# Macroeconomic effects of corporate tax policy*

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**Abstract**

Prior studies on the relation between corporate taxes and future macroeconomic growth present contradictory evidence. We argue this mixed evidence is at least partly due to the use of statutory corporate tax rates which ignore the complexity of tax exemptions, tax deductions, tax enforcement and firms' tax planning. We propose an alternative tax rate measure that aggregates cash effective tax rates of listed firms, which reflect not only statutory tax rates, but also other features of the tax code, enforcement, and firms' tax planning. We find a strong robust negative relation between country-level effective tax rates and future macroeconomic growth.

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## 1. Introduction

How does corporate tax policy affect macroeconomic growth? This issue has been the focal point of a number of theoretical and empirical macroeconomic studies and has recently attracted significant U.S. media attention due to the current tax reforms. In this study, we investigate whether and how corporate tax incentives, tax enforcement policies (which encompasses the complexity of tax credits, tax exemptions and tax deductions as well as tax enforcement aimed at mitigating firms' tax planning), statutory tax rates and firms' tax planning as captured by an aggregate country-level measure of effective tax rates, matter for macroeconomic growth.

A significant number of academic studies have devoted resources to examining the impact of corporate tax policies on the macroeconomy in a cross-country setting. However, empirical evidence from this literature is at best mixed (e.g. Angelopolous et al. 2007, Huang and Frentz 2014). We propose that the mixed evidence in prior literature is at least partly due to its almost exclusive focus on statutory tax rates. In specific, prior studies on corporate taxes typically ignore the effects of tax incentives, tax enforcement and firms' tax planning on macroeconomic growth. Other papers study the role of corporate tax collections, rather than just focusing on statutory tax rates, in affecting macroeconomic growth and use aggregate corporate taxes paid divided by aggregate corporate profits from national income accounts. However, profits in national income accounts are based on taxable income thus this measure approximates the top statutory tax rate with potential adjustments for tax credits. Thus, this measure ignores non-credit tax incentives such as bonus depreciation, tax enforcement, and firms' tax planning.[1]

[1] The importance of considering tax credits, incentives and tax planning in evaluating tax policies has not gone unnoticed in the macroeconomics literature. For instance, Mendoza et al. (1994) point out: "*Although there have been significant advances in the development of quantitative methods for studying complex intertemporal models, empirical studies in this area are still lacking reliable measures of actual aggregate tax rates on factor incomes and consumption. These tax rates are necessary both to develop quantitative applications of the theory and to help transform the theory into a policy-making tool. Thus, in this context, it seems that the rewards for making*

Moreover, incentives of firms to engage in tax planning are clearly correlated to statutory tax rates with higher statutory tax rates creating greater incentives for firms to engage in tax planning to reduce their taxes. Also, regimes with higher statutory tax rates are likely to offer more tax incentives, which could justify the reason for the higher tax rate in the first place. These arguments suggest that ignoring tax incentives and tax enforcement is unlikely to be innocuous and could introduce an omitted correlated variables problem.

The main objective of our study is to develop an aggregate corporate tax rate measure that encompasses the entirety of corporate tax policies, tax enforcement and firms' tax planning activities and to evaluate its importance relative to a unidimensional measure, viz. corporate statutory tax rates, for predicting economic growth and its importance in prior studies' conclusions. Additionally, we investigate whether the relationship between our corporate tax rate measure and future economic growth is causal by employing instruments for our aggregate corporate tax rate measure and by proposing and testing a mechanism through which corporate taxes matter for economic growth.

We compute our aggregate corporate tax rate measure, a country-level effective tax rate, using a bottom-up approach from firm-level financial data of all publicly listed firms in each country. Specifically, we compute this measure as the total asset weighted average of the firm-year level cash effective tax rate (ETR) where ETR is defined as cash taxes paid divided by pretax book income. As our measure is based only on publicly listed firms that, in numbers, form a small part of each country's economy, ex-ante, it is unclear whether cash effective tax rates aggregated across listed firms better capture the actual tax burden faced by all corporations in an economy as compared to statutory tax rates. Moreover, since the importance

*progress in the measurement of aggregate tax rates could be considerable."* Also, Riera-Crichton et al. (2016) point out that the macroeconomics literature has "rarely addressed" the implications of tax policy measurement.

of the listed sector varies from country to country, this could add further noise when this variable is analyzed across countries.

We empirically examine the relation between our aggregate corporate effective tax rate measure (hereafter, *Aggregate ETR*) and future economic growth, measured either as real GDP growth (hereafter, *Real GDP growth*) or employment growth, in a cross-country setting that covers 63 countries over the period 1995-2013. Our regressions include statutory tax rates as a control variable, and therefore the aggregate corporate effective tax rate measure captures the incremental effect of tax credits, tax exemptions, deductions, tax enforcement, and firms' tax planning activities that are not reflected in the statutory tax rates (STR).

Our main analyses reveal a negative relation between aggregate ETR and future macroeconomic growth, but a weak and non-robust relation between statutory tax rates and future growth. In terms of economic significance, a one standard deviation increase in *Aggregate ETR* (0.081) is associated with a decrease in future *Real GDP growth* of 0.6% and a decrease in future *Employment growth* of 0.2%. These results are economically meaningful given that the average one-year-ahead *Real GDP growth* rate in our sample is 3.3% and the average one-year-ahead *Employment growth* rate is 0.2%. We find that this relation is robust to a variety of additional controls, fixed effect choices, to estimating regressions in changes specification and to employing a two-stage instrumental variables (IV) approach. Our results consistently suggest that aggregate ETR subsumes the explanatory ability of STR for future growth, implying that macroeconomic growth is affected by the entirety of a country's corporate tax policy (including the STR) and its firms' tax planning activities and that a more comprehensive measure, viz. aggregate ETR, better captures these corporate tax effects.

To further establish causality, we propose and evaluate one potential mechanism through which aggregate ETRs affect future macroeconomic growth. We suggest that lower ETRs improve economic growth if businesses make more growth-oriented investments as compared

to governments. Unlike profit and growth-oriented corporations, governments' objectives also include social welfare, redistribution of wealth, and political. Thus, to the extent private-sector firms invest their tax savings more efficiently than governments, one would observe a negative relation between aggregate ETRs and future macroeconomic growth.[2]

We assess the above proposition in two ways: (i) by partitioning the sample countries into two groups based on government control of corruption and (ii) by examining the relationship between aggregate ETRs and components of future real GDP growth. We find that the negative relation between aggregate ETRs and economic growth is primarily observed in countries with poor government control of corruption, implying that lower corporate tax burdens aid macroeconomic growth when corruption diverts government funds away from economic growth. We also find that aggregate ETRs impact mainly business investment and personal consumption components of future real GDP growth, which are in line with our conjecture.

We finally provide evidence on whether the growth benefits of lower aggregate ETRs arise from corporations responding to government's tax incentives or aggressively exploiting ambiguities in tax rules. Towards this, our first analysis splits the sample countries into groups based on the likelihood that low aggregate ETRs occur through aggressive tax planning. Both country-level and firm-level analyses reveal that the growth-benefits of low aggregate ETRs occur mainly in countries where firms engage in aggressive tax planning. As an alternative test, we use financial constraint of a firm as an instrument for tax planning, as Edwards, Schwab, and Shevlin (2016) show that financially constrained firms engage in more tax planning activities. We find that the link between aggregate ETRs and future economic growth is mainly

[2] To clarify the timing of potential effects, we expect current year's tax savings to impact next year's investment plans. Since business investment is an important component of GDP, this implies current year's tax savings affect next year's macroeconomic growth (i.e., real GDP growth or employment growth). It is also important to note that we are not suggesting that tax planning or low ETRs create new investment or growth opportunities. But rather that low ETRs can facilitate economic growth by making more funds available for firms to invest when such opportunities exist.

driven by firms that are financially constrained – a finding that is hard to reconcile with an explanation based on government tax incentives. These conclusions are also in line with our finding that aggregate ETRs are associated with macroeconomic growth mainly in countries with poor control of corruption, as incentives offered by corrupt governments are more likely to be opportunistic than for stimulating the economy.

Our paper contributes to the macroeconomics literature that examines whether corporate tax rates affect economic growth by introducing a new measure of country-level corporate tax rates. Apart from showing that corporate effective tax rates matter for economic growth, we also provide evidence on why this occurs. Our results overturn some established evidence in the macroeconomics literature.

Our paper adds to the burgeoning macro-accounting literature. While existing studies in this literature (viz., Shivakumar, 2007, Konchitchki and Patatoukas 2014a,b, Gallo et al. 2016, Shivakumar and Urcan 2017) primarily focus on the macro information in accounting earnings, we show that aggregate country-level effective tax rates, also contain information about future macroeconomic growth. Although macro-economists have largely ignored information in accounting numbers, our study and other macro-accounting studies show that accounting numbers can provide timely signals of macro-performance that are incremental to other macro data, such as those provided by Bureau of Economic Analysis or Bureau of Labor Statistics.

Our paper also contributes to the literature examining the economic consequences of corporate tax planning. This literature provides mixed evidence on the impact of firm-level corporate tax planning on firm's equity market returns and future performance (e.g., Desai and Dharmapala, 2009; Wilson, 2009; Hanlon and Slemrod, 2009; Katz et al, 2013; Mironov, 2013; Blaylock, 2016). By extending the firm-level effective tax measure to the aggregate macroeconomic level, we contribute to this line of research and also help bridge the gap

between firm-level studies and macro-level studies examining the effects of tax policies on future macroeconomic growth.

## 2. Related studies and hypothesis development

### *2.1. Prior literature*

Prior empirical evidence on the effect of corporate taxes on macroeconomic growth is at best mixed (e.g. Angelopolous et al. 2007, Huang and Frentz 2014). Lee and Gordon (2005) examine a sample of seventy countries over the period 1980-1997 and find that statutory corporate tax rates are significantly and negatively associated with economic growth rates. Examining the effect of a variety of taxes (e.g., corporate, personal, consumption, and property taxes) on economic growth among OECD countries, Arnold et al. (2011) find that corporate taxes harm the economic growth the most mainly due to their effect on total factor productivity and investment. Mertens and Ravn (2013) use narrative records such as presidential speeches and Congressional reports in the U.S. to exogenously identify shifts in tax policy and find that cuts to corporate tax rates increase private sector investments and improve GDP growth.

In contrast to the above findings, Harberger (1964) and Mendoza et al. (1997) evaluate the effect of direct and indirect taxes on economic growth and conclude that tax policy is an ineffective instrument to influence growth. Easterly and Rebelo (1993) find tax rates on capital income (measured as taxes on labor income, corporate profits and capital gains/GDP) to be insignificantly related to GDP growth once initial income levels of a country are controlled for.[3] After controlling for simultaneity in the relation between growth and fiscal policies, Agell et al. (1997) report an insignificant relation between total taxes (as a share of GDP) and growth. Further, in line with some earlier studies, Angelopolous et al. (2007) document a negative

[3] Some macroeconomic studies, such as Easterly and Rebello (1993) and Mendoza et al. (1997), study the combined effects of taxes on labor income, capital gains and corporate profits. But the economic-growth effects of personal taxes differ from those of corporate taxes, as each tax structure has a different effect on firms and households' economic decisions (OECD, 2010). Therefore, these studies do not directly speak to the growth effects of corporate taxes.

relation between total taxes (as a share of GDP) and economic growth. However, when they disaggregate total taxes and focus on corporate taxes, they find statutory tax rates to be weakly positively associated with economic growth. Widmalm (2001) report a similar positive relation between corporate tax revenues (as share of total tax revenues) and economic growth.

### *2.2. Hypothesis development*

#### 2.2.1. Effective tax rates versus statutory tax rates

One possible explanation for the mixed findings on the effect of corporate tax rates on future macroeconomic growth in the prior literature is that these studies employ noisy proxies for the tax burden faced by corporations. Most of these studies use the top corporate statutory tax rate in a country to measure corporate tax burden, which is relatively simplistic and, as it ignores tax deductions, credits, incentives and tax planning, is not necessarily reflective of the actual rate of taxes paid by firms on their economic earnings.[4] This is an important concern, as countries with higher corporate tax rates might allow more tax incentives, justifying the existence of higher tax rates in the first place. This questions the basic premise of prior studies that firms in higher statutory corporate tax rate countries pay greater taxes. Also, as incentives to tax plan and take advantage of government's tax incentives are greater when statutory corporate tax rates are higher. Therefore, analyses that ignore the effects of tax credits/incentives and tax planning are likely to suffer from omitted correlated variables problems.

We address this problem by developing an aggregate measure of effective tax rates, cash taxes paid divided by pretax book income, using a bottom-up approach as done in prior studies of aggregate earnings (e.g., Kothari, Lewellen and Warner 2006, Shivakumar, 2007, Konchitchki and Patatoukas 2014a,b). The macro-accounting studies have shown, primarily in

[4] While some studies (e.g., Mertens and Ravn 2013) have used aggregate corporate taxes paid divided by aggregate corporate profits from national income accounts to measure the actual rate at which firms pay their taxes, profits in national income accounts are based on taxable income with adjustments and not financial (book) accrual-based profits and thus essentially this measure approximates statutory tax rates (possibly adjusted for tax credits).

the U.S context, that aggregating firm-level data in financial reports provides incremental information about macroeconomic performance.

