Tax Avoidance and Labor Investments

Simone Traini

s.traini@warwick.ac.uk

University of Warwick, Warwick Business School

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Abstract

I examine the relation between tax avoidance and firms' labor investments. Consistent with risks and uncertainties from tax avoidance making firms more cautious when investing, I provide evidence that firms with low cash effective tax rates, my proxy for tax avoidance, undertake sub-optimal labor investments relative to the level justified by their underlying economic fundamentals and industry medians. I find this effect using a quasi-natural experiment around Ireland's statutory corporate tax cut of December 1997. More importantly, I find my result to be more pronounced in sub-samples of firms exposed to greater tax risks and uncertainties, which is consistent with the view of firms withholding their investments in human capital in response to potential reductions in cash flows and shareholders' wealth.

Keywords: Tax avoidance; tax uncertainty; labor investment

JEL Classification: H26; D81; J23

1. Introduction

How does tax avoidance affect firms' labor investments? The importance of this question stems from the extensive use of tax incentives and tax breaks by policy-makers to stimulate growth and employment[1] and by the specific claims made by firms engaging in tax avoidance about their role in creating jobs and fostering local economic activity[2]. Using a sample of 3,062 U.S. firms over the years 1992-2017, I examine the effect of corporate tax avoidance, which encompasses statutory tax rates, incentives, complexities and enforcements of tax systems and firms' tax planning preferences, on firms' hiring policies.

Labor is an important factor of production which requires significant investments by firms[3]. Yet, there is substantial variation in net hiring across U.S. companies. Part of this variation can be anticipated by changes in firms' underlying economic fundamentals (such as sales growth, profitability, liquidity and financial constraints) and industry-level employment rates and is therefore expected. In this paper, I investigate whether abnormal variations in labor investments relative to expected levels can be explained by firms' low cash effective tax rates (*Low Cash ETR*), my proxy for corporate tax avoidance.

From a theoretical standpoint, risks and uncertainties associated with tax avoidance can generate an important friction in firms' investment opportunities (or real options) that can make firms more cautious when investing. Firms avoiding taxes are exposed to potential reductions of cash flow and investor wealth if, following an investigation, tax authorities rule the firm's tax strategy abusive. For

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[1] For example, Mattera et al. (2011) calculates that the 238 most significant state subsidy programs in force in the U.S. in 2011 (which include job creation income tax credits, cash grants, low cost forgivable loans, enterprise zones, reimbursement for worker training expenses and other types of company-specific assistance) cost taxpayers more than $11bn per year.

[2] For example, in an article bringing up how little taxes Amazon.com Inc. pays in Europe, a spokesman tells the Financial Times (2017): "*Amazon pays all the taxes that are required in every country where we operate […] We operate a pan-European business from our headquarters in Luxembourg where we have over 1,500 employees and growing, including our senior leadership team. We've invested over €20bn in Europe since 2010, and expect to hire 15,000 new employees this year, bringing our total permanent European workforce to over 65,000 people.*"

[3] As noticed by Jung et al. (2014), labor costs in the manufacturing sector were about $784bn in 2008 compared to a total capital expenditure of $166bn.

example, tax authorities can enforce penalties, additional payments of taxes and interests[4] and firms may also experience reputational loss due to increased public scrutiny (sometimes referred to as "tax shaming").

Empirical evidence suggests that tax risks impact firms' overall risk (Hanlon and Slemrod 2009; Kim et al. 2011; Guenther et al. 2017) and that firms take action to reduce tax risks (Dyreng et al. 2016). Similarly, tax avoidance can also generate tax uncertainty (proxied by additions to the unrecognized tax benefit (*UTB*) reserve) (Dyreng et al. 2018) and firms are found to increase their cash balances as a way hedge themselves from future tax payments (Hanlon et al. 2017).

A number of studies in the real option literature provide evidence that firms withhold investments in presence of uncertainty ("*wait and see*" strategy (Bloom et al. 2007)) and Dixit (1997) shows that a similar pattern also applies to labor investments[5]. Investments in human capital matter for firms' retaining policies because adjustment costs of labor are arguably high. For example firms incur the costs of searching, selecting, hiring, training and possibly firing (Bentolila and Bertola 1990; Dixit 1997) and these costs increase with higher job-specific skills (Ghaly et al. 2017).

Tax avoidance is a substantial source of uncertainty to firms' labor investments for several reasons. First, tax savings from tax avoidance are generally large. For example, Wilson (2009) estimates federal tax savings for the average tax shelter transaction to be of about $375.5m and globally the OECD (2013) calculates the loss from corporate tax revenues attributable to tax evasion and tax avoidance in the range of $100bn and $240bn per year. Uncertainty about future payments of unpaid taxes, interests and penalties can arguably lead firms to withhold their investments and especially those in human capital given their relatively high adjustment costs.

[4] For example, the European Union requires payments for previously unpaid taxes of €13bn from Apple Inc. and €250m from Amazon.com Inc. (The Guardian 2016).

[5] Among the others, Trigeorgis and Reuer (2017) provide a recent review of the real options literature.

Second, uncertainty concerning tax avoidance likely extends over multiple years and may generate extra-costs (for example legal costs) that distract resources otherwise available for other investments[6]. Third, tax risks and uncertainty increase if domestic and foreign policy-makers and tax authorities implement sudden changes to tax and disclosure legislations. For example, the growing international tax co-operation between countries can enhance transparency and raise significant risks and uncertainties to firms engaging in tax avoidance (OECD 2013). This has in turn potential implications for firms' investments, especially those subject to high adjustment cost such as human capital.

Fourth, tax uncertainty can also stem from news specifically targeting firms engaging in tax avoidance. Empirical evidence from stock market returns show that stock price declines following the public revelation of firms engaging in tax sheltering activities (Kim et al. 2011) especially for firms in the retail sector (Hanlon and Slemrod 2009), thereby pointing to a reputational interpretation of tax avoidance. Consistent with this argument, Dyreng et al. (2016) find that firms' tax and disclosure strategies respond to public pressure and a survey led by Graham et al. (2014) shows that a large majority of tax executives in their sample (69%) rank reputational concerns as an important factor deterring firms from avoiding taxes.

All the arguments above suggest that firms are likely to respond to increased uncertainty and risks from tax avoidance by withholding their investments and more specifically their labor demand. Therefore, I posit that firms with low cash effective tax rates (*Low Cash ETR*) undertake sub-optimal labor investments with respect to the level expected based on the firms' economic fundamentals and industry medians.

I lead my analysis on a sample of 3,062 publicly listed U.S. firms over the years 1992-2017. Following Pinnuck and Lillis (2007) and Jung et al. (2014), I compute an inverse measure of labor efficiency as the absolute value of the difference between a firm's net hiring and its expected level. The expected labor investment is based on a model of firms' change in hiring policies as a function

[6] For instance, in 2017 the European Union asked Apple Inc. to pay previously unpaid taxes for the years from 1991 through 2015 (The Guardian 2016)

of sales growth, profitability, liquidity and leverage developed by Pinnuck and Lillis (2007). This variable, therefore, captures changes in firms' hiring policies that cannot be explained by the firms' underlying economic fundamentals. In supplemental analysis, I replace the expected level of hiring with the industry-median net hiring and average net hiring in the previous three years. These variables therefore capture deviations of firms' changes in hiring policies from industry and prior years' human capital investments.

I find that firms with *Low Cash ETR* in the current year increase abnormal investments in net hiring in the following year. However, my results provide evidence that the effect is driven by a sub-sample of firms with net hiring below the expected level, which suggests that firms engaging in more aggressive tax avoidance also under-invest in labor force. I also present evidence that the positive relation between tax avoidance and sub-optimal labor investment is stronger for firms that are more exposed to tax risks and uncertainties as proxied by the volatility of firms' cash effective tax rates (*Cash ETR*) over a period of five years and additions to the uncertain tax benefit (*UTB*) reserve, respectively.

One source of concern with a causal interpretation of the effect of corporate tax policies on labor investments is that results can be biased because of the potential endogeneity that such a relation may entail. For example, firms' net hiring choices may reflect firm-specific characteristics that are unobservable to the researcher and that can also affect tax avoidance ability and opportunities. To address this issue, I run my analysis including several control variables in addition to industry and year fixed effects.

Another source of concern is reverse causality. That is, labor investment decisions may affect tax avoidance opportunities available to firms, for example providing access to governmental grants and tax credits. I address this concern by regressing current abnormal net hiring values on prior-year corporate tax avoidance and by exploiting an arguably exogenous source of variation in U.S. firms' tax avoidance in a quasi-natural experiment, where firms in the control group are selected using propensity score matching (PSM).

I find a positive and significant association between *Low Cash ETR* and firms' investments in human capital in the whole sample of U.S. publicly listed firms between the years 1992 and 2017. However, after breaking down the sample into firms with net hiring above (over-investment) and below (under-investment) the level justified by their underlying economic fundamentals, I find that the effect of tax avoidance on labor is asymmetric: it is statistically insignificant for firms over-investing in labor whereas it is positive and significant for firms under-investing in human capital. Overall, this result suggests that firms with *Low Cash ETR* increase sub-optimal hiring policies, by choosing a level of net hiring that is below the one expected based firms' fundamentals and industry medians.

To provide a causal support to my findings, I then exploit Ireland's statutory corporate tax cut occurred in December 1997 in a difference-in-differences design. For this test, my treatment group consists of U.S. multinationals with operations in Ireland before and during the phased reduction of the statutory tax rate that began in December 1997, whereas my control group includes U.S. multinationals with foreign operations in countries other than Ireland. Firms in the control group represent the best match (nearest neighbor with replacement) to firms in the treatment group based on several lagged (two-year lag) covariates (*Cash ETR*, *Market-to-book value*, *Size*, *PP&E*, *Global pre-tax income* and *Foreign-only pre-tax income*) and industry fixed effects. Overall, results from this tests are consistent with my main findings in that, following the reduction in Ireland's statutory corporate tax rate, firms with Irish operations withhold their investments in human capital compared to firms without Irish operations.

Next, I examine whether firms exposed to greater tax risks and uncertainties are associated with abnormal net hiring. The rationale of this test lays in the precautionary motives that can lead firms to choose a level of net hiring below the expected level (Bloom et al. 2007). I first examine a sub-sample of firms with high tax risk (proxied by a five-year volatility of *Cash ETR* above the sample median) and find that the effect on abnormal net hiring is stronger for this group of firms. Second, I use firms' uncertain tax benefit reserve (proxied by *UTB* above the sample median) to investigate whether firms

with higher tax uncertainty undertake abnormal labor investments. Consistent with my prediction, I find that firms with high tax uncertainty choose a level of net hiring that deviates from the expected level based on firms' fundamentals.

