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Managerial Ability and Tax Avoidance

Evidence from Europe

By

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Abstract

Prior studies model tax avoidance after firm characteristics without considering the effect of individual decision makers, or obtain contradictory results as to the effect of the ability of these individual decision makers on tax avoidance. This study investigates the effect of managerial ability on tax avoidance, presenting new empirical evidence from Europe. Our findings indicate that more able managers engage in greater tax avoidance, and that moving from the lower to the upper quartile of managerial ability in Europe is associated with a 1.84% reduction in a firm's one-year cash effective tax rate. Further tests show that this result is robust to a wide range of robustness tests, methodological considerations, and alternative explanations. Our results also remain consistent when we attempt to reconcile with differing models who have previously obtained contradictory results. Furthermore, we examine the importance ascribed to tax avoidance by managers, finding that it is not a first order concern, but confirm that managers are incentivized to engage in tax avoidance. Finally, we explore the relationship between managerial ability and tax reforms, finding that the disparity in ability in regards to tax avoidance is most pronounced in low tax environments.

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This thesis is written as part of the Master of Science in Economics and Business Administration at the Norwegian School of Economics, departments of Finance & Business Analysis and Performance Management. It addresses the relationship between managerial ability and tax avoidance. We have found the process to be challenging at times, yet both rewarding and highly educational. Throughout the work, we have focused on learning and gaining knowledge on the topics of tax avoidance and managerial ability.

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Erik Rønningen Ruhs

Ole Martin Østerås

Contents

List of Tables

Introduction

Hanlon and Heitzman (2010) conclude that the current tax literature cannot explain variation in tax avoidance particularly well. This is interesting, as in early empirics the role of managers has typically been ignored when trying to explain corporate behavior and performance, having been credited mainly to characteristics such as firm, industry, and market (Bertrand & Schoar, 2003). Furthermore, Hanlon and Heitzman (2010) identify the impact of individual decision makers on firms tax avoidance strategies as a potential gap in the literature. This gap is a plausible explanation as to why literature has been unable to explain variation in tax avoidance to a satisfactory degree, as the impact of individual decision makers on a firm's tax avoidance could be substantial. Following the publication by Hanlon and Heitzman (2010), managerial ability has become of high interest in tax avoidance literature. Several recent works (e.g., Dyreng et al., 2010; Francis et al., 2013; Park et al., 2016; Koester et al., 2017; Nurfauzi and Firmansyah, 2018) focus on the impact of individual decision makers on tax avoidance. The view that individual decision makers are essential for developing firms strategies is shared among top managers: "In the old days I would have said it was capital, history, the name of the bank. Garbage—it's about the guy at the top." —John Reed, CEO Citicorp.

This study examines the relationship between managerial ability and tax avoidance in Europe. Our definition of managers include all members of a firm's executive team, and our study is motivated by similar studies using data on US firms finding contradictory results. The first of these studies was conducted by Dyreng et al. (2010), who found a significant effect between managerial ability and greater tax avoidance using a manager fixed effects research design. However, the validity of studies using a manager fixed effects research design has later been drawn into question as the results may be econometrically invalid (Fee, et al., 2013). Following this subsequent studies have investigated the relationship between managerial ability and tax avoidance using different research designs, finding contradictory results, most notably Koester et al. (2017) and Francis et al. (2013) who utilize a measure for managerial ability develop by Demerjian et al. (2012).

We conduct our study using data from European firms, which enables us to present new empirical evidence. We estimate the measure for managerial ability developed by Demerjian et al. (2012), using a two-step approach, where we first use a data envelopment analysis (DEA)

to estimate total firm efficiency, before using a Tobit regressions to isolate the part of total efficiency which should be attributed to the manager. Using this measure for managerial ability, we conduct a series of regressions utilizing cash effective tax rate (cash ETR) as our primary dependent variable, in order to investigate the impact of managerial ability on tax avoidance. The regressions include control variables of firm characteristics known to be associated with tax avoidance and we test for differing levels of fixed effects.

Recent works on the relationship between managerial ability and tax avoidance have resulted in contradictory findings. The study using data on US firms by Koester et al. (2017) find a significant relationship between higher managerial ability and greater tax avoidance. While the study conducted by Francis et al. (2013) find a significant negative relationship between higher managerial ability and tax aggressiveness. It is important to be aware of Francis et al. (2013) primarily focusing on the tax aggressiveness subset of tax avoidance. However, their results remain consistent when utilizing proxies more appropriate to study the whole specter of tax avoidance. The findings of Francis et al. (2013) also remain consistent when running additional tests in an attempt to bridge with the findings of Koester et al. (2017). Both works have in later years found their respective results supported by studies conducted on Asian markets (Nurfauzi et al., 2018 and Park et al., 2016).

Contrary to previous studies, we focus on managerial ability in Europe, and it is important to be aware of potential differences in behavior and opportunity in regards to tax avoidance. Studies by Alm and Torgler (2006) and Avi-Yonah and Lahav (2011) highlight differences, concluding that tax morale is higher in the US compared to in Europe and that there is less opportunity for corporate tax avoidance in European countries. Leaving us to conclude that the effect of managerial ability on tax avoidance in Europe and the US need not be the same.

We follow the definition of tax avoidance presented by Hanlon and Heitzman (2010), who define tax avoidance as the reduction in explicit taxes. In addition to the tax avoidance definition, our choice of dependent variable is vital, as different tax avoidance proxies are better suited to capturing different types of tax avoidance. As a tax avoidance proxy, this study primarily use a one-year cash ETR, as it is the most powerful to capture both temporary and risky permanent tax avoidance strategies (De Simone, et al., 2018). As short run-cash ETRs are not reliable predictors for long-run cash ETRs, we also perform tests using both two- and four-year cash ETRs (Dyreng, et al., 2008).

Managerial ability is quantified using the measure developed by Demerjian et al. (2012) who define managerial ability as the ability to allocate resources effectively to generate revenue. This measure is especially suited for our study as it uses variables reported in financial statements making the measure available for use with big panel data sets, and because no other measure in previous literature has been able to show the same validation in empirical tests. We do, however, deviate from the original method used to estimate managerial ability by utilizing methodological consideration for DEA estimations on panel data recommended by Demerjian (2017).

Using a sample of 16,483 European firm-year observations spanning from 2009 to 2018, we find a positive association between higher managerial ability and greater tax avoidance, significant at the 1% level. Our results indicate that moving from the lower to the upper quartile of European managerial ability is associated with a 1.84% reduction in a firm's one-year cash ETR. Based on a mean pre-tax income before special items in our sample of $450 million, moving from the lower to the upper quartile of managerial ability translates to an $8.3 million in annual cash tax savings for the average firm. Using long-run measures for cash ETR, we continue to find a significant positive relationship between managerial ability and greater tax avoidance.

In order to investigate the robustness of our findings to methodological considerations, we run a multitude of tests. Continuing to find consistent results both when checking for possible skewness caused by sample selection, and when we reestimate our managerial ability score using altered methodological choices. In order to check for possible omitted variables bias, we run a series of tests including different control variables, checking for possible distortions in our results, continuing to find a significant positive relationship between higher managerial ability and greater tax avoidance[1]. Finally, we run a series of tests using different proxies for tax avoidance, both to check the robustness of our results, and in an attempt to confirm that managerial ability is associated with different types of tax avoidance strategies, finding that our results remain consistent for different tax avoidance proxies. All the tests indicate that our results are robust to alternative explanations.

[1] Controlling for pre-tax return on assets (PTROA) we find that MASCORE is only significant at the 10% level, but as stated by Koester et al. (2017), including PTROA as a control variable in our setting could figuratively be compared to "throwing the baby out with the bathwater".

When performing a test where the managerial ability coefficient is directly comparable to the one obtained by Koester et al. (2017) for US firms, we find that the marginal effect of managerial ability on tax avoidance is similar, but due to higher variation in European managerial ability, the effect has a greater explanatory power for tax avoidance in Europe. It is interesting that although previous literature implies substantial differences in tax avoidance between Europe and the US, the marginal effects of managerial ability on tax avoidance, using the research design of Koester et al. (2017), are similar for both samples.

In a final attempt to reconcile our findings with those of Francis et al. (2013), we run several tests to explore the robustness of our results to their empirical approach. The main difference being the utilization of lagged values of managerial ability. Our findings using their empirical approach continue to coincide with our initial findings, implying a significant positive effect of managerial ability on greater tax avoidance in Europe, independent of whether we choose to use concurrent or lagged values of managerial ability. Note that this does not necessarily contradict the primary findings of Francis et al. (2013) on US firms as their paper primarily focuses on tax aggressiveness rather than tax avoidance, although our findings do contradict their results obtained for the additional specification tests performed to address the results of Koester et al. (2017). Therefore, according to our findings, higher managerial ability is associated with greater tax avoidance in Europe, although we do not rule out the possibility of a negative relationship existing between managerial ability and tax aggressiveness.

We conclude our study by performing several additional tests. Firstly, we decompose the managerial ability score using a manager fixed effects framework to ensure that the measure captures manager-specific effects. The results confirm that our previous findings are not explained by the managerial ability measure capturing firm characteristics rather than manager-specific effects, strengthening our initial findings. Secondly, we investigate the relationship between managerial ability and tax reforms, by interacting corporate tax rate and our managerial ability measure. We find that an increase in corporate tax rate result in the disparity in tax avoidance between more and less able managers decreasing, likely because it becomes easier to avoid taxes in higher tax environments due to more tax avoidance possibilities. Thirdly, we investigate whether managers in Europe are incentivized to engage in tax avoidance. Our results show that cash effective tax rate is negatively associated with managerial compensation, implying that firms incentivize managers to engage in tax avoidance, which is consistent with the majority of findings from previous US studies (e.g., Rego & Wilson, 2012; Gaertner, 2014; Armstrong, et al., 2015). Finally, we investigate the

importance managers ascribe to tax avoidance, by checking whether high ability managers experience profits close to zero more often than their low ability peers, assuming tax avoidance to be the motivation. We are unable to find a significant result, implying that tax avoidance is not a first order concern for managers. Tax avoidance is instead likely to be one of many important concerns and has to be weighed against other important factors, as overall efficiency is managers primary goal.

Our study makes several contributions to the existing tax avoidance literature. This study answers the call made by Hanlon and Heitzman (2010) to investigate the effect of managers on firms tax avoidance strategies, by presenting new empirical evidence from Europe. We find that more able managers in Europe engage in greater tax avoidance than their less able peers. Furthermore, the study contributes to the tax avoidance literature by attempting to reconcile our findings with several models from previous literature, who obtained contradictory results, finding the results for European managers to be consistent. We also present findings on how managers of differing ability react to tax reforms, as well as confirm that managers are incentivized to engage in tax avoidance in European firms. Finally, we present findings that imply that tax avoidance is not a first order concern for managers, but one of many concerns that need to be weighted in order to contribute to overall efficiency. Our findings should be of interest to academics, corporate stakeholders and regulators in understanding how individual decision makers affect tax avoidance, while the knowledge that more able managers judge the marginal benefits of tax avoidance to surpass the marginal costs should be valuable. Additionally, board members should find our results to be of interest when evaluating the benefits and costs associated with hiring executives.

Our study is subject to several limitations. First and foremost, that we are unable to observe the daily decision making of managers, and that firms do not state their corporate tax avoidance strategies publicly, leading to our study being solely reliant on financial statements to infer managers strategic decisions. Secondly, that some of the variables used to capture tax avoidance are noisy proxies for the underlying economic constructs. Thirdly, that our different tax avoidance proxies fail to capture both implicit and non-conforming tax avoidance, which are essential tools managers use in order to avoid corporate taxes (Jennings, et al., 2012). The failure of our proxies in capturing conforming tax avoidance is especially critical due to

publicly listed firms of specific characteristics[2] systematically engaging in less non-conforming tax avoidance when engaging in more conforming tax avoidance (Badertscher, et al., 2019). This concern is alleviated by Badertscher et al. (2019) finding that conforming tax avoidance vary systematically with the capital market pressures to which a firm is subject, leaving little room for conforming tax avoidance to be affected by managerial ability. Finally, it is possible that our measure for managerial ability developed by Demerjian et al. (2012) captures some aspect of firm characteristics for which we do not control.

[2] For example, public firms that lack analyst following, do not issue equity securities, report lower sales growth, or smaller discretionary accruals (Badertscher, et al., 2019).

Related Literature and Hypothesis Development

In this section, we introduce the background for empirical research on managerial ability and tax avoidance, based on previous literature from both fields of study. Using this literature, we develop hypotheses which we look to test throughout this paper.

2.1 Tax Avoidance

In finance, taxation is viewed as a market imperfection in a Modigliani-Miller world. This view has led to a broad set of studies on how taxes affect firms concerning firm value, financial policy decisions, and investor portfolio decisions (Hanlon & Heitzman, 2010). Traditionally, tax avoidance is viewed as an instrument used to increase firm value by reducing the resources transferred from the firm to tax authorities. In recent years, however, a conflicting view has been presented into tax literature, considering to a larger extent the direct and indirect costs of tax avoidance. According to this view, the optimal level of tax avoidance varies depending on firm-specific factors.

Although strides have been made by important contributions focusing on firm characteristics such as Rego (2003) and Lisowsky (2010), it is concluded by Hanlon and Heitzman (2010) that the current tax literature cannot explain variation in tax avoidance particularly well. Moreover, most of the existing empirical tax avoidance studies focus on firm characteristics as determinants. The impact of individual managers on firms tax avoidance strategy could therefore according to Hanlon and Heitzman (2010) be considered a gap in tax literature. This gap in the literature is one of several plausible explanations as to why literature has been unable to explain variation in tax avoidance to a satisfactory degree, as the impact of individual decision makers on a firms tax avoidance could be substantial. Examples of other plausible explanations are the limitations of empirical measures of tax avoidance due to reliability on financial statements, or the fact that tax avoidance could be determined by several factors which may not all be measurable. Following the publication of Hanlon and Heitzman (2010), managerial ability has become of high interest in tax avoidance literature. Several recent works (e.g., Dyreng et al., 2010; Francis et al., 2013; Park et al., 2016; Koester et al., 2017; Nurfauzi and Firmansyah 2018) focus on the impact of individual decision makers on tax avoidance.

We add to this list by presenting results from new empirical evidence utilizing data on European firms.

A commonly known problem in empirical tax avoidance literature is defining and measuring tax avoidance. Researchers must carefully use the definition that is most appropriate for their research (Hanlon & Heitzman, 2010). This study follow the definition of Hanlon and Heitzman (2010), who broadly define tax avoidance as the reduction in explicit taxes. This definition reflects all the transactions that affect a firm's explicit tax liabilities and therefore encompasses tax savings from all activities in which a firm engages. Hanlon and Heitzman (2010) point out another important problem facing researchers when conducting tax avoidance studies, which is that most measures used in the literature capture only non-conforming tax avoidance. This is unsurprising as firms are unlikely to give the public insight into their tax avoidance strategy voluntarily. Although it is worth noting that a proxy attempting to capture conforming tax avoidance was recently published into literature by Badertscher et al. (2019). De Simone et al. (2018) empirically evaluates the power of commonly used proxies for tax avoidance, concluding that power varies for proxies depending on the type of tax avoidance. Thus, researchers must choose the empirical test that best suits their tax avoidance definition and research problem.

2.2 Managerial Ability

In early empirics the role of managers is typically ignored when trying to explain corporate behavior and performance, having been credited mainly to characteristics such as firm, industry, and market (Bertrand & Schoar, 2003). More recent empirical studies, however, are starting to credit managers and top executives when trying to explain corporate behavior and performance. The view that individual decision makers are essential for developing firms strategies is shared among top managers: "In the old days I would have said it was capital, history, the name of the bank. Garbage—it's about the guy at the top." —John Reed, CEO Citicorp. This new view also has support in empirical work, as economic models that rely only on industry- and firm-level characteristics have a large portion of unexplained variation. Another argument that implies that the manager's role has been neglected in earlier empirics is the disagreement about the roots of the diversity in investment policies across firms (Bertrand & Schoar, 2003).

The first to develop an econometric model that integrate management changes was Bertrand and Schoar (2003). Their research design involves following managers who move across firms over time using manager fixed effects to capture individual managers influence on corporate decision making. In what is referred to as management style literature, this contribution serves as the foundation, and their research design has later been adopted by several researchers such as Bamber et al. (2010), Dyreng et al. (2010) and Dejong and Ling (2013).

Bertrand and Schoar (2003) find that managerial ability is empirically important for many corporate variables. Their results show that, on average, adding managerial fixed effects to corporate models that already account for observable and unobservable firm characteristics increase the adjusted R^2 by more than four percentage points. Furthermore, their results show that managerial ability is more important in regards to some decisions than others. Several of these decision areas are strongly linked to possible tax avoidance, such as interest coverage and cost-cutting policy.

The research design developed by Bertand and Schoar (2003) has the significant drawback of constricting research to the number of firms where researchers can follow managers moving across over time. This method of capturing decision makers ability severely constricts sample size. Researchers have therefore tried to quantify managerial ability using alternative methods for ranking decision makers. One common approach is using accounting-based measures. Baik et al. (2011) among others have used a return on asset measure as a proxy for managerial ability, and Demerjian et al. (2012) have developed a measure by referring to managerial ability as the ability to manage resources effectively. This paper use the measure developed by Demerjian et al. (2012) to quantify managerial ability, as their measure has been empirically proven to outperform all existing managerial ability measures at the time of their study.

2.3 Managerial Ability and Tax Avoidance

Dyreng et al. (2010) were the first researchers to adopt the manager fixed effects framework to tax avoidance literature, finding that individual managers play a significant role in determining a firm's level of tax avoidance. However, the conclusions drawn in their study, as well as other studies using the manager fixed effects framework, have later been drawn into question. Reason being that manager fixed effects coefficients could be econometrically invalid in detecting the presence of significant individual management style effects when

testing for joint significance (Fee, et al., 2013), because when the properties of a standard F-test are unknown, and variables are highly serially correlated, standard asymptotic theory does not apply (Wooldridge, 2002). Fee et al. (2013) use a method of randomly moving CEOs to different hiring firms than the firms they in reality joined, and find that F-tests incorrectly find a significant manager fixed effects. This illustrates the econometric concern of the validity of previous findings and highlights the importance of continued research on managerial ability using different research designs.

Following a proposed measure of managerial ability by Demerjian et al. (2012), more studies on the impact of individual managers of tax avoidance have been conducted. By using financial statements to observe managers ability to use available resources effectively, the managerial ability measure is available for large panel data and has been shown to outperform other existing ability measures. Relative to a manager fixed effects framework, using this managerial ability measure helps studies avoid the concerns highlighted by Fee et al. (2013) and adds the possibility of drawing inferences from large panel data.

