



# Tax compliance and fiscal externalities: Evidence from U.S. diesel taxation<sup>☆</sup>

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## ABSTRACT

Fiscal externalities across jurisdictions can arise from tax evasion and avoidance. While the tax competition literature has generally focused on base shifting and the resulting positive fiscal externalities, we show theoretically and empirically that negative fiscal externalities can dominate when the tax base is apportioned across jurisdictions. This can lead to a negative relationship between jurisdiction size and the desired tax rate. Interstate truckers in the United States owe state diesel taxes based on diesel consumption, which is apportioned based on the miles driven in each state. We find that own-state diesel sales fall when the diesel tax rates of other states rise, suggesting that tax base evasion is the predominant source of externalities. We then estimate a tax reaction specification, finding that the own-state tax rate is negatively correlated with the tax rates set in other states and with state size, both consistent with the sign of the estimated fiscal externality.

## 1. Introduction

Tax compliance and enforcement lead to horizontal and vertical fiscal externalities in tax systems. As is widely recognized by academics and policymakers, a tax increase in one jurisdiction can lead shift the tax base to lower tax jurisdictions, creating a positive fiscal externality. Traditional tax evasion, on the other hand, results in a negative fiscal externality if a transaction in one jurisdiction generates a tax liability in other jurisdictions or at other levels of government.

A familiar example illustrating these two opposing externalities is the state corporate income tax, where the tax base is apportioned among states. An increase in a state's corporate income tax can lead a company to shift operations to other states, as well as to underreport corporate income. The former increases tax revenues in other states, while the latter reduces the tax revenues of any state in which the company operates. While the latter type of externality is less emphasized in discussions of horizontal fiscal externalities, it could dominate the positive externality from base shifting if tax evasion is easy or the location of the tax base is inelastic.

In this paper, we study how tax compliance creates fiscal externalities in the context of state diesel taxes in the U.S. and we examine the effect this has on how states set tax rates. Much like how corporate income is apportioned to US states based on a company's location of sales and capital, diesel consumption by truckers is apportioned to states based on the mileage the trucker drives in each state.

Apportioning diesel consumption based on state mileage sharply reduces the incentive for truckers to *avoid* taxes by purchasing fuel in low-tax jurisdictions. However, two incentives for tax *evasion* remain, which could lead to either positive or negative externalities. First, base shifting could still arise if truckers over-report the share of miles driven in low-tax states. Second, negative fiscal externalities could arise through the understatement of the tax base. A tax increase in one state may lead to a trucker reporting less diesel purchases overall, hurting revenue in all states to which those purchases are apportioned.

Whether the positive or negative fiscal externalities dominate has important implications for models of tax competition. In contrast to the case of base shifting in which tax rates in neighboring states are strategic complements, tax rates are likely to be strategic substitutes when local taxes exert negative fiscal externalities. This is because an increase in the tax of a competing jurisdiction leads to base erosion via evasion, thereby reducing the marginal revenue of the local tax rate. Furthermore, the important result of [Kanbur and Keen \(1993\)](#) that the desired tax rate increases with jurisdiction size may be overturned in the tax apportionment setting. The logic is as follows. More of the tax base is apportioned to a large jurisdiction, who will consequently internalize to a greater extent the impact its own tax rate has on the tax base.

We begin by estimating how the diesel excise tax rates set by other states affect own-state diesel tax revenues. To do so, we form a theoretically-motivated weighting of other states' diesel taxes that gives

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greater weight to the tax rates in states located on the truck shipping routes important to the home state. We find that other states' diesel tax rates are negatively correlated with own-state diesel tax revenue, suggesting that any base shifting is dominated by the effects of underreporting gallons consumed. We provide several pieces of evidence in support of this interpretation. First, we show that the negative spillovers result is driven entirely by our truck-route-based measure of competing tax rates and not by the tax rates set in neighboring states or states that are economically linked in other ways. Second, we find that fiscal externalities are less important for larger states and states for which interstate shipments are a smaller share of truck traffic. Third, in states where gallons underreporting is difficult, we see no evidence of spillovers. This bolsters the explanation that these fiscal externalities are driven by the method of taxing interstate truckers rather than other unobserved linkages between states, and that gallons underreporting is the likely explanation.

We then estimate an empirical model of tax setting to determine the sign of states' tax reaction functions, and to investigate the relationship between state size and the desired tax rate. We find that own-state diesel taxes are indeed lower when the tax rates of competing states are high. We also find that smaller states set higher tax rates. Both results are consistent with the theoretical model's predictions when negative fiscal externalities dominate.

Our paper relates to several strands of the tax literature. First, a large literature examines the fiscal externalities and the resulting strategic behavior imposed by interjurisdictional variation in tax rates.<sup>1</sup> Brueckner (2003) provides an excellent overview of both the theoretical literature relating to tax externalities and the empirical literature documenting horizontal tax competition with respect to cigarette, liquor, and sales taxes. Brueckner notes in this review that in a model of competition between jurisdictions where tax revenues fund purchases of public goods, reaction curves can slope either up or down depending on local preferences for public goods. In a seminal paper, Case et al. (1993) show that the slope of the reaction function depends on the degree of complementarity between the own-state and other-state strategic variable in the government's objective function. While the objective function they consider is the utility for public goods whose benefits may be shared across jurisdictions, the result parallels our model where the objective function is simply government revenues and the strategic complementarity or substitutability of taxes depends on the cross-derivative of marginal revenue with respect to other state taxes. The sign of the reaction curve is relevant for a tax union such as the one we study, as Konrad and Schjelderup (1999) find that when capital tax rates are strategic complements a tax union is welfare maximizing.

