuditor	- 0.0216	(0.5289)
Network controls	No	
Firm controls	Yes	
Fixed effects	Industry & Year	
SE cluster	Firm	
Observations	455	
Adjusted R2	0.1603	

Panel C Impact on low-tax firms

Dependent variable	cash ETR3	
Specification	only low-tax firms	
	coefficient	p-value
lowtohigh	- 0.0002	(0.9961)
Proximity	0.2021	(0.1885)
SameAuditor	- 0.0140	(0.5520)
Network controls	No	
Firm controls	Yes	
Fixed effects	Industry & Year	
SE cluster	Firm	
Observations	301	
Adjusted R2	0.0666	

Panel D Effect on Profitability

Dependent variable	ChangeEBITDA3	
	coefficient	p-value
hightolow	- 0.0069	(0.6569)
Proximity	0.0287	(0.4767)
SameAuditor	- 0.0194	(0.1936)
Network controls	Yes	
Firm controls	Yes (no EBITDA3)	
Fixed effects	Industry & Year	
SE cluster	Firm	
Observations	735	
Adjusted R2	0.3577	

Superscripts ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively, for two-tailed tests. In Panel A, nonsurvivors are excluded from the sample. A firm is deemed a nonsurvivor if the year of network initiation is the final or penultimate fiscal year of coverage of this firm in our panel. Panel B excludes increases in *cash ETR3* [$t_1; t_3$] in comparison to *pre cash ETR3* [$t_{-2}; t_0$]. We change our focus from high-tax to low-tax firms in Panel C and construct an indicator variable *lowtohigh*, which is set equal to one for low-tax firms in networks with high-tax firms and equal to zero for low-tax firms in networks with other low-tax firms. We cannot include *network controls* because we have the relevant information for networks of high-tax firms. In Panel D, we control for the (three-year) average annual growth rate in EBITDA (*ChangeEBITDA3*) subsequent to network initiation. All variables are defined in detail in the Appendix.

Table 7 Robustness Checks: Identification Strategy

Panel A Low-tax- and high-tax firms			Panel B Only high-tax firms		
Dependent variable	cash ETR3 [t1; t3]		Dependent variable	cash ETR3 [t1; t3]	
Specification	low-tax- and high-tax firms		Specification	high-tax firms only	
	coefficient	p-value		coefficient	p-value
Own industry-adjusted pre cash ETR3 [t-2; t0]	0.1606***	(0.0000)	Own industry-adjusted pre cash ETR3 [t-2; t0]	0.0616	(0.1216)
Partner industry-adjusted pre cash ETR3 [t-2; t0]	0.0300	(0.2828)	Partner industry-adjusted pre cash ETR3 [t-2; t0]	0.0592 *	(0.0936)
Proximity	- 0.0579	(0.1812)	Proximity	- 0.0760	(0.1004)
SameAuditor	- 0.0133	(0.3777)	SameAuditor	- 0.0134	(0.5110)
SameInd	- 0.0249 *	(0.0600)	SameInd	- 0.0337 *	(0.0551)
Network controls	No		Network controls	Yes	
Firm controls	Yes		Firm controls	Yes	
Fixed effects	No		Fixed effects	No	
SE cluster	Firm		SE cluster	Firm	
Observations	1276		Observations	728	
Adjusted R2	0.1487		Adjusted R2	0.1211	

Superscripts ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively, for two-tailed tests. We examine correlations of cash effective tax rates between network participants. Panel A contains low-tax and high-tax firms in network-firm observations. Panel B is limited to only high-tax firms. Both panels are limited to networks of two participants. We cannot include *network controls* in Panel A because we collected information for networks of high-tax firms. All variables are defined in detail in the Appendix.

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