When using the managerial ability measure developed by Demerjian et al. (2012), it is important to be aware of the definition of a manager's ability that is the basis for this measure. A manager's skill is measured by the ability to allocate resources effectively to generate revenue. Following this definition, we implicitly state that high ability managers are managers who best maximize value for shareholders, disregarding any ethical problems this may entail. One of these ethical problems may be the legality and righteousness of tax avoidance. Adhering to this definition of managerial ability, we do not take into account ethical problems related to tax avoidance in this study. Note that ethical consideration may be taken into account indirectly by rational managers due to costs associated with tax avoidance. Costs of tax avoidance may exist at a firm level, or at a personal level for managers in the future labor market.

Two notable contributions to tax avoidance literature using the measure developed by Demerjian et al. (2012) are Koester et al. (2017) and Francis et al. (2013), both of whom conduct the study using Compustat data for US firms. Interestingly the two studies obtain contradictory findings. Koester et al. (2017) find a significant negative relationship between cash effective tax rate (cash ETR) and managerial ability, while Francis et al. (2013) find a significant positive relationship. Francis et al. (2013) initially use a different research design than Koester et al. (2017), but in an effort to bridge their works adopt a largely similar design,

continuing to find contradictory results. Two smaller studies using the managerial ability score were conducted on Korean firms (Park, et al., 2016) and Indonesian firms (Nurfauzi & Firmansyah, 2018). While the results of Park et al. (2016) supports the findings of Francis et al. (2013), the findings of Nurfauzi and Firmansyah (2018) support that of Koester et al. (2017). Contradictory results of the US studies using the same data and managerial ability measure is interesting, highlighting the importance of continued research on the effect of managerial ability on tax avoidance.

One plausible explanation of the contradictory results of the US studies could be different definitions of tax avoidance. Koester et al. (2017) use the Hanlon and Heitzman (2010) definition of tax avoidance, while Francis et al. (2013) look at tax aggressiveness. Hanlon and Heitzman (2010) state that "if tax avoidance represents a continuum of tax planning strategies where something like municipal bond investments are at one end, then terms such as 'noncompliance,' 'evasion,' 'aggressiveness,' and 'sheltering' would be closer to the other end of the continuum." Thus, tax aggressiveness is only a subset of tax avoidance. A possible explanation for the contradictory findings is therefore that higher ability managers are more concerned with their reputation and will avoid the most aggressive part of tax avoidance, as it is more likely to catch the attention of the authorities and media. It is also plausible that the gain from tax avoidance only outweighs the costs for the least aggressive part of the tax avoidance continuum, something more able managers could be better at recognizing. Nonetheless, the studies show contradictory empirical results in tests utilizing an identical empirical proxy for tax avoidance, rendering the difference in definitions obsolete, implying a fundamental difference in empirical approach.

2.4 Hypothesis Development

Koester et al. (2017) predict that higher ability managers will engage in greater tax avoidance. Their hypothesis is supported by three main arguments. Firstly, higher ability managers should be able to better identify and exploit tax planning opportunities because they have a better understanding of their firm. A better understanding of the firm and its operating environment makes it easier to identify such opportunities. Secondly, more able managers are likely better at achieving their objectives compared to less able managers. One aspect of this is cost cutting, and tax avoidance could be argued to be a particularly appealing form of cost cutting to managers because reducing costs often lead to lower quality products, which in turn leads to

less satisfied customers and a fall in either demand or price. Reducing costs in tax payments, however, have no adverse effects on firm operations. Managers who are particularly talented at managing resources can therefore be expected to find this especially appealing. Finally, taxes paid do not yield any returns, cut in tax payments, on the other hand, may be reinvested and therefore yield a return. This should be more appealing to more able managers, as they should be able to expect a higher return on investment, and therefore tax avoidance might be worth the risk to a greater extent than for less able managers.

Koester et al. (2017) also list several reasons as to why more able managers may not engage in greater tax avoidance than their lower ability peers. All managers have the same incentive to engage in tax avoidance, but not all have the same opportunity. As stated by Hanlon and Heizman (2010), prior strategic decisions may lead to firm characteristics that influence tax avoidance. This might neglect the individual impact managers can exert on tax avoidance efforts. Incentive compensation has also been shown to influence tax avoidance (Rego & Wilson, 2012). If these two factors drive most of the variation in tax avoidance, there is very little room for a significant effect from managerial ability on a firms level of tax avoidance. On the other hand, incentive compensation might be a driver for higher ability managers to engage in greater tax avoidance, as the incentive effect is stronger if we expect them to avoid taxes more successfully than their lower ability peers. Another reason why more able managers may not engage in greater tax avoidance is that the skills necessary for managing resources effectively may not be the same skill set needed in order to conduct tax avoidance successfully. Also, all managers, regardless of ability, have the option of hiring consultants to help with tax avoidance activities. Although a strong case can be made for higher ability managers being able to locate more able experts, as this is a crucial aspect of managing resources effectively. Finally, according to Koester et al. (2017), the direct and indirect cost of tax avoidance may outweigh the benefits. This is the basis of the arguments suggested by Francis et al. (2013), who points out that it is empirically unclear whether the marginal benefits of tax aggressiveness exceed the marginal cost.

Francis et al. (2013) predict that higher ability managers engage in less tax aggressiveness. Firstly, because of the uncertainty of whether marginal benefits outweigh the marginals costs. Secondly, reputation and media coverage are some of the opportunity costs when engaging in tax planning strategies. Being caught might damage the reputation of both the firm and the manager. Thus, it can be argued that higher ability managers are less willing to engage in aggressive tax avoidance, as they are more concerned with maintaining a good reputation in

both capital and labor markets. However, this point has become heavily contested in recent tax avoidance literature. Gallemore et al. (2014) find no evidence supporting that top executives or their firms face significant reputational costs from tax avoidance, but utilizing a survey approach Graham et al. (2014) do find that a majority of executives rate reputation considerations as important or very important in their decision to avoid a tax planning strategy. Chyz and Gaertner (2018) find that both engaging in too much or too little tax avoidance can lead to forced CEO turnovers, implying that there might exist both a reputational and reverse reputational cost associated with tax avoidance. Lastly, Francis et al. (2013) argue that a manager's time and effort is a limited resource and should therefore be managed efficiently. Time should be devoted to the highest net present value (NPV) projects, and more able managers can be expected to better convert traditional resources into high NPV projects. Traditional projects should therefore have a relatively higher NPV compared to tax avoidance for more able managers, resulting in high ability managers devoting less time and effort to tax avoidance activities. We note that this last point could be offset if we believe that higher ability managers are able to acquire better experts or plan tax avoidance more effectively themselves, as this is likely to have a positive impact on the NPV of tax avoidance activities making them relatively more attractive.

It is also important to be aware of potential differences in behavior between European and US managers. Alm and Torgler (2006) analyze a quantitative measure for tax morale in the US and 15 European countries, obtaining results indicating that individuals in the US have the highest tax morale of all countries included in the study. It is important to note that these results are in terms of personal taxation, not corporate, but the findings of Chyz (2013) imply that executives who evidence a propensity for personal tax evasion are positively associated with proxies for corporate tax avoidance. In sum, these findings indicate that from a cultural standpoint, American managers can be considered as having higher average tax morale relative to European managers. Since our definition of managerial ability does not consider ethics, we assume that tax morale and managerial ability is unrelated, meaning that tax morale should be evenly distributed for managers of all abilities. Therefore, we can conclude that previous literature implies that managerial ability and tax avoidance should be more strongly associated for European than American managers, as the disparity in managerial ability in regards to tax avoidance is less likely to decrease due to tax morale. Another important driver for tax avoidance is opportunity. Avi-Yonah and Lahav (2011) compare effective tax rates for US and European multinationals, finding that the European effective cash rates on average are

higher than that of US multinationals even though the US statutory rate is 10pp higher than the average corporate statutory tax rate in the EU. Indicating greater tax avoidance opportunities for US multinationals, which implies that US firms have more of an opportunity to engage in tax avoidance than their European counterparts. We expect this to strengthen a potential association between higher ability managers and greater tax avoidance in Europe compared to the US, because we expect less opportunity for tax avoidance to increase the disparity in ability between high and low ability managers, as tax avoidance is likely to be more difficult for all concerned in legislations with less tax avoidance opportunities. Overall, previous literature indicates that there are substantial differences between Europe and the US in regards to tax avoidance culture and opportunity, and as such the effect of managerial ability on tax avoidance need not be the same. Furthermore, previous literature implies that the disparity in ability in regards to tax avoidance could be more pronounced in Europe.

Managerial ability is the ability to increase firm value by efficiently utilizing limited resources throughout business operations (Demerjian, et al., 2012). According to the traditional view presented by Koester et al. (2017), this should imply that more able managers engage in greater tax avoidance, as it increases firm value by reducing the transfer of resources to tax authorities. On the other hand, an agency theory view as presented by Francis et al. (2013), weighs the cost of tax avoidance more heavily, both for the aggressive subset of tax avoidance and for the entire spectrum of tax avoidance. More able managers should be able to weigh up the marginal benefits versus the marginal cost and make the correct adjustment, but the optimal level of tax avoidance may be entirely dependent on firm characteristics. However, a more able manager may be more concerned or aware of the potential reputational backlash of aggressive tax avoidance, both for himself and the firm. Also, higher ability managers may be able to create relatively more value focusing their limited time and energy on traditional activities, increasing the opportunity cost of tax avoidance for more able managers. Under this agency theory view, the relationship between managerial ability and tax avoidance may therefore be insignificant, or more able managers may engage in less tax avoidance. In addition to these conflicting theoretical approaches, differences in culture and opportunity between European and US managers concerning tax avoidance leaves doubt regarding whether the effect of managerial ability on tax avoidance should be expected to be the same in Europe and the US.

Accordingly, the relationship between tax avoidance and managerial ability in Europe is unclear, due to the conflicting prediction of theories and contradictory results from previous empirical studies. We specify our hypothesis in the null form, and conclude that ultimately the

relationship between managerial ability and tax avoidance is an empirical question, as is the difference in regards to the effect of managerial ability on tax avoidance in Europe compared to the US.

H_0: All else equal, managerial ability has no effect on tax avoidance. (H.A)

We also wish to investigate the relationship between managerial ability and tax reforms, as an understanding of this relationship could help explain in what types of tax environments the disparity between high and low ability managers is the most prominent. One such tax reform is a change in the corporate tax rate. According to the results presented by Avi-Yonah and Lahav (2011), it is possible that legislations with higher statutory corporate tax rates will have greater opportunities for tax avoidance, as demonstrated by the fact that US multinationals have on average a lower effective tax rate than that of European multinationals. Assuming we expect more able managers to engage in greater tax avoidance, we expect this relationship to be strengthened in a low tax environment, due to there likely being fewer tax avoidance opportunities. Fewer opportunities for tax avoidance is likely to increase the disparity in skill between low and high ability managers in regards to tax avoidance for low tax environments due to tax avoidance being more difficult. However, a case can also be made for the disparity in skill to increase with more opportunities for tax avoidance. Following the argument stated by Francis et al. (2013) that a manager's time is a limited resource, we would expect managers only to devote time to the highest NPV projects available. Tax avoidance is more likely to be one of these high NPV projects in higher tax environments as the opportunity for tax avoidance should be greater (Avi-Yonah & Lahav, 2011). If managers on average spend more time on tax avoidance activities, it is likely to lead to their disparity in skill having a greater effect. Overall, we find it likely that the relative difficulty of avoiding taxes will be the dominant effect on the disparity in skill. The time allocations argument only stands if we expect managers to not devote time to tax avoidance activities in lower tax environments, and overlooks the fact that hiring tax avoidance experts is more likely to be profitable in a high corporate tax environment, lessening the disparity in tax avoidance ability between managers.

Accordingly, we expect a decrease in corporate tax rate facing a firm over time to strengthen an already existing relationship between higher ability managers and greater tax avoidance, as a decrease in corporate tax rate reduces tax avoidance opportunities, increasing the disparity in skill between high and low ability managers.

H_0: All else equal, a decrease (increase) in corporate tax rate strengthens (weakens) the relationship between higher managerial ability and greater tax avoidance. (H.B)

A potential reason as to why managers might engage in tax avoidance is that they are incentivized to do so. Accordingly, we wish to investigate the relationship between tax avoidance and managerial compensation. This topic has been of high interest in tax avoidance literature in recent years, and several studies using data on US firms have been conducted. Rego and Wilson (2012) argue that since tax strategies hold the possibility of personal cost, as well as significant uncertainty for managers, managers must be incentivized to engage in tax avoidance that is expected to generate profit for shareholders. Their findings imply that equity risk incentives are associated with higher tax risk supporting the notion that managers being incentivized to engage in tax avoidance. The notion by Rego and Wilson (2012) is strengthened further by the findings of Gaertner (2014) who find that after-tax CEO incentives are negatively associated with effective tax rates. The findings of Armstrong et al. (2015) also supports the existence of managerial incentivizes for tax avoidance, and stress that managers may be incentivized to a degree in which they may engage in tax avoidance beyond the desired level for long-term shareholders. However, previous literature is not conclusive, Desai and Dharmapala (2006) find that a higher ratio of incentive compensation to total compensation is associated with a reduction in tax avoidance for firms with weak corporate governance. Also, Armstrong et al. (2010) find that there is no evidence for compensation being associated with any measure of tax avoidance for CEOs and CFOs. Furthermore, Gallemore et al. (2014) find no evidence of top executives facing significant reputational costs from tax avoidance which contradicts parts of the notion placed forward by Rego and Wilson (2012). The relationship between tax avoidance and managerial compensations for European managers is also drawn into question by previous studies being conducted on US firms, while, as previously argued, there is reason to suspect substantial differences in tax avoidance practices between Europe and the US. In summary, the majority of previous literature finds that managers are incentivized to engage in tax avoidance, and although differences are to be expected between European and US firms, we expect the relationship between managerial compensation and tax avoidance in Europe to remain consistent with the majority of previous studies conducted in the US.

H_0: All else equal, managers are incentivized to engage in tax avoidance. (H.C)

Finally, we want to investigate whether or not tax avoidance is a first order concern for European managers, assuming that managerial ability and tax avoidance are positively related. Previous literature tells us that accounting and taxable profits often bunch around zero, especially for multinational companies (Bilicka, 2019). One plausible explanation for this is tax avoidance, as multinationals to a greater extent have tax avoidance possibilities, and experience taxable profits closer to zero more often than domestic companies. The findings of Koester et al. (2017) imply that more able managers are able and willing to engage in greater tax avoidance. High managerial ability could therefore be a plausible explanation for firms experiencing profits close to zero, with tax avoidance being the motivation, indicating that tax avoidance is a first order concern for managers. Because the importance of tax avoidance would have to outweigh most other concerns by a considerable margin in order for more able managers to want to experience profits close to zero regularly, and, excluding tax avoidance, we would expect high ability managers to experience profits close to zero less frequently than low ability managers. One reason why tax avoidance might be a first order concern for managers is that tax avoidance could be argued to be an especially appealing form of cost cutting to managers as it does not adversely affect the quality of a firm's product. Furthermore, prior studies conducted on US firms imply that managers are incentivized to engage in tax avoidance (Rego & Wilson, 2012). However, Demerjian et al. (2012) define managerial ability as the ability to increase firm value by efficiently utilizing resources, and following this definition tax avoidance would have to outweigh other efficiency factors by a considerable margin in order for zero profits to be a goal. We find this to be somewhat unlikely, especially considering that not all firms in our sample are multinationals, with greater opportunities for tax avoidance. Overall, we expect tax avoidance to be one of several important concerns facing managers, but we do not expect it to outweigh other concerns by a considerable margin.

H_0: All else equal, managerial ability has a negative effect on profits being close to zero. (H.D)

Research Design

In this section, we present our research design, which is based on the one utilized by Koester et al. (2017) to capture the effect of managerial ability on tax avoidance[3]. The model uses country-year fixed effects to capture the average impact of unobservable time-variant economy-wide characteristics on the dependent variable across countries, and firm fixed effects capture the average impact of unobservable time-invariant characteristics of the firm. This model therefore looks at the within-firm variation over time. In order to capture managerial ability, this study use the ability measurement developed by Demerjian et al. (2012), henceforth called MASCORE. To isolate the effect of managerial ability on tax avoidance a number of control variables is also included. We include country-year fixed effects in order to eliminate the risk of macroeconomic characteristics that affect all firms in a particular year being picked up by MASCORE, and to eliminate the risk of MASCORE picking up country-specific characteristics. Including country-year fixed effects also eliminates the concern of the dependent variable being highly correlated with differing corporate tax rates. We include firm fixed effects to eliminate the concern of stationary firm attributes that affect MASCORE and cash ETR being inadequately controlled for in the creation of MASCORE, while it also reduces the likelihood of stationary firm attributes being captured by MASCORE. Our identifying assumption is that managerial ability is exogenous to tax avoidance policy within the firm, conditional on control variables, country-year fixed effects, and firm fixed effects.

$$CASHETR_{it} = \alpha_0 + \beta_1 MASCORE_{it} + Controls_{it} + CountryYearFixedEffects + FirmFixedEffects + \varepsilon_{it} \quad (3.1)$$

Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year, and all variables are defined in detail in this section.[4]

[3] Tests ran based on the research design utilized by Francis et al. (2013) in an attempt to reconcile with their findings is presented in chapter 6.1.

[4] Our approach deviates from that of Koester et al. (2017) in three aspects: We include country-year fixed effects rather than year fixed effects, there are slight differences in our control variables, and we calculate MASCORE following the recommendations presented in Demerjian (2017) while Koester et al. (2017) use values calculated by Demerjian et al. (2012).

3.1 Dependent Variable

The primary dependent variable in this study is cash ETR, which is denoted as firm *i*'s cash ETR in year *t*. As there are a variety of proxies used in previous literature that can be used to capture tax avoidance we follow the advice presented by Hanlon and Heitzman (2010) and choose the most appropriate proxy for our research. Cash ETR is the most appropriate tax avoidance proxy for this research because it most powerfully captures temporary tax avoidance (De Simone, et al., 2018). Furthermore, cash ETR is suited to this research because with respect to risky tax avoidance it is hindered the least by financial reporting for tax contingency reserves, and is therefore the proxy with the most power to detect risky permanent tax avoidance (De Simone, et al., 2018). Cash ETR is therefore the proxy that best represents a combination of both permanent and temporary tax-deferral strategies, which is of interest to us, as both strategies retain cash resources within a firm.

De Simone et al. (2018) nevertheless find that different measures are good at recognizing different types of tax avoidance, confirming the reasoning presented by Hanlon and Heitzman (2010). Other proxies for tax avoidance should therefore not be neglected completely. Two alternative tax avoidance proxies are GAAP ETR and total BTDs. GAAP ETR is the most powerful in tests to detect effects of permanent tax avoidance but has the drawback of not reflecting temporary tax savings from timing differences. BTDs proxies have the most power to detect hybrid tax savings strategies, but have the drawback of being less powerful at detecting both permanent and temporary tax avoidance than cash ETR, while also needing variables not available in our dataset in order to be calculated. In order to check the robustness of our results, we run robustness tests using GAAP ETR and a tax avoidance proxy developed by Henry and Sansing (2018) as dependent variables. We use GAAP ETR in order to check for the effect of managerial ability on permanent tax avoidance strategies. While we utilize the Henry and Sansing (2018) proxy due to it being more similar to BTD than ETR proxies, being more powerful than ETR proxies at detecting temporary tax avoidance strategies (De Simone, et al., 2018).