Finally, I examine whether the effect of tax avoidance is mitigated by higher labor adjustment costs. Consistent with the view of labor costs affecting firms' decision-making, Ghaly et al. (2017) find that firms hold larger cash balances as a precautionary measure against possible future volatility in the supply of skilled workers. To test whether labor costs influence my results, I divide the sample between firms operating in industries with larger percentages of skilled labor and those operating in industries with lower demand of skilled human capital[7]. I find that the effect of tax avoidance on abnormal net hiring is positive and significant only in the sub-sample of firms under-investing in labor force. In contrast, the effect is statistically insignificant for firms exhibiting labor investments above the expected level based on their economic fundamentals. Overall, these results lend support to the view of labor's large adjustment costs playing an important role in the effect of tax avoidance on firms' sub-optimal hiring policies.

My study connects several strands of the literature. The first focuses on tax risk and uncertainty. One potential consequence of firms avoiding taxes is the risk of incurring additional payments of greater taxes, interests and penalties and potential reputational loss if the tax strategy is later ruled improper, resulting in lower cash flow and investor wealth. Empirical evidence suggests that tax risks can impact firms' overall risk (Hanlon and Slemrod 2009; Kim et al. 2011; Guenther et al. 2017) and that firms take action to reduce tax risks (Dyreng et al. 2016). Tax avoidance can also generate tax uncertainty (Dyreng et al. 2018) and firms are found to increase their cash balances as a way hedge themselves from future tax payments (Hanlon et al. 2017). I contribute to this literature by presenting evidence that tax risks and uncertainties can affect firms' resource allocation by leading firms to make sub-optimal hiring decisions.

[7] Following Ghaly et al. (2017), I compute *High skill* as an indicator variable that equals one if the Labor Skill Index (LSI) is above the median and zero otherwise. See Table A.1 for all variable descriptions.

The second strand of the literature focuses on the effect of uncertainty on real options. Prior studies suggest that in the presence of uncertainty firms are less likely to undertake costly investments or disinvestments (i.e. inaction) (Dixit and Pindyck 1995; Bloom et al. 2007; Trigeorgis and Reuer 2017) and that uncertainty affects labor policies by leading firms to minimize costly adjustments due to hiring and firing (i.e. retention policies) (Oi 1962; Bentolila and Bertola 1990; Dixit 1997; Banker et al. 2013; Ghaly et al. 2017). I add to this strand of research by studying tax avoidance as a source of uncertainty and by providing evidence that tax avoidance affects firms' labor policies leading to sub-optimal hiring policies relative to the expected level based on firms' fundamentals and industry medians.

The third strand of literature focuses on the consequences of tax avoidance for corporate stakeholders. Overall, evidence from this area of research are consistent with the view of tax avoidance affecting different capital providers asymmetrically, with equity holders sharing the benefits of greater tax savings (Desai and Dharmapala 2009; Wilson 2009; Goh et al. 2016; Rego et al. 2017)[8] whereas debt holders being exposed to the risks, but not sharing the benefits, of firms' more aggressive tax strategies (Shevlin et al. 2013; Hasan et al. 2014). I extend this literature by focusing on an important class of corporate stakeholders - firms' workers and employees - and by presenting evidence that tax avoidance, involving the risks of future additional tax payments, penalties and reputational loss, leads firms to make sub-optimal labor investment decisions.

Finally, my study uses a similar setting as prior research on labor investment efficiency but asks a substantially different research question. More specifically, while Jung et al. (2014), Ben-Nasr and Alshwer (2016) and Ghaly et al. (2015) investigate whether information quality and shareholder monitoring affect a firm's labor investment that is justified by the firm's economic fundamentals, I

[8] Within this literature, Desai and Dharmapala (2009) and Wilson (2009) find that tax avoidance is positively associated with firm value in firms with shareholder-centric corporate governance and Hanlon and Slemrod (2009), Kim et al. (2011) and Gallemore et al. (2014) present evidence of a negative stock market reaction to the news of a firm's involvement in tax sheltering activities. More specifically, Hanlon and Slemrod (2009) find that the negative market reaction is stronger for firms in the retail sector, suggesting reputational costs associated with aggressive tax avoidance, whereas Gallemore et al. (2014) provide evidence that the decline in abnormal returns that follows the public revelation a firm's tax sheltering activity is only temporary.

study whether firms exposed to higher tax risks and uncertainties make sub-optimal hiring decisions. To isolate the effect of tax avoidance from information quality and shareholder monitoring, I control for institutional ownership and include a measure of accounting quality in supplemental analysis. Overall, results are largely unaffected by these additions, consistent with a tax interpretation of my results.

My findings can also have important policy implications. First, showing that tax avoidance reduces firms' investments into labor, my findings can be relevant to regulators, legislators and other corporate stakeholders when designing incentive mechanisms to foster employment. On this spirit, my paper contributes to Ljungqvist and Smolyansky (2016) who find no association between state corporate tax cuts and increases in employment in the U.S. and to Shevlin et al. (2018) who find a positive association between an tax avoidance and employment in a multi-country study by showing that, at least for a sub-set of firms with opportunities to avoid taxes, tax avoidance leads firms to make sub-optimal hiring decisions relative to the hiring level justified by firms' underlying economic fundamentals and industry medians.

Second, my finding that contractions in labor demand are stronger for firms with greater tax risks and uncertainty can be informative to legislators and other policy-makers when designing tax incentives to labor. Consistent with Dixit and Pindyck (1995), Dixit (1997) and Bloom et al. (2007), my results also suggest that fiscal stimuli to labor may be less effective in presence of tax risks and uncertainty. Moreover, my findings can be informative to legislators and to labor unions when contracting stricter employment protection mechanisms and wage increases (Bentolila and Bertola 1990; Banker et al. 2013; Hassett and Mathur 2015) and can provide an additional explanation to the fall of the labor share of GDP investigated by Autor et al. (2017). The remainder of this paper is organized as follows: section 2 presents my data and research design, section 3 shows and discusses my findings and section 4 concludes.

2.0 Data and research design

Using a sample that encompasses 3,062 publicly listed U.S. firms over the years 1992-2017, this study investigates the effect of tax avoidance on firms' labor investments. I start the sample in 1992 to allow enough years in the pre-treatment period of Ireland's statutory corporate tax cut occurred in December 1997 through January 2003. Overall, the final sample includes 21,971 firm-year observations.

I collect the data about labor investment and tax avoidance from Compustat. Starting from the whole population of firms in the database over the years 1992-2017, I remove utilities (SIC codes 4900-4999) and financial services firms (SIC codes 6000-6999) as these firms are subject to different regulations. Moreover, I drop all firms with negative pre-tax income and missing data in any dependent, explanatory or control variable. By construction, I require each firm in the sample to report the relevant financial information for at least three subsequent years. Finally, I windsorize all variables at 1% level to mitigate the influence of extreme values on the analysis. Variable definitions are in table A.1 and descriptive statistics are in tables 1 and 2.

2.1 Labor investment variables

The level of labor investments undertaken by firms is, for each year, the absolute value of a firm's abnormal net hiring activity relative to the expected change in labor force based on the firm's underlying economic fundamentals (|*Abnormal net hire*|). Conceptually, deviations from expected levels of hiring indicate sub-optimal labor investments undertaken by firms (abnormal net hiring = actual net hiring - expected net hiring). In this study, I examine whether firms' tax aggressiveness leads to sub-optimal investment decisions in human capital.

Pinnuck and Lillis (2007) estimate for each firm-year the expected level of net hiring by regressing the percentage change in a firm's labor force on a number of variables capturing the firm's economic fundamentals (such as sales growth, profitability, size, liquidity and leverage). Similar to Pinnuck and Lillis (2007), I estimate *Model (1)* using the following equation:

$$
\begin{aligned}
Net\ hire_{it} = {} & \alpha_0 + \alpha_1 Sales\ growth_{it-1} + \alpha_2 Sales\ growth_{it} + \alpha_3 \Delta ROA_{it} + \alpha_4 \Delta ROA_{it-1} \\
& + \alpha_5 ROA_{it} + \alpha_6 Return_{it} + \alpha_7 Size\_r_{it-1} + \alpha_8 Quick\ ratio_{it-1} \\
& + \alpha_9 \Delta Quick\ ratio_{it-1} + \alpha_{10} \Delta Quick\ ratio_{it} + \alpha_{11} Leverage_{it-1} \\
& + \alpha_{12} Loss\ bin1_{it-1} + \alpha_{13} Loss\ bin2_{it-1} + \alpha_{14} Loss\ bin3_{it-1} \\
& + \alpha_{15} Loss\ bin4_{it-1} + \alpha_{16} Loss\ bin5_{it-1} + \alpha_j Industry\ FE + \varepsilon_{it} \qquad (1)
\end{aligned}
$$

Where *Net hire* is the percentage change in employees for firm *i* at the end of year *t*, *Sales growth* is the percentage change in revenues from sales, *ROA* is net income divided by total assets at the beginning of the year, *Return* is the annual stock return, *Size_r* is the percentile rank of the natural logarithm of market value at the beginning of the year, *Quick ratio* is the sum of cash, short term investments and receivables divided by current liabilities, *Leverage* is long term debt divided by total assets at the beginning of the year and *Loss bin* variables indicate 0.005 loss intervals between -0.005 and 0 of prior year ROA. All variables are defined in table A.1.

Descriptive statistics in panel A of table 1 report a mean (median) *Net hire* of 8% (2%) in *Model (1)*, indicating that labor force increased on average in the sample of U.S. firms between 1992 and 2017. *Net hire* is -5% in the 25th percentile and 13% in the 75th percentile. Sample averages show a positive *Sales growth* (18%) and stock *Return* (1%) but a negative return on assets (*ROA*) (-5%) during the period. Finally, on average *Quick ratio* is 2.07 and *Leverage* is 24%.

Panel B of table 1 presents the results of *Model (1)*. Coefficient estimates show that *Net hire* is positively associated with sale growth (*Sales growth*$_{it-1}$ and *Sales growth*$_{it}$), profitability (*ROA*$_{it}$), stock return (*Return*$_{it}$), firm size (*Size*$_{it-1}$) and liquidity (*Quick*$_{it-1}$ and *ΔQuick*$_{it-1}$). In contrast, changes in profitability (*ΔROA*$_{it}$ and *ΔROA*$_{it-1}$), current liquidity (*ΔQuick ratio*$_{it}$), leverage (*Leverage*$_{it-1}$) and small reported losses (*Loss bin* variables) are negatively associated with *Net hire*. Overall, these estimates are consistent with those reported by Pinnuck and Lillis (2007) and Jung et al. (2014), thus giving additional support to my analysis.