Our ETR measure uses data from only publicly listed firms and since the importance of publicly listed firms vary across countries, it is possible that aggregating effective tax rates across listed firms might not improve upon statutory corporate tax rates in a cross-country setting aimed at investigating the growth effect of corporate taxes.

Thus, our main hypothesis stated in the null from is that:

***H1:*** Aggregate effective tax rates of publicly listed firms contain no incremental information about future macroeconomic growth over those reflected in statutory tax rates.

The alternative prediction to H1 is that aggregate effective tax rates of publicly listed firms, but not necessarily statutory tax rates, negatively predict future macroeconomic growth. This alternative is based on the presumption that private sector firms are more efficient than the government in investing for economic growth. (Throughout, 'investment efficiency' refers to the ability of investments to drive future economic growth). If firms invest funds saved through lower taxes in productive activities within the economy, then lower ETRs would lead to greater future economic growth. However, such economic growth would also be achieved if government limits firms tax planning activities and invests the resultant tax collections in growth-oriented or productivity-enhancing activities (such as in infrastructure, education, utilities, legal system).[5] Note that we are not suggesting that corporations and governments necessarily invest in the same activities, although some government spending could substitute for corporate sector investments (e.g., energy production and distribution, transportation). If

[5] These expenditures are labeled productive government expenditures by Kneller et al. (1999) and Angelopoulus et al. (2007). Specifically, education, health, and housing expenditures are classified as productive government expenditures because they increase the size and productivity of the labor force, defense, transport and communication. General public services expenditures are also classified as productive government spending because some of the expenditures increase the size and productivity of the labor force increasing growth. Social security and welfare expenditures, expenditure on recreation and on economic services are classified as unproductive government services (Kneller et al. 1999).

government investments are as efficient in enhancing growth as those made in the private sector, then we expect little relation between ETRs and future economic growth. This is because, in such a case, economic growth would be invariant to whether it is fueled by investments made by private firms (using tax savings) or by governments (using funds collected through limiting tax deductions or enforcing tax rules rigorously). We conduct several tests to provide evidence on the veracity of this assumption.

2.2.2. Tax incentives versus tax planning as an explanation

Evidence supporting the alternative hypothesis to H1 can stem either from tax laws that allow tax deductions and tax credits or more aggressive tax planning activities by managers. In other words, lower aggregate ETRs could arise from either governments intentionally offering tax incentives to firms to undertake investments (via accelerated depreciation, bonus depreciation, investment and R&D tax credits) or from governments loosely enforcing tax rules, creating incentives for firms to aggressively tax plan to exploit ambiguities in tax laws in unintended ways. Both these alternatives for reduced corporate tax payments could explain potential associations between corporate ETRs and future economic growth. For instance, government tax incentives could stimulate firms' investment activities which in turn lead to future economic growth. Alternatively, firms' aggressive tax planning could temper the adverse consequences of inefficient or corrupt governments and channel resources towards more growth-oriented activities.

These arguments lead us to our second hypothesis, which stated in the null form, is:

***H2:*** The effect of aggregate ETRs on future macroeconomic growth equally arises from both government's tax incentives and aggressive corporate tax planning.

## 3. Research design and sample selection

### *3.1. Research design*

We estimate the following OLS model to examine the association between aggregate effective tax rates and country-level macroeconomic growth:

$$Growth_{it+1} = \alpha_0 + \alpha_1 Aggregate\ ETR_{it} + \alpha_2 Statutory\ tax\ rate_{it} + \alpha_3 Control\ variables_{it} + Country\ fixed - effects + Year\ fixed - effects + error \quad (1)$$

where $Growth_{it+1}$ is either *Real GDP* or *Employment growth* for country i from year t to year t+1. We specifically focus on two widely-used measures of economic growth, namely, real GDP growth and employment growth. *Real GDP growth* is the proportional annual change in real GDP measured at constant 2011 prices, while *Employment growth* is measured as the annual change in percentage of population employed. All macroeconomic data are obtained from Penn World Tables. We obtain identical conclusions using real GDP per capita growth as an alternative growth measure. The main variables of interest in the above regression are aggregate corporate cash effective tax rates (*Aggregate ETR$_{it}$*) and the top statutory corporate tax rate (*Statutory tax rate$_{it}$*) in year t for country i.[6] To compute *Aggregate ETR$_{it}$*, we first measure firm-level cash effective tax rates as:

$$Firm - level\ ETR_{jt} = \frac{CTP_{jt}}{PTEBX_{jt}} \quad (2)$$

where *CTP$_{jt}$* is cash paid for taxes for firm j in year t (Thomson Reuters Eikon item Cash Taxes Paid) and *PTEBX$_{jt}$* is the pre-tax earnings before special items for firm j in year t (Thomson Reuters Eikon[7] item Net Income before Taxes – Total Special Items). Consistent with prior literature examining firm-level tax planning (for example, Chen et al. 2010), we exclude

[6] The statutory tax rate reflects the top marginal rate when a progressive rate structure is used. We hand-collect statutory corporate tax rate information from KPMG global tax tools and resources, Organization for Economic Co-operation and Development (OECD) Tax Database and various governmental internet resources. These rates include state and province level statutory corporate tax rates.

[7] We obtain firm-specific financial information from the Thomson Reuters' Eikon platform instead of the Compustat database due to more extensive data coverage of Eikon. Data coverage is better in Eikon than Compustat even for the U.S. Our results remain qualitatively similar when we conduct our analyses with observations from Compustat but our sample size decreases by 137 country-year observations.

observations with negative $PTEBX_{jt}$ as well as negative $CTP_{jt}$ (i.e., tax refunds), as negative values of effective tax rates are difficult to economically interpret. We also constrain *Firm-level ETR* to be less than 1 to eliminate outliers. We use cash taxes paid rather than total accrued tax expense as deferred tax payments represent current period cash tax savings. We then calculate our aggregate ETR measure by computing asset-weighted averages of *Firm-level* $ETR_{jt}$ across all firms head-quartered in country i for year t. Because Equation (1) includes *Statutory tax rate*$_{it}$, *Aggregate* $ETR_{it}$ captures the incremental effect of tax credits, exemptions, deductions specific to taxable income, enforcement, and firms' tax planning activities that are not reflected in the statutory tax rate. If aggregate ETRs incrementally matter for future macroeconomic growth as predicted in the alternative to H1, we expect $\alpha_1$ to be significantly negative. Instead of including aggregate ETR, we could have alternatively defined our tax measure as the difference between the STR and ETR (i.e., STR – ETR). However, as shown in the appendix, regressions that include this variable along with *Statutory tax rate*$_{it}$ are, econometrically equivalent to including aggregate ETR and statutory tax rate as separate variables. We present results under both approaches below. If statutory tax rates matter for macroeconomic growth, we expect $\alpha_2$ to be significant in Equation (1).

Our regressions also control for real GDP growth and population in year t. These variables are included to control for mean reversion in economic growth and growth potential of countries, respectively. We include country fixed-effects to control for time-invariant cross-country differences in institutional features and developmental activities that have been shown by prior literature to be associated with economic growth rates. Although during our sample period, statutory corporate tax rates exhibit within-country variation over time for most of the sample countries, allowing for potential identification of the corporate tax effects on growth, it is possible that the inclusion of country fixed effects subsumes the tax effects. Such a situation leaves the true relationship between corporate taxes and macroeconomic growth unidentified.

Therefore, to obtain a clearer identification of the corporate tax effects on macroeconomic growth, we also estimate models without country fixed-effects. We include year fixed-effects in the model to control for macroeconomic conditions such as worldwide macroeconomic shocks. Finally, to control for serial correlation within each country, we present t-statistics based on clustering observations at the country level for all regressions. When we alternatively use Newey-West standard errors with five lags, the t-values are slightly larger in magnitude. Our conclusions also remain unaffected if we alternatively include five lags of the dependent variable as controls for serial correlations.

### *3.2. Sample selection*

We start our sample selection process with 77 countries for which we have firm-level financial statement data between 1995 and 2013 from Eikon.[8] We start the sample period with 1995, as data necessary to calculate ETR for many countries are unavailable before 1995. We end the sample in 2013 as data for one-year-ahead real GDP and employment growth are available through the Penn World Tables only till the end of 2014. As the unit of observation in all our analyses is the country-year, the final sample includes a maximum of 19 annual observations for each country.

From our initial sample of public firms with available data on Eikon and Compustat Global (for the 15 countries mentioned in footnote 8), we exclude observations with missing cash taxes paid or pre-tax income before special items. Finally, we require a country-year to have at least 10 observations to calculate our annual aggregate ETR measure. After these exclusions, our sample contains 854 country-year observations covering 63 unique countries in years between 1995 and 2013.

[8] While randomly checking data in Eikon against raw data reported in firm's annual reports, we observed that cash taxes paid data had an erroneous sign for some firms in the following 15 countries: Australia, Bangladesh, Bosnia and Herzegovina, Bulgaria, Chile, China, Indonesia, Kazakhstan, New Zealand, Peru, Portugal, Russia, Serbia, Tunisia, and Ukraine. For these countries alone, we obtain cash taxes paid data from Compustat Global. While our overall conclusions are unaffected if we use cash taxes paid data from Eikon for all countries, the statistical significance of the results are weaker than those reported here.

Even though we use a panel dataset covering several countries and years, when including country and year fixed effects, our regressions identify the associations using within-country time-series variation in statutory tax rates and aggregate ETR measures and relates these to variations in future macroeconomic growth measures.

### *3.3. Data description and descriptive statistics*

Table 1 provides the distribution of the country-level observations by year. The number of countries included in the sample generally increases over time, reflecting the improved coverage of firms in Eikon and Compustat Global. This time trend in data coverage should, however, not affect our conclusions as all analyses include country and year fixed effects. The number of country-level observations in any given year varies between a low of 17 for 1995 and a high of 64 for the years 2010 and 2012.

Table 2 reports overall (Panel A) and country-level (Panel B) descriptive statistics for our sample. The average country has 14 annual observations. Further, fourteen countries (Canada, Denmark, Hong Kong, Ireland, Israel, Japan, Netherlands, Singapore, Sweden, Switzerland, Taiwan, Thailand, United Kingdom and the United States) satisfy our data selection requirements every year. These countries constitute 31% of our final sample.

Average annual real GDP growth across the countries is 3.3% with most countries having positive real GDP growth during the sample period. The average employment growth is 0.2% across the countries. These averages, however, hide significant time-variation within economies. The cross-country and over time variations in economic growth provide a strong setting for us to examine the role of corporate taxes on economic growth.

The average statutory tax rate across countries is 28.8%, with Oman having the lowest corporate tax rate of 12% and United Arab Emirates imposing the highest average statutory tax

rate of 55% over the sample period.[9] The average of *Aggregate ETR* is 21.9%. Comparing this figure to the average *Statutory tax rate*$_{it}$ of 28.8% implies that firms tend to pay about 6.9% (= 28.8% - 21.9%) lower in taxes than the amount they would have paid had their financial profits been fully taxable. Surprisingly, for ten countries, we find that average effective tax rates are greater than statutory tax rates suggesting that, in these countries, firms actually pay more cash in taxes than that suggested by their financial income. This could arise, for instance, when certain expenses on the income statement are not tax deductible.

Panel C of Table 2 provides univariate Pearson and Spearman correlations among our variables of interest. We find that *Aggregate ETR* is significantly and negatively correlated with both real GDP and employment growth variables. On the other hand, statutory tax rates and future economic growth are not significantly correlated with the exception of a modest negative Spearman correlation between statutory tax rates and future employment growth. *Aggregate ETR* is also positively correlated with statutory corporate tax rates suggesting that countries with higher statutory corporate tax rates are also countries where firms face greater corporate tax burdens. These correlations provide initial support on the relative importance of aggregate ETRs and statutory tax rates in explaining growth.

## 4. Empirical findings

### *4.1. Validation of aggregate ETR proxy*

To evaluate whether aggregate effective tax rates matter more than statutory tax rates for capturing corporate tax effects, we directly test the relative importance of *Aggregate ETR* and *Statutory tax rate* in explaining corporate tax collections across countries. This test acts as a validation of *Aggregate ETR* and *Statutory tax rate* as measures for aggregate corporate tax

[9] UAE does not have federal corporation taxes, but each emirate in UAE issues its own tax decrees. Although in theory these emirate-level decrees impose tax on the income of all corporate entities, in practice the tax is only enforced on foreign oil companies engaged in the exploration and production of oil and branches of foreign banks. This results in the aggregate effective tax rate for UAE working out to a relatively low 8.8% in comparison to the maximum statutory tax rate of 55%.

burdens in an economy.

Using corporate tax revenues (scaled by GDP) obtained from OECD tax database, we estimate a model similar to Equation (1), except we replace macroeconomic growth with corporate tax revenue as the dependent variable. The results in Table 3 show that statutory tax rate is at best marginally (one sided p-value < 0.10) related to corporate tax revenues when country and year fixed-effects are not included and statistically insignificant when fixed-effects are included. These findings raise questions about the validity of statutory tax rates to capture tax burden of firms. In contrast, there is a significant positive association between aggregate ETR and contemporaneous corporate tax revenues. In particular, the coefficient on *Aggregate ETR* is 0.020 (*t*-statistic = 2.47). In terms of economic significance, a one standard deviation decrease in aggregate ETR reduces GDP deflated corporate tax revenue by 0.15%, which is economically large given that average GDP scaled corporate tax revenue is 3.10% in our sample. This result is noteworthy as the regression controls for statutory tax rates as well as country and year fixed effects, suggesting that the observed effects for *Aggregate ETR* are incremental to other factors affecting corporate tax collections.