Following Dyreng et al. (2008) and Koester et al. (2017), we define cash ETR as cash taxes paid scaled by pre-tax income before special items. One-year cash ETR is utilized as our main proxy because MASCORE is constructed at the firm-year level and because multi-year proxies require additional years of data limiting our sample size while potentially including survivorship bias. Nonetheless, following the concern of Dyreng et al. (2008) that short-run

proxies might be a noisy measure for long-run tax avoidance, we include two-year and four-year cash ETRs as alternative measures in this study[5]. Also, De Simone et al. (2018) note that one-year cash ETRs ability to detect tax avoidance may be negatively affected due to cash ETRs inability to match tax payments to pre-tax income for a certain period, as tax payments may be affected by book income from a prior period. These concerns are somewhat alleviated by low one-year cash ETRs being more persistent than high one-year cash ETRs (Dyreng, et al., 2008).

Long-run cash ETR is defined as the sum of cash taxes paid divided by the sum of pre-tax income before special items. When we use long-run ETRs proxies as the dependent variable MASCORE and control variables are averaged over the two- and four-year periods accordingly.

3.2 Managerial Ability Score

We use the MASCORE measure developed by Demerjian et al. (2012) as a proxy for managerial ability. MASCORE is a measure based on a managers ability to manage a firm's resources effectively in order to generate revenue. The underlying intuition is that more able managers are able to generate higher revenue given the resources available than their peers. The estimation of MASCORE is a two-stage process, first using a data envelopment analysis (DEA) estimation we calculate total firm efficiency, then using a Tobit regression we isolate the part of total efficiency which should be attributed to the manager.

Demerjian et al. (2012) validate MASCORE using a three-pronged approach. First, using a variety of tests, they show that MASCORE outperforms all existing ability measures used in management style literature. Secondly, MASCORE is shown to be strongly associated with manager fixed effects. Finally, replacing CEOs with more able candidates, according to MASCORE, is associated with a subsequent improvement in firm performance, and stock markets react positively to the turnover of a low ability CEO and negatively to the turnover of a high ability CEO. No measure used in previous literature can show the same validation, and

[5] We utilize two- and four-year cash ETRs rather than the three- and five-year ETRs utilized by Koester et al. (2017) due to sample size considerations.

MASCORE is the only ability measure to focus on a managers ability to manage resources effectively.

As pointed out by Koester et al. (2017), a major advantage of MASCORE is that all variables used when estimating managerial ability are pre-tax measures, mitigating concerns of a mechanical relationship between MASCORE and tax avoidance. On the other hand, one issue that raises concerns regarding a potential mechanical relationship is that resources retained due to tax avoidance could represent a possible omitted variable bias in the Tobit regression. Assuming retained earnings due to tax avoidance is partly attributable to firms reaching the efficiency frontier in our DEA analysis. The concern of a mechanical relationship is mitigated by the fact that the Tobit regressions include several firm characteristics that partly control for tax avoidance, such as firm size and the presence of foreign operations (Rego, 2003)[6]. A final concern raised by Koester et al. (2017) is that managers who engage in tax avoidance might be harder pressed to reinvest cash tax savings efficiently, as Jensen (1986) predicted that firms with more available free cash flow more often will invest excess cash inefficiently. This could lead to firms moving away from the efficiency frontier in our DEA estimation due to tax avoidance activities, creating a bias against high ability managers engaging in tax avoidance.

3.2.1 Data Envelopment Analysis

The measure developed by Demerjian et al. (2012) uses the classic data envelopment analysis (DEA) methodology proposed by Charnes et al. (1978), which is an input-oriented model that assumes constant returns to scale. DEA is a method for calculating the relative efficiency of decision-making units (DMUs). Each DMU converts inputs (capital, operating expenditures, etc.) into outputs (revenue, income, etc.). DEA efficiency is defined as the ratio of outputs over inputs.

$$max_{v,u}\theta = \frac{\sum_{i=1}^{s} u_i\, y_{ik}}{\sum_{t=1}^{m} v_t\, m_{tk}} \tag{3.2}$$

Subject to:

[6] Concerns regarding MASCORE capturing unspecified firm characteristics rather than managerial ability have been further mitigated by CEO turnover tests conducted by Koester et al. (2017).

$$\frac{\sum_{i=1}^{s} u_i\, y_{ik}}{\sum_{t=1}^{m} v_t\, m_{tk}} \leq 1 \ (k = 1, \dots, n); \tag{3.3}$$

$$v_1, v_2, \dots, v_m \geq 0; \tag{3.4}$$

$$u_1, u_2, \dots, u_s \geq 0. \tag{3.5}$$

An input-oriented DEA model estimates an efficiency frontier by minimizing the amount of inputs while satisfying a given output level. This is done by varying the weight for each input and output within given restraints. The most efficient DMUs are placed on an efficiency frontier, and the further the distance from the efficiency frontier, the lower the efficiency score. The DEA estimation gives DMUs an efficiency score between the values of 0 and 1. A value of 1 implies that the DMU is on the efficiency frontier. DMUs with a score less than 1 is not fully efficient and would need to either reduce inputs or increase outputs in order to be deemed efficient. A score of 0.9 means that the given DMU is 10% less efficient than a DMU on the efficiency frontier.

When conducting a DEA estimation on large panel data of financial accounting information, four methodological considerations need to be taken into account (Demerjian, 2017). The first consideration is the size of the calculation group. DEA measures relative efficiency and is therefore vulnerable to error when subject to a small calculation group. Smaller calculation groups lead to a higher mean efficiency score as relatively more firms will be deemed fully efficient. This problem increases with the number of inputs and outputs used in the DEA analysis, as each DMU will have more reference points to the efficiency frontier when using a larger set of inputs and outputs. For small calculation groups, efficiency scores may therefore be difficult to interpret. The second consideration is related to the measurement and interpretation of efficiency over time. Demerjian (2017) shows that both calculating efficiencies separately by year or by pooling multiple years presents potential inference problems. Given a roughly similar number of observations, and relatively stationary efficiency frontier, Demerjian (2017) believes that calculation by year leads to the fewest amount of errors. Small changes in the efficiency frontier can be controlled for using fixed effects in the later Tobit regression. The third issue is the calculation group classification. Prior literature has classified by industry[7] rather than year (e.g., Demerjian et al., 2012 and Koester et al.,

[7] The 48 Industrial Classifications by Fama and French (1997) is utilized throughout this study, for firms with several SIC Primary Codes, the first one recorded is utilized.

2017) or by both industry and year (e.g., Leverty & Qian, 2011), because firms within the same industry are likely to have a similar mix of capital and expenses to produce revenue. Demerjian (2017) identified that this might be problematic due to variability in calculations group sizes and possible look-ahead bias. Demerjian (2017) also provides empirical evidence that time-based sorting is generally preferable when using accounting information.

Because of these methodological considerations, we classify calculation groups by years rather than industry. Classification by year leads to larger, more consistent, calculation groups on average than industry based sorting. This is in line with Demerjian's (2017) conclusion that time-based sorting is generally more efficient when using accounting information. Our choice is further supported by the fact that we have a dataset of limited size, which in turn might lead to industry-based sorting results being difficult to interpret due to calculation group size[8]. At the same time, our calculation groups are of roughly similar size using year-based sorting (see Table 2), and our Tobit regressions include year fixed effects to control for the small number of changes we observe at the efficiency frontier[9].

The final consideration arise when calculating efficiency for research which limits the sample to a greater degree than the calculation of managerial ability. Whether the researcher calculate efficiency for all available observations, or only for a subset of firm-year observations, may potentially affect inference (Demerjian, 2017). Due to concerns regarding the size of calculation groups in our small sample, and following Koester et al. (2017), this study will calculate the efficiency score based on the full sample.

In chapter 5.3, we conduct several additional tests that confirm the robustness of our results to these different methodological choices.

3.2.2 Managerial Ability Score Estimation

In order to calculate our MASCORE, we solve the following DEA optimization problem by year.

$$max_v \boldsymbol{\theta} = \frac{Revenue}{v_1 CoGS + v_2 SG\&A + v_3 PPE + v_4 R\&D + v_5 Goodwill + v_6 OtherIntan} \quad (3.6)$$

[8] Our sample consists of data from 10 years, while it consists of firms from 42 industries.
[9] Excluding the efficiency frontier of 2018, our efficiency frontiers percentage range from 1.3% - 2.2%. While the smaller calculation group of 2018 has an efficiency frontier containing 4.6% of observations (untabulated).

The model estimates firm efficiency within years, comparing revenue on the following firm characteristics: Cost of Goods Sold, Selling, General and Administrative expenses[10], Net Property, Plant and Equipment, Net Research and Development, Purchased Goodwill and Other Intangible Assets. Note that the four stock variables (PPE, R&D[11], Goodwill, and OtherIntan) are measured at the beginning of year *t*, because past decisions regarding these variables are expected to affect revenues in the current period. The two flow variables (CoGS and SG&A) are measured over year *t*. The variables are defined in detail in Appendix A Table 14. The six inputs are chosen because they, to a large degree, capture the choices managers make in generating revenue. Our model deviates from Demerjian et al. (2012) in that we do not include Net Operating Leases. This is due to the variable not being available in Compustat Global. We note that Demerjian et al. (2012) specify that their results are qualitatively and quantitatively similar if they exclude Net Operating Leases from their DEA estimation.

The efficiency score that we obtain from the DEA estimation represents total firm efficiency. In order to isolate the efficiency attributed to the manager, we estimate a Tobit regression by industry on firm characteristics expected to affect firm efficiency in a way that is out of managerial control (Demerjian, et al., 2012). Country-year fixed effects are included, to controll for systematic differences in firm efficiency across countries and years, while standard errors are clustered by firm to control for cross-sectional and intertemporal correlation.

$$Firm\ Efficiency_{it} = \alpha_0 + \beta_1 Ln(Total\ Assets)_{it} + \beta_2 MarketShare_{it} + \beta_3 Free\ Cash\ Flow\ Indicator_{it} + \beta_4 Ln(Age)_{it} + \beta_5 Business\ Segment\ Concentration_{it} + \beta_6 Foreign\ Currency\ Indicator_{it} + CountryYearFixedEffects + \varepsilon_{it} \quad (3.7)$$

Following Demerjian et al. (2012), we predict larger firms and firms with a bigger market share to be more effective, keeping managerial ability unchanged, due to more power in negotiations. At the same time, we predict firms with available cash (measured using an indicator variable for positive free cash flows) and more mature firms who need to invest less than start-ups to be more effective. On the other hand, we consider the diversification of a

[10] R&D expenses are a component of SG&A, to avoid counting R&D twice, R&D expenses are subtracted from SG&A.
[11] To calculate net R&D we follow Demerjian et al. (2012) and use a five-year capitalization of R&D expenses calculated using the following formula $R\&D = \sum_{t=-4}^{0}(1 + 0.2t) * RD_{exp}$.

firm, both operationally[12] and geographically, to make effective resource allocation more challenging. The variables are defined in detail in Appendix A Table 14. Industry-level drivers of efficiency, such as competition are omitted due to the regression being run by industry. Following Demerjian et al. (2012) we opt to err on the side of caution when attributing manager characteristics to the firm, in order to maximize the likelihood of the residual being attributable to the manager. Variation in MASCORE is for example dampened by controlling for firm size, due to better managers having an increased likelihood of being hired by bigger firms (Rosen, 1992).

MASCORE is the remaining unexplained portion of firm efficiency, the residual from Equation (3.7), and will serve as our measure for managerial ability. Demerjian et al. (2012) admit that Equation (3.7) may not entirely exclude the effect of unidentified features. This concern is mitigated by the performance of MASCORE in validity tests. Firm fixed effects are noticeably excluded from Equation (3.7) in order to maximize comparability between firms, as the inclusion would remove important firm-level variation (Demerjian, et al., 2012).

3.3 Control Variables

Control variables are included in Equation (3.1) to isolate the effect of managerial ability on tax avoidance. All control variables are known firm characteristics associated with tax avoidance (Dyreng et al., 2010; Koester et al., 2017). The variables controlled for in this study are; Research and Development (R&D), Capital Expenditures (CAPEX), Leverage (LEV), Foreign Operations (FOREIGN), Firm Size (SIZE), Intangible Assets (INTANG), and Net Operating Loss Utilization (NOL_DECREASE)[13]. All the control variables are defined in Appendix A Table 15. Unlike Koester et al. (2017), we do not include Advertisement Costs as a control variable due to the variable not being available in the Compustat Global database. Instead, we consider adding Selling, General, and Administrative Expenses (SG&A) as a control variable following Dyreng et al. (2010). We choose to omit this variable due to the variable being present in calculating firm efficiency, where it unlike variables such as

[12] Our measure of Business Segment Concentration differs from Demerjian et al. (2012) as the Compustat Business Industry Segment File is unavailable for our sample. Instead, we follow Denis et al. (1997) and look at the number of reported industries to capture diversification. Both Primary and Secondary SIC codes are included.
[13] We deviate from Koester et al. (2017) in how we estimate the control variables FOREIGN and NOL_DECREASE. See Appendix A Table 15 for details.

INTANG is not lagged or split up into separate components. Untabulated analysis shows that our findings remain consistent and the SG&A coefficient insignificant if we include it as a control variable.[14]

Using previous tax avoidance literature, we attempt to predict direction for each of the control variables (Chen et al., 2010; Dyreng et al., 2010; Rego and Wilson 2012; Koester et al., 2017). Previous studies generally find a negative relationship between most of our control variables and cash ETR. The amount of tax avoidance is often found to increase in more leveraged firms, in firms with foreign operations, and in firms utilizing net loss carry-forward. R&D costs, capital expenditures, and more intangibles in the balance sheet are also generally firm characteristics found to increase the amount of tax avoidance (negative impact on cash ETR). We are unable to predict the effect of firm size, due to previous tax avoidance literature having no conclusive answers as to the relationship between cash ETR and firm size.

[14] Advertisement costs are insignificant in the primary model of Koester et al. (2017) when firm fixed effects are included.

Data, Sample Selection and Descriptive Statistics

In this section, we describe the source of the data on which we base our analysis, followed by the rationale behind our sample selection. We also present results for the estimation of managerial ability, and the descriptive statistics for our final sample.

4.1 Data Source

Our data originates from two sources. We use accounting data from Compustat Global, combined with firm-level data for European firms gathered by Bureau van Dijk presented in the Orbis database. Our data represents all European publicly listed companies available in both Orbis and Compustat Global. We utilize data from two sources due to data on foreign subsidiaries and secondary SIC codes being unavailable in Compustat Global. The original sample consists of 75,938 firm-year observation from the time period 2009 to 2018. The geographical location of the companies in the sample distinguishes this study from previous studies, which has focused primarily on the US, and will enable us to draw conclusions based upon new empirical evidence. Our final sample consists of 16,483 firm-year observations, from 36 countries and territories, and is smaller in terms of observations than similar studies conducted in the US. Our sample is restricted due to the time span of the Orbis database and European reporting practices. We choose not to combine newer firm-level data in Orbis with older accounting data in Compustat Global due to concerns regarding survivorship bias, changes in reporting practice, and differing calculation group sizes for our DEA model.

All monetary values in our sample are presented in USD thousand, converted using yearly currency rate averages from the Compustat Global Currency file. Yearly corporate tax rates are collected from OECD Stat, which reports the central government corporate tax rate[15].

[15] Corporate tax rates for countries missing from OECD Stat are collected from tradingeconomics.com.

4.2 Sample Selection

We start by extracting all European firms in Orbis classified as very large, or who have reported through the detailed format at least once in the last ten years. This extract includes all European firms listed on stock exchanges, and therefore all European firms with ISIN codes matching the ones we find in Compustat Global according to Orbis software. We then merge firm-level data from Orbis with accounting information obtained through Compustat Global from 2009 to 2018 using ISIN codes. ISIN codes are especially suitable as all firms in the Compustat Global database are publicly listed. Details of the further sample selection process are provided in Table 1. Note that some of our DEA model variables are lagged, and that we therefore use older Compustat Global data for select accounting information. Most notably, R&D who uses a five-year lag going back as far as 2003, survivorship bias is not a concern as missing values for R&D are reset to zero following Koester et al. (2017)[16]. Detailed information about the source of individual variables and their definitions can be found in Appendix A Table 15.

Table 1. **Sample Selection**

No.	Sample Selection	Number of firm-years
(1)	Publicly listed European firm-years available in both Compustat Global and Orbis (years 2009-2018)	75,938
(2)	Excluding firm-years missing managerial ability data and containing implausible observations*	39,981
(3)	Excluding financial services and utilities firms**	36,638
(4)	Excluding firm-years missing cash ETR data	22,344
(5)	Excluding firm-years missing control variables	21,671
(6)	Excluding firm-years with negative pre-tax book income before special items and negative cash taxes paid	16,537
(7)	Excluding countries with less than 20 firm-year observations	16,483

Notes. This table describes the sample selection process. *Guns industry dropped due to an insufficient number of firm-year observations to run the Tobit regression. **Final MASCORE sample.

[16] Firm-year observations from 2009 also gather the following accounting information from 2008 due to the use of one-year lags in the DEA model: Goodwill, Other Intangibles, and PPE.

In order to obtain our managerial ability score, we need to exclude all firm-years missing variable observations needed to estimate MASCORE. Therefore, we exclude all firm-years with missing observations for variables in Equation (3.6) or Equation (3.7). Gun companies are also excluded, due to an insufficient number of observations to run Equation (3.7) for that particular industry. Following Demerjian et al. (2012) we also exclude all financial services industries (banks, insurance, real estate, and finance companies) from our sample, due to the uniqueness of their capital structure and revenue streams. Utilities companies are also excluded due to the regulation of output prices. This selection of 36,638 firm-year observations represents the sample used to calculate MASCORE. All continuous variables used when estimating MASCORE are winsorized at the 1st and 99th percentile.

Our final sample is created by excluding firm-year observations missing data for either the dependent variable, cash ETR, or any of the control variables present in Equation (3.1). Consistent with previous literature (e.g., Dyreng et al., 2010; Koester et al., 2017) we require observations to have positive cash taxes paid and a positive pre-tax income before special items. De Simone et al. (2018) shows, using empirical evidence, that despite eliminating a significant portion of the sample, the power of the tests generally improves when removing observations with negative pre-tax income or negative total tax expense[17]. Improving the power of our tests is especially important due to the power of tax avoidance measures in general being significantly impaired when using sub-samples of Compustat data that report the variables needed to estimate MASCORE (De Simone, et al., 2018)[18]. Our final sample consists of 16,483 firm-year observations.