The residual estimate from *Model (1)* provides a measure of labor investment that captures deviations from the expected level of hiring based on firms' economic characteristics. My main labor investment variable (|*Abnormal net hire*|) is, then, the absolute value of the residual from *Model (1)*. Descriptive statistics in panel A of table 2 report an average (median) |*Abnormal net hire*| of 0.13 (0.07), which is also consistent with the average (median) value for this variable found by Jung et al. (2014). Panel A of figure 1 shows the time trend of *Net hire* (blue line in the middle) and |*Abnormal net hire*| broken down into its two components: a firm's net hiring above its expected level (red line at the top) and a firm's net hiring below its expected level (green line at the bottom).

In supplemental analyses, I replace the expected level of net hiring using the industry median net hiring (|*Abnormal ind. adj. net hire*|) and firms' average net hiring in the previous three years (|*Abnormal av. net hire*|). Therefore, unlike |*Abnormal net hire*| that reflect deviations from expected levels of hiring based on firms' own economic characteristics, |*Abnormal ind. adj. net hire*| and |*Abnormal av. net hire*| capture deviations from the median labor force employed in the industry and previous years' average net hiring, respectively.

2.2 Tax avoidance variables

I use *Low Cash ETR* as my primary measure of tax avoidance. *Low Cash ETR* is an indicator variable that equals one if the *Cash ETR* of a firm (computed as Income taxes paid / (Pre-tax income – Special items)) is in the first quartile (or twentieth percentile) of the *Cash ETR* distribution. Panel A of table 2 shows that firm-year observations in the first quartile have a mean (median) *Cash ETR* equal to 0.04 (0.03) with a minimum value of 0.00 and a maximum value of 0.10. In contrast, *Cash ETR* is on average (median) equal to 0.16 (0.17), 0.27 (0.27) and 0.48 (0.41) for firm-year observations in the second, third and fourth quartile, respectively. Overall, panel A of table 2 indicates that firms in the first quartile of the *Cash ETR* distribution engage in more aggressive tax avoidance as they pay a smaller amount of taxes relative to other firms.

I use *Cash ETR* for my main analysis because effective tax rates are easy to compute and easily observable by corporate shareholders and other stakeholders, such as employees, trade unions and media (Chyz et al. 2013). By construction, *Cash ETR* capture all firms engaging in non-conforming (but not conforming) tax avoidance activities and strategies that lead to a reduction of corporate tax payments. Relative to *GAAP ETR* (computed as Total income taxes / (Pre-tax income – Special items), *Cash ETR* reflects also tax deferral strategies aimed at postponing current tax payments to future fiscal periods as well as current payments of taxes due in previous periods (Dyreng et al. 2008; Hanlon and Heitzman 2010).

Panel B of table 2 reports the distribution of firms with *Low Cash ETR* by industry using the Fama-French 48 industry classification. The largest number of firms with *Low Cash ETR* in my sample operate in the Electronic Equipment sector (925 firm-year observations), followed by the Business Services (867 observations) and Computers (496 observations) sectors. In line with anecdotal evidence and prior studies (for example Dyreng et al. (2013)), firms operating in these industries may have larger opportunities to avoid taxes using intangible assets, R&D expenses and their likely global supply chain. Finally, panel B shows that firms with the lowest average *Cash ETR* operate in the Precious Metal (0.01) and Shipbuilding, Railroad Equipment (0.01) industries.

2.3 Control variables

I select a number of control variables that previous studies have found to affect tax avoidance and labor investments. The first set of variables I include in *Model (2)* helps separate the effect of tax avoidance on firms' hiring policies from other firm-specific characteristics (*Size* and *Leverage*). For example, while large firms are potentially subject to higher tax payments, leveraged firms can benefit from tax deductions of their interest expenses. Controlling for these factors appears particularly important because large firms are often also among the largest employers whereas firms experiencing financial distress are traditionally associated with large layoffs (Manzon and Plesko 2002; Frank et al. 2009; Berk et al. 2010).

The second set of variables controls for factors that can affect firms' investments in general, such as growth opportunities (*Market-to-book value*), liquidity (*Quick ratio*), dividend payout policies (*Dividend*), cash flow and sales volatilities (*CFO volatility* and *Sales volatility*), and tangible capital (*PP&E*) (McNichols and Stubben 2008; Biddle et al. 2009; Jung et al. 2014). In addition, because firms' investments can reflect managerial empire building behavior, I also control for differences in shareholders' monitoring on corporate management across firms (*Institutional ownership*) (Chen et al. 2007; Hall 2016; Asker et al. 2015; Ghaly et al. 2015).

The third set of control variables can directly affect firms' labor investments. Namely, these variables are *Labor intensity*, *Net hire volatility* and the percentage of union membership per industry (*Unionized labor*) (Chyz et al. 2013; Bova 2013; Jung et al. 2014). Finally, to control for the effect of other (non-labor) investment decisions on firms' labor policies, *Model (2)* includes the variable |*Abnormal other investment*| computed as the absolute value of the residual of the following model: $Other\ investment = \beta_0 + \beta_1 Sale\ growth_{it-1} + \varepsilon_{it}$, where *Other investment* is the sum of capital, acquisition and R&D expenses minus cash receipts from the sale of PP&E divided by one-year lag total assets (Jung et al. 2014). As a result, I estimate *Model (2)* using the following equation:

$$
\begin{aligned}
|Abnormal\ net\ hire|_{it} &= \beta_0 + \beta_1 Low\ Cash\ ETR_{it-1} + \beta_2 Market - to - book\ value_{it-1} \\
&+ \beta_3 Size_{it-1} + \beta_4 Quick\ ratio_{it-1} + \beta_5 Leverage_{it-1} + \beta_6 Dividend_{it-1} \\
&+ \beta_7 CFO\ volatility_{it-1} + \beta_8 Sales\ volatility_{it-1} + \beta_9 PP\&E_{it-1} \\
&+ \beta_{11} Insitutional\ ownership_{it-1} + \beta_{12} Net\ hire\ volatility_{it-1} \\
&+ \beta_{13} Labor\ intensity_{it-1} + \beta_{14} Unionized\ labor_{it-1} \\
&+ \beta_{15} |Abnormal\ other\ investment|_{it-1} + \beta_j Industry\ FE + \beta_i Year\ FE \\
&+ \varepsilon_{it}
\end{aligned}
\tag{2}
$$

Where *Market-to-book* value is the ratio market to book value of common equity at the beginning of the year, *Size* is the natural logarithm of market value of equity at the beginning of the year, *Dividend* is an indicator variable that equals one if a firm pays dividends in the previous year and zero otherwise, *CFO volatility* is the standard deviation of cash flow from operations over the years t-5 to t-1, *Sales volatility* is the standard deviation of revenues from sales over the years t-5 to t-1, *PP&E* is property, plant and equipment divided by total assets, *Institutional ownership* is for each firm-year the sum of the holdings of institutional investors divided by the firm market capitalization in the previous year, *Net hire volatility* is the standard deviation of the percentage change in employees over the years t-5 to t-1, *Labor intensity* is number of employees divided by total assets at the beginning of the year, *Unionized labor* is the industry-level rate of labor unionization in the previous year and |*Abnormal other investment*| is the absolute value of the residual from the following model: $Other\ investment = \beta_0 + \beta_1 Sale\ growth_{it-1} + \varepsilon_{it}$, and all other variables are as previously defined and described in table A.1. All explanatory and control variables are lagged by one year to mitigate simultaneous causality concerns and panel C of table 2 presents descriptive statistics.

3.0 Results

Table 3 reports pairwise correlation coefficients. |*Abnormal net hire*| is positively correlated with *Low Cash ETR*, suggesting that firms engaging in more aggressive tax avoidance undertake sub-optimal labor investments. Similarly, firms experiencing growth (for example proxied by *Market-to-book value* and |*Abnormal other investment*|) and uncertainties (for example proxied by *CFO volatility*, *Sale volatility* and *Net hire volatility*) are positively associated with |*Abnormal net hire*|. In contrast, larger (*Size*), leveraged (*Leverage*) and dividend paying firms (*Dividend*) are negatively associated with |*Abnormal net hire*|.

Table 4 reports the results of *Model (2)*. Consistent with univariate findings, the coefficient estimates on *Low Cash ETR* in column 1 is positive and significant (0.0079), which suggests that firms engaging in tax avoidance undertake sub-optimal labor investments. Moreover, |*Abnormal net*

hire| is positively associated with firms experiencing growth (*Market-to-book value* and |*Abnormal other investment*|) and uncertainties (*Quick ratio*, *CFO volatility*, *Sales volatility* and *Labor volatility*). In contrast, abnormal hiring is negatively associated with *Size*, *Leverage*, *Dividend*, *Labor intensity* and *Unionized labor*.

Column 2 presents the results of *Model (2)* on a sub-sample of firms with net hiring above its expected level based on firms' fundamentals (over-investment). The coefficient estimate on *Low Cash ETR* is statistically insignificant, which means that over-investments in human capital are unrelated to tax avoidance. To mitigate the effect of small changes in labor demand, I further divide the over-investment sub-sample based on its median net hiring. In column 3 the dependent variable |*Larger abnormal net hire*| represents over-investment in labor above the median. Consistent with column 2, results in column 3 show a statistically insignificant coefficient on *Low Cash ETR* on a sample of firms whose hiring policies are largely more generous than the level justified by the firms' underlying economic fundamentals.

In contrast with these results, column 4 presents a positive and significant coefficient (0.0055) on *Low Cash ETR* when the sub-sample consists of firms with net hiring below the expected level (under-investment), meaning that firms paying little taxes in the current year under-invest in human capital in the following year. Similarly, focusing exclusively on larger reductions in labor investments (under-investment below the median), results in column 5 suggest that tax avoidance is positively associated with lower hiring policies relative to the level justified by firms' economic fundamentals (0.0097). Overall, columns 2-5 provide evidence that corporate tax avoidance has an asymmetric effect on firms' labor investments: it affects sub-optimal investments towards a lower level of hiring whereas it is unrelated to over-hiring.

Table 5 presents the results of *Model (2)* after breaking down over-investment into over-hiring (positive expected net hiring) and under-firing (negative expected net hiring), and under-investment into under-hiring (positive expected net hiring) and over-firing (negative expected net hiring) (Jung et al. 2014). Columns 1 and 2 report statistically insignificant coefficients on *Low Cash ETR*, meaning

that tax avoidance is unrelated to firms' over-hiring and under-firing policies relative to the expected labor investment based on their economic fundamentals. In contrast, the coefficient estimate on *Low Cash ETR* in column 3 is positive and significant. Consistent with my research hypothesis, this result suggests that firms engaging in tax avoidance withhold their investments in human capital, thereby resulting in these firms under-hiring relative to the level justified by the firms' underlying economic characteristics. Finally, results in column 4 indicate that tax avoidance is unrelated to firms under-investing in labor by means of over-firing relative to the expected labor policy.