### *4.2. Relation between aggregate ETRs and future macroeconomic growth*

We next turn our attention to testing Hypothesis H1. We report a number of different specifications in Table 4 and Panel A (B) reports results using real GDP (employment) growth as the dependent variable. In the real GDP growth regression in column (1) that excludes our measure of aggregate ETR and no fixed effects, we find that the coefficient on the statutory corporate tax rate is −0.023 (t-statistics = −1.75). Although this negative relation is consistent with the findings in Lee and Gordon (2005), untabulated results reveal that this coefficient turns insignificant when additional control variables based on Mankiw et al (1992), Barro (1997), and Lee and Gordon (2005) are added to the regression (see Section 4.3.1 for the list of the additional control variables). The negative relation also does not carry over to the

employment growth regression as seen in column (1) of Panel B. These results suggest that the relation between statutory tax rates and future macroeconomic growth is at best weakly negative, but that this relation is not robust. This inference is also corroborated by regressions that include fixed effects in column (2) of both panels, where the coefficients on *Statutory tax rate* are statistically insignificant in both the real GDP and employment growth regressions.[10] These findings highlight the fragile nature of the relation between statutory tax rates and macroeconomic growth and are consistent with the mixed evidence in prior literature where inferences on growth effects of statutory corporate tax rates are sensitive to methodological choices.

To test our arguments that the coefficient on STR is biased due to the exclusion of tax credits, tax exemptions, tax deductions, tax enforcement and firms' tax planning, we repeat the above regressions after including the difference between STR and aggregate ETR (i.e, *Aggregate tax diff*) as an additional variable. Inclusion of *Aggregate tax diff* has the econometric effect of directly including the correlated omitted variable when STR is in the regression on its own. In this specification, our arguments predict the coefficient on STR to be negative and the coefficient on *Aggregate tax diff* to be positive, but of equal magnitude (see Appendix). Results in columns (3) confirm these predictions. In Column (4), when we include fixed effects, the coefficient on STR turns insignificant in real GDP growth regression consistent with our findings in Column (2), but the coefficient on *Aggregate tax diff* continues to be positive and significant for both proxies of future macroeconomic growth, suggesting that

[10] To examine whether inclusion of country fixed effects subsumes the explanatory power of relatively time invariant statutory tax rates, we split our sample countries into two groups based on the median number of times statutory tax rate is changed by a country in our sample period. If country fixed effects over-control for time invariant tax rates, we should find an insignificant coefficient for *Statutory tax rate* primarily in countries that do not vary their statutory tax rates much and not in countries that have above median changes in statutory tax rates (i.e., have changed tax rates at least 4 times in 1995-2013 sample period). In untabulated analyses, we find that the coefficient on *Statutory tax rate* is insignificant for both sets of countries, suggesting that the lack of significance for *Statutory tax rate* is not exclusively due to lack of time variation in statutory tax rates.

tax credits, deductions, etc significantly affect future macroeconomic growth even when time-invariant country characteristics are controlled for.[11]

In columns (5) and (6) of both panels we include *Aggregate ETR* on its own. With and without fixed effects, the coefficient on *Aggregate ETR* is significantly negative in both the real GDP and employment growth regressions. In columns (7) and (8) of both panels, we include both *Aggregate ETR* and the statutory tax rate as explanatory variables in the regressions. In column (7) we find a strong negative coefficient on our *Aggregate ETR* in both regressions of real GDP and employment growth. The coefficient on *Statutory tax rate* in the real GDP growth regressions (excluding fixed effects) turns insignificant when *Aggregate ETR* is included, consistent with the analysis in the appendix indicating a potential omitted correlated variables bias when aggregate ETR is not considered in the analysis. The *Statutory tax rate* coefficient turns weakly positive in the real GDP growth regression that includes fixed effects (Column 8) and is statistically insignificant in all regressions of employment growth. In terms of economic significance, the coefficient of -0.071 in the one year-ahead *Real GDP growth* regression and -0.020 in the one year-ahead *Employment growth* regression (Column 8 in panels A and B) suggest that a one standard deviation decrease in aggregate ETR (0.081) is associated with an increase in real GDP growth of 0.6% and an employment growth of 0.2%. These effects are economically meaningful given that average real GDP growth in our sample is 3.3% and the average employment growth is 0.2%.

For the remainder of the paper, we report results from regressions that include both aggregate ETR and STR (i.e., the specifications in Columns 8) rather than from regressions that include STR and *Aggregate tax diff* as we wish to examine whether aggregate ETR subsumes the effects of STR. Our findings show that aggregate ETR subsumes the explanatory ability of STR for future growth. It is important to note that we are not claiming that STR is

[11] The predictions from the Appendix need not apply when fixed effects are included in the regression.

irrelevant for taxes, but that aggregate ETR provides a better measure that captures the entirety of corporate tax policy effects, including the effects arising through STR.

While population level is significantly and positively linked to real GDP growth, its impact on employment growth changes according to whether we include fixed effects. In sum, our results provide robust evidence that aggregate ETRs, but not necessarily statutory tax rates, are significantly and negatively associated with country-level macroeconomic growth. In untabulated analyses, when we replace the 1-year growth measures with growth in each of the 2nd to 5th years, we find weakly significant coefficients on *Aggregate ETR* in years 2 and 3 year-ahead growth. This result is at least partly due to fixed effects subsuming persistent tax effects on growth. This finding also boosts confidence that our results for 1-year growth are unlikely to be driven by persistent omitted correlated variables.

### *4.3. Robustness checks*

#### 4.3.1. Correlated omitted variables

There appears to be little consensus in the prior literature on the choice of control variables in country-level predictive regressions for macroeconomic growth. So, we check the robustness of our results to additional controls and alternative econometric approaches. First, we follow Mankiw et al (1992), Barro (1997), and Lee and Gordon (2005) and extend our list of control variables to include real GDP, Human capital, Government consumption, Exports / Imports, Rule of law, Inflation rate, Population growth, and Aggregate investment (variable definitions are in Table 5).[12]

Panel A of Table 5 shows that the coefficient on *Aggregate ETR* continues to be significantly negative in the extended regressions and remains largely unchanged from those reported in Table 4. The coefficient on *Statutory tax rate* is unexpectedly significantly positive

[12]We obtain these additional control variables from Penn World tables with the exception of *Rule of Law*, which is obtained from the Worldwide Governance Indicators project website, *Inflation rate*, which is obtained from The World Bank, and *Aggregate investment*, which is obtained from Compustat.

in the future real GDP growth regression, which possibly reflects the endogentiy in this variable arising from governments adjusting corporate tax rates in anticipation of economic growth or recessions. With the exception of *Log(Real GDP)* and *Government consumption*, the additional control variables tend to have insignificant coefficients. The negative coefficient on *Government consumption* is consistent with increases in government spending adversely affect future macroeconomic growth, an assumption underlying H1 (discussed further in Section 5).

In untabulated analyses, we also considered the real GDP growth rate averaged (equally weighted or real GDP weighted) across all other countries as an additional explanatory variable to proxy for global economic growth. This variable has an insignificant coefficient in the regressions and its inclusion does not affect any of our conclusions. We also included aggregate earnings changes and aggregate accruals (defined as the asset-weighted averages of annual change in earnings or accruals scaled by sales) as additional control variables. Inclusion of these variables leaves our main results largely unchanged. Our results are unaffected by including more lags of real GDP growth. For instance, when we include five lags of real GDP growth as control variables, the coefficient on *Aggregate ETR* in Table 4 is is -0.065 (t-stat = -2.87) in future real GDP growth regression and -0.020 (t-stat = -2.54) in future employment growth regression.

4.3.2. Changes analysis

When we estimate Equation (1) using a changes specification, we find from Table 5, Panel B, that *Aggregate ETR* continues to be negatively associated with both macroeconomic growth proxies. This result increases our confidence that our earlier results are unlikely to be driven by omitted correlated variables. In contrast to the robust results for ETR, we find the coefficient on changes in statutory corporate tax rate is insignificant in both regressions of growth, which corroborates the fragile nature of the relationship between statutory corporate tax rates and macroeconomic growth.

4.3.3. The impact of the U.S.A. and China

The U.S. contributes the highest number of firm-year level observations to our sample. Although this should not matter for our country-year level analyses, we confirm in untabulated results that our findings are robust to dropping observations from the U.S. Our conclusions also remain unaffected when we exclude observations from China, to take into account the fact that the Chinese economy is heavily regulated and controlled by the government and a large portion of firms in China are state-owned enterprises.

4.3.4. Presence of multinational corporations

Our sample includes both domestic and multinational firms (MNCs). But since the ETR measure for multinational firms is based on worldwide earnings and worldwide cash taxes, this could attenuate our results if MNCs primarily save taxes in lower tax foreign countries and their tax savings are not repatriated and reinvested in the home country. However, if MNCs engage in more tax planning than domestic firms (due to their ability to transfer profits across jurisdictions) and invest such tax savings in their home country, then including MNCs would make the ETR-macroeconomic growth relation stronger. After removing multinational firms (we define MNCs as firms that Worldscope reports as having current or deferred foreign income tax expense), we obtain results that are more consistent with the latter explanation and our earlier conclusions remain unchanged.

4.3.5. The impact of earnings management

As our ETR measure is based on reported earnings numbers, it could potentially be affected by accruals management. This would merely introduce noise in the analysis as long as accrual management by firms does not proportionally change current period taxes. However, our earlier inferences could be potentially affected if overstated (understated) profits systematically deflate (inflate) values of *Aggregate ETR* and such manipulated profits affect future macroeconomic fundamentals (e.g., Shivakumar, 2007, Konchitchki and Patatoukas

2014a,b; Shivakumar and Urcan 2017). To directly test the sensitivity of our results to controlling for accruals management, we re-estimate Equation (1) after including aggregate-level discretionary accruals as an additional control variable. We measure aggregate-level discretionary accruals by first estimating the performance-adjusted discretionary accruals model of Kothari, Leone, and Wasley (2005) for each firm-year and then averaging these on an asset-weighted basis for each country-year. Untabulated results show that while aggregate discretionary accruals are significant (insignificant) in the real GDP growth (employment growth) regression, inclusion of this variable does not qualitatively change our main results.s.

### *4.4. Endogeneity concerns*

Theoretical literature in economics suggests the possibility of a strong endogeneity element in the choice of fiscal policy, implying that the regressions reported above could suffer from either a reverse causality or a simultaneity bias (e.g., Barro, 1990). Further, although we find our regression results to be robust, it is possible that there are unobserved time-varying country characteristics that cause our aggregate ETR measure to be correlated with future macroeconomic growth.

To directly address these concerns, we use an instrumental variables regression approach. We implement this test using two instruments for aggregate ETR. First, we use the number of visits or required meetings with tax officials in a country-year. While this measure is directly related to intensity of tax authorities' oversight and enforcement and thus, inversely correlated with firms' ETR (as required by the inclusion criteria), there is little reason to expect the level of this variable in a specific country-year to be directly related to future macroeconomic growth (satisfying the exclusion criteria). The second instrument follows Lee and Gordon (2005) and is calculated as the distance-weighted average of aggregate ETR in other countries within the same year. For each country and year, we compute this instrument by weighting other countries' contemporaneous aggregate ETR measures by the inverse of the logarithm of the

distance between the two countries' capital cities. While the competition to attract businesses should cause tax incentives and enforcement of a country to be correlated with those of nearby countries (satisfying the inclusion criteria), the aggregate ETRs in other countries should have virtually no effect on the future macroeconomic growth rate of a country (satisfying the exclusion criteria). This is especially true when the concerned country is small relative to regional and world economy, making the weighted average of effective tax rates elsewhere a good instrument for the local effective tax rates. Panel A of Table 2 shows that the average number of visits or required meetings with tax officials in a country-year is 1.59 and the average of aggregate ETRs in other countries is 0.214 which, not surprisingly, is close to the average aggregate ETR of 0.219.

The results from the IV regressions are reported in Table 6. In the first-stage regression, we find that our aggregate ETR measure of a specific country is strongly related to the number of tax office visits and the distance-weighted average measure of ETR in other countries. The Kleibergen-Paap LM test for whether the model is under-identified is strongly rejected at less than the 1% significance level. This result suggests that our excluded instrumental variables are strongly correlated with aggregate ETRs. The Kleibergen-Paap Wald F statistic test of weak instruments reveals an F-statistic of 55.70, which is far greater than the 10% Stock-Yogo (2005) weak ID test critical value of 19.93. This statistic rejects the null that our instrumental variables are only weakly correlated with aggregate ETRs. Also based on the Sargan-Hansen test of overidentifying restrictions, we cannot reject the null that the instruments are uncorrelated with the error term and that the excluded instruments are correctly excluded from the estimated equation. These tests confirm that the instruments employed are valid and that the model is fully identified.

In the second-stage regression, we find a statistically significant and negative relation between the instrumented aggregate ETR and future macroeconomic growth. The coefficient

on the instrumented aggregate ETR measure is -0.105 for real GDP growth regressions and -0.034 for employment growth regressions, which are comparable to the OLS coefficients reported in Table 4 of -0.071 and -0.020, respectively. The IV regressions confirm that the relation between aggregate ETR and future macroeconomic growth is robust to controls for endogeneity concerns. In untabulated analyses, we also consider each instrument separately and continue to find a strong negative relation between the instrumented aggregate ETR measure and future macroeconomic growth.