In order to improve the power of our model, all continuous control variables are winsorized at the 1st and 99th percentile, as skewness affects power. Following Koester et al. (2017) and Dyreng et al. (2010), we also winsorize all ETR proxies at zero and one. Winsorizing at zero and one has a relatively stronger impact on power than winsorizing at the 1st and 99th percentile for ETR proxies, while being superior to truncating, which dramatically reduces the power of tests (De Simone, et al., 2018). In order to further strengthen the robustness of our model, we exclude all countries with less than 20 firm-year observations. Finally, we use robust

[17] De Simone et al. (2018) remove negative total tax expense, which deviates slightly from our approach of removing negative cash taxes paid.
[18] De Simone et al. (2018) look at a US sample, confirming that this reduction in power is attributable to a smaller sample size and not the fact that Execucomp firms are larger and more profitable.

regressions to address skewness, which also increases the power of our tests (Leone, et al., 2019).

When using long-run cash ETR proxies, we winsorize the cash ETR proxies at zero and one, while the averages of the continuous variables are winsorized at the 1st and 99th percentile. Furthermore, we require the sum of cash taxes paid and the sum of pre-tax income before special items to be positive for the period in question.

4.3 Estimation of Managerial Ability

Panel A of Table 2 provides summary statistics for total firm efficiency. The mean value reported is 0.315, while the median value is 0.268, and in total 1.97% of firm-year observations are on the efficiency frontier (untabulated). Due to our methodological choice of estimating firm efficiency by year, we obtain a lower mean value for firm efficiency and fewer

Table 2. **Descriptive Statistics: Firm Efficiency and MASCORE**

	N	Mean	P50	SD	P25	P75
Panel A: Firm efficiency measure						
Firm efficiency	36,638	0.3146	0.2677	0.2108	0.1620	0.4188
Panel B: Firm efficiency measure by year						
2009	3,301	0.3933	0.3770	0.1885	0.2533	0.4957
2010	3,491	0.3095	0.2764	0.1858	0.1692	0.4083
2011	3,650	0.2554	0.1899	0.1909	0.1330	0.3195
2012	3,787	0.3344	0.2953	0.1947	0.1874	0.4379
2013	3,890	0.3031	0.2572	0.1875	0.1979	0.3266
2014	4,016	0.3479	0.2956	0.2066	0.2057	0.4497
2015	4,070	0.3011	0.2567	0.2264	0.1239	0.4014
2016	4,218	0.2210	0.1229	0.2214	0.0769	0.2819
2017	4,234	0.3030	0.2723	0.1892	0.1625	0.3984
2018	1,981	0.4710	0.4445	0.2376	0.2816	0.6307
Panel C: Managerial ability measure						
MASCORE	36,638	-0.0281	-0.0538	0.2253	-0.1696	0.0778

Notes. This table present descriptive statistics. Panel A presents firm efficiency for the full DEA sample. Panel B presents firm efficiency sorted by year. Panel C presents managerial ability score for the full DEA sample. All variables are defined in Appendix A.

fully efficient observations than Demerjian et al. (2012) who find a mean value of 0.569. Our firm efficiency scores are similar to those obtained by Demerjian (2017) for classification groups split by year, the lower mean compared to Demerjian et al. (2012) is likely because fewer firm-year observations obtain artificially high efficiency scores due to calculation groups of insufficient size. This is supported by the fact that we see relatively fewer

observations on the efficiency frontier than Demerjian et al. (2012), who find that 4.5% of their firm-year observations are fully efficient.

Panel B of Table 2 presents summary statistics for firm efficiency by year. The firm efficiency mean across years is relatively stable, containing only a few outliers, most notably in 2018, likely due to the size of the calculation group. Ignoring 2018, the variation in mean between years are of a similar level to what is obtained by Demerjian (2017) for year based sorting. We choose to include 2018 nonetheless due to differences in mean being controlled for by including country-year fixed effects in the Tobit regressions when estimating MASCORE, which smoothes out the mean (see Table 17 in Appendix B). Variation across industries is of similar magnitude to the variation across years. Construction is the most efficient industry with a mean of 39.8%, and gold is the least efficient with a mean of 22.6% (untabulated). Systematic differences between industries are removed when estimating MASCORE, due to the Tobit regression being run by industry.

Table 3. **Tobit Estimation**

Dependent variable = Firm Efficiency

	Predicted sign	Average coefficient (Fama-MacBeth t-statistic)	Proportion significant (%)	Proportion with predicted sign (%)
Ln(Total Assets)	+	-0.016*** (-4.39)	52.4	19.0
Market Share	+	0.248** (1.99)	23.8	59.5
Free Cash Flow Indicator	+	0.036*** (4.90)	47.6	83.3
Ln(Age)	+	0.008 (1.07)	14.3	59.5
Business Segment Concentration	-	-0.010 (-0.66)	19.0	52.4
Foreign Currency Indicator	-	-0.009 (-1.00)	11.9	57.1
Intercept		0.482*** (9.97)		
Year fixed effects		Included		
Adjusted R^2		0.288		
Industry estimations		42		

Notes. This table presents the averages from the Tobit estimation (3.7) by industry, of which MASCORE is the residual. We present the average of the industry coefficients, and estimate t-statistics based on the standard errors using a Peterson (2009) take on Fama and Macbeth (1973). The significance percentage is determined using one-tailed tests at the 5% level. The percentage with predicted sign is the proportion of the 42 industries with coefficients in the predicted direction. In order to calculate average R^2, we estimate equation (3.7) by industry using an OLS regression. All continuous variables are winsorized at the 1st and 99th percentiles, and all variables are defined in Appendix A.
***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

In order to isolate the manager-specific efficiency drivers from overall firm drivers, we run firm efficiency scores through the Tobit regression presented in Equation (3.7), and MASCORE is defined as the unexplained residual portion. We summarize the results from the regression ran by industry in Table 3. The average coefficient across the 42 industries is presented, alongside significance percentage, and the percentage of observations with predicted sign. T-statistics are estimated using an altered method of Fama and Macbeth (1973) provided by Peterson (2009) and are presented in parenthesis. All coefficients except for firm size is estimated with the predicted direction, and the average adjusted R^2 of 28,8%, suggest that firm characteristics identified in Equation (3.6) on average attributes to almost a third of total firm efficiency. The main difference in our results from those obtained by Demerjian et al. (2012) is a lower proportion of significant coefficients and the direction of the firm size coefficients. There are several plausible explanations, the most likely of which are that we operate with a smaller sample, differences between American and European firms, and that we include country-year fixed effects in our Tobit regression.

Panel C of Table 2 presents summary statistics for our managerial ability score. The mean value of managerial ability is -2.81% while the median is -5.38%. Note that we use the actual firm efficiency value and subtract the Tobit estimation to compute the residual, these computed differences need not sum to zero, unlike the case if we used an OLS estimation. The interquartile range is -16,95% to 7,78%, and the standard deviation is 22,53%.

Table 16, which can be found in Appendix B, presents summary statistics for all variables used in estimating MASCORE.

4.4 Descriptive Statistics

Our sample selection process yields a sample of 16,483 firm-year observations. Table 4 reports descriptive statistics for our regression variables on the final sample. The distribution of our control variables are comparable with prior studies (e.g., Dyreng et al., 2010; Koester et al., 2017), but differences between American and European firms are to be expected. For this sample, cash ETR has a mean of 26.7%, with an interquartile range of 13.6% to 32.3%. Consistent with what is observed in prior studies, values for long-run cash ETR measures are higher than for a one-year measure. Our mean cash ETRs are marginally lower than what is obtained by Koester et al. (2017) for US firms, but the difference is smaller than the gap in

corporate tax rate should indicate[19]. We also note that the interquartile range for one-year cash ETR is wider for US firms, ranging from 8.8% to 36.9%. These findings are consistent with those obtained by Avi-Yonah and Lahav (2011) and imply a greater opportunity for corporate tax avoidance in the US. The mean MASCORE for the sample is -3.6%, with an interquartile range of -16.3% to 6.4%. The mean MASCORE is lower than for prior studies, while the standard deviation is higher, likely due to calculation groups for our DEA model being divided by years, and greater differences in managerial ability across European firms than within the US. An untabulated analysis reveals that MASCORE values are relatively stable within firms from year to year, with a within-firm correlation of 56.0%. There may be several reasons as to why firms experience varying values of MASCORE over time according to Koester et al. (2017). Firstly, there may be a change in the composition of the management team. Secondly, a management team may tackle different macroeconomic conditions with varying degrees of competence, and finally, changes in the societies demand for products delivered by a firm may lead to managers reallocating resources.

Table 4. **Descriptive Statistics: Primary Model Variables**

	N	Mean	P50	SD	P25	P75
Dependent variables						
CETR	16,483	0.2668	0.2177	0.2156	0.1354	0.3225
CETR2	13,160	0.2698	0.2244	0.2081	0.1487	0.3198
CETR4	8,268	0.2774	0.2357	0.1979	0.1628	0.3214
Independent variable of interest						
MASCORE	16,483	-0.0364	-0.0545	0.2089	-0.1629	0.0642
Control variables						
R&D	16,483	4.3481	0.0000	4.9496	0.0000	9.1465
CAPEX	16,483	0.1012	0.0759	0.0969	0.0469	0.1199
LEVERAGE	16,483	0.2168	0.2034	0.1722	0.0889	0.3132
FOREIGN	16,483	0.6971	1.0000	0.4595	0.0000	1.0000
SIZE	16,483	13.5192	13.3616	1.9862	12.0695	14.8679
INTANG	16,483	0.2003	0.1358	0.1983	0.0289	0.3238
NOL_DECREASE	16,483	0.0805	0.0000	0.2721	0.0000	0.0000

Notes. This table presents descriptive statistics for our main regression variables. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A.

The remaining control variables introduce some differences compared to prior American studies (e.g., Dyreng et al., 2010; Koester et al., 2017). Our sample consists of bigger firms who spend more on R&D. Furthermore, a bigger percentage of firms in our sample has foreign

[19] The average corporate tax rate in our sample is 22.5% while the average corporate tax rate in the sample of Koester et al. (2017) is 35%.

operation, 69.7%, likely due to our sample containing larger firms and the European Union facilitating for foreign operations within much of Europe. Finally, our NOL_DECREASE proxy has a lower mean value, likely due to differences in estimation, and our sample not containing the financial crisis of 2008.

Table 5. **Pairwise Correlations**

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CETR										
CETR2	*0.529*									
CETR4	*0.323*	*0.469*								
MASCORE	*-0.054*	*-0.076*	*-0.087*							
R&D	0.002	0.003	0.007	*-0.162*						
CAPEX	*-0.021*	*-0.022*	*-0.025*	*0.139*	*-0.025*					
LEVERAGE	*0.057*	*0.074*	*0.091*	*-0.077*	*-0.069*	*-0.046*				
FOREIGN	*0.048*	*0.053*	*0.061*	*-0.056*	*0.294*	0.005	*0.043*			
SIZE	*0.016*	*0.034*	*0.046*	*-0.154*	*0.308*	*-0.076*	*0.242*	*0.391*		
INTANG	*0.021*	*0.018*	0.007	*-0.179*	*0.121*	*0.138*	*0.086*	*0.167*	*0.172*	
NOL_DECREASE	-0.004	*0.037*	*0.121*	*0.029*	*-0.033*	*-0.044*	0.001	*-0.101*	*-0.177*	*-0.081*

Notes. This table presents Pearson product–moment correlations. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. Column (2) and (3) contain data on variables averaged over the respective period (t+1 and t+3). Correlation coefficients who are significant at the 10% level or stronger (two-tailed tests) are presented in italic.

In Table 5, the results from Pearson correlations are presented. The results show that CASHETR, CASHTER2, and CASHETR4 are all negatively correlated with MASCORE[20]. This implies that higher ability managers engage in more tax avoidance, not considering other explanatory factors. Most of the control variables are significantly correlated with both short- and long-run proxies for tax avoidance, a result which states the importance of including these control variables in our model. Short- and long-run cash ETR proxies are significantly correlated, but looking at the coefficient magnitudes we observe what was stated by Dyreng et al. (2008), that one-year cash ETR is an inaccurate measure for long-run cash ETRs.

Table 17, Table 18 and Table 19, all of whom can be found in Appendix B, present summary statistics grouped by years, country, and industry. All variables are similarly distributed over the years of the sample. Across industries, the main variables of interest, cash ETR and MASCORE, are evenly distributed. However, there are significant differences in some control variables such as R&D. We observe more variation in the main variables of interest across countries, especially for MASORE, where several outliers are present. Most of these outliers are countries of less reliable reporting or are countries that have few firm-year observations,

[20] Both short- and long-run cash ETRs are significant with their respective MASCORE at the 1% level using a two-tailed test (untabulated).

but some of these outliers such as Norway and Belgium are of both reliable reporting and have a substantial amount of observations. A plausible explanation for these particular outliers could be that some countries have stronger efficiency focus than others as it is important and challenging for export firms in relatively small open economies in well-off countries to be competitive in an international market. Another plausible explanation is that for the smaller economies in our sample, the companies who meet our variable requirements might be a skewed sample in terms of management ability. Note that our primary model includes country-year fixed effects and that as a robustness test we run the model excluding countries of unreliable financial reporting.

Primary Findings

In this section, we present our primary findings. We first present the results from our primary model in the form of five regressions, including both short- and long-run ETR proxies, with differing levels of fixed effects included. We then present several alternative tests, including a variety of results from differing methodological considerations and several robustness tests.

5.1 Main Analysis

Table 6 presents results from estimating Equation (3.1). The predicted directions of the coefficients are presented in the predicted sign column of both panels. We predict that cash ETR is decreasing in Research and Development, Capital Expenditures, Leverage, Foreign and Intangible Assets.

The first regression, presented in column (1) of Panel A, is our baseline model. Control variables for tax avoidance, as well as country-year fixed effects, are included. This regression shows that cash ETR is increasing in Leverage, a result that is significant at the 1% level in a different direction than predicted. There are several plausible explanations. Firstly, European firms may behave differently than American firms, on results which we based our prediction. Secondly, our sample is subject to several restrictions, and the corresponding firms may show differing behavior for firm characteristics than what we would expect for a larger sample of firms, where small and medium sized companies are included. Finally, restricting firms with negative cash taxes paid and pre-tax income before special items may have affected the direction of our control variables. We also find that Size and Capital Expenditures are negatively associated with tax avoidance at the 10% and 5% level respectively, while the effect of Foreign, R&D, and NOL_Decrease are found to be economically insignificant. Foreign being insignificant is the most surprising, but it may result from the fact that the majority of publicly listed European firms, of which our sample exclusively consists, engage in foreign operations and the indicator becoming weakened as a result[21].

[21] 69.7% of firm-year observations engage in foreign operations, see Table 4.

Table 6. **Primary Model Results**

Panel A: One-year measure of CASHETR							
		(1) Baseline model with controls for tax avoidance		(2) Including MASCORE		(3) Including MASCORE and firm fixed effects	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?			**-0.0545*** **	**-3.94**	**-0.0812*** **	**-3.96**
R&D	-	-0.0009	-1.77	-0.0012**	-2.60	0.0008	0.68
CAPEX	-	-0.0528**	-3.02	-0.0364*	-1.91	0.0096	0.33
LEVERAGE	-	0.0523***	3.66	0.0501***	3.57	0.2224***	5.17
FOREIGN	-	0.0113	1.51	0.0107	1.43		
SIZE	?	-0.0040*	-2.19	-0.0044**	-2.36	0.0088	0.72
INTANG	-	0.0253	1.79	0.0118	0.75	0.1177**	2.90
NOL_DECREASE	-	-0.0082	-1.29	-0.0072	-1.09	-0.0215	-1.71
Fixed effects		Country-year		Country-year		Firm and country-year	
St. errors clustered by		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.0630		0.0648		0.3247	
N		16,483		16,483		16,483	

Panel B: Long-run measures of CASHETR					
		(1) Y = CASHETR2		(2) Y = CASHETR4	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?	**-0.1129*** **	**-4.63**	**-0.1255* **	**-2.14**
R&D	-	-0.0001	-0.08	0.0002	0.08
CAPEX	-	-0.0321	-0.65	-0.1609	-1.94
LEVERAGE	-	0.1976***	3.87	0.2760**	3.15
SIZE	?	0.0238	1.51	0.0223	1.18
INTANG	-	0.0449	0.80	-0.0260	-0.32
NOL_DECREASE	-	0.0056	0.36	0.1351**	2.98
Fixed effects		Firm and country-year		Firm and country-year	
St. errors clustered by		Firm and year		Firm and year	
Adjusted R^2		0.4209		0.6197	
N		13,160		8,268	

Notes. This table presents the results from estimating OLS regressions on Equation (3.1). In Panel A, we use a one-year measure for cash ETR. In panel B, we use long-run measures for cash ETR. In column (1) and (2) of panel B, the dependent and independent variables are averaged over the time period t through t+1 and t+3 respectively so the dependent and independent variables are measured contemporaneously. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. MASCORE coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

In column (2) of Panel A, we add MASCORE to the baseline model. Our null hypothesis state that we are unable to predict the effect of MASCORE on tax avoidance due to contradictory theories and differing results in prior studies. The findings show that cash ETR is decreasing in MASCORE, a result that is significant at the 1% level, consistent with the findings obtained by Koester et al. (2017) using a similar model. This contradicts the findings obtained by Francis et al. (2013) which we address in Chapter 6.1. When MASCORE is included, we note

several changes compared to our baseline model. Capex becomes less significant, now only at the 10% level, while the R&D coefficient becomes significant at the 5% level in the predicted direction. Adding MASCORE as a control variable also results in an increase in adjusted R^2.

In column (3) of Panel A, we add firm fixed effects to the regression model used in column (2). We add firm fixed effects to the model to separate effects that are firm-specific from the effects of the manager, and refer to this as the primary model in our paper. The effect of managerial ability remains negative and significant at the 1% level. In other words, we find that managerial ability has a positive significant effect on tax avoidance using a one-year cash ETR as tax avoidance proxy. All else equal, using the coefficient from Panel A column (3), we find that moving from the lower to the upper quartile of MASCORE is associated with a 1.84% reduction in a firm's one-year cash ETR.

Two other coefficients are significant in this column; Leverage and Intangible Assets. Intangible Assets are significant at the 5% level while Leverage is significant at the 1% level, both in the opposite direction of our prediction. Koester et al. (2017) also find a significant positive effect of Leverage on cash ETR, so our findings is not without precedent. Although uncommon, there is also some prior research that supports our findings of a positive relation between Intangible Assets and cash ETR (e.g., Chen et al., 2010). We note that FOREIGN is omitted from the regression when including firm fixed effects, as there is no within-firm variation over time for our definition of this variable.

As presented in Panel A, including firm fixed effects change our results. The control variable R&D is an example. Prior research has found that increasing usage of R&D is associated with lower cash ETRs (Rego & Wilson, 2012), but this study does not utilize firm fixed effects, while including firm fixed effects renders R&D insignificant in our model. This result implies that it is variation in R&D across firms that drives the negative coefficient, not variation within firms over time. Looking at the change in R^2 through Panel A, from 6.3% in column (1) to 32.5% in column (3), we see that firm fixed effects explains a significant portion of tax avoidance. Including firm fixed effects mean that significant findings are due to time-variation within firms, not variation across firms. This is because firm fixed effects control for factors that are constant within firms over time and factors that are correlated with the model's independent variables.