3.1 Corporate risk and tax uncertainty

A number of studies provide evidence that risks and uncertainties can lead firms to withhold investments (Bloom et al. 2007; Gulen and Ion 2015). In this section, I test whether tax risk and uncertainty stemming from potential additional tax payments, interests and reputational loss, lead firms to undertake sub-optimal labor investments. Labor is especially relevant to this setting because of the likely high adjustment costs of associated with investments in human capital (Bentolila and Bertola 1990; Dixit 1997; Ghaly et al. 2017). In table 6 I examine the effect of tax avoidance on firms' hiring policies for firms exposed to higher tax risks and uncertainties. Following Guenther et al. (2017), I proxy for tax risk using an indicator variable that equals one if a firm's *Cash ETR* volatility over a five-year period is above the sample median and zero otherwise (*Tax risk*). Similar to Dyreng et al. (2018) and Guenther et al. (2018), my proxy for tax uncertainty is the unrecognized tax benefit (*UTB*) reserve as reported on corporate statements. *Tax uncertainty* is then an indicator variable which equals one if a firm's *UTB* is above the sample median and zero otherwise.

Results in columns 1 and 2 of table 6 show that the effect of tax avoidance on over-investments in human capital is statistically insignificant for firms exposed to greater tax risks. In contrast, consistent with my research hypothesis, results in columns 3 and 4 provide evidence that the positive effect of tax avoidance on firms' sub-optimal labor policies is more pronounced in firms subject to higher tax risks and uncertainties. More specifically, the coefficient estimate on *Low Cash ETR* on a sub-sample

of high tax risk firms (column 3) is approximately 0.0057. Similarly, column 4 reports a coefficient estimate of 0.0089 *Low Cash ETR* suggesting that firms exposed to tax risks and uncertainty exhibit a level of net hiring below the expected level based on firms' economic fundamentals.

Overall, these results are consistent with the view that firms experiencing risks and uncertainties are more likely to be cautious when making investment decisions (Bloom et al. 2007), thereby leading to sub-optimal investments relative to the level justified by their underlying economic characteristics. Firms' tax avoidance and labor investments choices are especially relevant in such a setting because of the high adjustment costs associated with hiring and firing (Oi 1962; Bentolila and Bertola 1990) and the greater tax risks and uncertainties faced by firms engaging in corporate tax avoidance (Guenther et al. 2017; Dyreng et al. 2018).

3.2 Labor cost

Table 7 presents the results of the effect of tax avoidance on labor investment after splitting the sample between firms requiring skilled human capital, and therefore exposed to higher adjustment costs of labor, and those that rely less on skilled labor. Following Ghaly et al. (2017), I measure job-specific skills using the industry-level Labor Skill Index (LSI) and compute *High skill* as an indicator variable that equals one if a firms' LSI is above the sample median and zero otherwise. In robustness tests, I measure labor cost more directly using the staff cost reported by firms in their financial statements.

Columns 1 and 2 of table 7 show a statistically insignificant coefficient on *Low Cash ETR* for firms that over-invest in labor force and for both sub-samples of firms operating in industries that require a higher percentage of skilled labor and those that rely on a less skilled workforce. In contrast, the coefficient estimate on *Low Cash ETR* in column 3 is positive and significant for firms that under-invest in labor and require larger skilled human capital to carry on their activity. Consistent with my research hypothesis, this result suggests that firms with *Low Cash ETR* are more likely to withhold their hiring policies when adjustment costs of labor are higher. Finally, results in column 4 indicate

that the positive effect of tax avoidance on firms' sub-optimal labor investments vanishes in the sub-sample of firms exhibiting lower percentages of skilled human capital.

3.3 Quasi-natural experiment: Ireland's statutory corporate tax rate cut

A cause of concern in estimating the effect of corporate tax avoidance on firms' labor investments is the potential endogeneity that such a relation may entail. For example, unobservable firm-specific characteristics (for instance, related to managerial preferences) could affect both firms' (labor) investments and tax policies, thereby leading to biased results. To mitigate this concern, I analyze the relation between tax avoidance and labor investment around Ireland's statutory corporate tax cut occurred in December 1997 in a quasi-natural experiment design using difference-in-differences regressions.

Starting in December 1997, indeed, Ireland began a phased reduction of its corporate tax rate, taking it down to 12.5% from an original rate of 32% by January 1, 2003. Anecdotal evidence suggests that following the reduction of Ireland's statutory corporate tax rate, tax planning by North American and European multinationals with operations in Ireland substantially increased to take advantage of the lower tax rate. One channel traditionally employed by multinational firms to shift profits from a high tax country to a lower tax country is transfer pricing. Relevant to my study, international transfer pricing transactions are also exposed to a high degree of uncertainty (Klassen et al. 2017; Towery 2017; Drake et al. 2018). Therefore, I use the Irish tax cut of December 1997 to provide a causal support to my analysis. More specifically, I estimate the following difference-in-differences equation (3):

$$|Abnormal\ net\ hire| = \gamma_0 + \gamma_1 Treated \times Post + \gamma_2 Treated + \gamma_3 Post + \gamma_j Industry\ FE + \gamma_i Year\ FE + \varepsilon \quad (3)$$

Where *Treated* × *Post* is the interaction term that captures the effect of the Irish statutory tax cut on the treated group relative to the unaffected control group. *Post* is an indicator variable that equals one from 1998 (year in which the phased reduction of Ireland's statutory corporate tax began) onward and *Treated* is an indicator variable that equals one if a firm-year is in the treatment group and zero otherwise.

The treatment group consists of U.S. multinationals with operations in Ireland (*Treated* = 1), whereas the control group includes U.S. multinationals with operations in countries other than Ireland (*Treated* = 0). I identify the location of U.S. multinationals' foreign subsidiaries using Exhibit 21 data available on Scott Dyreng's website (Dyreng and Lindsey 2009). Each firm in the control group is matched with one firm in the treatment group (nearest neighbor with replacement) based on several lagged (two-year lags) covariates (*Cash ETR*, *Market-to-book value*, *Size*, *PP&E*, *(Global) pre-tax income* and *Foreign pre-tax income*) and industry fixed effects. The analysis is led on a sample that includes only treated and control firms.

Figure 2 shows the annual *Cash ETR* averages for treatment (lower blue line) and control (upper red line) groups. Before the introduction of the Irish corporate tax cut in December 1997 (which entered into force in January 1, 1998) the tax payments of treatment and control groups were aligned, as shown by the parallel trend before January 1998 (which is represented by the vertical red line). After the introduction of the statutory tax cut, the average tax payment of U.S. multinationals with Irish operations (*Treated* = 1) decreases substantially (from about 0.30 to 0.24 in the two following years) diverging from the tax payments of U.S. multinationals with foreign operations in countries other than Ireland (*Treated* = 0) which show a rather flat trend. Overall, figure 2 suggests that the matched control group is a good counterfactual to U.S. multinationals with operations in Ireland had not the tax cut been introduced.

Table 8 presents the results of difference-in-differences analysis around (two-year window) Ireland's statutory corporate tax cut. To isolates the impact of tax avoidance on firms' labor investments from other changes in the Irish legislation, and more generally from changes in the Irish

economy, that may be concurrent and potentially correlated with the statutory corporate tax cut, I drop the year 1998 in which the new tax regime began. Moreover, to control for industry- and year-specific unobservable characteristics that might bias my results (such as periods of economic recession), I include industry and year fixed effects.

The coefficient estimate on *Treated* × *Post* in column 1 is statistically insignificant, which suggests that firms' abnormal labor policies are unrelated to tax avoidance. Yet, after breaking down |*Abnormal net hire*| into its components (over- and under-investment), I find a positive and significant coefficient on *Treated* × *Post* for a sub-sample of firms that under-invest in human capital (0.0278), whereas the coefficient on *Treated* × *Post* is statistically insignificant for the sub-sample of firms that over-invest in labor. Overall, in line with my research hypothesis and the analysis above, these results indicate that the greater tax avoidance opportunities available to U.S. multinationals following the reduction of Ireland's statutory tax rate lead firms to undertake sub-optimal hiring policies by retaining their investments in human capital by about 3 percentage points.

3.4 Tax credits and tax grants to labor investments

Another potential source of endogeneity may stem from tax credits and other incentives to labor investment granted by local governments (i.e. at state level) or foreign countries to U.S. domestic and multinational firms. For example, firms can take advantage of tax incentives granted by governments with the aim of stimulating employment and economic growth to lower their tax payments. If regressions pick up this effect, my coefficient estimates would be biased towards finding larger over-investments in labor. My results above provide evidence that this not the case, with coefficients on *Low Cash ETR* constantly insignificant in the sub-sample of firms over-investing in human capital. An interpretation of this finding is that firms engaging in tax avoidance have access to similar opportunities to reduce their tax payments, perhaps reflected in tax avoiders' concentration in specific industries (panel B of table 2 shows that Electronic Equipment and Business Services industries together account for 33% of firm-year observations in the *Low Cash ETR* sub-sample).

To further address endogeneity, I follow Armstrong et al. (2015) and Shevlin et al. (2018) and construct a proxy for tax avoidance that is adjusted for firms' peers' tax avoidance positions. More specifically, using a sample that includes only U.S. domestic firms without foreign operations, I first compute the difference between a firm's *Cash ETR* and the average *Cash ETR* of the firm's industry (based on Fama-French 48 industry classification) and size (based on the sample median of total assets) peers. Second, I divide the distribution of the above difference into quartiles and define firm-year observations in the first quartile (i.e. the one with the lowest difference) as *Low peer-adjusted Cash ETR*.

The rationale of this test relies on the assumption that U.S. domestic firms operating in similar industries and of similar size should on average have access to similar tax incentives[9] and ultimately should show consistent tax outcomes in the absence of a more aggressive tax planning approach. That is, while all domestic U.S. firms can similarly benefit from tax incentives (to labor, R&D and capital investments), firms' tax aggressiveness can vary substantially across my sample (see panel A of table 2). As a results, *Low peer-adjusted Cash ETR* captures U.S. domestic firms' tax avoidance that exceeds government tax incentives (i.e. proxied by peer average *Cash ETR*).