### *4.5. Implications for prior studies*

As discussed earlier, most prior macroeconomic studies have relied on statutory tax rates or on the ratio of tax revenues to GDP to study effects of governments' tax policies. We argue that ETRs better capture corporate tax policies, enforcement, and firm's tax planning. We re-examine the evidence in Mendoza et al. (1997) using our aggretae ETR measure. Mendoza et al. find that tax rates on factor incomes and consumption tend to be insignificantly related to GDP per capita growth. They interpret their results as supporting Haberger's (1964) superneutrality conjecture that tax policy is an ineffective tool to influence economic growth.

Mendoza et al. (1997) rely on effective tax rates for consumption, labor income and capital income computed from national income accounts and revenue statistics. These effective tax rates, based on an approach proposed by Mendoza et al. (1994), approximate tax revenues from each source (viz., consumption, labor income, and capital income) divided by the pre-tax value of the corresponding source. Specifically, the consumption tax rate (*Taxcon*) is computed as the total of general taxes on goods and services plus excise taxes divided by pre-tax value of consumption, where the pre-tax value of consumption is given by the total of private consumption and government consumption expenditures reported in the national income accounts minus the total of excise taxes, general taxes on goods and services, and employee compensation paid by producers of government services. The effective tax on labor income

(*Taxlab*) is the sum of household's average tax on their wage or salary income, their social security contributions and their payroll taxes, divided by the total of wages/salaries and employer's contribution to social security. Lastly, the tax rate on capital income (*Taxcap*) is defined as the total of capital income taxes paid by individuals and corporations divided by the operating surplus of the economy. The sources of capital income taxes considered in computation of *Taxcap* are (i) taxes on capital income for individuals, (ii) taxes on income, profits, and capital gains of corporations, (iii) recurrent taxes on immovable property and (iv) taxes on financial and capital transactions. Mendoza et al. (1997) do not distinguish between the tax rates on corporate profits and individual taxes on capital gains and document that taxes on capital income are unrelated to GDP per capita growth. However, this difference might be important because businesses face different effective tax rates compared to individuals and have different incentives to respond (via tax planning and real corporate decisions) in a timely manner to government's tax policies.

We replicate the Mendoza et al. (1997) analysis in our sample period and extend their analysis by additionally considering our aggregate ETR measure as an explanatory variable for GDP per capita growth. Following Mendoza et al. (1997), we restrict the analysis to OECD countries and compute the dependent variable as the average GDP per capita growth over a five-year period. But, in line with our earlier analyses, we also report results based on one-year-ahead GDP per capita growth as the dependent variable.

The results from this analysis are presented in Table 7. We initially replicate Mendoza et al (1997) results for our sample period.[13] Consistent with the Mendoza et al. (1997) findings, in Column (1) we observe that initial income (GDP 1995) is the only statistically significant

[13] Mendoza et al. (1997) cover the time period 1966 to 1990. Since the data to compute our aggregate ETR measure are unavailable for that period, we re-examine the conclusions of Mendoza et al. (1997) for our sample period of 1995 to 2013. Mendoza et al. (1997) control for initial national income (GDP values in 1965) in their regressions. Instead, we include the logarithm of the GDP values in 1995 as our sample period starts in 1995 and we want to minimize the effects of extreme GDP values. Our conclusions are unchanged when GDP values are included without logarithmic transformations.

variable in the regression. Specifically, the coefficients on all tax measures are insignificant. When we extend the Mendoza et al. (1997) regression to include aggregate ETR, we find in Column (2) that the aggregate ETR is significantly and negatively related to average GDP per capita growth. The significantly negative coefficient continues to hold when we estimate the regressions using annual growth rates and replace initial national income with country and year fixed effects, as done in our previous analyses. Our results cast doubt on Harberger's (1964) superneutrality conjecture at least with regards to corporate taxes and points out that aggregate ETRs negatively predict future macroeconomic growth.

### *4.6. Further analysis of assumptions underlying H1*

An assumption underlying H1 is that the private corporate sector, on average, is more efficient than the government sector in spending/investing leading to economic growth. To provide further evidence on H1, we test the following cross-sectional predictions of the assumption underlying the hypothesis: (1) The aggregate ETR - macroeconomic growth relation is stronger in countries with poorer control of corruption, (2) Lower corporate taxes and thus ETRs occur mainly through investments by firms and so is primarily related to business investments and personal consumption components of real GDP growth and (3) Investments by the corporate sector lead to increased labor productivity and utilization. The following sub-sections explain and test these predictions.

#### *4.6.1. Control of corruption*

We use 'control of corruption' to proxy for relative efficiency of investments by private firms and governments based on the premise that corrupt and bureaucratic governments will fritter away tax collections on unproductive investments. In countries with poor control of corruption, corporate tax payments are partly a deadweight loss to the economy and we predict that in such countries, investments of corporations of their tax savings can boost economic growth. On the other hand, in countries with low corruption and bureaucracy, government

investments can support economic development as productively and efficiently as investments by the private sector. Thus, lower corporate taxes in these economies may make little difference to economic growth.

We test these predictions by re-estimating Equation (1) separately for poor- and strong-corruption control countries, where countries are defined as strong- or poor control of corruption countries based on whether their control of corruption index from World Governance Indicators is above or below the sample median. The results, reported in Table 8, Panel A, indicate that *Aggregate ETR* is significantly and negatively associated with future real GDP growth as well as employment growth only in poor corruption control countries. The relationship between *Aggregate ETR* and future economic growth is insignificant in countries with strong control of corruption, suggesting that in such countries, both governments and the private sector are equally efficient in investing for growth. Thus in such economies, whether firms pay taxes that are subsequently invested by the government or whether firms invest such tax-savings themselves have similar effects on economic growth. The coefficient on *Statutory tax rate* is insignificant in all regressions, again casting doubt about the robustness of the relationship between statutory tax rates and economic growth. Overall, these results suggest that the earlier documented link between aggregate ETRs and future economic growth is at least partly explained by the investment efficiency of private firms in countries with high corruption.

#### *4.6.2. Components of real GDP growth*

If our argument that aggregate corporate ETRs affects future macroeconomic growth through firms investing funds tax savings in profitable growth opportunities is descriptive, then we should observe aggregate ETR to be negatively associated with business investment and to some extent the personal consumption components of real GDP. The latter follows because

increases in business investment will increase employment, which in turn will increase total wages and salaries earned by the workforce resulting in higher personal consumption.

We test this conjecture by obtaining data on the components of real GDP (viz., personal consumption, business investment, government spending or net exports) from Penn World Tables and re-estimating regression Equation (1) after replacing real GDP growth with growth in its individual components. Our results, documented in Table 8, Panel B, show that *Aggregate ETR* has a relatively strong negative relation to growth in the business investment component of real GDP (lower corporate taxes, higher business investment) and to a lesser extent on personal consumption component. The coefficients on *Aggregate ETR* are -0.327 (*t*-statistic = -4.00) and -0.096 (*t*-statistic = -3.09) respectively in these regressions. We do not find any significant relationship between *Aggregate ETR* and government spending growth as well as net exports growth.[14]

#### *4.6.3. Labor productivity and utilization*

The prior 2 sub-sections provide evidence that corporations invest their tax savings more efficiently than governments invest their tax collections. In this conclusion, 'investment efficiency' refers to the ability of investments to drive future economic growth. This improved efficiency could manifest both in improved labor productivity (measured as GDP per hour worked) and/or in better labor utilization (hours worked per capita). We do not have an ex-ante prediction on which of these mechanisms is relatively more important in driving future economic growth. In panel C of Table 8, we report results of regressing our *Aggregate ETR* measure on labor productivity (column 1) and labor utilization (column 2). We obtain labor productivity and labor utilization data from the OECD website. The results show that

[14] As an alternative approach to examine whether the relationship between ETRs and future economic growth mainly occurs through lower corporate taxes enabling higher future investments, we re-estimate Equation (1) after including one-year-ahead aggregate investment. Consistent with the above conjecture, the inclusion of future investments in the regression attenuates the coefficient on ETR. We have also replicated the results in Tables 4 to 6 after replacing future real GDP growth with the growth in business investment component of real GDP. Our conclusions remain unaltered.

*Aggregate ETR* negatively predicts one-year ahead labor productivity growth and one-year ahead labor utilization growth. These results provide additional evidence on the mechanisms by which lower corporate taxes lead to future economic growth.

## 5. Tests of H2 "government incentives versus tax planning" hypothesis

In order to shed light on whether the earlier documented relation between aggregate ETRs and economic growth is due to government's tax incentives or due to aggressive corporate tax planning activities both of which lower ETRs (Hypothesis 2), we split our country-year observations into two groups based on a proxy for tax planning aggressiveness. The proxy for tax planning aggressiveness is based on the notion that in the absence of aggressive tax planning, tax incentives lead to similar tax outcomes for similarly placed firms. That is, government tax incentives apply similarly to firms with similar business activities, but that this need not be the case for tax planning activities by firms. We categorize country-years in which firms have comparable *Firm-level ETRs* as instances where lower ETRs reflect government-intended tax incentives, whereas remaining observations are categorized as aggressive tax planners. Specifically, we implement this categorization as follows: For each firm-year, we compute an industry-adjusted *Firm-level ETR* by subtracting *Firm-level ETR* from its industry average, where the industry average is computed for each country-year across all firms in a given two digit SIC code. In the absence of any aggressive tax planning, the industry-adjusted *Firm-level ETR* is expected to be relatively similar. We then compute *Volatility of ETR* as the standard deviation of industry-adjusted *Firm-level ETRs* for each country-year and categorize country-years with an above-median standard deviation as observations with aggressive tax planning.[15] Country-years with below-median standard deviation are likely to be cases where lower ETRs reflect incentives incorporated in tax codes. This proxy for tax planning is

[15] Panel A of Table 2 documents that the average *Volatility of ETR* across countries is 0.145 for our sample period, while Panel C of Table 2 shows that this variable has about 10 per cent correlation with Control of Corruption index.

admittedly noisy, which can reduce the power of tests to distinguish between the two sources of lower ETRs.

We estimate Equation (1) separately for each of the above groups. If our earlier results are driven primarily by government tax incentives (firms' tax planning), we expect the coefficient on *Aggregate ETR* to be more strongly associated with future economic growth for the below-median (above-median) group. We restrict our focus in this analysis to the coefficient on *Aggregate ETR*, as we have no specific predictions for statutory tax rates across these samples.

From Table 9, Panel A, we observe that *Aggregate ETR* is significantly negatively associated with future real GDP growth and future employment growth only for country-years with aggressive tax planning (i.e., above-median group). The coefficients on *Aggregate ETR* are insignificant for the below-median group and their magnitudes are substantially smaller than that for the above-median group. These results are consistent with aggressive tax planning by firms, rather than tax incentives provided by governments, explaining the negative association between ETRs and economic growth. Also, as documented in Section 6, we obtain identical conclusions when we focus on firm-level analysis. One potential explanation for the lack of any relationship between government tax incentives and future economic growth is that governments do not always grant tax incentives that are necessarily effective or efficient from the viewpoint of economic growth.

As an additional test to provide evidence on whether it is government tax incentives or firms' aggressive tax planning that likely explains the negative association between corporate ETRs and future economic growth, we partition firms based on financial constraints. Edwards et al. (2016) show that firms that are financially constrained turn to cheaper internal sources, such as tax planning, that lowers the cash spent on taxes, freeing up the cash for other uses. By definition, firms that are financially constrained are restricted in taking advantage of their

investment opportunities. Thus, saving taxes is a source of funds which these firms can then use to fund operations and investments. We therefore examine whether the association between ETRs and future macroeconomic growth is stronger (more evident) among firms that are financially constrained. If, however, financially constrained firms' increased tax savings does not affect its investments, we expect little difference in this relation across financially constrained and unconstrained firms. Further, if the negative association is driven by firms responding to government tax incentives, then firms facing lower financial constraints are likely to respond more and we would expect a stronger association between corporate ETRs and future macroeconomic growth among the less financially constrained firms.

Hadlock and Pierce (2010) document that firm size and age are better proxies for firm financial constraints as compared to commonly used financial constraints measures employed in prior literature (e.g., Kaplan and Zingales index, Whited and Wu index). We calculate aggregate ETRs separately for firms with high and low financial constraints as follows: First, we calculate firm-level financial constraints (i.e., FC index) as the first factor of Size and Age, where Size equals the natural logarithm of total assets in U.S. dollars, and Age is the number of years the firm is listed on Thomson Eikon or Compustat databases. To aid in interpretation, we multiply the factor score with -1 so that FC index is an increasing function of financial constraints. Next, for each country-year, we divide observations into two groups at the median level of the change in the FC index (ΔFC), those below (above) median are less (more financially) constrained, and calculate aggregate ETRs separately for each financial constraints group within each country-year. We sort firms within each country-year rather than across countries, as the FC index may need not be comparable across countries. Finally, we estimate equation (1) separately for firms with high and low financial constraints.[16]

[16] We focus on changes in the FC index rather than levels, as the components of FC index in levels (namely size and age) are mechanically related to the importance of firms for an economy. Also, by splitting firms within each country-year into financially constrained and unconstrained groups, our approach controls for country-level differences in growth and financial constraints. We do not conduct these analyses using country-level measures

From Table 9, Panel B, we observe that *Aggregate ETR* is significantly negatively related to future real GDP growth and future employment growth only for firms classified as financially constrained (i.e., above-median ΔFC group). The coefficients on *Aggregate ETR* are insignificant for the below-median group. These results are consistent with financially constrained firms driving the negative relationship between aggregate ETR and future economic growth lending further support to the argument that the negative association is likely driven by firms with aggressive tax planning rather than firms responding to government tax incentives.[17] This conclusion is also in line with our findings based on control of corruption, as corrupt governments are likely to target tax incentives for their personal benefit rather than to stimulate the economy.