A number of papers have tested for both horizontal and vertical fiscal interdependence, including the setting of taxes and spending across jurisdictions. Case et al. (1993) consider the reaction of state government expenditures to the spending in other states. Brueckner and Saavedra (2001) examine the strategic setting of property taxes across cities within the Boston metro area. Lockwood and Migali (2009) find evidence of increased excise tax competition for alcohol after the 1993 introduction of the EU single market. Consequently, the tax rates tend to be too low, as local jurisdictions compete over a mobile tax base. Brulhart and Jametti (2006) examine personal and corporate tax rates of Swiss cantons and find evidence that the vertical tax externalities dominate the horizontal ones. Devereux et al. (2007) test for evidence of horizontal and vertical tax competition in the context of U.S. state cigarette and gasoline taxes and find that horizontal competition is more important for an easily storable good like cigarettes. Agrawal (2015) examines the sales tax rates set by local jurisdictions near and far from state borders with large state sales tax differentials and finds

that local tax rates on the high and low-tax sides of the border smooth the differential in state sales taxes. Waseem (2014) shows evidence of the negative externality of evasion across tax bases, as the evasion of business income in Pakistan leads to a reduction in the VAT tax take. Buettner (2003) estimates the fiscal externalities of business taxation across neighboring German municipalities.

Another set of papers examines the relationship between tax enforcement and collections. Trandel (1992) and Lovely (1994) formalize the welfare effects of evasion and enforcement in a world with interjurisdictional tax differentials and cross-border sales. De Paula and Scheinkman (2010) and Pomeranz (2015) examine the self-enforcing nature of the value-added tax and illustrate how enforcement efforts targeting one point in the supply chain can have effects on evasion up- and down-stream from the targeted firm. More specific to our particular setting, several papers examine evasion and enforcement in the context of fuel taxes. Marion and Muehlegger (2008) estimate the effect of a key regulatory innovation, the dyeing of untaxed diesel, on taxed and untaxed diesel sales in the U.S. Agostini and Martinez (2012) examine the effect of audit threats on tax reporting in Chile.

Finally, our paper overlaps with issues in corporate taxation — in particular, the rules used to apportion a firm's profits across the jurisdictions in which it maintains staff, capital and sales. Gordon and Wilson (1986) highlights the implicit tax on capital and labor, the distortion to firm input decisions and the distortions to state fiscal policy created by apportioning profits based on factors that can be reallocated across jurisdictions. A more recent literature (e.g., Shackelford and Slemrod, 1998; Goolsbee and Maydew, 2000; Devereux and Loretz, 2008; Clausing, 2009; Hines, 2010, and Suarez Serrato and Zidar, 2016) empirically document distortions to firm input decisions, the fiscal externalities, and the attendant effects on state fiscal policy in both the U.S. and E.U. The empirical literature finds evidence that firms set capital and labor strategically in response to the apportionment formula and interjurisdictional differences in corporate tax rates. Business mobility and endogenous allocation of labor create the incentive for states to both lower the overall corporate tax rate and shift away from apportionment based on capital and labor and towards sales. Suarez Serrato and Zidar (2016) find that after accounting for fiscal externalities and apportionment rules, current state corporate taxes are close to revenue-maximizing levels.

While recognizing the theoretical possibility of negatively sloped reaction curves, the existing literature tends to strongly emphasize the positive externalities that local taxes impose on neighboring jurisdictions due to cross-border sales, tax avoidance, or endogenous firm location decisions. This paper presents an alternative source of fiscal externalities, those arising from tax evasion and enforcement, that we demonstrate in the context of diesel fuel taxes lead to negative externalities and suggest that tax rates may be higher than they would be in the absence of the fiscal externality.

We begin by presenting a simple model of firm decisions that illustrate the relevant fiscal externalities. We then present our empirical approach and results. We conclude with a discussion of the implications of our results for other tax policies, such as taxing income from foreign sources, taxing internet transactions, and other excise taxes.

## 2. Tax evasion, fiscal externalities and strategic taxation

We motivate our empirical analysis by formalizing a model of tax evasion in diesel fuel markets. Importantly, taxation of diesel fuel is based on *point-of-use* — firms are responsible for taxes in the states in which they traveled rather than the states in which they purchased fuel. This sharply reduces the incentive for firms to avoid taxes by selectively purchasing fuel in low-tax jurisdictions. Yet, firms can *evade* taxes either by underreporting the total number of taxed gallons they used or by over-reporting mileage in low-tax jurisdictions. We demonstrate that the sign of the fiscal externality (and tax interaction), depend on which of the two methods of evasion dominates.

<sup>1</sup> More broadly, a very large literature examines interjurisdictional competition with respect to regulation, tax policy, and fiscal policy.

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