Table 9 reports the results of *Model (2)* after controlling for tax incentives to labor in a sample that includes only U.S. domestic firms. The coefficient estimate on *Low peer-adjusted Cash ETR* is statistically insignificant in column 1, which means that tax avoidance is unrelated to abnormal labor investments after taking into account tax incentives. However, after breaking down |*Abnormal net hire*| into its two components, I find that the effect is insignificant for a sample of firms with net hiring above the expected level whereas it is positive and significant for the sample of firms with net hiring below the level justified by their economic fundamentals. Overall these results are consistent with my main findings in table 4 in that they show that firms engaging in tax avoidance in the current year

[9] Chirinko and Wilson (2013) and Heider and Ljungqvist (2015) show that almost all states in the U.S. use tax incentives, in the form of tax credits or tax grants, to stimulate employment and economic growth within the last 30 years.

undertake sub-optimal labor investments in the following year, regardless potential asymmetries in firms' ability to (access to and) benefit from governmental tax incentives.

3.5 Robustness tests

In panels A and B of table 10 I replace |*Abnormal net hire*| using |*Abnormal ind. adj. net hire*| and |*Abnormal av. net hire*|, respectively. More specifically, |*Abnormal ind. adj. net hire*| is, for each year, the difference between a firm's net hiring and the industry-median net hiring. Unlike |*Abnormal net hire*| that reflect deviations from expected levels of hiring based on firms' own economic characteristics, |*Abnormal ind. adj. net hire*| captures deviations from the median workforce employed in the industry. Results in panel A are substantially unchanged with respect to my main results in table 4. Tax avoidance is associated with firms' sub-optimal hiring policies and, more specifically, firms exhibit labor investments below the level justified by their underlying economic fundamentals.

In panel B of table 10 I replace |*Abnormal net hire*| using |*Abnormal av. net hire*|. |*Abnormal av. net hire*| is, for each year, the difference between a firm's net hiring and the firm's average net hiring in the previous three years. Unlike |*Abnormal net hire*|, |*Abnormal av. net hire*| captures deviations from previous years' labor policies. Columns 1 and 2 present statistically insignificant coefficient on *Low Cash ETR* for both the whole sample and the sub-sample of firms with net hiring above the expected level. However, consistent with my research hypothesis and above results, firms with *Low Cash ETR* are positively associated with under-investments in human capital. Overall, results in panels A and B provide evidence that firms engaging in tax avoidance withhold their investments in labor.

Table 11 presents a number of additional robustness checks. First, in panel A I replace *Low Cash ETR* with *Low Cash ETR tercile* which is based on the same definition of my main explanatory variable extending firm-year observations that fall into my tax avoidance definition. Coefficient estimates show that results are substantially unchanged, with firms engaging in tax avoidance in the current year making sub-optimal labor investments in the following year. Similarly, panel B provides

evidence that the effect on reduced net hiring is not driven by firms that experience losses in the previous years and use these losses to minimize *Cash ETR*.

In panel C I report the results of *Model (2)* after dropping all firms that change their labor investments from above to below the level justified by their underlying economic characteristics (and vice versa) between two contiguous years. That is, I remove all firms that over-invest in human capital in the current year and under-invest in the following year and vice versa. After applying this screen, I find that results in table 4 still hold. Lastly, in panel D, I run *Model (2)* on a sub-sample of firms with high staff cost. Similar to results in table 7, I find that the effect of tax avoidance on lower human capital investments is more pronounced in firms that exhibit higher labor costs; consistent with the view of adjustment costs of labor playing an important role in firms' retaining policies.

4.0 Concluding remarks

This paper addresses the important research question of how tax avoidance affects firms' labor investments. Using a sample of 3,062 U.S. publicly listed firms over the years 1992-2017, I find that firms with low cash effective tax rates (*Low Cash ETR*), my proxy for tax avoidance, make sub-optimal labor investment decisions and more specifically under-invest in human capital relative to the level justified by their underlying economic fundamentals and industry medians. This result is consistent with tax avoidance generating a withholding effect to firms' hiring opportunities through increased tax risks and uncertainties.

To test this prediction, I then focus on sub-samples of firms exposed to high tax risks (proxied by an *ETR* volatility over a five-year period above the median) and high uncertainty (proxied by additions to *UTB* reserves above the median) in separate regressions. I find the positive effect of tax avoidance on firms' sub-optimal hiring policies to be stronger for firms with high tax risks and uncertainties. In an additional analysis, I also test whether the effect on reduced net hiring is mediated the adjustment cost of labor. To this end, I isolate the impact of labor cost using sub-samples of firms operating in industries with larger percentages of skilled labor and by using a more direct proxy of

labor cost (i.e. staff cost). After this test, I continue to find evidence of a positive association between tax avoidance and sub-optimal hiring policies. More importantly, I provide evidence that the effect is more pronounced in presence of high labor costs.

Overall, my results suggest that tax avoidance affects firms' human capital policies by reducing labor investments, consistent with the view of firms withholding their labor demand in response to increased tax risks and uncertainty. These results are also robust to a number of additional tests and to a plausibly exogenous event affecting U.S. firms' tax avoidance opportunities. Finally, these findings can inform policy-makers and other corporate stakeholders (such as labor unions) when designing, implementing or enforcing policies aimed at generating new jobs and stimulating economic growth.

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Appendix

Table A.1. Variable description

Variable	Description
Model (1):	
Net hire$_{it}$	Percentage change in labor investment (Compustat: (emp-L.emp)/L.emp)
Sales growth$_{it}$	Percentage change in revenues from sales (Compustat: (revt-L.revt)/L.revt)
ROA$_{it}$	Net income divided by one-year lag total assets (Compustat: ni/L.at)
ΔROA$_{it}$	Percentage change in ROA
Return$_{it}$	Total stock return (CRSP: retx)
Size$_{it-1}$	Natural logarithm of market value (Compustat: (csho*prcc_f))
Size_r$_{it-1}$	Percentile rank of Size$_{it-1}$
Quick ratio$_{it-1}$	Quick ratio (Compustat: ((che+rect)/lct)
ΔQuick ratio$_{it-1}$	Percentage change in Quick$_{it-1}$
Leverage$_{it-1}$	Sum of total debt in current and long-term liabilities divided by total assets (Compustat: (dlc+dltt)/at)
Loss bins$_{it-1}$	Negative ROA values separate five bins every 0.005 intervals. Loss bin1=1 if ROA ranges between -0.005 and 0. Loss bin2=1 if ROA ranges between -0.005 and -0.010. Loss bin3=1 if ROA ranges between -0.010 and -0.015. Loss bin4=1 if ROA ranges between -0.015 and -0.020. Loss bin5=1 if ROA ranges between -0.020 and -0.025.
Model (2):	
|Abnormal net hire|$_{it}$	Absolute value of the difference between actual and expected net hire, computed following Pinnuck and Lillis (2007) from *Model (1)*
Low Cash ETR$_{it-1}$	Indicator variable equal to one if a firm-year observation is in the first quartile of the Cash ETR (Compustat: txtpd/(pi-spi)) distribution, and zero otherwise
Market-to-book value$_{it-1}$	Market price at the end of the period times common shares outstanding at the end of the period divided by total assets (Compustat: (csho*prcc_f)/ceq)
Dividend$_{it-1}$	Indicator variable equal one if a firm's paid dividend at the end of the previous period and zero otherwise (Compustat: dvpsp_f)
CFO volatility$_{it-1}$	Standard deviation of cash flow from operation from t-5 to t-1 (Compustat: oancf)
Sales volatility$_{it-1}$	Standard deviation of revenues from sales from t-5 to t-1 (Compustat: revt)
PP&E$_{it-1}$	Net property plant and equipment divided by total assets (Compustat: ppent/at)
Loss firms$_{it-1}$	Indicator variable equal to one if a firm's has negative ROA and zero otherwise
Institutional ownership$_{it-1}$	Percentage of ownership held by institutional investors (Thomson Reuters)
Net hire volatility$_{it-1}$	Standard deviation of net hire from t-5 to t-1
Labor intensity$_{it-1}$	Number of employees divided by total assets (Compustat: emp/at)
Unionized labor$_{it-1}$	Percentage of union membership per year at industry-level (Union Membership and Coverage by Hirsch and Macpherson (2003))
|Abnormal other investment|$_{it}$	Absolute value of the residual from the following model: Other investment$_{it}$=β_0 + β_1Sale growth$_{it-1}$ + ε_{it}. Where Other investment is the sum of capital, acquisition and R&D expenses minus cash receipts from the sale of PP&E divided by one-year lag total assets (Compustat: ((capx$_{it}$+aqc$_{it}$+xrd$_{it}$-sppe$_{it}$)/at$_{it-1}$)

Additional variables:	
Over-investment	Net hiring above the expected level (i.e. positive Abnormal net hiring)
Under-investment	Net hiring below the expected level (i.e. negative Abnormal net hiring)
|Larger abnormal net hire|	Above the median over- or under-investment
Over-hire	Over-investment when expected net hiring is positive
Under-fire	Over-investment when expected net hiring is negative
Under-hire	Under-investment when expected net hiring is positive
Over-fire	Under-investment when expected net hiring is negative
Tax risk	Indicator variable equal to one if the standard deviation of Cash ETR over a five-year period is above the median and zero otherwise
Tax uncertainty	Indicator variable equal to one if uncertain tax benefit (UTB) reserve divided by total assets (Compustat: txtubend/at) is above the median and zero otherwise
High skill	Indicator variable equal to one if the Labor Skill Index (LSI) is above the median and zero otherwise. LSI measures the reliance of industries on skilled labor and is computed using OES employment data from the Bureau of Labor statistics and labor skill data from the U.S. Department of Labor's O*NET
Low peer-adjusted Cash ETR	Indicator variable equal to one if a firm is in the first quartile of the peer-adjusted Cash ETR difference distribution. Peer-adjusted Cash ETR is the difference of a firm's Cash ETR and the average Cash ETR of the firm's industry (Fama-French 48) and size (total assets) peers
|Abnormal ind. adj. net hire|	Absolute value of industry-adjusted net hiring, computed as the difference between a firm's net hiring and the industry and year median net hiring
|Abnormal av. net hire|	Absolute value of the difference between a firm's net hiring and the average net hiring of the previous three years
High staff cost	Indicator variable equal to one if staff cost (Compustat: xlr/at) is above the median and zero otherwise

Table 1. *Model (1)*: Descriptive statistics and regression results

Panel A. Descriptive statistics

	N	Mean	Median	Std. dev.	25th	75th
Net hire$_{it}$	83,453	0.0831	0.0205	0.3836	-0.0500	0.1333
Sales growth$_{it-1}$	83,453	0.2481	0.0840	0.9440	-0.0303	0.2514
Sales growth$_{it}$	83,453	0.1769	0.0702	0.7729	-0.0431	0.2165
ΔROA$_{it}$	83,453	0.0070	-0.0009	0.5287	-0.0521	0.0407
ΔROA$_{it-1}$	83,453	0.0306	-0.0001	0.7159	-0.0519	0.0435
ROA$_{it}$	83,453	-0.0532	0.0314	0.4710	-0.0652	0.0854
Return$_{it}$	83,453	0.0101	0.0045	0.1667	-0.0695	0.0803
Size$_{it-1}$	83,453	5.6795	5.6604	2.3246	4.0171	7.2603
Quick ratio$_{it-1}$	83,453	2.2005	1.2888	3.0692	0.7881	2.3587
ΔQuick ratio$_{it-1}$	83,453	-0.0523	-0.0071	2.2927	-0.3015	0.2523
ΔQuick ratio$_{it}$	83,453	0.1589	-0.0143	1.3035	-0.2206	0.2083
Leverage$_{it-1}$	83,453	0.2362	0.1732	0.3295	0.0152	0.3435