## 6. Firm-level analyses

Thus far all our analyses have been based on country-level data. However, unlike statutory tax rates that are available only at the country level, analyses using effective tax rates can be conducted at the firm-level, as effective tax rates vary across firms within a country. To provide corroborative evidence to Hypothesis H2, we directly investigate how individual firm's investment behavior is associated with that individual firms' ETR.

If a firm's lower taxes, as measured by ETR, impacts economic growth through productive investments of tax-saved funds, then, ceteris paribus, we should observe a negative association between a firm's investment and ETR. Further, if this association is driven by

of financial constraints (similar to our analyses of control of corruption), as countries with poorer control of corruption are also likely to be the ones facing greater financial constraints, raising concerns about the independences of these two tests. Nonetheless, in unreported analyses, we run a similar analysis to the control of corruption analysis after splitting the sample at the median level of sovereign credit ratings and find that our results are entirely driven by country-years with low sovereign credit ratings.

[17] Similar to the argument for financially constrained firms, one could argue that when firms reduce their corporate tax payments through increased tax planning activities, governments may increase their spending by replacing corporate-tax shortfalls with either borrowed funds or other non-corporate taxes. And, if government spending is as efficient as corporate investments, the additional borrowings or alternative taxes could explain the improved economic growth associated with corporate ETRs. That is, government borrowing or additional non-corporate taxes are possible correlated omitted variables. We checked for these alternative explanations for the link between ETRs and economic growth, but fail to find any supportive evidence.

government tax incentives rather than firm's tax planning activities, we should find the relation between investments and ETRs mainly at the industry-level, as all firms in an country-industry-year will be similarly affected by tax incentives. In other words, an industry-level ETR variable should subsume any relation between firms' investments and our firm-level ETR measure.

We test these predictions by adapting the approach in Polk and Sapienza (2009) and regressing firms' investments on *Firm-level ETR*$_{jt}$ as defined in Equation (2):

$$
\begin{aligned}
Investment_{\,jt+1} \\
&= \alpha_0 + \alpha_1 Firm - level\ ETR_{jt} + \alpha_2 Investment_{jt} \\
&+ \alpha_3 Firm - spesific\ control\ variables_{jt} \\
&+ \alpha_4 Country - spesific\ control\ variables_{it} + Firm\ fixed - effects \\
&+ Year\ fixed - effects + Country - industry - year\ fixed - effects \\
&+ error \qquad (3)
\end{aligned}
$$

where *Investment*$_{jt+1}$ denotes investments made by firm j in year t+1 and refers to two alternative measures of investment, namely, capital expenditures scaled by total assets (*Capex*$_{t+1}$) and natural logarithm of number of employees (*Log(Employees)*$_{t+1}$). The regression controls for country and firm-specific characteristics as well as firm and year fixed effects or alternatively, country-industry-year fixed effects. Regressions that include the country-industry-year fixed effects should also help distinguish between government tax incentives and tax planning activities in driving firm's investment decisions, as these fixed effects would capture the effects of government tax incentives, which as argued earlier are likely to be relatively constant for all firms within a country-industry-year. As an alternative proxy to capture effects of government tax incentives, we also consider average *Firm-level ETR* for each country-industry-year (*Industry ETR*). As done in our earlier analyses, we cluster standard errors at the country level. If tax savings by firms increase firms' investments, then we expect the coefficient on *Firm-level ETR* to be significantly negative. If government tax incentives

drive firms' investments, we expect *Industry ETR* to be significantly negative. However, to the extent that this industry average (*Industry ETR*) is a noisy proxy for extracting the effects of government incentives, we should expect the coefficient on *Firm-level ETR* and on *Industry ETR* to be similar, as otherwise there is little reason to expect these coefficients to differ.

The regression results are reported in Table 10.[18] The coefficients on *Firm-level ETR* are significantly negative for both investment proxies. The negative coefficients indicate that firms use tax savings on capital expenditures and to hire more employees. The coefficients are also largely insensitive to including country-industry-year fixed effects to capture government tax incentives, suggesting that the negative relation between *Firm-level ETR* and investments is likely the results of firms using funds saved through tax planning for investment purposes, rather than reflecting effect of government incentives on firms' investments. Moreover, the coefficient on *Industry ETR* is statistically insignificant for both macroeconomic growth proxies, which is also inconsistent with government incentives being the main driver of investments. Overall these analyses reveal a consistent picture in lower ETRs resulting from tax planning increases firms' investments.

## 7. Conclusion

This study re-visits the mixed evidence presented in the economics literature between tax rates and future economic growth. We argue that the mixed evidence in prior literature is at least partly due to the use of statutory tax rates to capture the tax burden of firms. The statutory corporate tax rate ignores the complexity of tax credits, exemptions and tax deductions, enforcement, and firms tax planning. Moreover, given that incentives to tax plan are likely to be positively correlated with statutory tax rates, we suggest that statutory tax rates

[18] Although we present results for investment levels, our conclusions remain unaltered when we use changes in investment levels as the dependent variable. Also, we obtain even stronger results than those reported if we consider only country-industry-year fixed effects and exclude firm fixed effects in the regressions. Regressions with country-industry-year fixed effects do not include country-level control variables, such as real GDP growth, as these are subsumed by the fixed effects.

are unlikely to capture the true extent of taxes paid by corporations. Consistent with these concerns, we document that the association between future macroeconomic growth and statutory tax rates are sensitive to choice of growth proxies, model specification and control variables. We propose an alternate tax rate measure that aggregates cash effective tax rates of listed firms and document strong and robust negative relations between this measure of corporate tax rates and macroeconomic growth.

We address endogeneity concerns between macroeconomic growth and tax policy (as reflected in firms' ETRs) using a two-stage instrumental variable approach where we employ the number of tax visits or required meetings with tax officials in a country-year and the distance-weighted average of aggregate ETRs in other countries within the same year as instruments. We continue to find a significantly negative association between the instrumented aggregate ETR and future macroeconomic growth consistent with our main results.

Additional analyses show that the negative relationship between aggregate corporate ETRs and future macroeconomic growth is particularly observed in countries with poor control of corruption and when lower ETRs occur through firm's tax planning activities rather than by governments providing tax credits or intentionally creating tax incentives for firms. Our results based on the new proxy for corporate tax rates reveals that lower corporate taxes can be helpful to macroeconomic growth if governments are inefficient in running an economy on account of corruption or if governments are unable to effectively target tax benefits to firms or industries with high growth opportunities. Finally we find that the relation between aggregate corporate ETRs and future economic growth can be partly explained through the association of individual firms' tax planning with their capital expenditure and employment decisions.

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## Appendix: Econometric Specifications

To clarify our econometric propositions for our main conjecture that aggregate effective tax rate (ETR) is a better measure of corporate tax policy effects than statutory tax rate (STR), we start from the below identity:

$$ETR = STR - Diff \quad (1)$$

where Diff = STR – ETR. That is, the actual tax burden for companies (ETR) is the outcome of two variables – STR, which is directly legislated by the government, and Diff, which is determined partly by government's tax policies relating to tax credits, deductions, exemptions, strictness of enforcement, etc. and partly by a firm's tax planning decisions.

The paper's arguments imply that Diff is positively associated with STR because regimes with higher statutory tax rates are likely to offer more tax incentives to attract business investments to their country and these greater tax incentives could justify the reason for the higher tax rate in the first place. In addition, incentives of firms within a country to engage in tax planning are clearly correlated with statutory tax rates. Higher statutory tax rates create greater incentives for firms to engage in tax planning to reduce their taxes.

In contrast, ETR may or may not be correlated with either STR or Diff. For instance, consider a situation where all countries have different STRs and firms in higher STR regimes receive greater tax-credits and engage in more tax planning. In this scenario, it is possible for all countries to have the same ETR. This situation, for instance, could arise if competition to attract businesses across countries causes all countries to charge their businesses similar effective taxes on average. In such a situation, ETR would be uncorrelated with both STR and Diff. That is the expected positive correlation between STR and Diff could leave ETR uncorrelated with either of its components (STR or Diff).[19]

Our hypothesis is that macroeconomic growth is affected by the actual extent of taxes paid on company profits (i.e., ETR), which is determined by the entirety of a country's tax policies (viz. the statutory tax rate, tax credits, exemptions, deductions, strictness of enforcement) and firms' tax planning activities. Thus, under our hypothesis, the true relation between corporate taxes and macroeconomic growth is given by the following equation:

$$Growth = a0 + a1 * ETR + CONTROLS + e \quad (2)$$

where $a1 < 0$

However, previous studies have tested the hypothesis effectively using the following regression and report mixed results for the b1 coefficient:

$$Growth = b0 + b1 * STR + CONTROLS + e \quad (3)$$

[19] Empirially, in our sample, we find that *Aggregate tax diff* is is significantly and positively (negatively) correlated with statutory tax rate (aggregate ETR) and is also positively correlated with future real GDP growth, and employment growth, our two main dependent variables.

These studies view STR as a proxy for ETR, the actual extent of corporate tax burden and therefore, Equation (3) suffers from standard measurement error issues relating to proxy variables (Woolridge, "Introductory Econometrics", 4th edition, Section 9.2). In this paper we propose a method to estimate the effective tax rates, which allows us to estimate Equation (2) directly. Thus, we test our hypothesis by regressing the following equation:

$$Growth = a0 + a1 * ETR + b1 * STR + CONTROLS + e \quad (4)$$

Comparing Equation (4) with the true relation given in Equation (2) suggests that, if our hypothesis is correct, then: $a1 < 0$ and $b1 = 0$. This is the main prediction tested throughout the paper. It is worth emphasizing that a finding consistent with this prediction (i.e. a significant a1 and an insignificant b1) does not mean that statutory tax rates are irrelevant for economic growth. Our main point is that ETR provides a better measure that captures the entire corporate tax policy effects for a country, including the effects arising through statutory tax rates and that ignoring tax credits, tax deductions, tax exemptions and firms' tax planning activities can lead to the coefficient on STR being biased in growth regressions.

In fact, our approach to estimating ETR also allows us to test whether estimated the coefficients in Equation (3) are potentially biased. To see, we start by substituting for STR from Equation (1) into Equation (2). This yields the following:

$$Growth = b0 + a1 * STR - a1 * Diff + CONTROLS + e \quad (5)$$

Under our null, if STR is employed as a proxy for corporate tax rate, then the correct specification would be to include an estimate of Diff as an additional variable (although this specification would still be less powerful than estimating Equation (2) directly). Comparing Equation (5) with (3) indicates that a significant coefficient on Diff in Equation (5) and a coefficient on STR that is equal and opposite in sign to that on Diff would indicate that coefficients in Equation (3) are biased on account of the correlated omitted variables problem.

**Table 1**
**Sample composition**

This table provides an overview of the sample composition by year.

| Year | Observations | Year | Observations |
|---|---|---|---|
| 1995 | 17 | 2005 | 51 |
| 1996 | 23 | 2006 | 56 |
| 1997 | 26 | 2007 | 57 |
| 1998 | 28 | 2008 | 61 |
| 1999 | 31 | 2009 | 62 |
| 2000 | 34 | 2010 | 64 |
| 2001 | 33 | 2011 | 63 |
| 2002 | 37 | 2012 | 64 |
| 2003 | 39 | 2013 | 63 |
| 2004 | 45 | ***Total*** | ***854*** |

**Table 2**
**Descriptive statistics**

This table provides descriptive statistics (Panel A) and country-level average values (Panel B) of variables used in the analyses. *Real GDP growth*$_{it+1}$ is the proportional change in real gross domestic product at constant 2011 prices in a country i from year t to year t+1. *Employment growth*$_{it+1}$ is the change in population employed in a country i from year t to year t+1. *Aggregate ETR*$_{it}$ is the asset weighted average of *Firm-level ETR*$_{jt}$ calculated as (cash taxes paid / pre-tax income net of special items) for all firms j within a country i in year t. The ratio is first computed at the firm-year level and then aggregated at the country-year level. *Statutory tax rate*$_{it}$ is statutory corporate tax rate in country i during year t. *Population*$_{it}$ is the number of people living in country i during year t. *Control of corruption*$_{it}$ reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Corruption scores range between -2.5 (weak) to 2.5 (strong) governance performance. *Volatility of ETR*$_{it}$ is the standard deviation of industry-adjusted firm-level ETR. *Tax visit*$_{it}$ is number of visits or required meetings with tax officials in country *i* and year *t*. *Other ETR*$_{it}$ is calculated as the weighted average of aggregate ETR of other countries (other than country *i*) in our sample in year t. Panel C provides Pearson (above diagonal) and Spearman (below diagonal) correlations among variables of interest. Correlations significant at 10 percent level or better are in bold. The sample period is between 1995 and 2013. The sample (*Tax visit*$_{it}$ and *Other ETR*$_{it}$) has 854 (511) observations. All non-indicator variables are winsorized at the top and bottom one-percentiles.