We are also interested in the effect of managerial ability on long-run cash ETRs, due to the concern of short-run cash ETR being a noisy long-run tax avoidance proxy. In panel B we present long-run variations of the model used in column (3) Panel A, where the dependent variables are two- and four-year cash ETRs, while the control variables are the corresponding long-run averages. Column (1) in Panel B presents the results from the regression model using a two-year cash ETR as the dependent variable. The results show that two-year cash ETR is decreasing in MASCORE, a result which is significant at the 1% level. All else equal, we find that moving from the lower to the upper quartile of MASCORE is associated with a 2.56% reduction in a firm's two-year cash ETR[22]. The regression also shows that two-year cash ETR is increasing in Leverage significant at the 1% level, while all other control variables are insignificant.

In column (2) Panel B, the dependent variable is a four-year cash ETR. The MASCORE coefficient becomes less significant in this regression, now only at the 10% level, but remains negative. This regression also shows that the four-year cash ETR is increasing in Leverage and NOL_Decrease, results which are significant at the 5% level in the opposite of the predicted direction. We note that due to our sample spanning a relatively short time-period the size of our sample using a four-year average is significantly impaired, a concern noted by De Simone et al. (2018) when considering long-run tax avoidance proxies.

In sum, our results imply that higher managerial ability is associated with greater tax avoidance. When controlling for confounding factors and country-year fixed effects running robust regressions, we obtain a significant negative effect of MASCORE on one-year cash ETR at the 1% level with or without firm fixed effects. Our findings are also significant at the 1% level using a two-year cash ETR model. We note that when using a four-year cash ETR model, our findings only show significance at the 10% level. This concern is alleviated by the fact that the MASCORE coefficient remains negative and of similar magnitude compared to our previous results, while there is a decrease in the t-statistic, making the smaller sample size a likely reason for the loss of power.

[22] Calculated using one-year MASCORE quartiles

5.2 Methodological Considerations

Table 7 presents results from four regressions using our primary model. Each column addresses a different methodological consideration, in order to show the robustness of our results to these different considerations.[23]

In column (1), data from 2018 is excluded. This is done to control for 2018 being a smaller calculation group when estimating our DEA model, resulting in a higher mean firm efficiency for the group. After dropping the 879 firm-year observations from 2018, our findings are similar to those initially obtained when including all year groups. The MASCORE coefficient remains negative, being significant at the 1% level, implying that including 2018 data do not cause skewness in our original results, regardless of our sample consisting of relatively fewer firm-year observations for 2018.

In column (2), we exclude countries that are considered as unreliable in terms of financial reporting or have less than 100 firm-year observations[24]. We define unreliable reporting as legislations where IFRS standards have not been required for all publicly listed companies for the duration of our sample. This is done to alleviate the concern that our results may be driven by sub-par financial reporting. The findings from the regression are similar to those previously obtained. Both coefficients and significance levels remain closely related to those obtained using the full sample. Although MASCORE experiences a drop in significance, likely due to the reduction in the number of observations, now being significant only at the 5% level. This test shows that including countries of unreliable reporting does not cause skewness in our original results.

In column (3), the DEA calculation of firm efficiency is estimated using industry-split calculation groups following Koester et al. (2017) and Demerjian et al. (2012), rather than the year-split calculation groups we initially utilize following Demerjian (2017). As expected, the mean firm efficiency is higher using an industry-split, now being 57.2% (untabulated). This is likely due to the reduction in average calculation group size[25]. The results in this test differ

[23] We rerun the Tobit regressions for all columns, but recalculate total firm efficiency for columns (3) and (4) only.
[24] The following countries (and territories) are excluded from our original sample: Croatia, Czech Republic, Estonia, Hungary, Iceland, Isle of Man, Jersey, Latvia, Malta, Russia, Serbia, Slovakia, Slovenia, Switzerland, and Turkey.
[25] Supported by the fact that we see a relatively larger number of firms on the efficiency frontier, now 5.89% of firm-year observations compared to 1.97% previously (untabulated).

Table 7. **Methodological Considerations Results**

		(1) 2018 excluded		(2) Unreliable countries excluded		(3) DEA by industry		(4) DEA on sample sub-set	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?	**-0.0815*** **	**-3.57**	**-0.0786** **	**-3.07**	**-0.1793*** **	**-6.57**	**-0.0776*** **	**-4.13**
R&D	-	0.0010	0.77	0.0012	0.84	0.0007	0.61	0.0007	0.57
CAPEX	-	0.0107	0.37	0.0237	0.77	0.0322	1.12	0.0112	0.39
LEVERAGE	-	0.2344***	4.89	0.2388***	5.38	0.2168***	5.02	0.2240***	5.19
SIZE	?	0.0105	0.78	0.0093	0.76	0.0081	0.66	0.0078	0.65
INTANG	-	0.0916**	2.52	0.1184**	2.84	0.1081**	2.39	0.1245**	2.90
NOL_DECREASE	-	-0.0223	-1.59	-0.0119	-0.89	-0.0225	-1.80	-0.0222	-1.79
Fixed effects		Firm and country-year		Firm and country-year		Firm and country-year		Firm and country-year	
St.errors clustered by		Firm and year		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.3210		0.3244		0.3274		0.3248	
N		15,604		13,792		16,483		16,483	

Notes. This table presents the results from estimating OLS regressions on Equation (3.1) using differing methodological considerations. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. Managerial ability coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year.

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

from our original findings, in that the MASCORE coefficient more than doubles in the negative direction while remaining significant at the 1% level. This is mostly explained by the fact that our within-firm variation in MASCORE is reduced using industry-split calculation groups, and firm fixed effects resulting in our model looking at within-firm variation in cash ETR over time, which is unchanged, increasing the MASCORE coefficient[26]. This is verified by there being no significant change in the MASCORE coefficient from our previous tests if we choose to exclude

[26] Within-firm variation in MASCORE decreases due to all firm-year observation for a firm now being pooled in the same calculation group when running the DEA estimation. Within-firm correlation for MASCORE increases from 56.0% to 86.6%, while within-firm variation decreases from 11.7% to 9.0% (untabulated).

firm fixed effects from our model. Utilizing this method we obtain a MASCORE coefficient of -0.035% significant at the 1% level (untabulated), which is reasonably similar to the coefficient presented in Panel A column (2) of Table 6. For the control variables, there are no significant changes from previous results. This test shows that running our DEA estimation using industry-split calculation groups would have strengthened the magnitude of our results, indicating that our findings are robust in regards to this methodological consideration. Furthermore, using industry-split calculation groups, the MASCORE coefficient remains negatively significant at the 1% level using both two- and four-year models (untabulated).

Column (3) is the only test where the magnitude of our MASCORE coefficient is directly comparable to that obtained by Koester et al. (2017) as we use the same DEA methodology. Our coefficients are of similar magnitude to that of Koester et al. (2017) who obtain MASCORE coefficients of -0.045 and -0.188 when not including and including firm fixed effects, respectively. This implies that the relationship between managerial ability and tax avoidance is similar for European and US managers, which is an interesting result considering the substantial differences in tax avoidance between Europe and the US previous literature imply. When looking at the effect of moving from the lower to the upper quartile of managerial ability, however, we see a significant difference, due to a broader interquartile range in MASCORE for our sample compared to that of Koester et al. (2017). All else equal moving from the lower to the upper quartile of MASCORE is associated with a 7.55% reduction in cash ETR (untabulated) for our sample, while Koester et al. (2017) find a reduction in cash ETR of 3.15%. The marginal effect is the same but due to the higher variation in MASCORE, managerial ability has greater explanatory power for tax avoidance in Europe compared to the US[27].

The final methodological consideration we consider, tabulated in column (4), is running the DEA estimation using the subset of firm-years on which we have data to run our primary model. Calculating firm efficiency on this subset does not change our initial findings. Both coefficients and significance levels are similar to those which were obtained when running the

[27] We continue to find a greater effect of managerial ability on tax avoidance than Koester et al. (2017) when comparing three- and five-year cash ETRs (untabulated).

DEA calculation on the full sample. This test shows that using the whole set of observations in the calculation of MASCORE does not cause inference issues in this study.

All four tests taken into consideration, the results initially obtained looks to be robust in regards to methodological consideration of sample selection[28] and DEA methodology problems presented by Demerjian (2017). Furthermore, our findings using a DEA methodology similar to that of Koester et al. (2017) indicate that European and American managerial ability has a similar marginal effect on tax avoidance.

5.3 Robustness Tests

Table 8 presents results from seven robustness tests that help rule out alternative explanations to our findings. As presented in Panel A, we run four regressions checking for possible distortions in our results due to the inclusion or exclusion of control variables. In Panel B, we run our original model using different proxies for tax avoidance, recalling that different proxies are good at recognizing different types of tax avoidance. Note that for all regressions except column (1) Panel A, previous control variables are included, but not reported to save space, see Appendix C for detailed reporting.[29]

In column (1) of Panel A, we present results from a regression using MASCORE as the only control variable. This robustness test is done in order to check whether potential collinearity with the control variables drives our results. Our findings show that MASCORE is significantly negative at the 1% level, consistent previous findings. As expected, the model has a lower adjusted R^2 than the models with control variables included, likely due to variables which we expect to explain tax avoidance being omitted from the model.

In column (2) of Panel A, we add Pretax Return on Assets (PTROA) to our original model, because it is possible that firms with higher-ability managers have better incentives and more resources available, making tax planning more lucrative or accessible (Koester, et al., 2017). It is therefore possible that MASCORE is capturing the effect of pretax profitability on tax avoidance. Rego (2003) found a negative relationship between GAAP ETR and PTROA, and

[28] If we choose to restrict the sample based on positive total tax expense rather than positive cash taxes paid the MASCORE coefficient remains negative and significant at the 1% level using one- and two-year models (untabulated). When using a four-year model, MASCORE becomes significant at the 5% level (untabulated).
[29] All Robustness tests use the same sample selection process as our original model, finally excluding firm-year observations missing data necessary for additional variables.

suggest that this implies that high profitability firms have greater incentives to engage in and lower costs associated with tax avoidance. The result from our regression shows that PTROA is significant at the 1% level, the coefficient being negative as expected. MASCORE becomes less significant when we include PTROA as a control variable, now only significant at the 10% level. This shows that MASCORE initially was capturing some of the relationship between PTROA and tax avoidance in our study. We do not initially include PTROA in our model because previous literature suggests that including PTROA exempts some of the attributes which we want to contribute to high-ability managers. Firstly, Baik et al. (2011), among others, have previously used PTROA as a proxy for managerial ability. Secondly, as stated by Koester et al. (2017), we believe that managers of profitable firms, not the profitable firms by proxy, use tax deductions, credits, and benefits efficiently. Therefore, while we note that PTROA describes some of the effect on tax avoidance previously attributed to MASCORE, we do not believe it correct to discredit this effect from the effect of managerial ability on tax avoidance.

In column (3) of Panel A, we add market-to-book ratio (MB) as a control variable. This is done because it is possible that high-ability managers are drawn towards firms with higher growth opportunities (Koester, et al., 2017). It is also possible that firms with high growth opportunities are able to avoid more taxes. The result from this test shows that MB does not have a significant effect on cash ETR, meaning we do not find empirical proof for the theory[30]. We also find that the MASCORE coefficient remains negative and significant at the 1% level when we include MB as a control variable, alleviating concerns that omitting MB from our original model create bias.

In column (4) of Panel A, we control for available cash flow and holdings. We do so by including two additional control variables, pretax free cash flows (PTFCF) and cash holdings (CASH), to our model. According to Koester et al. (2017), this test should be conducted because firms with higher cash holdings and free cash flow have greater resources available for tax planning strategies, indicating that more cash flow and holdings might lead to greater tax avoidance. At the same time, incentives for tax planning strategies might be weaker when a firm is not cash constrained, implying that more cash holdings might lead to less tax

[30] We do not find MB to be pairwise correlated with MASCORE at the 10% level or stronger (untabulated), further discrediting the theory that more able managers are drawn to firms with higher growth.

Table 8. **Robustness Tests Results**

Panel A: Control variables									
		(1) Controlling for distortion by control variables		(2) Controlling for profitability		(3) Controlling for growth opportunities		(4) Controlling for cash flow and holdings	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?	**-0.0911*** **	**-4.12**	**-0.0298***	**-1.86**	**-0.0795*** **	**-4.02**	**-0.0765*** **	**-3.82**
PTROA	-			-1.2224***	-18.48				
MB	-					-0.0014	-1.52		
PTFCF	?							-0.2071***	-5.38
CASH	?							-0.0920*	-2.09
Firm-level controls		Not included		Included		Included		Included	
Fixed effects		Firm and country-year		Firm and country-year		Firm and country-year		Firm and country-year	
St.errors clustered by		Firm and year		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.3170		0.3789		0.3260		0.3280	
N		16,483		16,483		15,574		16,482	

Panel B: Alternative definitions of tax avoidance							
		(1) Y = CASHTAX_NC		(2) Y = CASHETR_ADJ		(3) Y = GAAP ETR	
	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?	**-0.0035*** **	**-4.68**	**-0.0627*** **	**-3.92**	**-0.0193** **	**-2.26**
Firm-level controls, firm fixed effects, and country-year fixed effects		Included		Included		Included	
St.errors clustered by		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.4345		0.2990		0.3654	
N		15,573		16,483		16,482	

Notes. This table presents the results of differing robustness tests. ETR measures are winsorized at [0,1], CASHTAX NC and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. Previous control variables are included in all regressions with the exemption of column (1) Panel A, but hidden for brevity. Managerial ability coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year.
***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

avoidance, making the total effect difficult to predict. The results show that the coefficients for both of the added control variables are significant. PTFCF is significant at the 1% level, and CASH is significant at the 10% level. Both coefficients are negative, which implies that firms with higher cash holdings and free cash flow engage in more tax avoidance. The coefficient of MASCORE remains negative and significant at the 1% level, confirming that higher ability managers do not engage in more tax avoidance due the relationship between tax avoidance and managerial ability being affected by cash flows and holdings.

In column (1) of Panel B, we use CASHTAX NC as the dependent variable for the model. CASHTAX NC is a measure developed by Henry and Sansing (2018), where the difference between cash taxes paid and the corporate tax rate multiplied by pre-tax income before special items are divided by the market value of assets. Lower values indicate greater tax avoidance. The measure removes the potential for a mechanical relationship between MASCORE and tax avoidance by removing pre-tax income from the denominator. According to Koester et al. (2017), a positive correlation between pre-tax book income and MASCORE may induce a negative relationship between cash ETR and MASCORE. Furthermore, while CASHTAX NC identifies less permanent and temporary tax saving strategies than cash ETR, according to De Simone et al. (2018), it is slightly better at identifying hybrid tax avoidance strategies. Our results show that MASCORE is negatively associated with CASHTAX NC significant at the 1% level. This confirms that our previous findings were not the result of a mechanical relationship existing between MASCORE and pre-tax book income. These findings also indicate that higher managerial ability is positively associated with hybrid tax avoidance strategies. Henry and Sansing (2018) express concern regarding the effect of removing observations with negative cash taxes paid and negative pre-tax income before special items, including these observations we run the regression on 20,351 firm-year observation, and continue to find a negative relation between MASCORE and CASHTAX NC significant at the 1% level (untabulated).

In column (2) of Panel B, we use cash ETR adjusted as the dependent variable. The proxy is a cash ETR measure adjusted for both firm size and industry, developed by Balakrishnan et al. (2012) due to the importance of firm size and industry membership when addressing tax avoidance. Koester et al. (2017) highlight the possibility of higher ability managers belonging to larger firms and industries with lower effective tax rates, implying that they have greater opportunity for tax planning. Our results show that we continue to find that MASCORE is positively related to greater tax avoidance at the 1% significance level when using adjusted

cash ETR as the dependent variable. Confirming that our initial findings are not explained by managers of higher ability merely having greater opportunities for tax avoidance compared to low ability managers.

In column (3) of Panel B, we use GAAP ETR as the dependent variable. De Simone et al. (2018) find that GAAP ETR is the most powerful proxy for detecting permanent tax avoidance strategies. Although cash ETR is better at detecting both temporary and risky permanent tax avoidance. Nonetheless, GAAP ETR is an interesting measure to use as a robustness test in order to check the effect of managerial ability on permanent tax avoidance strategies. Our results show that MASCORE has a negative coefficient significant at the 5% level when using GAAP ETR as the dependent variable. All else equal, moving from the lower to the upper quartile of managerial ability is associated with a 0.44% reduction in a firm's one-year GAAP ETR. These findings are especially interesting in two regards. Firstly, because it indicates that managerial ability is positively associated with permanent tax avoidance, as GAAP ETR is a proxy that barely recognizes temporary or hybrid strategies for tax avoidance (De Simone, et al., 2018). Secondly, because it indicates that temporary tax avoidance strategies are the strategies that are most strongly associated with managerial ability. As we see the magnitude of the MASCORE coefficient increase significantly when utilizing cash ETR as compared to GAAP ETR, and cash ETR identify less permanent tax avoidance strategy than GAAP ETR, only the risky (De Simone, et al., 2018), leaving the rest of the coefficient to be explained primarily by temporary tax avoidance strategies.

In conclusion, all of the robustness tests indicate that there is a positive economically significant relationship between greater tax avoidance and more able managers. Controlling for pre-tax return on assets we find that MASCORE is only significant at the 10% level, but as stated by Koester et al. (2017) including PTROA as a control variable in our setting could figuratively be compared "throwing the baby out with the bathwater". Furthermore, these robustness tests indicate that higher managerial ability is positively associated with all types of tax avoidance strategies.

Additional Tests

In this section, we present the results from several additional tests. We first present results from tests using an empirical approach similar to that of Francis et al. (2013), followed by findings obtained utilizing a fixed effects research design. We then look at the relationship between managerial ability and tax reforms before looking at the association between managerial incentives and tax avoidance. Lastly, we investigate whether tax avoidance is a first order concern for managers.

6.1 Introducing Lagged MASCORE and Dummy Cash ETR

Using the similar data on US firms Koester et al. (2017) and Francis et al. (2013) find contradictory results, both of whom have support in theory, complicating the inference of their respective results. It is important to note that while Koester et al. (2017) look at the relationship between managerial ability and tax avoidance, Francis et al. (2013) look at tax aggressiveness, which is the more ethically challenged subset of tax avoidance. This could explain the contradictory findings, but the studies also find differing results when using identical proxies for tax avoidance, implying a fundamental difference in the empirical approach. Thus far, our findings on European firms coincide with those of Koester et al. (2017), but in an attempt to reconcile with Francis et al. (2013) we run several additional tests to explore the robustness of our results attempting to use their empirical approach.