Panel B. Regression results: Expected and actual net hiring

VARIABLES	(1) Net hire
Sales growth$_{it-1}$	0.0297***
	(0.0039)
Sales growth$_{it}$	0.1600***
	(0.0088)
ΔROA$_{it}$	-0.0761***
	(0.0117)
ΔROA$_{it-1}$	-0.0290***
	(0.0054)
ROA$_{it}$	0.0403***
	(0.0099)
Return$_{it}$	0.0381***
	(0.0099)
Size_r$_{it-1}$	0.0012***
	(0.0002)
Quick ratio$_{it-1}$	0.0054***
	(0.0009)
ΔQuick ratio$_{it-1}$	0.0130***
	(0.0022)
ΔQuick ratio$_{it}$	-0.0053**
	(0.0022)
Leverage$_{it-1}$	-0.0168**
	(0.0065)
Loss bin1$_{it-1}$	-0.0360***
	(0.0077)
Loss bin2$_{it-1}$	-0.0363***
	(0.0071)
Loss bin3$_{it-1}$	-0.0312***
	(0.0116)
Loss bin4$_{it-1}$	-0.0070
	(0.0109)
Los sbin5$_{it-1}$	-0.0297***
	(0.0102)
Observations	65,149
R-squared	0.1142
Industry FE	YES

Table 2. *Model (2)*: Descriptive statistics and correlation matrix

Table 2 presents descriptive statistics of Cash ETR by quartiles (Panel A) and by industry defined using Fama-French 48 industry classification (Panel B). Panel C reports descriptive statistics of all *Model (2)*'s variables.

Panel A. Quartile distribution of Cash ETR

Variable	Quartile	N	Mean	Median	Std. Dev.	Min	Max
Low Cash ETR	**1**	**5,493**	**0.0351**	**0.0290**	**0.0319**	**0.0000**	**0.0982**
-	2	5,493	0.1639	0.1662	0.0354	0.0982	0.2220
-	3	5,493	0.2743	0.2741	0.0300	0.2220	0.3274
High Cash ETR	4	5,492	0.4818	0.4051	0.1877	0.3274	1.0000
Total		21,971	0.2388	0.2220	0.1909	0.0000	1.0000

Panel B. Low Cash ETR by industry

Industry	N	Mean	Industry	N	Mean
Unclassified	18	0.04	Automobiles & Trucks	81	0.04
Agriculture	13	0.05	Aircrafts	43	0.04
Food Products	62	0.03	Shipbuilding, Railroad Equipment	11	0.01
Candy & Soda	6	0.02	Defense	25	0.03
Beer & Liquor	10	0.04	Precious Metals	22	0.01
Recreation	37	0.03	Non-Metallic & Metallic Mining	26	0.05
Printing & Publishing	18	0.04	Coal	5	0.05
Consumer Goods	57	0.04	Petroleum & Natural Gas	81	0.03
Apparel	22	0.03	Communication	117	0.03
Medical Equipment	285	0.04	Personal Services	277	0.03
Pharmaceutical Products	298	0.03	Business Services	867	0.04
Chemicals	163	0.03	Computers	496	0.04
Rubber & Plastic Products	46	0.03	Electronic Equipment	925	0.03
Textiles	10	0.02	Measuring & Control Equipment	232	0.04
Construction Materials	94	0.04	Business Supplies	87	0.04
Construction	7	0.02	Shipping Containers	30	0.04
Steel Works etc.	63	0.03	Transportation	22	0.03
Fabricated Products	19	0.03	Wholesale	169	0.03
Machinery	269	0.04	Retail	271	0.03
Electrical Equipment	52	0.04	Restaurants, Hotels & Motels	155	0.04

Panel C. Descriptive statistics

	N	Mean	Median	Std. dev.	25th	75th
|Abnormal net hire|	21,971	0.1225	0.0657	0.1890	0.0256	0.1443
Low Cash ETR	21,971	0.2500	0.0000	0.4330	0.0000	1.0000
Market-to-book-value	21,971	3.0894	2.2907	5.8166	1.4327	3.6865
Size	21,971	6.6885	6.7433	2.2087	5.2125	8.2286
Quick ratio	21,971	1.9626	1.3521	2.1978	0.8584	2.2595
Leverage	21,971	0.4612	0.4465	0.3164	0.2827	0.6003
Dividend	21,971	0.4607	0.0000	0.4985	0.0000	1.0000
CFO volatility	21,971	0.5147	0.3826	0.4416	0.2217	0.6672
Sales volatility	21,971	0.2025	0.1595	0.1766	0.0944	0.2591
PP&E	21,971	0.2276	0.1758	0.1840	0.0875	0.3173
Institutional ownership	21,971	0.2151	0.2134	0.1545	0.0673	0.3409
Net hire volatility	21,971	0.1601	0.1083	0.1676	0.0590	0.1920
Labor intensity	21,971	0.0067	0.0039	0.0084	0.0022	0.0074
Unionized labor	21,971	0.1050	0.1025	0.0367	0.0880	0.1285
|Other investment|	21,971	0.1048	0.0926	0.1027	0.0503	0.1302

Table 3. Correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1)	|Abnormal net hire|	1.00														
(2)	Low Cash ETR	**0.07**	1.00													
		(0.00)														
(3)	Market-to-book value	**0.03**	-0.01	1.00												
		(0.00)	(0.08)													
(4)	Size	**-0.07**	**-0.20**	**0.15**	1.00											
		(0.00)	(0.00)	(0.00)												
(5)	Quick ratio	**0.04**	**0.09**	-0.00	**-0.14**	1.00										
		(0.00)	(0.00)	(0.55)	(0.00)											
(6)	Leverage	**-0.03**	-0.00	0.02	**0.11**	**-0.37**	1.00									
		(0.00)	(0.50)	(0.02)	(0.00)	(0.00)										
(7)	Dividend	**-0.14**	**-0.23**	**0.03**	**0.39**	**-0.16**	**0.10**	1.00								
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)									
(8)	CFO volatility	**0.09**	**0.17**	**-0.05**	**-0.32**	**0.10**	**-0.05**	**-0.25**	1.00							
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)								
(9)	Sales volatility	**0.17**	**0.11**	0.01	-0.02	**0.15**	**-0.05**	**-0.23**	**0.26**	1.00						
		(0.00)	(0.00)	(0.09)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)							
(10)	PP&E	**-0.07**	**-0.05**	**-0.04**	**0.10**	**-0.26**	**0.10**	**0.16**	**-0.18**	**-0.09**	1.00					
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
(11)	Institutional ownership	-0.00	**-0.08**	**0.08**	**0.35**	0.01	-0.02	0.01	**-0.12**	0.02	**-0.10**	1.00				
		(0.50)	(0.00)	(0.00)	(0.00)	(0.05)	(0.02)	(0.19)	(0.00)	(0.01)	(0.00)					
(12)	Net hire volatility	**0.15**	**0.13**	**-0.03**	**-0.16**	**0.04**	-0.01	**-0.22**	**0.20**	**0.46**	**-0.10**	**-0.05**	1.00			
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)				
(13)	Labor intensity	0.00	**-0.02**	**-0.03**	**-0.28**	**-0.17**	**0.06**	**-0.09**	-0.02	**-0.08**	**0.31**	**-0.10**	-0.02	1.00		
		(0.81)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)			
(14)	Unionized labor	**0.04**	**0.03**	-0.01	-0.02	**0.10**	**-0.04**	**0.06**	0.02	0.01	-0.01	**-0.19**	**0.06**	**-0.27**	1.00	
		(0.00)	(0.00)	(0.12)	(0.01)	(0.00)	(0.00)	(0.00)	(0.02)	(0.20)	(0.22)	(0.00)	(0.00)	(0.00)		
(15)	|Abnormal other investment|	**0.29**	**0.02**	-0.01	**-0.03**	**-0.05**	**0.11**	-0.01	**0.02**	**0.04**	**-0.04**	**-0.04**	**0.04**	**-0.04**	**-0.03**	1.00
		(0.00)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)	(0.44)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Table 4. Tax avoidance and labor investment

Regressions of labor investment on corporate tax avoidance using longitudinal data on U.S. non-financial and non-utility firms covering the years 1992-2017. Table A.1 in the Appendix reports variable definitions. All the explanatory variables are lagged by one year. Standard errors are robust to heteroskedasticity and adjusted for clusters at firm-level (in parentheses). ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	Whole-sample	Over-investment		Under-investment	
	(1)	(2)	(3)	(4)	(5)
VARIABLES	|Abnormal net hire|	|Abnormal net hire|	|Larger abnormal net hire|	|Abnormal net hire|	|Larger abnormal net hire|
Low Cash ETR	**0.0079****	0.0080	0.0027	**0.0055*****	**0.0097*****
	(0.0038)	(0.0067)	(0.0104)	(0.0020)	(0.0033)
Market-to-book value	0.0015***	0.0021***	0.0018	0.0000	-0.0002
	(0.0003)	(0.0006)	(0.0015)	(0.0002)	(0.0003)
Size	-0.0035***	-0.0058***	-0.0101***	-0.0017***	-0.0012
	(0.0011)	(0.0018)	(0.0031)	(0.0005)	(0.0008)
Quick ratio	0.0030**	0.0168***	0.0111***	0.0012***	0.0003
	(0.0014)	(0.0026)	(0.0032)	(0.0004)	(0.0005)
Leverage	-0.0254	-0.0264**	-0.0027	0.0074**	0.0121***
	(0.0160)	(0.0132)	(0.0085)	(0.0029)	(0.0025)
Dividend	-0.0200***	-0.0069	0.0182	-0.0031*	-0.0014
	(0.0037)	(0.0067)	(0.0122)	(0.0018)	(0.0029)
CFO volatility	0.0086**	0.0125	0.0117	0.0043**	0.0035
	(0.0042)	(0.0078)	(0.0116)	(0.0021)	(0.0034)
Sales volatility	0.0674***	0.0827***	0.0395	0.0052	-0.0081
	(0.0158)	(0.0249)	(0.0298)	(0.0062)	(0.0087)
PP&E	-0.0231*	-0.0067	-0.0133	-0.0209***	-0.0213**
	(0.0118)	(0.0220)	(0.0368)	(0.0062)	(0.0099)
Institutional ownership	0.0658***	0.0223	-0.0490	0.0083	-0.0242**
	(0.0119)	(0.0217)	(0.0363)	(0.0058)	(0.0098)
Net hire volatility	0.0644***	0.0873***	0.1028***	0.0363***	0.0405***
	(0.0147)	(0.0233)	(0.0303)	(0.0075)	(0.0118)
Labor intensity	-0.7295***	-2.0756***	-4.4076***	0.4412**	0.2206
	(0.2491)	(0.4528)	(0.7862)	(0.1821)	(0.2685)
Unionized labor	-0.3021**	-0.1960	0.3678	0.0609	0.0749
	(0.1494)	(0.2590)	(0.4124)	(0.0867)	(0.1346)
|Abnormal other investment|	0.4957***	0.6286***	0.6022***	-0.0263***	-0.0209
	(0.0398)	(0.0400)	(0.0413)	(0.0095)	(0.0173)
Observations	17,277	7,054	3,460	10,223	4,893
R-squared	0.1521	0.2327	0.2020	0.0529	0.0530
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Table 5. Tax avoidance and over- and under- labor investment