**Panel A: Descriptive statistics**

| | Mean | SD | P10 | P50 | P90 |
|---|---|---|---|---|---|
| *Real GDP growth*$_{it+1}$ | 0.033 | 0.034 | −0.005 | 0.034 | 0.074 |
| *Employment growth*$_{it+1}$ | 0.002 | 0.008 | −0.007 | 0.002 | 0.011 |
| *Aggregate ETR*$_{it}$ | 0.219 | 0.081 | 0.312 | 0.220 | 0.115 |
| *Statutory tax rate*$_{it}$ | 0.288 | 0.082 | 0.175 | 0.298 | 0.389 |
| *Real GDP growth*$_{it}$ | 0.035 | 0.034 | −0.005 | 0.036 | 0.077 |
| *Population*$_{it}$ *(in millions)* | 95 | 236 | 4 | 23 | 170 |
| *Control of corruption*$_{it}$ | 0.736 | 1.120 | −0.740 | 0.635 | 2.229 |
| *Volatility of ETR*$_{it}$ | 0.145 | 0.046 | 0.075 | 0.152 | 0.197 |
| *Tax visit*$_{it}$ | 1.591 | 1.282 | 0.500 | 1.300 | 2.900 |
| *Other ETR*$_{it}$ | 0.214 | 0.012 | 0.196 | 0.217 | 0.229 |

**Panel B: Country-level statistics**

| *Country* | *N* | *Real GDP growth*$_{it+1}$ | *Employment growth*$_{it+1}$ | *Aggregate ETR*$_{it}$ | *Statutory tax rate*$_{it}$ | *Real GDP growth*$_{it}$ | *Population*$_{it}$ *(in millions)* | *Control of corruption*$_{it}$ | *Volatility of ETR*$_{it}$ | *Tax visit*$_{it}$ | *Other ETR*$_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | 11 | 0.054 | 0.006 | 0.243 | 0.350 | 0.062 | 40 | -0.449 | 0.144 | 2.573 | 0.211 |
| Australia | 16 | 0.033 | 0.004 | 0.208 | 0.314 | 0.031 | 21 | 1.966 | 0.125 | − | − |
| Austria | 16 | 0.017 | 0.004 | 0.203 | 0.289 | 0.019 | 8 | 1.878 | 0.130 | − | − |
| Bangladesh | 5 | 0.061 | 0.006 | 0.216 | 0.275 | 0.059 | 153 | -0.971 | 0.116 | 1.420 | 0.216 |
| Belgium | 13 | 0.014 | 0.002 | 0.236 | 0.349 | 0.014 | 11 | 1.425 | 0.141 | − | − |
| Botswana | 6 | 0.043 | 0.004 | 0.232 | 0.235 | 0.046 | 2 | 0.958 | 0.099 | 0.967 | 0.219 |
| Brazil | 10 | 0.034 | 0.004 | 0.198 | 0.340 | 0.040 | 196 | -0.055 | 0.134 | 0.700 | 0.211 |
| Bulgaria | 9 | 0.023 | 0.003 | 0.174 | 0.127 | 0.029 | 7 | -0.199 | 0.058 | 2.489 | 0.213 |
| Canada | 19 | 0.026 | 0.004 | 0.199 | 0.366 | 0.026 | 32 | 2.069 | 0.181 | − | − |
| Chile | 8 | 0.038 | 0.007 | 0.165 | 0.179 | 0.043 | 17 | 1.440 | 0.100 | 2.950 | 0.215 |
| China | 16 | 0.083 | 0.001 | 0.019 | 0.300 | 0.079 | 1293 | -0.463 | 0.053 | 1.200 | 0.217 |
| Croatia | 10 | 0.003 | 0.001 | 0.241 | 0.200 | 0.008 | 4 | 0.041 | 0.104 | 0.700 | 0.212 |
| Denmark | 19 | 0.013 | 0.000 | 0.251 | 0.290 | 0.014 | 5 | 2.433 | 0.172 | − | − |
| Egypt | 10 | 0.044 | 0.005 | 0.167 | 0.210 | 0.046 | 80 | -0.591 | 0.141 | 3.170 | 0.210 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Estonia | 1 | -0.054 | 0.002 | 0.079 | 0.220 | 0.077 | 1 | 0.914 | 0.071 | 0.300 | 0.194 |
| Finland | 18 | 0.022 | 0.004 | 0.269 | 0.271 | 0.024 | 5 | 2.380 | 0.149 | − | − |
| France | 17 | 0.015 | 0.001 | 0.306 | 0.361 | 0.017 | 63 | 1.379 | 0.163 | − | − |
| Germany | 18 | 0.013 | 0.003 | 0.301 | 0.402 | 0.013 | 81 | 1.876 | 0.191 | 1.300 | 0.215 |
| Ghana | 6 | 0.073 | 0.007 | 0.221 | 0.313 | 0.083 | 25 | -0.010 | 0.112 | 4.033 | 0.219 |
| Greece | 14 | 0.001 | -0.002 | 0.265 | 0.292 | 0.003 | 11 | 0.231 | 0.170 | 1.700 | 0.213 |
| Hong Kong | 19 | 0.035 | 0.003 | 0.125 | 0.165 | 0.035 | 7 | 1.705 | 0.135 | − | − |
| Hungary | 15 | 0.020 | 0.001 | 0.178 | 0.184 | 0.020 | 10 | 0.497 | 0.099 | 1.480 | 0.217 |
| India | 18 | 0.069 | 0.001 | 0.229 | 0.362 | 0.069 | 1133 | -0.423 | 0.162 | 2.600 | 0.213 |
| Indonesia | 18 | 0.045 | 0.002 | 0.268 | 0.293 | 0.047 | 224 | -0.780 | 0.145 | 0.200 | 0.213 |
| Ireland | 19 | 0.047 | 0.003 | 0.211 | 0.194 | 0.050 | 4 | 1.601 | 0.140 | 1.300 | 0.216 |
| Israel | 19 | 0.039 | 0.003 | 0.182 | 0.319 | 0.041 | 7 | 1.031 | 0.133 | 0.600 | 0.213 |
| Italy | 10 | -0.005 | -0.002 | 0.369 | 0.337 | -0.003 | 59 | 0.193 | 0.186 | − | − |
| Jamaica | 6 | -0.006 | -0.005 | 0.248 | 0.319 | -0.008 | 3 | -0.386 | 0.158 | 0.500 | 0.220 |
| Japan | 19 | 0.008 | -0.001 | 0.414 | 0.425 | 0.009 | 126 | 1.240 | 0.211 | − | − |
| Jordan | 13 | 0.053 | 0.002 | 0.199 | 0.216 | 0.055 | 6 | 0.191 | 0.140 | 1.661 | 0.211 |
| Kazakhstan | 5 | 0.068 | 0.003 | 0.263 | 0.260 | 0.072 | 16 | -0.932 | 0.072 | 2.780 | 0.209 |
| Kenya | 12 | 0.051 | 0.000 | 0.224 | 0.300 | 0.047 | 38 | -0.959 | 0.143 | 6.266 | 0.210 |
| Kuwait | 9 | 0.025 | 0.001 | 0.068 | 0.328 | 0.038 | 3 | 0.315 | 0.068 | − | − |
| Lithuania | 6 | 0.018 | -0.003 | 0.193 | 0.158 | 0.017 | 3 | 0.225 | 0.135 | 0.983 | 0.220 |
| Malaysia | 18 | 0.046 | 0.002 | 0.235 | 0.268 | 0.048 | 26 | 0.308 | 0.171 | 2.100 | 0.213 |
| Mauritius | 12 | 0.041 | 0.003 | 0.122 | 0.198 | 0.039 | 1 | 0.483 | 0.109 | 0.500 | 0.212 |
| Mexico | 13 | 0.031 | 0.004 | 0.207 | 0.315 | 0.027 | 109 | -0.369 | 0.133 | 0.754 | 0.217 |
| Morocco | 1 | 0.024 | -0.001 | 0.306 | 0.300 | 0.047 | 33 | -0.363 | 0.157 | 0.300 | 0.218 |
| Netherlands | 19 | 0.019 | 0.003 | 0.239 | 0.309 | 0.020 | 16 | 2.169 | 0.159 | − | − |
| N Zealand | 10 | 0.019 | 0.004 | 0.273 | 0.306 | 0.019 | 4 | 2.358 | 0.094 | − | − |
| Nigeria | 12 | 0.068 | 0.001 | 0.193 | 0.300 | 0.072 | 150 | -1.119 | 0.140 | 3.000 | 0.212 |
| Norway | 18 | 0.020 | 0.002 | 0.208 | 0.280 | 0.021 | 5 | 2.158 | 0.168 | − | − |
| Oman | 9 | 0.046 | 0.016 | 0.103 | 0.120 | 0.046 | 3 | 0.215 | 0.074 | − | − |
| Pakistan | 16 | 0.041 | 0.002 | 0.259 | 0.349 | 0.040 | 156 | -0.924 | 0.184 | 1.531 | 0.212 |
| Peru | 8 | 0.060 | 0.005 | 0.402 | 0.300 | 0.066 | 29 | -0.294 | 0.157 | 1.550 | 0.211 |
| Philippines | 17 | 0.046 | -0.001 | 0.211 | 0.287 | 0.046 | 86 | -0.533 | 0.166 | 1.500 | 0.215 |
| Poland | 16 | 0.038 | 0.002 | 0.251 | 0.258 | 0.041 | 39 | 0.426 | 0.155 | 3.419 | 0.216 |
| Portugal | 8 | -0.006 | -0.007 | 0.227 | 0.253 | -0.005 | 11 | 0.991 | 0.102 | 1.600 | 0.215 |
| Russia | 13 | 0.042 | 0.004 | 0.304 | 0.248 | 0.045 | 144 | -0.964 | 0.152 | 1.462 | 0.211 |
| S Arabia | 9 | 0.039 | 0.006 | 0.065 | 0.191 | 0.041 | 27 | -0.106 | 0.096 | − | − |
| Singapore | 19 | 0.053 | 0.004 | 0.179 | 0.229 | 0.055 | 4 | 2.227 | 0.159 | − | − |
| Slovenia | 9 | 0.012 | 0.000 | 0.260 | 0.250 | 0.018 | 2 | 0.935 | 0.140 | 0.356 | 0.211 |
| S Africa | 18 | 0.030 | 0.002 | 0.244 | 0.347 | 0.031 | 48 | 0.370 | 0.161 | 0.800 | 0.214 |
| S Korea | 7 | 0.046 | 0.008 | 0.208 | 0.258 | 0.052 | 48 | -1.067 | 0.144 | 2.200 | 0.220 |
| Spain | 10 | 0.005 | -0.005 | 0.241 | 0.318 | 0.007 | 46 | 1.078 | 0.150 | 1.500 | 0.212 |
| Sri Lanka | 14 | 0.058 | 0.001 | 0.173 | 0.287 | 0.057 | 20 | -0.257 | 0.160 | 1.300 | 0.213 |
| Sweden | 19 | 0.024 | 0.001 | 0.216 | 0.273 | 0.025 | 9 | 2.276 | 0.152 | 0.100 | 0.215 |
| Switzerland | 19 | 0.019 | 0.003 | 0.225 | 0.269 | 0.019 | 7 | 2.132 | 0.139 | − | − |
| Taiwan | 19 | 0.044 | 0.003 | 0.145 | 0.233 | 0.046 | 23 | 0.672 | 0.140 | − | − |
| Thailand | 19 | 0.033 | 0.003 | 0.205 | 0.295 | 0.037 | 64 | -0.225 | 0.163 | 1.000 | 0.212 |
| Turkey | 14 | 0.042 | 0.002 | 0.233 | 0.251 | 0.046 | 69 | -0.102 | 0.159 | 1.478 | 0.213 |
| UAE | 8 | 0.030 | 0.006 | 0.088 | 0.550 | 0.036 | 8 | 1.075 | 0.086 | − | − |
| UK | 19 | 0.021 | 0.002 | 0.222 | 0.316 | 0.021 | 60 | 1.927 | 0.166 | − | − |
| USA | 19 | 0.024 | -0.001 | 0.267 | 0.396 | 0.024 | 293 | 1.515 | 0.181 | − | − |
| Vietnam | 8 | 0.059 | 0.005 | 0.174 | 0.261 | 0.061 | 88 | -0.622 | 0.148 | 0.900 | 0.212 |
| Zimbabwe | 4 | 0.072 | -0.005 | 0.233 | 0.258 | 0.094 | 14 | -1.313 | 0.153 | 1.800 | 0.217 |