Francis et al. (2013) deviate from Koester et al. (2017) in two fundamental ways. They run all tests using lagged values of MASCORE, and they use different proxies for tax avoidance. We neglect using their two main proxies, tax shelter probability and predicted UTB, as they are more appropriate for tax aggressiveness than tax avoidance (Lisowsky, et al., 2013). Instead, we continue to use cash ETR, which they utilize in an effort to bridge with Koester et al. (2017) continuing to find contradictory results and a dummy cash ETR proxy which they utilize throughout their paper. The tests utilize lagged values of MASCORE, while some tests include both lagged and concurrent values for MASCORE. We continue to use the control variables from Koester et al. (2017), noting that Francis et al. (2013) find contradictory results

only including these control variables[31]. Lastly, following Francies et al. (2013), we run our tests using different levels of fixed effects, country-year fixed effects, country-year and industry fixed effects, as well as country-year and firm fixed effects. Standard errors are two-way clustered by firm and year to adjust for heteroskedasticity, and all variables are defined in Appendix A Table 15. Note that the control variables are included, but not reported in Panel A and B to save space, see Appendix C for detailed reporting.[32]

Francis et al. (2013) argue that using lagged values for managerial ability is appropriate for two primary reasons. Firstly, because both tax avoidance and tax aggressiveness are long-term by nature (Hanlon & Heitzman, 2010), and secondly because endogeneity is a severe concern in these studies as tax avoidance could impact expenditures used in calculating MASCORE. Using lagged MASCORE is not without precedent, most notably by Demerjian et al. (2013) who use lagged values of MASCORE. However, the Demerjian et al. (2013) study used lagged values of MASCORE for entirely different reasons, as they were investigating earnings quality. Furthermore, while we agree with the argument that both tax aggressiveness and tax avoidance are long-term in nature, we do not believe that using lagged values of MASCORE is the correct solution. Instead, we believe that checking the relationship using long-run cash ETR proxies is the preferable approach. Lastly, while endogeneity is a serious concern, we argue that this is partly mitigated by the fact that several of the variables used in calculating MASCORE are lagged. We also argue that the non-lagged variables used in calculating MASCORE, such as Cost of Goods Sold, is unlikely to be affected by non-conforming tax avoidance, and conforming tax avoidance is not captured by the majority of proxies in current tax avoidance literature. Collectively, we believe using concurrent values for MASCORE to be the correct approach, but in an attempt to reconcile our findings with those of Francis et al. (2013), and test the robustness of our results, we nonetheless include these tests.

In Panel A of Table 9, we present our findings using cash ETR as the dependent variable and lagged values of MASCORE. The three columns represent different levels of fixed effects, and we find that all coefficients of lagged MASCORE are negative regardless of the level of

[31] We acknowledge that Francis et al. (2013) find three additional control variables to be significant when included in Equation (3.1) and that excluding these could result in omitted variable bias. We exclude ROA due to the reasons mentioned in subchapter 5.3, while we exclude Equity Income and NOL due to the variables not being available in Compustat Global.
[32] The sample selection process is similar to that of our original model, while also excluding all firms without a one-year lagged value of MASCORE.

Table 9. **Francis et al.** *(2013)* **Models Results**

		Panel A: Lagged MASCORE						Panel B: Concurrent and lagged MASCORE					
		(1) Baseline		(2) Including industry fixed effects		(3) Including firm fixed effects		(1) Baseline		(2) Including industry fixed effects		(3) Including firm fixed effects	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?							-0.0408**	-2.57	-0.0452**	-2.82	-0.0740**	-3.22
Lagged MASCORE	?	**-0.0241***	**-2.22**	**-0.0307****	**-2.78**	**-0.0261***	**-2.01**	0.0031	0.32	-0.0023	-0.26	-0.0251*	-2.04
SUM MASCORE	?							**-0.0377****		**-0.0475****		**-0.0991*****	
Firm-level controls		Included		Included		Included		Included		Included		Included	
Fixed effects		Country-year		Industry and country-year		Firm and country-year		Country-year		Industry and country-year		Firm and country-year	
St. errors clustered by		Firm and year		Firm and year		Firm and year		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.0640		0.0738		0.3642		0.0646		0.0745		0.3655	
N		11,657		11,657		11,657		11,657		11,657		11,657	

		Panel C: Dummy CETR					
		(1) Concurrent MASCORE		(2) Lagged MASCORE		(3) Concurrent and Lagged MASCORE	
Dep. Var: Dummy CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?	**0.0870***	**2.00**			0.0979**	2.57
Lagged MASCORE	?			**-0.0160**	**-0.39**	-0.0173	-0.41
SUM MASCORE	?					**0.0806**	
R&D	+	0.0004	0.23	0.0002	0.09	0.0001	0.05
CAPEX	+	-0.1309	-1.68	0.0265	0.29	0.0175	0.19
LEVERAGE	+	-0.0510	-0.83	-0.0337	-0.50	-0.0359	-0.54
SIZE	?	-0.0484**	-2.39	-0.0258	-1.03	-0.0254	-1.02
INTANG	+	-0.1979**	-3.15	-0.2534**	-2.61	-0.2310**	-2.40
NOL_DECREASE	+	0.1084***	5.41	0.1393***	4.40	0.1411***	4.42
Fixed effects		Firm and country-year		Firm and country-year		Firm and country-year	
St. errors clustered by		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.3201		0.3406		0.3411	
N		16,483		11,657		11,657	

Notes. This table presents the results from estimating OLS regressions on Equation (3.1). In Panel A, we use lagged MASCORE. In panel B, we use both concurrent and lagged MASCORE. In Panel C, we use Dummy CASHETR as the dependent variable. In panel A and B control variables are hidden for brevity. Sum MASCORE is not included in the regressions but is tested for joint significance using a Wald test. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. MASCORE coefficients and t-statistics of interest are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year.
***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

fixed effects, similar to our findings using concurrent MASCORE. We do note that the coefficient is only significant at the 10% level when using firm fixed effects and that it is smaller in magnitude than what we observe using concurrent MASCORE. Overall, we continue to find an econometrically significant relationship between higher managerial ability and greater tax avoidance.

In Panel B of Table 9, we present our findings, including both concurrent and lagged values of MASCORE in order to view the joint effect of MASCORE on cash ETR. Similar to the findings of Francis et al. (2013), we find that the coefficient of concurrent MASCORE is negative and significant for all levels of fixed effects. Our results deviate from those of Francis et al. (2013) in that we fail to find a significant effect of lagged MASCORE in columns (1) and (2), and in that, we find a negative effect in column (3) significant at the 10% level. More importantly, we find that the joint coefficient between concurrent and lagged MASCORE is negative, significant at the 5% level for column (1) and (2), and significant at the 1% level for column (3). These results further confirm a positive relationship between managerial ability and tax avoidance in Europe.

Overall our findings suggest that using lagged values of MASCORE, or both concurrent and lagged values of MASCORE, there still exists a positive relationship between higher managerial ability and greater tax avoidance in Europe. Although we believe it correct to use concurrent values, these results strengthen our findings in terms of the robustness of our empirical approach.[33]

Finally, we test the relationship between managerial ability and tax avoidance by utilizing a dummy cash ETR proxy as our dependent variable. The dummy variable equals one if industry adjusted cash ETR is in the bottom quantile of a particular year. Our results are presented in Panel C of Table 9, we run tests using both concurrent and lagged values of MASCORE individually, as well as test their joint effect. Firm fixed effects are included in all columns. We include tests using dummy cash ETR in a last effort to reconcile our results and that of Francis et al. (2013), noting that this is the only tax avoidance proxy used throughout their paper which represents the whole spectrum of tax avoidance, rather than the subset of tax aggressiveness. Furthermore, according to Kim and Zhang (2016) using dummy cash ETR

[33] Our results are empirically similar using a two-year cash ETR as the dependent variable (untabulated). Our results are also empirically similar using a four-year cash ETR as the dependent variable, except when we include firm fixed effects as we fail to find a significant relationship (untabulated).

alleviate the concern of our results being attributable to changes in firm characteristics, rather than tax avoidance, as it is not a linear combination of a set of firm characteristic. Note that when we use dummy cash ETR a positive relationship indicates greater tax avoidance. In column (1), using concurrent values of MASCORE, we find a positive relation significant at the 10% level between managerial ability and dummy cash ETR. In column (2), using lagged values of MASCORE, we fail to find a significant relationship between tax avoidance and managerial ability. Finally, in column (3), we find that the coefficient for concurrent MASCORE is associated with greater tax avoidance significant at the 1% level, but we fail to find a significant joint effect. Believing that using concurrent values of MASCORE is empirically correct these results further strengthen our belief of an existing positive relationship between managerial ability and tax avoidance.

Utilizing dummy cash ETR as our dependent variable lead to several changes in our other control variables compared to our previous findings. Leverage is no longer significant in column (1), while Size and NOL_Decrease become significant at the 5% and 1% level. Increasing Size is associated with decreasing tax avoidance, while increasing NOL_Decrease is associated with increased tax avoidance. In column (2) and (3) NOL_DECREASE remain significant at the 1% level, while Leverage remains insignificant.

When using dummy cash ETR as our dependent variable, we continue to find results that imply that higher managerial ability is related to higher tax avoidance, although our results are less significant than for tests utilizing cash ETR, or other tax avoidance proxies. We stress that we believe tax avoidance proxies previously utilized in this study to be more appropriate, and that following the lead of Francis et al. (2013) we utilize dummy cash ETR primarily as a control proxy.

In conclusion, our findings on European firms continue to coincide with the findings of Koester et al. (2017), which is somewhat surprising considering that we are performing tests similar to those Francis et al. (2013) performed obtaining contradictory results. Our findings continue to imply a significant relationship between higher managerial ability and greater tax avoidance in Europe, independent of whether we choose to use concurrent or lagged values of MASCORE. It is important to stress that this does not necessarily contradict the primary findings of Francis et al. (2013) as their paper primarily focuses on proxies more appropriate to capture tax aggressiveness, which is only a subset of tax avoidance. It is plausible for higher ability managers to engage in more tax avoidance while avoiding to a greater extent the tax

aggressiveness part of the tax avoidance spectrum. Our findings do, however, differ from the results obtained by Francis et al. (2013) for the additional specification tests they perform to address the results of Koester et al. (2017). A plausible reason is that we utilize a different DEA methodology following Demerjian (2017), another is that, as previously stated, the effect of managerial ability on tax avoidance need no be the same for European and US firms.

6.2 Fixed Effects Research Design

A potential concern is that our measure of managerial ability is capturing firm characteristics rather than manager-specific effects. This concern is partly mitigated by the fact that Demerjian et al. (2012) finds MASCORE to be associated with manager fixed effects, as well as showing that market reactions to turnover and MASCORE are aligned. We nonetheless perform an additional test, using a fixed effects research design to decompose MASCORE, in order to ensure that MASCORE is capturing managers impact on firm efficiency.

We decompose MASCORE by using a Koester et al. (2017) take on the Bertrand and Schoar (2003) fixed effects research design. Data on managers is collected from the Capital IQ People Intelligence database, which we merge with our firm-year-level data using ISIN codes. Our firm-year-level data is subject to the same sample selection process as our original model. In order to decompose MASCORE into two components we estimate the following regression:

$$MASCORE_{it} = \beta_k * ManagerFixedEffects + \alpha_i * FirmFixedEffects + \gamma_t * CountryYearFixedEffects + \varepsilon_{it} \quad (6.1)$$

We identify managers in each of the firms as individuals flagged both as professionals and key executives, and estimate Equation (6.1) on the sub-sample of managers who hold a position for at least two years in two or more separate firms[34]. Using this method, we obtain a manager fixed effects coefficient for 152 individual managers. In the identification of managers, we deviate from previous literature who have identified managers as the top five most highly compensated. We deviate in order to increase our sample size, as a substantial amount of our observations are missing compensation data[35].

[34] We allow managers to hold positions at several firms in one year, and firms to have several managers occupying a specific position in one year.
[35] Our empirical results are similar if we identify managers as the top five most highly compensated, or limit our sample to managers flagged as top key executives (untabulated).

We label the manager fixed effects coefficients as MASCORE_MGFE, which is a stationary manager specific component. While we compute the unexplained portion of our managerial ability score as MASCORE_OTHER, which is the residual of subtracting MASCORE_MGFE from MASCORE. Our intention is that the first component isolates the stationary effect of managers over time, the portion of MASCORE which we are certain can be attributed to managers, while the second component captures all other determinants of MASCORE, which are unrelated to the stationary effect of individual managers. We emphasize that using this research design has several limitations compared to our original model. Firstly, it severely limits the size of our sample. Secondly, concerns raised by Fee et al. (2013) that the results could be econometrically invalid are re-introduced. The second concern is alleviated by the fact that our model focus on individual manager fixed effects coefficients, and not their joint significance. We nonetheless advise caution against using this test as strong empirical evidence but include it as a supporting argument to our original findings.

Table 10. **Decomposed MASCORE Results**

Panel A: Manager Fixed Effects					
		(1) Executive-year-level		(2) Firm-year-level	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE_MGFE	?	**-0.7312*** **	**-6.79**	**-0.6442** **	**-2.86**
MASCORE_OTHER	?	0.0149	0.21	-0.0093	-0.14
Firm-level controls, firm fixed effects, and country-year fixed effects		Included		Included	
St.errors clustered by		Manager and year		Firm and year	
Adjusted R^2		0.4664		0.3942	
N		1,061		885	

Panel B: CEO Fixed Effects			
		(1) Executive-year-level	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.
MASCORE_CEOFE	?	**-0.5337***	**-2.05**
MASCORE_OTHER	?	0.2215	0.98
Firm-level controls, firm fixed effects, and country-year fixed effects		Included	
St.errors clustered by		CEO and year	
Adjusted R^2		0.0892	
N		252	

Notes. This table presents the results from estimating OLS regressions on Equation (3.1) using decomposed MASCOREs. In Panel A, MASCORE is decomposed using manager fixed effects. In panel B, MASCORE is decomposed using CEO fixed effects. Control variables are hidden for brevity. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. Fixed effects MASCORE coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm or manager and year.

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

The results of reestimating our original model using the decomposed MASCORE is presented in Table 10 Panel A. Note that previous control variables are included, but not reported to save space, see Appendix C for detailed reporting. Column (1) of Panel A presents an analysis at the executive-year-level, and our control variable of interest MASCORE_MGFE has a negative coefficient significant at the 1% level, providing further evidence of a manager-specific effect on tax avoidance. The coefficient of MASCORE_OTHER is not significant, reflecting a non-significant effect of the managerial ability not explained by the stationary effect of managers over time in this sub-sample. MASCORE_OTHER include potential effects of time-varying firm characteristics not specified in the construction of MASCORE, the joint effect of management working together, and the impact of time-varying manager characteristics (Koester, et al., 2017). Two plausible explanations for MACORE_OTHER being insignificant is the small size of the sample, or that the non-stationary effects of managers over time do not affect tax avoidance.

In column (2) of Panel A, we present the results of the manager fixed effects research design at the firm-year-level. For the 316 executive-year observations where more than one manager hold a position at the same firm, we sum the manager fixed effects coefficient within each firm-year observation. Using this method, we calculate a single MASCORE_MGFE observation at the firm-year level. As shown in column (2), our results are qualitatively similar to those obtained at the executive-year-level, supporting our original findings.

Initially, we focus on a manager fixed effects design rather than a CEO fixed effects design as all executives have the potential to affect the planning of corporate tax avoidance (Dyreng, et al., 2010). Focusing solely on CEO fixed effects also severely restrict our analysis in terms of sample size. Nonetheless, we acknowledge the importance of CEOs in setting firm policies by including a CEO fixed effects analysis, which is presented in Panel B.

We utilize the same research design as for manager fixed effects, and we require CEOs to hold a position for at least two years in two separate firms[36]. We obtain a CEO fixed effects coefficient for 35 individual CEOs, and label it MASCORE_CEOFE, while MASCORE_OTHER is the residual of MASCORE subtracted by MASCORE_CEOFE. We only run our analysis at the executive-year-level as we do not want to summarize the joint fixed effects of different CEOs. Our results are qualitatively similar to those obtained using

[36] We allow CEOs to hold positions at several firms in one year, and firms to have several CEOs in a specific year.

the manager fixed effects design, strengthening our previous results. However, we advise caution against using this test as strong empirical evidence, due to limited sample size, and include it primarily as a complementary analysis.

Overall our findings using a fixed effects research design coincides with the results obtained using our original model, alleviating concerns that our measure of managerial ability is capturing firm characteristics rather than manager-specific effects.

6.3 Managerial Ability and Tax Reforms

An explanation of how the approach to tax avoidance may differ for high ability managers compared to low ability managers could be how they react to tax reforms. One such tax reform could be a change in corporate tax rate. In order to investigate whether there is a difference in approach, we perform a test interacting MASCORE and corporate tax rate. We expect tax avoidance to be easier in legislations with higher corporate tax rates, following the findings of Avi-Yonah and Lahav (2011), which we, in turn, expect to decrease the disparity in tax avoidance created by managerial ability. Because tax avoidance will be easier for all managerial teams due to more opportunies. Although, tax avoidance might become a relatively higher NPV project in a higher tax environment, which could lead to managers devoting more time to tax avoidance, and the disparity in ability in regards to tax avoidance therefore becoming more pronounced. This argument, however, builds on the assumption that all managers devote limited amount of time on tax avoidance in low tax environments. Overall, we find it likely that the relative difficulty of avoiding taxes will be the dominant effect on the disparity in managerial ability in regards to tax avoidance. We therefore predict that an increase in corporate tax rate is associated with diminishing the difference in tax avoidance created by managerial ability.

We observe changes in the corporate tax rate from 2009 to 2018 for 24 of the countries, which represent 68% of our sample[37]. Most notably, in terms of the number of observations, we see changes in the corporate tax rate for both the United Kingdom and France. UK firms experience a drop of 9pp in corporate tax rate over the sample period, while French firms

[37] We observe tax reforms for the following countries: Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Italy, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Serbia, Slovakia, Slovenia, Spain, Sweden, Turkey, and United Kingdom.

experience an increase in the corporate tax rate for a short period before the corporate tax rate is restabilized at 34.4%. The most significant one-year variation we observe is Hungary's 10pp drop from 2016 to 2017. Most tax reforms in our sample are introduced incrementally.

We test the relationship between managerial ability and changes in corporate tax by rerunning Equation (3.1) now including an interaction between MASCORE and the corporate tax rate, utilizing the sample selection process from our original model. Note that this coefficient does not capture the direct effect of corporate tax rate changes on cash ETR, because of the country-year and firm fixed effects included in our model. Rather, the coefficient captures whether managerial ability is more or less associated with greater tax avoidance if the corporate tax rate increases (or decreases) within a firm over time. The corporate tax rate is defined as the difference from the average corporate tax rate in our sample, see Appendix A Table 15 for details.