Regressions of labor investment on corporate tax avoidance using longitudinal data on U.S. non-financial and non-utility firms covering the years 1992-2017. Table A.1 in the Appendix reports variable definitions. All the explanatory variables are lagged by one year. Standard errors are robust to heteroskedasticity and adjusted for clusters at firm-level (in parentheses). ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	Over-investment		Under-investment	
	Over-hiring	Under-firing	Under-hiring	Over-firing
	(1)	(2)	(3)	(4)
VARIABLES	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|
Low Cash ETR	0.0093	0.0028	**0.0046*** **	0.0308
	(0.0060)	(0.0849)	(0.0018)	(0.0190)
Market-to-book value	0.0019***	0.0047	0.0002	-0.0004
	(0.0005)	(0.0035)	(0.0001)	(0.0009)
Size	-0.0046***	0.0208	-0.0016***	-0.0016
	(0.0015)	(0.0132)	(0.0004)	(0.0038)
Quick ratio	0.0144***	0.1056**	0.0012***	0.0070
	(0.0027)	(0.0417)	(0.0004)	(0.0099)
Leverage	-0.0338**	-0.0604**	-0.0097***	-0.0008
	(0.0137)	(0.0263)	(0.0035)	(0.0045)
Dividend	-0.0047	-0.1226**	-0.0043***	0.0375**
	(0.0057)	(0.0600)	(0.0016)	(0.0173)
CFO volatility	0.0104	0.1094	0.0033*	-0.0005
	(0.0068)	(0.0714)	(0.0019)	(0.0189)
Sales volatility	0.0699***	-0.0700	0.0085	-0.1123**
	(0.0215)	(0.2172)	(0.0062)	(0.0481)
PP&E	-0.0053	0.0479	-0.0174***	-0.0786
	(0.0197)	(0.1772)	(0.0057)	(0.0501)
Institutional ownership	0.0173	0.2681	0.0126**	0.0989**
	(0.0187)	(0.1993)	(0.0051)	(0.0432)
Net hire volatility	0.0979***	-0.0054	0.0354***	0.0028
	(0.0198)	(0.1764)	(0.0073)	(0.0675)
Labor intensity	-1.3774***	-10.4266**	0.4647**	-0.3861
	(0.4090)	(4.3664)	(0.1815)	(1.6137)
Unionized labor	-0.1170	-2.8784	0.0692	0.1851
	(0.2258)	(3.7010)	(0.0783)	(0.8535)
|Abnormal other investment|	0.5581***	0.6899***	-0.0186**	-0.0080
	(0.0322)	(0.2236)	(0.0089)	(0.0775)
Observations	6,742	312	9,732	491
R-squared	0.2302	0.6221	0.0660	0.2655
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Table 6. The role of tax risk and uncertainty

Regressions of labor investment on corporate tax avoidance using longitudinal data on U.S. non-financial and non-utility firms covering the years 1992-2017. Table A.1 in the Appendix reports variable definitions. All the explanatory variables are lagged by one year. Standard errors are robust to heteroskedasticity and adjusted for clusters at firm-level (in parentheses). ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	Over-investment		Under-investment	
	Tax risk = 1	Tax uncertainty = 1	Tax risk = 1	Tax uncertainty = 1
	(1)	(2)	(3)	(4)
VARIABLES	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|
Low Cash ETR	0.0121	0.0076	**0.0057***	**0.0089****
	(0.0105)	(0.0116)	(0.0031)	(0.0043)
Market-to-book value	0.0012	0.0004	0.0005*	0.0002
	(0.0015)	(0.0011)	(0.0003)	(0.0003)
Size	-0.0069**	-0.0066*	-0.0020***	-0.0009
	(0.0028)	(0.0036)	(0.0007)	(0.0014)
Quick ratio	0.0161***	0.0066*	0.0013**	0.0017
	(0.0042)	(0.0036)	(0.0006)	(0.0010)
Leverage	-0.0619**	-0.0580*	0.0099	0.0075
	(0.0303)	(0.0320)	(0.0061)	(0.0089)
Dividend	-0.0056	-0.0171	-0.0011	-0.0013
	(0.0085)	(0.0126)	(0.0024)	(0.0037)
CFO volatility	-0.0043	-0.0137	0.0013	0.0022
	(0.0101)	(0.0184)	(0.0028)	(0.0052)
Sales volatility	0.0723*	0.0603**	0.0170*	-0.0017
	(0.0400)	(0.0241)	(0.0089)	(0.0091)
PP&E	-0.0196	-0.0870*	-0.0202**	-0.0188
	(0.0276)	(0.0448)	(0.0081)	(0.0143)
Institutional ownership	0.0557	0.0329	0.0062	-0.0241
	(0.0340)	(0.0441)	(0.0080)	(0.0152)
Net hire volatility	0.1290***	0.0370	0.0283***	0.0558***
	(0.0371)	(0.0466)	(0.0095)	(0.0203)
Labor intensity	-2.0636**	-4.4245**	0.4651**	0.2434
	(0.8076)	(1.8727)	(0.2170)	(0.3351)
Unionized labor	-0.3834	-0.7434	-0.0615	-0.3643
	(0.3814)	(1.1894)	(0.1324)	(0.2557)
|Abnormal other investment|	0.5865***	0.5928***	-0.0181	-0.0290
	(0.0600)	(0.0830)	(0.0132)	(0.0288)
Observations	3,066	1,429	4,937	2,371
R-squared	0.2482	0.2428	0.0517	0.0797
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Table 7. The role of skilled labor

Regressions of labor investment on corporate tax avoidance using longitudinal data on U.S. non-financial and non-utility firms covering the years 2003-2017. Table A.1 in the Appendix reports variable definitions. All the explanatory variables are lagged by one year. Standard errors are robust to heteroskedasticity and adjusted for clusters at industry-year level (in parentheses). ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	Over-investment		Under-investment	
	High skills = 1	High skills = 0	High skills = 1	High skills = 0
	(1)	(2)	(3)	(4)
VARIABLES	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|
Low Cash ETR	-0.0061	-0.0054	**0.0144***	0.0011
	(0.0183)	(0.0176)	(0.0082)	(0.0058)
Market-to-book value	0.0014	0.0024	0.0005	-0.0003
	(0.0011)	(0.0024)	(0.0004)	(0.0002)
Size	0.0034	-0.0157***	-0.0022*	-0.0015
	(0.0050)	(0.0051)	(0.0012)	(0.0013)
Quick ratio	0.0346***	0.0201*	0.0012	0.0036**
	(0.0098)	(0.0112)	(0.0008)	(0.0015)
Leverage	-0.0040	-0.0099	-0.0066	0.0125***
	(0.0231)	(0.0061)	(0.0077)	(0.0016)
Dividend	-0.0046	0.0001	0.0060	-0.0042
	(0.0181)	(0.0228)	(0.0045)	(0.0048)
CFO volatility	-0.0059	0.0196	0.0147*	-0.0022
	(0.0144)	(0.0274)	(0.0085)	(0.0049)
Sales volatility	0.1058*	0.0675	-0.0073	0.0190*
	(0.0632)	(0.0500)	(0.0394)	(0.0098)
PP&E	-0.0428	-0.1760*	-0.0157	-0.0325**
	(0.0723)	(0.0916)	(0.0229)	(0.0133)
Institutional ownership	-0.0287	0.0962*	0.0228	0.0096
	(0.0496)	(0.0527)	(0.0186)	(0.0159)
Net hire volatility	0.0599	0.0248	0.0591**	0.0005
	(0.0497)	(0.0503)	(0.0283)	(0.0142)
Labor intensity	-1.7163***	-0.3511	0.5681	0.3901
	(0.6511)	(1.0326)	(0.4272)	(0.3834)
Unionized labor	-0.6440	1.7621	-0.1826	0.0744
	(1.3267)	(1.1175)	(0.3245)	(0.3483)
|Abnormal other investment|	0.7685***	0.5455***	-0.0821	-0.0469**
	(0.1160)	(0.1057)	(0.0571)	(0.0228)
Observations	729	680	1,107	1,070
R-squared	0.3946	0.2549	0.0783	0.0791
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Table 8. Difference-in-differences around Ireland's statutory corporate tax cut

Difference-in-differences around Ireland's statutory corporate tax cut occurred in December 1997 (two-year window). The treatment group includes U.S. multinationals with operations in Ireland whereas the control group consists of U.S. multinationals without operations in Ireland. Table A.1 in the Appendix reports variable definitions. Firms in the control group are selected using propensity score matching with replacement that best matches each firm in the treatment group based on several lagged (two-year) variables (Cash ETR, Market-to-book value, Size, PP&E, Global pre-tax income and Foreign-only pre-tax income) and industry characteristics. Standard errors are robust to heteroskedasticity and adjusted for clusters at firm-level (in parentheses). ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	Whole sample	Over-investment	Under-investment
	(1)	(2)	(3)
VARIABLES	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|
Treated × Post	0.0211	0.0620	**0.0278****
	(0.0252)	(0.0403)	(0.0123)
Treated	0.0085	0.0045	-0.0163**
	(0.0234)	(0.0343)	(0.0075)
Post	0.0305	0.0958**	-0.0179
	(0.0251)	(0.0411)	(0.0118)
Observations	1,876	1,105	771
R-squared	0.0944	0.1725	0.0695
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