**Table 2 (cont.)**

**Panel C: Univariate correlations**

| | *Real GDP growth$_{it+1}$* | *Employment growth$_{it+1}$* | *Aggregate ETR$_{it}$* | *Statutory tax rate$_{it}$* | *Real GDP growth$_{it}$* | *Population$_{it}$* | *Control of corruption$_{it}$* | *Volatility of ETR$_{it}$* | *Tax visit$_{it}$* | *Other ETR$_{it}$* |
|---|---|---|---|---|---|---|---|---|---|---|
| *Real GDP growth$_{it+1}$* | | **0.43** | **-0.27** | 0.00 | **0.47** | **0.26** | **-0.28** | **-0.19** | **0.17** | **-0.26** |
| *Employment growth$_{it+1}$* | **0.39** | | **-0.20** | -0.03 | **0.33** | -0.03 | 0.01 | **-0.17** | -0.01 | **-0.22** |
| *Aggregate ETR$_{it}$* | **-0.28** | **-0.22** | | **0.29** | **-0.27** | **-0.16** | **0.07** | **0.59** | **-0.10** | **0.09** |
| *Statutory tax rate$_{it}$* | -0.01 | **-0.05** | **0.35** | | 0.01 | **0.18** | **0.09** | **0.21** | 0.07 | -0.04 |
| *Real GDP growth$_{it}$* | **0.55** | **0.31** | **-0.30** | -0.03 | | **0.23** | **-0.28** | **-0.23** | **0.18** | **-0.27** |
| *Population$_{it}$* | **0.15** | **-0.06** | **0.22** | **0.43** | **0.13** | | **-0.29** | **-0.09** | 0.05 | 0.02 |
| *Control of corruption$_{it}$* | **-0.34** | 0.02 | **0.07** | 0.05 | **-0.35** | **-0.51** | | **0.12** | **-0.28** | 0.04 |
| *Volatility of ETR$_{it}$* | **-0.20** | **-0.17** | **0.57** | **0.24** | **-0.27** | **0.25** | **0.09** | | 0.01 | 0.07 |
| *Tax visit$_{it}$* | **0.22** | -0.03 | **-0.09** | 0.03 | **0.23** | **0.16** | **-0.31** | 0.05 | | -0.01 |
| *Other ETR$_{it}$* | **-0.27** | **-0.22** | **0.10** | -0.04 | **-0.30** | -0.02 | 0.06 | 0.06 | -0.02 | |

**Table 3**
**The relationship between corporate tax revenue and aggregate ETR**

This table reports the results from OLS estimation models that examine the effect of country-level ETR and statutory tax rates on country-level corporate tax revenue scaled by GDP. The sample period is between 1995 and 2013. All non-indicator variables are winsorized at the top and bottom one-percentiles. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. Variables are defined in Table 2.

| | *Dependent variable = Corporate tax revenue$_{it}$* | | |
|---|---|---|---|
| *Aggregate ETR$_{it}$* | – | – | 0.020 |
| | | | (2.47) |
| *Statutory tax rate$_{it}$* | 0.035 | 0.022 | 0.018 |
| | (1.88) | (0.88) | (0.72) |
| Control variables | | | |
| *Real GDP growth$_{it}$* | 0.043 | 0.054 | 0.062 |
| | (1.40) | (2.53) | (2.74) |
| *Log(Population)$_{it}$* | −0.004 | 0.016 | 0.010 |
| | (−1.57) | (1.29) | (0.78) |
| Intercept | Yes | Yes | Yes |
| Country fixed effects | No | Yes | Yes |
| Year fixed effects | No | Yes | Yes |
| *N* | 441 | 441 | 441 |
| Adj. $R^2$ | 0.088 | 0.838 | 0.841 |

**Table 4**
**Tests of H1: The relationship between GDP growth, employment growth and aggregate ETR**

This table reports the results from OLS estimation models that examine the effect of country-level ETR and statutory tax rate on country-level growth in real GDP or employment. *Aggregate tax diff*$_{it}$ is the difference between statutory tax rate and aggregate ETR. The sample period is between 1995 and 2013. All non-indicator variables are winsorized at the top and bottom one-percentiles. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. Variables are defined in Table 2.

**Panel A: Corporate tax policy and future real GDP growth**

| | *Dependent variable = Real GDP growth*$_{it+1}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| *Aggregate ETR*$_{it}$ | − | − | − | − | −0.080 | −0.065 | −0.079 | −0.071 |
| | | | | | (−5.06) | (−2.91) | (−4.66) | (−3.08) |
| *Aggregate tax diff*$_{it}$ | − | − | 0.078 | 0.069 | − | − | − | − |
| | | | (4.86) | (3.11) | | | | |
| *Statutory tax rate*$_{it}$ | −0.023 | 0.052 | −0.079 | −0.007 | − | − | −0.003 | 0.061 |
| | (−1.75) | (1.56) | (−5.16) | (−0.19) | | | (−0.19) | (1.72) |
| Control variables | | | | | | | | |
| *Real GDP growth*$_{it}$ | 0.445 | 0.269 | 0.391 | 0.259 | 0.390 | 0.275 | 0.391 | 0.259 |
| | (9.19) | (5.13) | (7.75) | (4.92) | (7.71) | (4.57) | (7.72) | (4.90) |
| *Log(Population)*$_{it}$ | 0.003 | 0.038 | 0.004 | 0.044 | 0.004 | 0.041 | 0.004 | 0.045 |
| | (3.11) | (1.69) | (4.14) | (2.05) | (4.47) | (1.77) | (4.15) | (2.08) |
| Intercept | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country fixed effects | No | Yes | No | Yes | No | Yes | No | Yes |
| Year fixed effects | No | Yes | No | Yes | No | Yes | No | Yes |
| *N* | 854 | 854 | 854 | 854 | 854 | 854 | 854 | 854 |
| Adj. $R^2$ | 0.246 | 0.636 | 0.276 | 0.644 | 0.276 | 0.639 | 0.276 | 0.644 |

**Panel B: Corporate tax policy and future employment growth**

| | *Dependent variable = Employment growth*$_{it+1}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| *Aggregate ETR*$_{it}$ | − | − | − | − | −0.010 | −0.020 | −0.011 | −0.020 |
| | | | | | (−2.09) | (−2.52) | (−2.24) | (−2.60) |
| *Aggregate tax diff*$_{it}$ | − | − | 0.011 | 0.021 | − | − | − | − |
| | | | (2.40) | (2.89) | | | | |
| *Statutory tax rate*$_{it}$ | −0.000 | −0.003 | −0.009 | −0.020 | − | − | 0.002 | −0.000 |
| | (−0.08) | (−0.33) | (−1.28) | (−2.03) | | | (0.46) | (−0.05) |
| Control variables | | | | | | | | |
| *Real GDP growth*$_{it}$ | 0.079 | 0.089 | 0.071 | 0.086 | 0.071 | 0.086 | 0.071 | 0.086 |
| | (5.31) | (4.19) | (4.64) | (4.11) | (4.61) | (3.97) | (4.65) | (4.10) |
| *Log(Population)*$_{it}$ | −0.001 | 0.006 | −0.001 | 0.008 | −0.000 | 0.008 | −0.001 | 0.008 |
| | (−2.37) | (0.70) | (−1.68) | (0.92) | (−1.62) | (0.90) | (−1.67) | (0.92) |
| Intercept | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country fixed effects | No | Yes | No | Yes | No | Yes | No | Yes |
| Year fixed effects | No | Yes | No | Yes | No | Yes | No | Yes |
| *N* | 854 | 854 | 854 | 854 | 854 | 854 | 854 | 854 |
| Adj. $R^2$ | 0.122 | 0.328 | 0.134 | 0.342 | 0.133 | 0.340 | 0.133 | 0.340 |

**Table 5**
**Robustness checks for correlated omitted variables concerns**

This table reports OLS regression results from robustness checks for correlated omitted variables concerns in analyses that examine the effect of country-level ETR on country-level growth in real GDP or employment. Panel A presents results from estimation of Equation (1) after including additional control variables. Panel B presents results from estimating Equation (1) in changes specifications, where changes for variables are measured from year t-1 to year t. For all the analyses, the sample period is 1995 to 2013. All non-indicator variables are winsorized at the top and bottom one-percentiles. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. *Real GDP* is real gross domestic product at constant 2011 prices (measured in millions US$), *Human capital* is the human capital index computed by Penn World based on years of schooling and returns to investment in education, *Government consumption* is the share of government consumption (or equivalently government expenditure) in GDP, *Exports / Imports* is the share of merchandise exports in GDP divided by share of merchandise imports in GDP), *Rule of law* is the Rule of law index provided by Worldwide Governance Indicators project website, *Inflation rate* is the annual proportional change in consumer price index, *Population growth* is the proportional change in population. *Aggregate investment* is asset-weighted average of capital expenditures defined as capital expenditures scaled by total assets in a country-year. All other variables are defined in Table 2.

**Panel A: Additional control variables**

| | *Dependent variable = Real GDP growth$_{t+1}$* | *Dependent variable = Employment growth $_{t+1}$* |
|---|---|---|
| | 1 | 2 |
| *Aggregate ETR$_{it}$* | −0.069 | −0.020 |
| | (−2.83) | (−2.31) |
| *Statutory tax rate$_{it}$* | 0.057 | −0.001 |
| | (2.08) | (−0.10) |
| Control variables | | |
| *Real GDP growth$_t$* | 0.281 | 0.096 |
| | (4.93) | (4.27) |
| *Log(Population)$_t$* | 0.083 | 0.022 |
| | (3.03) | (2.40) |
| *Log(Real GDP)$_t$* | −0.047 | −0.015 |
| | (−3.15) | (−4.26) |
| *Human capital$_t$* | −0.011 | 0.011 |
| | (−0.62) | (1.69) |
| *Government consumption$_t$* | −0.150 | −0.034 |
| | (−2.89) | (−1.81) |
| *Exports / Imports$_t$* | 0.001 | 0.001 |
| | (0.12) | (0.60) |
| *Rule of law$_t$* | −0.005 | −0.001 |
| | (−0.67) | (−0.46) |
| *Inflation rate$_t$* | 0.014 | −0.003 |
| | (0.42) | (−0.29) |
| *Population growth$_t$* | −0.793 | −0.022 |
| | (−2.49) | (−0.24) |
| *Aggregate investment$_{it}$* | 0.080 | 0.010 |
| | (1.23) | (0.40) |
| Intercept | Yes | Yes |
| Country fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| *N* | 818 | 818 |
| Adj. $R^2$ | 0.673 | 0.348 |

**Table 5 (cont.)**

**Panel B: Changes analysis**

| | *Dependent variable = ΔReal GDP growth$_{it+1}$* | *Dependent variable = ΔEmployment growth$_{it+1}$* |
|---|---|---|
| | 1 | 2 |
| *ΔAggregate ETR$_{it}$* | −0.091 | −0.012 |
| | (−3.47) | (−1.84) |
| *ΔStatutory tax rate$_{it}$* | 0.014 | −0.005 |
| | (0.29) | (−0.54) |
| Control variables | | |
| *ΔReal GDP growth$_{it}$* | −0.286 | 0.014 |
| | (−8.92) | (1.21) |
| *ΔLog(Population)$_{it}$* | −0.065 | −0.008 |
| | (−1.11) | (−0.84) |
| Intercept | Yes | Yes |
| Country fixed effects | No | No |
| Year fixed effects | Yes | Yes |
| *N* | 809 | 809 |
| Adj. $R^2$ | 0.491 | 0.166 |

**Table 6**
**Instrumental variable regressions**

This table reports instrumental variable (IV) regression results for analyses that examine the effect of country-level ETR on country-level growth in real GDP or employment. The sample period is 1995 to 2013. All non-indicator variables are winsorized at the top and bottom one-percentiles. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. In the second stage regressions, *Aggregate* $ETR_{it}$ is instrumented by *Log(Tax visit)*$_{it}$ and by *Other* $ETR_{it}$. *Log(Tax visit)*$_{it}$ is calculated as natural logarithm of one plus number of visits or required meetings with tax officials in country *i* and year *t*. *Other* $ETR_{it}$ is calculated as the weighted average of aggregate ETR of other countries (other than country *i*) in our sample in year t, weighting by the inverse of the logarithm of the distance between the two countries' capital cities. All other variables are defined in Table 2. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. Other variables are defined in Table 2.

| | **First Stage Regression** | **Second Stage Regression** | |
|---|---|---|---|
| | *Dependent variable = Aggregate* $ETR_{it}$ | *Dependent variable = Real GDP* $growth_{it+1}$ | *Dependent variable = Employment* $growth_{it+1}$ |
| | 1 | 2 | 3 |
| *Aggregate* $ETR_{it}$ | – | −0.105 | −0.034 |
| | | (−3.18) | (−2.36) |
| *Statutory tax rate*$_{it}$ | 0.085 | 0.154 | 0.017 |
| | (1.42) | (3.46) | (1.03) |
| Control variables | | | |
| *Real GDP growth*$_{it}$ | −0.061 | 0.277 | 0.082 |
| | (−0.77) | (4.92) | (3.18) |
| *Log(Population)*$_{it}$ | 0.077 | 0.030 | 0.003 |
| | (1.45) | (1.15) | (0.22) |
| *Log(Tax visit)*$_{it}$ | 0.037 | – | – |
| | (3.10) | | |
| *Other* $ETR_{it}$ | −31.702 | – | – |
| | (−9.67) | | |
| Intercept | Yes | Yes | Yes |
| Country fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| *N* | 511 | 511 | 511 |
| Adj. $R^2$ | 0.792 | 0.665 | 0.304 |
| Kleibergen-Paap LM statistic | 26.106 (p-value = 0.00) | | |
| Kleibergen-Paap F statistic | 55.704 | | |
| Hansen's J statistic | | 0.309 (p-value = 0.58) | 2.403 (p-value = 0.12) |