Table 11. **MASCORE and Corporate Tax Rate Results**

Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.
MASCORE	?	-0.0797***	-3.83
MASCORE × Corporate Tax Rate	+	**0.0041***	**2.00**
R&D	-	0.0008	0.68
CAPEX	-	0.0100	0.35
LEVERAGE	-	0.2212***	5.12
SIZE	?	0.0091	0.74
INTANG	-	0.1173**	2.90
NOL_DECREASE	-	-0.0214	-1.71
Fixed effects		Firm and country-year	
St. errors clustered by		Firm and year	
Adjusted R^2		0.3249	
N		16,483	

Notes. This table presents the results from estimating an OLS regression on Equation (3.1) and including an interaction coefficient between MASCORE and Corporate Tax Rate. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. The interaction coefficient and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

In Table 11 column (1) we present the results of interacting MASCORE and corporate tax rate. We find that the interaction coefficient is positive and significant at the 10% level[38]. The effect of the standalone MASCORE coefficient is similar in magnitude to the one originally obtained. All other control variables remain quantitatively and qualitatively similar to the original results, and there is no significant change in adjusted R^2. The interaction coefficient

[38] Results are econometrically similar if we exclude countries of unreliable reporting from our sample (untabulated). The interaction coefficient is not significant if we utilize two- and four-year forward-looking cash ETR measures (untabulated).

can be interpreted as managerial ability being associated with greater tax avoidance if the corporate tax rate decreases.

These results imply that managerial ability has a greater effect on tax avoidance in low-tax environments, consistent with our prediction. Furthermore, it confirms that greater ability to detect tax avoidance strategies is one of the levers through which more able managers avoid taxes, as our results imply that managerial ability is more important in regards to tax avoidance in legislations where detecting tax avoidance opportunities is more challenging.

6.4 Incentives and Tax Avoidance

One of the reasons as to why managers engage in tax avoidance may be because they are incentivized to do so. It is therefore interesting to test the relationship between managerial compensation and managerial ability. Several prior studies have investigated this relationship using data on US firms. Rego and Wilson (2012) find that equity risk incentives are associated with greater tax risk, while Gartner (2014) finds that after tax-CEO incentives are negatively associated with effective tax rates. Amstrong et al. (2015) also find results that indicate that managers are incentivized to engage in tax avoidance. These previous findings are strengthened by our empirical findings thus far showing that higher ability managers engage in more tax avoidance, implying that tax avoidance is a positive NPV activity, and managers are usually incentivized to engage in positive NPV activities. We do note that not all previous literature finds a significant relationship between compensation and managerial ability (e.g., Armstrong et al., 2010; Dharmapala, 2006), and acknowledge that the association might differ for European and US managers. Overall, we expect incentives in European firms to be similar to the ones in US firms, and following the majority of previous literature, predict that managers are incentivized to engage in tax avoidance.

We test the relationship between managerial compensation and tax avoidance by estimating Equation (6.2), which utilizes the natural logarithm of compensation as the dependent variable, and cash ETR as the only control variable, while including country-year fixed effects as well as firm fixed effects. We also include manager fixed effects in order to control for managerial ability as it may impact managerial compensation. Compensation is defined as the sum of

salary, bonuses, and other annual compensation[39], and data on managers is collected from the Capital IQ People Intelligence database. The firm-year-level data is subject to the same sample selection process as our original model.

$$LNPAY_{it} = \beta_1 CASHETR_{it} + ManagerFixedEffects + FirmFixedEffects + CountryYearFixedEffects + \varepsilon_{it} \quad (6.2)$$

The results from our analysis are presented in Table 12 column (1). We find a negative relationship between cash ETR and LNPAY, significant at the 5% level, implying that managers are incentivized to engage in tax avoidance, regardless of ability, which follows our prediction[40]. It is important to note that due to the fixed effects included in the model, we are looking at the over time variation in individual manager compensation within firms. In order to check the robustness of our findings, we run another analysis using only the sub-sample of CEO observations presented in column (2). We find that the coefficient of cash ETR remains negative, now only significant at the 10% level, but the magnitude of the coefficient remains consistent, pointing to a loss in power due to reduction in sample size.

Table 12. **Pay and Tax Avoidance Results**

		(1) Full sample		(2) CEO sub-sample	
Dep. Var: LNPAY	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.
CASHETR	-	**-0.0757****	**-2.42**	**-0.0813***	**-1.93**
Fixed Effects		Manager, firm and country-year		CEO, firm and country-year	
St.errors clustered by		Manager and year		CEO and year	
Adjusted R^2		0.7182		0.6057	
N		16,538		5,114	

Notes. This table presents the results from estimating OLS regressions on Equation (6.2). ETR measures winsorized at [0,1]. All variables defined in Appendix A. Cash ETR coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by manager and year.
***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

Our results indicate that European firms incentivize both CEOs and managers to engage in tax avoidance, which is in accordance with the majority of findings from previous US studies. This could be one of the drivers behind our findings indicating that higher ability managers engage in greater tax avoidance. Because it is plausible that managers, regardless of ability are incentivized to avoid taxes, but due to ability, the degree to which they succeed and are

[39] We include the top five most highly compensated managers per firm, who are all required to be flagged as professionals to exclude non-executives.
[40] Due to the inclusion of stock-options in our compensation variable, there exists a possibility of a mechanical relationship between tax avoidance and compensation, due to tax avoidance possibly affecting stock value. This concern is alleviated by our results remaining consistent when excluding stock-options from our compensation variable (untabulated).

subsequently rewarded may differ. It is nonetheless important to stress that this is only one of several plausible explanations as to why higher ability managers engage in greater tax avoidance and that factors such as reputational cost, which may be argued to be more significant for more able managers, are omitted from this test. Furthermore, the test relies solely on fixed effects to control for firm and manager characteristics.

6.5 Managerial Ability and Taxable Profits

Our previous findings imply that higher ability managers engage in greater tax avoidance, but we are unable to assess how much importance managers ascribe to it. Previous literature tells us that accounting and taxable profits often bunch around zero, especially for multinational companies (Bilicka, 2019). One plausible explanation for this is tax avoidance, as multinationals to a greater extent have tax avoidance possibilities, and experience taxable profits closer to zero more often than domestic companies. Furthermore, our findings, as well as those of Koester et al. (2017), indicate that more able managers are able to engage in greater tax avoidance. Testing the relationship between MASCORE and profits could therefore be an indicator as to the importance placed on tax avoidance by managers. A relationship where more able managers experience profits close to zero more often than their less able peers is only plausible if tax avoidance is a first order concern for managers. This is because the importance of tax avoidance would have to outweigh most other concerns by a considerable margin in order for more able managers to want to experience profits close to zero regularly, and, excluding tax avoidance, we would expect high ability managers to experience profits close to zero less frequently than low ability managers. A significant positive relationship between profits being close to zero and MASCORE would therefore imply that tax avoidance is a first order concern for managers. However, due to managerial ability being defined by Demerjian et al. (2012) as the ability to increase firm value by efficiently utilizing resources, we find it unlikely that this significant positive relationship exists, and predict managerial ability to have a negative effect on profits being close to zero. It is in our opinion more likely that other concerns in regards to the effective utilization of resources take precedence over the lone argument for profits being closer to zero, which is taxation, especially as not all firms in our sample are multinationals with their greater opportunity for effective tax avoidance. A significant positive relationship is plausible, however, as managers likely see tax avoidance as an especially appealing form of cost cutting, and as according to our previous findings managers are incentivized to engage in tax avoidance.

When testing the relationship between MASCORE and profits close to zero, we use the model presented in Equation (3.1), but utilize a Zero Profits Dummy as the dependent variable. Control variables, country-year fixed effects, and firm fixed effects are included to control for firm characteristics[41]. We calculate the Zero Profits Dummy both as a relative and absolute measure, meaning that we calculate it using both relative and absolute measures of profitability, see Appendix A Table 15 for details. Due to data restrictions, we only look at an accounting profits measure[42]. We utilize the same sample selection process as for our original model, except that we include firm-year observations with negative pre-tax income before special items, and firm-year observations with negative cash taxes paid. We note that interacting MASCORE and accounting profits raises the concern of a mechanical relationship, as one would expect more efficient managers, defined using accounting data, to extract greater accounting profits. This concern is mitigated in part by the MASCORE definition of efficiency being primarily focused on revenue.

Table 13. **Zero Profits Dummy Results**

		(1)		(2)	
		Relative measure		Absolute measure	
Dep. Var: Zero Profits Dummy	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	-	**-0.0154**	**-0.98**	**-0.0067**	**-0.32**
R&D		0.0001	0.15	-0.0002	-0.36
CAPEX		-0.0409	-1.27	-0.0451	-1.32
LEVERAGE		0.0117	0.89	-0.0038	-0.57
SIZE		0.0119	1.61	-0.0403***	-6.65
INTANG		0.0332	0.94	0.0931**	2.87
NOL_DECREASE		0.0952***	8.44	0.0735***	9.83
Fixed effects		Firm and country-year		Firm and country-year	
St. errors clustered by		Firm and year		Firm and year	
Adjusted R^2		0.1889		0.4142	
N		21,618		21,618	

Notes. This table presents the results from estimating OLS regressions on Equation (3.1) when cash ETR is exchanged for a Zero Profit Dummy. All continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. MASCORE coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year.
***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

The results of our test are presented in Table 13, with column (1) presenting the relative measure, and column (2) presenting the absolute measure. Both columns report an insignificant coefficient for MASCORE, implying that there is no significant relationship

[41] Our results are econometrically similar for the MASCORE coefficient if we exclude firm fixed effects (untabulated).
[42] Cash taxes paid close to zero could be an indicator of taxable profits being close to zero. Our results are qualitatively and quantitatively similar using a cash taxes paid close to zero dummy.

between managerial ability and profits being close to zero. We also see that SIZE unsurprisingly is only significant when we use an absolute measure. NOL_DECREASE is the only variable with a significant positive relationship in both columns. Likely because a firm who has loss carryforwards due to previous losses are more likely to experience profits close to zero than previously profitable firms.

According to our findings, managers in Europe do not necessarily view tax avoidance as a first order concern, as we find no evidence indicating that tax avoidance outweighs other concerns by a considerable margin. Avoiding taxes could be an opportunity to increase efficiency, but our results imply it may not be worth it at all costs. We note, however, that excluding tax avoidance effects we would expect managerial ability to have a significant negative relationship with our zero profits dummies, which we do not find.

Conclusion

This study examines the relationship between managerial ability and tax avoidance in Europe. Our results show that higher ability managers engage in greater tax avoidance. We find that moving from the lower to the upper quartile of managerial ability in Europe is associated with a 1.84% (2.56%) reduction in a firm's one-year (two-year) cash ETR. Our findings are robust to a multitude of methodological choices and alternative explanations. Additional tests show that the association between higher managerial ability and greater tax avoidance is strengthened in low tax environments, due to tax avoidance being more difficult, creating a greater disparity in ability in regards to tax avoidance between more and less able managers. We also find that firm incentivize both CEOs and managers to engage in greater tax avoidance. This is likely one of the drivers behind higher ability managers engaging in more tax avoidance, as they are incentivized to do so, and succeed to a greater degree than their low ability peers. Finally, we fail to find evidence suggesting that managers view tax avoidance as a first order concern.

Our study is subject to several limitations. Firm's do not state their tax avoidance strategies publicly, our study therefore relies on information extracted from financial statements to infer strategic choices. Furthermore, our measure for tax avoidance only captures explicit and non-conforming tax avoidance. As a result, we do not provide evidence on conforming tax avoidance strategies. In addition, we acknowledge that some of the variables used to capture tax avoidance are noisy proxies for the underlying economic constructs. Finally, it is possible that our measure of managerial ability does capture some aspects of firm characteristics. We do, however, test for this concern using a fixed effects research design, and our findings suggest that our measure of managerial ability is capturing manager-specific effects, but we cannot completely rule out this alternative explanation.

Our study makes several contributions to the existing tax avoidance literature. Presenting new empirical evidence from Europe, our findings highlight that more able managers engage in greater tax avoidance compared to their less able peers. Furthermore, we contribute to the literature by attempting to reconcile our findings with both Koester et al. (2017) and Francis et al. (2013), finding the results for European managers to be consistent. We also present findings on how managers of differing ability react to tax reforms, as well as confirm that managers are incentivized to engage in tax avoidance in European firms. Finally, we present

results indicating that tax avoidance is not a first order concern for managers, more likely being one of several important concerns. Our findings should be of interest to academics, corporate stakeholders and regulators in understanding how individual decision makers affect tax avoidance, while the knowledge that more able managers judge the marginal benefits of tax avoidance to surpass the marginal costs should be valuable. Additionally, board members should find our results to be of interest when evaluating the benefits and costs associated with hiring executives. We encourage further research to identify manager characteristics associated with tax planning, as well as to provide more evidence on the specific mechanisms used in tax avoidance strategies.

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Appendix

9.1 Appendix A. Variable Definitions

Table 14. **MASCORE Estimation Definitions**

Variable	Definition	Source
Business Segment Concentration	Defined as the number of secondary industries reported using primary or secondary sic codes. Industries defined using the Fama-French 48 Industrial Classifications	Orbis
CoGS	Defined as cost of goods sold (*cogs*) in period *t*	Compustat Global
Foregin Currency Indicator	Indicator coded to 1 if a firm have a nonzero value for foreign currency adjustments (*fca*) in period *t*	Compustat Global
Free Cash Flow Indicator	Indicator coded to 1 if earnings before depreciation and amortization (*oibdp*) less the change in working capital less the capital expenditures (*capx*) are greater than 0 in period *t*	Compustat Global
Goodwill	Defined as goodwill (*gdwl*) in period *t-1*	Compustat Global
Ln(Age)	Defined as the natural log of company age	Orbis
Ln(Total Assets)	Defined as the natural log of total assets (*at*)	Compustat Global
OtherIntan	Defined as intangible assets (*intan*) less goodwill (*gwdl*) in period *t-1*	Compustat Global
MarketShare	Defined as total revenue for company *i* in year *t* to total revenue in the correnspondingFama-French 48 industry in year *t*	Compustat Global, Orbis
PPE	Defined as net property, plant, and equipment (*ppent*) in period *t-1*	Compustat Global
Revenue	Defined as revenues (*revt*) in period *t*	Compustat Global
R&D	Defined as net R&D calculated as a five year capitalization of R&D expenses (*xrd*) using weights. $R\&D = \sum_{t=-4}^{0}(1 + 0.2t) * RD_{exp}$	Compustat Global
SG&A	Defined as selling, general, and administrative expenses (*xsga*) in period *t*	Compustat Global

Table 15. **Variable Definitions**

Variable	Definition	Source
	Dependent variables	
CASHETR	Defined as cash taxes paid (*txpd*) divided by pretax book income before special items (*pi-spi*) in period *t*	Compustat Global
CASHETR2	Defined as cash taxes paid (*txpd*) in periods *t* and *t+1* divided by pretax book income before special items (*pi-spi*) in periods *t* and *t+1*	Compustat Global
CASHETR4	Defined as cash taxes paid (*txpd*) in periods *t* until *t+3* divided by pretax book income before special items (*pi-spi*) in periods *t* until *t+3*	Compustat Global
CASHETR ADJ	Defined as the difference between cash ETR for firm *i* and the mean cash ETR for the group of firms that belong in the corrensponding Fama-French 48 industry and asset-size quintile	Computstat Global, ORBIS
CASHTAX NC	Difference between cash taxes paid and corporate tax rate in country *i* multiplied by pretax income adjusted for special items, deflated by the market value of assets (*at + prcc_f * csho – seq*)	Compustat Global, OECD Stat
Dummy CASHETR	Equal one if the industry adjusted cash ETR is in the bottom quantile of a particular year. Industry adjustment differs from CASHETR ADJ in that asset-size quantile is not taken into account	Compustat Global, ORBIS
GAAP ETR	Defined as total tax expense (*txt*) divided by pretax book income before special items (*pi-spi)*	Compustat Global
LNPAY	Defined as the natural log of the sum of salary*(ctype1)*, bonus*(ctype2)* and other annual compensation*(ctype3)*	Capital IQ
Zero Profits Dummy	Defined using both a relative and a absolute measure. The relative measure equal one if pre-tax income before special items (*pi-spi*) is within ± revenue (*revt*) multiplied by 1%. The absolute measure equal one if pre-tax income before special items (*pi-spi*) is within ± $1 million USD	Compustat Global
	Independent Variables	
CAPEX	Defined as capital expeditures (*capx*) divided by gross property, plant, and equipment (*ppegt*)	Compustat Global
CASH	Defined as the ratio of cash holdings (*che*) to total assets (*at*)	Compustat Global
Corporate Tax Rate	Difference from average corporate tax rate in the sample. Utilizing yearly central government corporate tax rate.	OECD Stat, tradingeconomics.com

FSUBSIDI	Indicator coded to 1 if the company have one or more foreign subsidiaries with majority ownership and a minimum of 1 million USD in operational revenue	Orbis
INTANG	Defined as intangible assets (*intan*) divided by total assets (*at*)	Compustat Global
Lagged MASCORE	Managerial Ability Score developed by Demerjian et al. (2012) lagged by one year	Compustat Global, Orbis
LEVERAGE	Defined as total debt (*dltt + dlc*) divided by total assets (*at*)	Compustat Global
MASCORE	Managerial Ability Score developed by Demerjian et al. (2012)	Compustat Global, Orbis
MASCORE_CEOFE	CEO fixed effects coefficient computed from estimating Equation (6.1) on the subsmaple of CEOs who move across firms staying atleast two years with two separate firms	Capital IQ, Compustat Global, Orbis
MASCORE_MGFE	Manager fixed effects coefficient computed from estimating Equation (6.1) on the subsmaple of managers who move across firms staying atleast two years with two separate firms	Capital IQ, Compustat Global, Orbis
MASCORE_OTHER	Difference between MASCORE and MASCORE_CEOFE or MASCORE_MGFE	Capital IQ, Compustat Global, Orbis
MB	Defined as the ratio of martket value of common equity (*csho*prcc_f*) to book value of common equity (*ceq*). End of year stock price manually seperated from daily stock price (*prcc*)	Compustat Global
NOL_DECREASE	Indicator coded to one if NOL carry forward is availableand pretax income is positive in year *t*. NOL carry forward is calculated using EBIT and corporate tax rate, and we assume a NOL carry forward of zero for all firms coming into 2009	Compustat Global, OECD Stat
PTFCF	Defined as pretax free cash flows. Calculated as the ratio of (operating cash flows (*oancf*) – capital expeditures (*capx*) + cash taxes paid (*txpd*)) to total assets (*at*)	Compustat Global
PTROA	Defined as pretax book income (*pi*) deflated by total assets (*at*)	Compustat Global
R&D	Defined as the natural log of one pluss research and development expenses (*xrd*). Missing values are reset to zero following Koester et al. (2017)	Compustat Global
SIZE	Defined as the natural log of one pluss total assets (*at*)	Compustat Global

9.2 Appendix B. Descriptive Statistics

Table 16. **Descriptive Statistics: MASCORE Variables**

	N	Mean	P50	SD	P25	P75
DEA variables						
Revenue	36,638	2,016,464	178,782	6,357,290	35,381	931,551
CoGS	36,638	1,233,782	103,786	3,936,881	19,016	532,167
SG&A	36,638	267,902	23,257	847,458	4,169	121,831
PPE	36,638	687,066	38,797	2,406,150	4,892	240,138
R&D	36,638	77,826	0	394,126	0	7,022
Goodwill	36,638	345,631	4,511	1,360,185	0	69,626
OtherIntan	36,638	194,113	3,459	841,403	245	35,539
Tobit variables						
Ln(Total Assets)	36,638	12.3680	12.2379	2.2420	10.7989	13.8582
MarketShare	36,638	0.0115	0.0009	0.0426	0.0001	0.0053
Free Cash Flow Indicator	36,638	0.7209	1.0000	0.4486	0.0000	1.0000
Ln(Age)	36,638	3.4285	3.3322	0.8711	2.8332	4.0775
Business Segment Concentration	36,638	0.2657	0.0000	0.5972	0.0000	0.0000
Foreign Currency Indicator	36,638	0.6681	1.0000	0.4709	0.0000	1.0000

Notes. This table presents descriptive statistics for variables used in MASCORE estimation. All continuous variables are winsorized at the 1st and 99th percentiles (pooled), and all variables defined in Appendix A.