Table 9. Controlling for tax incentives to labor in U.S. domestic firms only

Regressions of labor investment on corporate tax avoidance using longitudinal data on U.S. domestic firms only. The sample excludes utility and financial firms and covers the years 1992-2017. All the explanatory variables are lagged by one year. All regressions include industry and year fixed effects. Standard errors are robust to heteroskedasticity and adjusted for clusters at firm-level (in parentheses). ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	Whole sample	Over-investment	Under-investment
	(1)	(2)	(3)
VARIABLES	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|
Low peer-adjusted Cash ETR	0.0047	-0.0014	**0.0073****
	(0.0069)	(0.0124)	(0.0035)
Market-to-book value	0.0016	0.0018	-0.0001
	(0.0014)	(0.0028)	(0.0003)
Size	-0.0028	-0.0062*	-0.0013
	(0.0019)	(0.0034)	(0.0009)
Quick ratio	0.0027*	0.0199***	0.0014***
	(0.0015)	(0.0036)	(0.0005)
Leverage	-0.0136	-0.0187	0.0081***
	(0.0130)	(0.0117)	(0.0029)
Dividend	-0.0154**	0.0102	-0.0040
	(0.0071)	(0.0139)	(0.0032)
Cash flow volatility	0.0171**	0.0277*	0.0090***
	(0.0077)	(0.0148)	(0.0032)
Sales volatility	0.0684***	0.1004**	-0.0053
	(0.0260)	(0.0464)	(0.0108)
PP&E	-0.0186	-0.0023	-0.0126
	(0.0193)	(0.0344)	(0.0093)
Institutional ownership	0.0770***	0.0165	0.0210*
	(0.0234)	(0.0435)	(0.0110)
Net hire volatility	0.0620**	0.0992**	0.0335**
	(0.0282)	(0.0447)	(0.0141)
Labor intensity	-0.6655*	-2.0233***	0.4820*
	(0.3438)	(0.5593)	(0.2670)
Unionized labor	-0.4272	-0.5372	0.0964
	(0.2639)	(0.4856)	(0.1548)
|Abnormal other investment|	0.4527***	0.6671***	-0.0542***
	(0.0695)	(0.0730)	(0.0151)
Observations	5,310	2,136	3,174
R-squared	0.1438	0.2630	0.0930
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

Table 10. Robustness tests: alternative proxies for expected net hiring

Regressions of labor investment on corporate tax avoidance using longitudinal data on U.S. non-financial and non-utility firms covering the years 1992-2017. All the explanatory variables are lagged by one year. All regressions include industry and year fixed effects. Standard errors are robust to heteroskedasticity and adjusted for clusters at firm-level (in parentheses). ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Panel A. Industry-median net hiring

	Whole-sample	Over-investment	Under-investment
	(1)	(2)	(3)
VARIABLES	|Abnormal ind. adj. net hire|	|Abnormal ind. adj. net hire|	|Abnormal ind. adj. net hire|
Low Cash ETR	**0.0071***	0.0061	**0.0061****
	(0.0037)	(0.0056)	(0.0029)
Market-to-book value	0.0012***	0.0017***	-0.0002
	(0.0003)	(0.0005)	(0.0002)
Size	-0.0035***	-0.0049***	-0.0020***
	(0.0010)	(0.0014)	(0.0006)
Quick ratio	0.0031**	0.0040**	0.0007
	(0.0012)	(0.0018)	(0.0005)
Leverage	-0.0184	-0.0291**	0.0100***
	(0.0130)	(0.0132)	(0.0028)
Dividend	-0.0143***	-0.0139***	-0.0001
	(0.0035)	(0.0052)	(0.0026)
CFO volatility	0.0077*	0.0079	0.0026
	(0.0041)	(0.0064)	(0.0031)
Sales volatility	0.0576***	0.0731***	0.0022
	(0.0144)	(0.0195)	(0.0087)
PP&E	-0.0244**	-0.0211	-0.0266***
	(0.0112)	(0.0172)	(0.0086)
Institutional ownership	0.0411***	0.0203	-0.0149*
	(0.0111)	(0.0162)	(0.0079)
Net hire volatility	0.0622***	0.0682***	0.0462***
	(0.0141)	(0.0194)	(0.0103)
Labor intensity	-0.6966***	-1.7073***	0.5124**
	(0.2400)	(0.3437)	(0.2578)
Unionized labor	-0.2148	-0.2176	-0.0185
	(0.1408)	(0.2159)	(0.1146)
|Abnormal other investment|	0.4833***	0.6162***	-0.0210*
	(0.0382)	(0.0375)	(0.0114)
Observations	17,277	9,680	7,106
R-squared	0.1416	0.1883	0.0523
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

Panel B. Three-year average net hiring

	Whole-sample	Over-investment	Under-investment
	(1)	(2)	(3)
VARIABLES	|Abnormal av. net hire|	|Abnormal av. net hire|	|Abnormal av. net hire|
Low Cash ETR	0.0063	0.0060	**0.0127*** **
	(0.0042)	(0.0061)	(0.0046)
Market-to-book value	0.0004	0.0004	0.0004
	(0.0004)	(0.0006)	(0.0003)
Size	-0.0034***	-0.0069***	-0.0015
	(0.0012)	(0.0016)	(0.0011)
Quick ratio	-0.0002	0.0028	-0.0025***
	(0.0011)	(0.0018)	(0.0008)
Leverage	-0.0099	-0.0291**	0.0251**
	(0.0086)	(0.0119)	(0.0103)
Dividend	-0.0030	0.0004	-0.0104***
	(0.0040)	(0.0061)	(0.0039)
CFO volatility	0.0025	0.0073	-0.0050
	(0.0051)	(0.0081)	(0.0057)
Sales volatility	0.0555**	0.0278	0.1175***
	(0.0222)	(0.0285)	(0.0276)
PP&E	-0.0336***	-0.0245	-0.0318**
	(0.0129)	(0.0201)	(0.0137)
Institutional ownership	0.0376***	0.0018	0.0039
	(0.0122)	(0.0176)	(0.0119)
Net hire volatility	0.2478***	0.1243***	0.3234***
	(0.0216)	(0.0315)	(0.0210)
Labor intensity	-0.5157*	-2.4728***	0.6894*
	(0.3084)	(0.4593)	(0.3689)
Unionized labor	-0.5564***	-0.0738	0.5523**
	(0.2035)	(0.2651)	(0.2181)
|Abnormal other investment|	0.3721***	0.6184***	0.0412
	(0.0407)	(0.0437)	(0.0275)
Observations	17,065	7,125	8,770
R-squared	0.1443	0.1954	0.2129
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

Table 11. Other robustness tests

Regressions of labor investment on corporate tax avoidance using longitudinal data on U.S. non-financial and non-utility firms covering the years 1992-2017. All regressions include model (2)' control variables and industry and year fixed effects. Table A.1 in the Appendix reports variable definitions. All the explanatory variables are lagged by one year. Standard errors are robust to heteroskedasticity and adjusted for clusters at firm-level (in parentheses). ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	Whole sample	Over-investment	Under-investment
	(1)	(2)	(3)
VARIABLES	|Abnormal net hire|	|Abnormal net hire|	|Abnormal net hire|
Panel A. Tercile distribution of Cash ETR			
Low Cash ETR tercile	**0.0079****	0.0080	**0.0055*****
	(0.0038)	(0.0067)	(0.0020)
Observations	17,277	7,054	10,223
R-squared	0.1521	0.2327	0.0529
Panel B. Controlling for net operating loss carry-forward			
Low Cash ETR	**0.0084****	0.0065	**0.0058*****
	(0.0037)	(0.0066)	(0.0021)
NOL	0.0007	-0.0042	0.0021
	(0.0033)	(0.0059)	(0.0017)
Δ NOL	-0.0024	0.0078	0.0037**
	(0.0037)	(0.0177)	(0.0017)
Observations	16,390	6,647	9,743
R-squared	0.1529	0.2319	0.0520
Panel C. Excluding labor policy changes in contiguous years			
Low Cash ETR	**0.0096****	0.0080	**0.0079*****
	(0.0047)	(0.0067)	(0.0027)
Observations	13,610	7,054	6,556
R-squared	0.1803	0.2327	0.0553
Panel D. Sub-sample of firms with high staff cost			
Low Cash ETR	0.0057	0.0056	**0.0048****
	(0.0040)	(0.0069)	(0.0022)
Observations	15,856	6,566	9,290
R-squared	0.1565	0.2379	0.0548

Figure 1. Net hiring and abnormal net hiring

Figure A shows net hiring and abnormal net hiring based on economic fundamentals. The blue line in the middle of the graph represents the annual average *Net hire*. The red (green) line at the top (bottom) represents net hiring above (below) its expected level. All variables are as defined in table A.1.

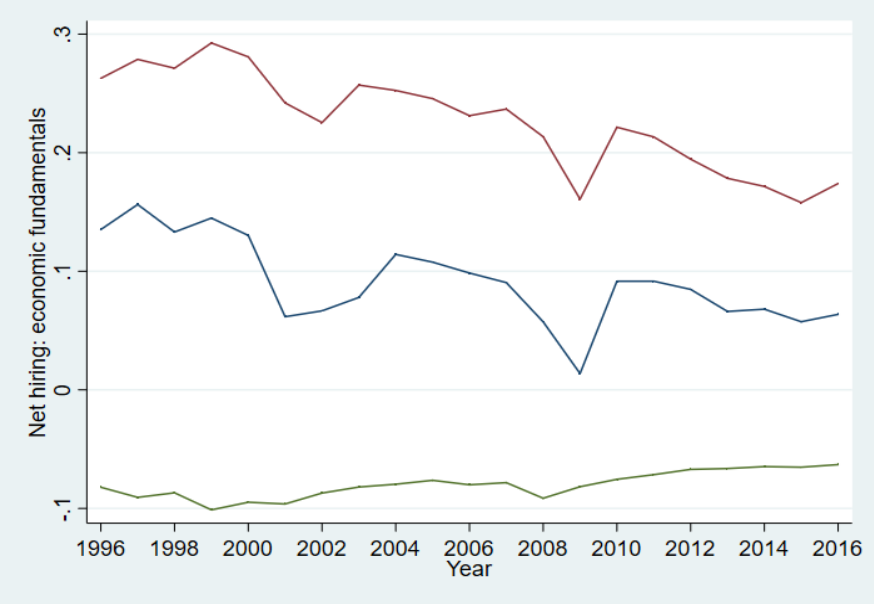

Figure 2. Difference-in-differences around Ireland's statutory corporate tax cut

Figure 2 shows the annual average Cash ETR for U.S. multinationals with operations in Ireland (Treated = 1) represented by the blue lower line and the annual average Cash ETR for U.S. multinationals with foreign operations in countries other than Ireland (Treated = 0) represented by the red top line. The phased reduction of Ireland's statutory corporate tax rate was approved in December 1997 and entered into force in January 1, 1998 (red vertical line).