**Table 7**
**Replication of Mendoza, Milesi-Ferretti, and Asea (1997)**

This table reports replicates results in Table 5 of Mendoza, Milesi-Ferretti, and Asea (1997). The sample period is 1995 to 2013. All non-indicator variables are winsorized at the top and bottom one-percentiles. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. Taxcon, Taxlab and Taxcap are computed as described in Mendoza et al. (1997) and are the effective tax rate on consumption, labor income and capital income respectively. All other variables are defined in Table 2. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level.

| | *Dependent variable = GDP per capita growth$_{it}$* | | | |
|---|---|---|---|---|
| **Observation level** | *5-year averages* | | *Annual* | |
| | 1 | 2 | 3 | 4 |
| *Aggregate ETR$_{it}$* | – | −0.099 | – | −0.074 |
| | | (−2.96) | | (−2.45) |
| *Taxcon$_{it}$* | 0.029 | 0.030 | 0.052 | 0.046 |
| | (1.07) | (1.15) | (1.17) | (0.92) |
| *Taxlab$_{it}$* | −0.031 | −0.016 | −0.036 | −0.052 |
| | (−1.41) | (−0.75) | (−0.48) | (−0.67) |
| *Taxcap$_{it}$* | −0.019 | −0.025 | 0.055 | 0.103 |
| | (−0.67) | (−1.03) | (0.62) | (1.41) |
| *Log(GDP 1995)$_{it}$* | −0.004 | −0.001 | – | – |
| | (−2.24) | (−0.67) | | |
| Intercept | Yes | Yes | Yes | Yes |
| Country fixed effects | No | No | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| *N* | 96 | 96 | 451 | 451 |
| Adj. $R^2$ | 0.205 | 0.289 | 0.547 | 0.563 |

**Table 8**
**Additional tests of assumptions underlying H1**

Panel A reports sub-sample results from OLS estimation models that examine the effect of country-level ETR on country-level growth in real GDP or employment. The model is estimated separately for poor and strong control of corruption score countries. Control of corruption scores data are obtained from the Worldwide Governance Indicators and sample is divided into poor- and strong-control of corruption at the median of corruption index. Panel B reports the relationship between real GDP growth components and aggregate ETR. Panel C reports the relationship between ETR and future labor productivity (measured as growth in GDP per hour worked) and labor utilization growth (measured as growth in hours worked per capita). The sample period is 1995 to 2013. All non-indicator variables are winsorized at the top and bottom one-percentiles. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. Other variables are defined in Table 2. $^{***}$, $^{**}$, and $^{*}$ indicate that the coefficients across the two sub-samples are significantly different at the 1%, 5%, and 10% levels, respectively, in one-tailed tests.

**Panel A: The impact of corruption**

| | *Dependent variable = Real GDP growth$_{it+1}$* | | *Dependent variable = Employment growth$_{it+1}$* | |
|---|---|---|---|---|
| **Control of corruption** | *Poor-control* | *Strong-control* | *Poor-control* | *Strong-control* |
| | 1 | 2 | 3 | 4 |
| *Aggregate ETR$_{it}$* | −0.094 | −0.005$^{**}$ | −0.022 | −0.006$^{*}$ |
| | (−2.59) | (−0.19) | (−1.96) | (−0.71) |
| *Statutory tax rate$_{it}$* | 0.053 | 0.037 | −0.000 | −0.000 |
| | (1.04) | (0.77) | (−0.05) | (−0.01) |
| Control variables | | | | |
| *Real GDP growth$_{it}$* | 0.225 | 0.247 | 0.051 | 0.147$^{***}$ |
| | (4.03) | (2.33) | (2.10) | (4.10) |
| *Log(Population)$_{it}$* | 0.027 | 0.031$^{**}$ | 0.014 | 0.003 |
| | (1.02) | (0.92) | (1.41) | (0.18) |
| Intercept | Yes | Yes | Yes | Yes |
| Country fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| *N* | 427 | 427 | 427 | 427 |
| Adj. $R^2$ | 0.634 | 0.684 | 0.291 | 0.498 |

**Panel B: Real GDP growth components**

| **Dependent variable =** | *Personal consumption growth$_{it+1}$* | *Business investment growth$_{it+1}$* | *Government spending growth$_{it+1}$* | *Net exports growth$_{it+1}$* |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| *Aggregate ETR$_{it}$* | −0.096 | −0.327 | −0.040 | −0.073 |
| | (−3.09) | (−4.00) | (−0.78) | (−1.24) |
| *Statutory tax rate$_{it}$* | 0.135 | 0.198 | 0.018 | 0.106 |
| | (3.01) | (2.02) | (0.36) | (1.15) |
| Control variables | | | | |
| *Real GDP growth$_{it}$* | 0.308 | 0.209 | 0.216 | 0.053 |
| | (4.30) | (0.94) | (1.84) | (0.32) |
| *Log(Population)$_{it}$* | 0.053 | 0.024 | 0.088 | 0.028 |
| | (1.32) | (0.25) | (1.30) | (0.35) |
| Intercept | Yes | Yes | Yes | Yes |
| Country fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| *N* | 854 | 854 | 854 | 854 |
| Adj. $R^2$ | 0.258 | 0.334 | 0.205 | 0.587 |

**Table 8 (cont.)**

**Panel C: Labor productivity and utilization growth**

| | *Dependent variable = Labor productivity growth$_{it+1}$* | *Dependent variable = Labor utilization growth$_{it+1}$* |
|---|---|---|
| | 1 | 2 |
| *Aggregate ETR$_{it}$* | −0.045 | −0.049 |
| | (−1.87) | (−2.34) |
| *Statutory tax rate$_{it}$* | 0.069 | −0.006 |
| | (2.04) | (−0.23) |
| Control variables | | |
| *Real GDP growth$_{it}$* | 0.069 | 0.319 |
| | (1.20) | (4.41) |
| *Log(Population)$_{it}$* | 0.048 | −0.019 |
| | (1.62) | (−0.52) |
| Intercept | Yes | Yes |
| Country fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| *N* | 499 | 499 |
| Adj. $R^2$ | 0.368 | 0.457 |

**Table 9**
**Tests of H2: Tax incentives versus tax planning**

Panel A reports sub-sample results from OLS estimation models that examine the effect of country-level ETR on country-level growth in real GDP or employment conditioned on tax planning. The model is estimated separately for low and high *Volatility of ETR* countries. First, we compute industry-adjusted *Firm-level ETR* as the difference between *Firm-level ETR* and its industry average, where the average is computed using all firms in a 2 digit SIC for each country and year. Next, for each country and year, *Volatility of ETR* is computed as the standard-deviation of Industry-adjusted *Firm-level ETR*. Finally, country-years with above-median (below-median) standard deviation are categorized in the 'High' ('Low') group. Panel B reports sub-sample results from OLS estimation models that examine the effect of country-level ETR on country-level growth in real GDP or employment conditioned on financial constraints. To do so, we calculate *Aggregate ETR* separately for firms with high and low financial constraints. For this table, firm-level observations are sorted into groups as follows: First, we calculate firm-level financial constraints (i.e., FC index) as the first factor of Size and Age, where Size equals the natural logarithm of total assets in U.S. dollars, and Age is the number of years the firm is listed on Thomson Eikon or Compustat databases. To aid in interpretation, we multiply the factor score with -1 so that FC index is an increasing function of financial constraints. Next, for each country-year, we divide observations into two groups at the median level of change in FC index (ΔFC). Finally, we calculate *Aggregate ETR* separately for each financial constraints group within each country-year. The sample period is 1995 to 2013. All non-indicator variables are winsorized at the top and bottom one-percentiles. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. Other variables are defined in Table 2. $^{***}$, $^{**}$, and $^{*}$ indicate that the coefficients across the two sub-samples are significantly different at the 1%, 5%, and 10% levels, respectively, in one-tailed tests.

**Panel A: The impact of tax planning**

| | *Dependent variable = Real GDP growth$_{it+1}$* | | *Dependent variable = Employment growth$_{it+1}$* | |
|---|---|---|---|---|
| **Volatility of ETR** | *Low* | *High* | *Low* | *High* |
| | 1 | 2 | 3 | 4 |
| *Aggregate ETR$_{it}$* | −0.029 | −0.109$^{**}$ | −0.010 | −0.044$^{**}$ |
| | (−1.13) | (−2.88) | (−1.01) | (−4.43) |
| *Statutory tax rate$_{it}$* | 0.027 | 0.097 | −0.003 | 0.010 |
| | (0.58) | (2.34) | (−0.27) | (1.01) |
| Control variables | | | | |
| *Real GDP growth$_{it}$* | 0.293 | 0.209 | 0.084 | 0.083 |
| | (4.30) | (2.86) | (3.32) | (2.56) |
| *Log(Population)$_{it}$* | 0.018 | 0.042 | 0.006 | 0.002 |
| | (0.57) | (1.34) | (0.62) | (0.16) |
| Intercept | Yes | Yes | Yes | Yes |
| Country fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| *N* | 427 | 427 | 427 | 427 |
| Adj. $R^2$ | 0.619 | 0.748 | 0.405 | 0.404 |

**Table 9 (cont.)**

**Panel B: The impact of financial constraints**

| | *Dependent variable = Real GDP growth$_{it+1}$* | *Dependent variable = Employment growth$_{it+1}$* |
|---|---|---|
| | 1 | 2 |
| *Aggregate ETR$_{it}$* | −0.014 | −0.010 |
| *(ΔFC = Low)* | (−0.55) | (−1.40) |
| *Aggregate ETR$_{it}$* | −0.059 | −0.018 |
| *(ΔFC = High)* | (−2.37) | (−2.24) |
| *Statutory tax rate$_{it}$* | 0.053 | 0.003 |
| | (1.36) | (0.34) |
| Control variables | | |
| *Real GDP growth$_{it}$* | 0.246 | 0.084 |
| | (3.97) | (3.56) |
| *Log(Population)$_{it}$* | 0.020 | 0.015 |
| | (0.76) | (1.52) |
| Intercept | Yes | Yes |
| Country fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| *N* | 685 | 685 |
| Adj. $R^2$ | 0.647 | 0.357 |

**Table 10**
**The relationship between firm-level investment and firm-level ETRs**

This table reports the results from firm-level OLS estimation models that examine the effect of firm-level ETR on one-year ahead firm-level capital expenditures ($Capex_{jt+1}$) and log of number of employees ($Log(Employees)_{jt+1}$). *Capex* is defined as capital expenditures scaled by total assets. In addition to the set of country-level control variables in Equation (1), we control for contemporaneous levels of dependent variables, country-industry-year average of firm-level ETR ($Industry\ ETR_{kt}$), total assets of the firm ($Total\ assets_{jt}$), firm-level growth opportunities ($Q_{jt}$) and firm-level cash flows from operations ($CFO_{jt}$). The sample period is between 1995 and 2013. All non-indicator variables are winsorized at the top and bottom one-percentiles. The *t*-values, reported in parentheses, are based on standard errors clustered at the country level. Other variables are defined in Table 2.

| | *Dependent variable =* $Capex_{jt+1}$ | | | *Dependent variable =* $Log(Employees)_{jt+1}$ | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| $Firm\text{-}level\ ETR_{it}$ | −0.004 | −0.003 | −0.003 | −0.014 | −0.011 | −0.014 |
| | (−3.28) | (−3.17) | (−3.26) | (−4.05) | (−3.21) | (−4.33) |
| $Industry\ ETR_{it}$ | – | – | −0.005 | – | – | −0.003 |
| | | | (−1.59) | | | (−0.09) |
| $Statutory\ tax\ rate_{it}$ | 0.023 | – | 0.023 | 0.199 | – | 0.199 |
| | (1.63) | | (1.65) | (3.14) | | (3.16) |
| Control variables | | | | | | |
| $Capex_{jt}$ | 0.262 | 0.247 | 0.262 | – | – | – |
| | (9.03) | (8.54) | (9.03) | | | |
| $Log(Employees)_{jt}$ | – | – | – | 0.668 | 0.659 | 0.668 |
| | | | | (19.05) | (17.89) | (19.02) |
| $Log(Total\ assets)_{jt}$ | −0.004 | −0.004 | −0.004 | 0.132 | 0.140 | 0.132 |
| | (−3.80) | (−5.16) | (−3.79) | (7.50) | (7.26) | (7.51) |
| $Q_{jt}$ | 0.004 | 0.004 | 0.004 | 0.028 | 0.028 | 0.028 |
| | (13.27) | (25.72) | (13.25) | (15.28) | (18.62) | (15.30) |
| $CFO_{jt}$ | 0.037 | 0.030 | 0.037 | 0.195 | 0.200 | 0.195 |
| | (4.79) | (6.08) | (4.82) | (12.82) | (13.66) | (12.80) |
| $Real\ GDP\ growth_{it}$ | 0.089 | – | 0.087 | 0.341 | – | 0.340 |
| | (2.34) | | (2.31) | (2.13) | | (2.08) |
| $Log(Population)_{it}$ | −0.012 | – | −0.011 | −0.391 | – | −0.390 |
| | (−0.30) | | (−0.28) | (−3.46) | | (−3.47) |
| Intercept | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | No | Yes | Yes | No | Yes |
| Country-industry-year effects | No | Yes | No | No | Yes | No |
| *N* | 68,445 | 68,445 | 68,445 | 68,445 | 68,445 | 68,445 |
| Adj. $R^2$ | 0.148 | 0.088 | 0.148 | 0.663 | 0.615 | 0.663 |