Table 17. **Descriptive Statistics: Primary Model Variables by Year**

Year	N	CETR	MASCORE	R&D	CAPEX	LEV	FOREIGN	SIZE	INTANG	NOL_D
2009	1,343	0.304	-0.023	4.134	0.101	0.222	0.703	13.582	0.196	0.032
2010	1,634	0.259	-0.059	4.214	0.102	0.216	0.692	13.530	0.192	0.116
2011	1,659	0.272	-0.018	4.462	0.111	0.213	0.703	13.623	0.198	0.081
2012	1,719	0.291	-0.029	4.521	0.102	0.211	0.709	13.527	0.199	0.072
2013	1,705	0.278	-0.024	4.410	0.103	0.209	0.703	13.549	0.201	0.077
2014	1,793	0.269	-0.046	4.313	0.102	0.212	0.689	13.477	0.196	0.083
2015	1,882	0.262	-0.070	4.234	0.100	0.213	0.690	13.309	0.195	0.094
2016	1,945	0.252	-0.052	4.190	0.098	0.223	0.685	13.345	0.201	0.086
2017	1,924	0.243	-0.019	4.181	0.096	0.219	0.679	13.417	0.204	0.085
2018	879	0.238	-0.002	5.282	0.097	0.242	0.752	14.279	0.236	0.056
Total	1,705	0.267	-0.036	4.348	0.101	0.217	0.697	13.519	0.200	0.081

Notes. This table presents descriptive statistics for our main regression variables by year. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A.

Table 18. **Descriptive Statistics: Primary Model Variables by Country**

Country	N	CETR	MASCORE	R&D	CAPEX	LEV	FOREIGN	SIZE	INTANG	NOL_D
Austria	266	0.259	0.035	7.137	0.103	0.225	0.936	14.007	0.105	0.068
Belgium	370	0.269	0.089	6.085	0.078	0.228	0.946	14.072	0.196	0.049
Bulgaria	105	0.155	-0.045	0.461	0.064	0.290	0.381	11.801	0.054	0.057
Croatia	147	0.230	-0.029	0.380	0.045	0.215	0.388	12.789	0.050	0.102
Cyprus	139	0.228	-0.054	0.824	0.073	0.289	0.439	12.456	0.046	0.151
Czech Republic	46	0.187	0.064	0.745	0.070	0.104	0.696	13.370	0.099	0.065
Denmark	359	0.283	0.005	5.061	0.086	0.234	0.889	13.612	0.224	0.106
Estonia	85	0.178	0.001	1.597	0.056	0.204	0.741	12.164	0.132	0.165
Finland	575	0.298	0.014	6.705	0.095	0.227	0.854	13.405	0.215	0.106
France	1,660	0.314	0.006	4.504	0.124	0.229	0.849	14.187	0.254	0.057
Germany	1,974	0.304	-0.045	6.633	0.109	0.194	0.808	13.569	0.182	0.094
Greece	371	0.372	0.018	2.121	0.079	0.268	0.526	12.512	0.070	0.146
Hungary	45	0.185	-0.069	5.291	0.082	0.160	0.644	13.529	0.078	0.044
Iceland	40	0.193	-0.066	3.215	0.092	0.285	0.525	13.052	0.330	0.075
Ireland	170	0.182	-0.069	4.423	0.073	0.227	0.947	14.426	0.253	0.024
Isle Of Man	26	0.134	0.153	5.540	0.173	0.114	0.846	13.212	0.318	0.000
Italy	681	0.400	-0.252	4.211	0.076	0.273	0.769	13.963	0.227	0.116
Jersey	100	0.219	0.031	1.984	0.111	0.271	0.770	14.819	0.332	0.000
Latvia	43	0.222	0.062	2.109	0.069	0.112	0.326	10.772	0.056	0.186
Lithuania	100	0.149	0.114	0.616	0.093	0.170	0.420	11.701	0.023	0.170
Luxembourg	148	0.257	0.008	3.499	0.110	0.238	0.845	14.432	0.194	0.007
Malta	43	0.249	0.143	2.906	0.120	0.220	0.465	12.292	0.176	0.023
Netherlands	528	0.232	-0.092	4.994	0.097	0.234	0.837	14.415	0.272	0.070
Norway	355	0.262	0.147	4.188	0.109	0.280	0.704	14.071	0.187	0.099
Poland	1,211	0.229	-0.010	1.474	0.123	0.167	0.312	11.884	0.118	0.107
Portugal	171	0.279	0.012	1.693	0.062	0.337	0.766	14.224	0.240	0.035
Romania	115	0.219	0.040	0.744	0.083	0.134	0.183	11.694	0.019	0.087
Russia	558	0.279	-0.123	1.395	0.095	0.294	0.382	14.566	0.045	0.095
Serbia	31	0.223	0.021	2.040	0.076	0.194	0.645	12.893	0.016	0.000
Slovakia	26	0.256	-0.051	1.772	0.084	0.149	0.923	12.978	0.155	0.231
Slovenia	61	0.281	0.004	2.721	0.044	0.269	0.820	13.399	0.064	0.066
Spain	472	0.282	-0.046	3.235	0.091	0.276	0.754	14.294	0.178	0.102
Sweden	840	0.249	-0.040	4.897	0.103	0.210	0.894	13.281	0.306	0.093
Switzerland	726	0.249	-0.079	7.556	0.079	0.176	0.894	14.321	0.190	0.055
Turkey	714	0.213	-0.170	3.700	0.091	0.206	0.308	12.781	0.044	0.105
United Kingdom	3,182	0.234	-0.032	4.360	0.111	0.195	0.657	13.430	0.289	0.051
Total	1,358	0.267	-0.036	4.348	0.101	0.217	0.697	13.519	0.200	0.081

Notes. This table presents descriptive statistics for our main regression variables by country. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A.

Table 19. **Descriptive Statistics: Primary Model Variables by Industry**

Industry	N	CETR	MASCORE	R&D	CAPEX	LEV	FOREIGN	SIZE	INTANG	NOL_D
aero	116	0.210	-0.083	11.105	0.081	0.180	0.897	15.690	0.207	0.103
agric	209	0.269	-0.022	1.516	0.083	0.161	0.584	12.619	0.075	0.057
autos	399	0.248	-0.048	8.812	0.081	0.262	0.772	14.542	0.110	0.075
beer	294	0.235	-0.088	1.838	0.063	0.267	0.636	14.304	0.224	0.017
bldmt	732	0.290	-0.107	4.618	0.066	0.209	0.682	13.374	0.149	0.070
books	335	0.296	-0.128	1.779	0.077	0.263	0.496	13.617	0.420	0.122
boxes	133	0.249	-0.151	4.535	0.067	0.256	0.925	13.747	0.128	0.053
bussv	2,503	0.282	0.027	3.870	0.159	0.167	0.739	12.713	0.339	0.080
chems	514	0.250	-0.084	6.988	0.072	0.226	0.759	13.964	0.142	0.041
chips	647	0.264	-0.033	8.170	0.111	0.168	0.898	12.980	0.190	0.124
clths	258	0.283	-0.079	3.442	0.114	0.160	0.826	13.233	0.186	0.085
cnstr	648	0.271	0.075	1.590	0.112	0.202	0.610	14.161	0.122	0.111
coal	36	0.281	-0.113	0.775	0.112	0.238	0.361	13.712	0.040	0.167
comps	101	0.249	-0.080	7.118	0.185	0.205	0.594	12.528	0.281	0.059
drugs	477	0.259	-0.082	9.637	0.084	0.185	0.841	14.346	0.271	0.090
eleq	243	0.266	-0.057	5.630	0.087	0.173	0.543	12.461	0.093	0.070
enrgy	502	0.294	0.050	3.403	0.107	0.235	0.759	15.322	0.087	0.139
fabpr	78	0.282	-0.111	3.718	0.077	0.229	0.423	13.191	0.147	0.051
food	600	0.239	-0.069	4.443	0.075	0.249	0.670	13.515	0.178	0.045
fun	270	0.255	0.001	1.659	0.116	0.229	0.578	12.876	0.332	0.144
gold	64	0.255	-0.009	1.073	0.119	0.121	0.750	13.866	0.083	0.094
hlth	130	0.273	-0.096	1.280	0.077	0.313	0.531	13.042	0.255	0.092
hshld	433	0.285	-0.105	6.682	0.090	0.211	0.758	13.465	0.158	0.074
labeq	162	0.215	-0.151	9.962	0.108	0.199	0.815	13.536	0.274	0.062
mach	899	0.298	-0.071	7.675	0.086	0.188	0.802	13.274	0.153	0.116
meals	309	0.239	-0.010	0.340	0.083	0.260	0.583	13.444	0.134	0.049
medeq	187	0.259	-0.142	7.180	0.112	0.182	0.872	13.417	0.321	0.053
mines	230	0.260	-0.029	3.351	0.095	0.215	0.717	14.900	0.071	0.048
misc	23	0.300	-0.223	1.415	0.105	0.161	0.565	12.206	0.183	0.174
paper	339	0.258	-0.070	4.809	0.052	0.248	0.761	13.477	0.135	0.068
persv	111	0.274	-0.116	2.311	0.115	0.239	0.441	12.296	0.232	0.081
rtail	710	0.261	-0.033	1.482	0.104	0.210	0.658	13.897	0.191	0.044
rubbr	264	0.265	-0.073	6.534	0.075	0.226	0.727	12.652	0.126	0.034
ships	68	0.325	-0.084	7.155	0.096	0.218	0.765	13.945	0.107	0.265
smoke	42	0.192	-0.220	4.192	0.077	0.328	0.881	15.431	0.303	0.000
soda	157	0.223	-0.156	4.210	0.073	0.225	0.643	13.502	0.222	0.045
steel	383	0.278	-0.023	5.182	0.073	0.249	0.676	14.012	0.062	0.133
telcm	828	0.256	-0.061	3.646	0.107	0.277	0.595	14.279	0.305	0.054
toys	123	0.228	-0.088	4.839	0.131	0.218	0.480	12.344	0.192	0.106
trans	908	0.248	0.053	1.518	0.091	0.291	0.642	14.165	0.143	0.065
txtls	173	0.262	-0.084	3.383	0.081	0.218	0.451	11.827	0.059	0.168
whlsl	845	0.264	0.002	1.989	0.096	0.230	0.625	12.883	0.155	0.076
Total	835	0.267	-0.036	4.348	0.101	0.217	0.697	13.519	0.200	0.081

Notes. This table presents descriptive statistics for our main regression variables by industry. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A.

9.3 Appendix C. Unreported Control Variables

Table 20. **All control variables included for Table 8 Panel A**

Panel A: Control variables									
		(1) Controlling for distortion by control variables		(2) Controlling for profitability		(3) Controlling for growth opportunities		(4) Controlling for cash flow and holdings	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?	**-0.0911*** **	**-4.12**	**-0.0298***	**-1.86**	**-0.0795*** **	**-4.02**	**-0.0765*** **	**-3.82**
PTROA	-			-1.2224***	-18.48				
MB	-					-0.0014	-1.52		
PTFCF	?							-0.2071***	-5.38
CASH	?							-0.0920*	-2.09
R&D	-			0.0008	0.65	0.0010	0.77	0.0009	0.73
CAPEX	-			0.0867**	2.87	0.0210	0.66	-0.0316	-1.23
LEVERAGE	-			0.0415	1.05	0.2172***	5.67	0.1932***	4.53
SIZE	?			0.0011	0.09	0.0100	0.92	0.0072	0.60
INTANG	-			0.0315	0.72	0.0967*	2.21	0.0773	1.64
NOL_DECREASE	-			-0.0372**	-3.02	-0.0210	-1.59	-0.0232*	-1.86
Fixed effects		Firm and country-year		Firm and country-year		Firm and country-year		Firm and country-year	
St.errors clustered by		Firm and year		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.3170		0.3789		0.3260		0.3280	
N		16,483		16,483		15,574		16,482	

Notes. This table presents the results of differing robustness tests. ETR measures are winsorized at [0,1] and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. Managerial ability coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

Table 21. **All control variables included for Table 8 Panel B**

Panel B: Alternative definitions of tax avoidance							
		(1) Y = CASHTAX_NC		(2) Y = CASHETR_ADJ		(3) Y = GAAP ETR	
	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?	**-0.0035*** **	**-4.68**	**-0.0627*** **	**-3.92**	**-0.0193** **	**-2.26**
R&D	-	0.0000	0.66	0.0009	0.79	0.0013	1.23
CAPEX	-	0.0001	0.07	0.0173	0.60	-0.0508*	-2.17
LEVERAGE	-	0.0068***	5.37	0.1934***	5.21	0.0777***	3.90
SIZE	?	0.0003	0.86	0.0066	0.66	-0.0123*	-1.88
INTANG	-	0.0034**	2.36	0.1016**	2.39	0.0043	0.16
NOL_DECREASE	-	-0.0016***	-3.43	-0.0158	-1.36	0.0211	1.78
Fixed effects		Firm and country-year		Firm and country-year		Firm and country-year	
St.errors clustered by		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.4345		0.2990		0.3654	
N		15,573		16,483		16,482	

Notes. This table presents the results of differing robustness tests. ETR measures are winsorized at [0,1] and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. Managerial ability coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

Table 22. **All control variables included for Table 9 Panel A and B**

		Panel A: Lagged MASCORE						Panel B: Concurrent and lagged MASCORE					
		(1) Baseline		(2) Including industry fixed effects		(3) Including firm fixed effects		(1) Baseline		(2) Including industry fixed effects		(3) Including firm fixed effects	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE	?							-0.0408**	-2.57	-0.0452**	-2.82	-0.0740**	-3.22
Lagged MASCORE	?	**-0.0241***	**-2.22**	**-0.0307****	**-2.78**	**-0.0261***	**-2.01**	0.0031	0.32	-0.0023	-0.26	-0.0251*	-2.04
SUM MASCORE	?							**-0.0377****		**-0.0475****		**-0.0991*****	
R&D	-	-0.0009*	-1.87	-0.0007	-1.33	0.0006	0.39	-0.0010*	-1.97	-0.0008	-1.39	0.0006	0.44
CAPEX	-	-0.0436	-1.73	-0.0584**	-2.33	0.0051	0.17	-0.0405	-1.62	-0.0561*	-2.24	0.0119	0.39
LEVERAGE	-	0.0521**	3.28	0.0671***	4.04	0.2074***	4.48	0.0513**	3.26	0.0666***	4.03	0.2090***	4.52
FOREIGN	-	0.0005	0.06	-0.0027	-0.31	0.0000	0.00	0.0003	0.04	-0.0030	-0.34	0.0000	0.00
SIZE	?	-0.0040*	-2.16	-0.0047**	-2.42	0.0083	0.63	-0.0041*	-2.21	-0.0048**	-2.48	0.0079	0.60
INTANG	-	0.0296	1.83	0.0373*	2.18	0.1134**	2.51	0.0264	1.60	0.0331*	1.94	0.0965*	2.27
NOL_DECREASE	-	-0.0259*	-1.97	-0.0334**	-2.54	-0.0633**	-2.97	-0.0256*	-1.95	-0.0332**	-2.54	-0.0646**	-3.00
Fixed effects		Country-year		Industry and country-year		Firm and country-year		Country-year		Industry and country-year		Firm and country-year	
St. errors clustered by		Firm and year		Firm and year		Firm and year		Firm and year		Firm and year		Firm and year	
Adjusted R^2		0.0640		0.0738		0.3642		0.0646		0.0745		0.3655	
N		11,657		11,657		11,657		11,657		11,657		11,657	

Notes. This table presents the results from estimating OLS regressions on Equation (3.1). In Panel A, we use lagged MASCORE. In panel B, we use both concurrent and lagged MASCORE. Sum MASCORE is not included in the regressions but is tested for joint significance using a Wald test. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. MASCORE coefficients and t-statistics of interest are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm and year.

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).

Table 23. **All control variables included for Table 10**

		Panel A: Manager Fixed Effects				Panel B: CEO Fixed Effects	
		(1) Executive-year-level		(2) Firm-year-level		(1) Executive-year-level	
Dep. Var: CASHETR	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
MASCORE_MGFE	?	**-0.7312*** **	**-6.79**	**-0.6442** **	**-2.86**	**-0.5337***	**-2.05**
MASCORE_OTHER	?	0.0149	0.21	-0.0093	-0.14	0.2215	0.98
R&D	-	0.0027	1.01	0.0015	0.53	0.0044	0.57
CAPEX	-	-0.0009	-0.01	0.0160	0.14	0.2307	1.79
LEVERAGE	-	0.5430***	3.44	0.5689***	3.84	0.9699*	2.06
SIZE	?	-0.0917*	-1.99	-0.1033**	-2.90	-0.3080**	-2.52
INTANG	-	0.1349	1.50	0.1474*	1.93	0.6129	1.58
NOL_DECREASE	-	0.0643	0.92	0.0647	1.01	0.4155*	1.89
Fixed effects		Firm and country-year		Firm and country-year		Firm and country-year	
St. errors clustered by		Manager and year		Firm and year		CEO and year	
Adjusted R^2		0.4664		0.3942		0.0892	
N		1,061		885		252	

Notes. This table presents the results from estimating OLS regressions on Equation (3.1) using decomposed MASCOREs. In Panel A, MASCORE is decomposed using manager fixed effects. In panel B, MASCORE is decomposed using CEO fixed effects. ETR measures winsorized at [0,1], and all continuous variables are winsorized at the 1st and 99th percentiles (pooled). All variables defined in Appendix A. Fixed effects MASCORE coefficients and t-statistics are presented in bold. Standard errors are adjusted for heteroskedasticity and two-way clustered by firm or manager and year.

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests).