Do the Laws of Tax Incidence Hold? Point of Collection and the Pass-through of State Diesel Taxes

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Abstract

The canonical theory of taxation holds that the incidence of a tax is independent of the side of the market which is responsible for remitting the tax to the government. However, this prediction does not survive in certain circumstances, for example when the ability to evade taxes differs across economic agents. In this paper, we estimate in the context of state diesel fuel taxes how the incidence of a quantity tax depends on the point of tax collection, where the level of the supply chain responsible for remitting the tax varies across states and over time. Our results indicate that moving the point of tax collection from the retail station to higher in the supply chain substantially raises the pass-through of diesel taxes to the retail price. Furthermore, tax revenues respond positively to collecting taxes from the distributor or prime supplier rather than from the retailer, suggesting that evasion is the likely explanation for the incidence result.

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1 Introduction

The independence between statutory and economic incidence of a tax is a widely accepted result in the theory of taxation. The textbook law of tax incidence holds that the party responsible for remitting the tax to the government has no impact on who actually bears the burden, at least in the long run. Despite its general acceptance, this law holds only under special circumstances. In particular, when parties differ in their ability to evade taxes, the identity of the tax remitter may impact the pattern of post-tax prices and therefore the location of their burden. Due to different evasion technologies available to the different sides of a market, a tax levied on the demand side may shift the demand curve to a different degree than a similar tax levied on supply side would shift the supply curve.

In this paper, we empirically examine how the identity of the tax remitter affects incidence in the diesel fuel market. States differ in the stage of the supply chain responsible for remitting the tax (none require final consumer remittance), and over time states have in general moved the point of tax collection to higher in the supply chain. In the early 1980s, states were almost evenly split between collecting taxes from retail stations and collecting from intermediate wholesale distributors. Over the subsequent twenty years, many states have moved away from collecting from retail stations and toward collecting from prime suppliers.

In addition to the considerable variation in the point of collection, the nature of tax evasion in the diesel market makes it a desirable setting for studying the effect of remittance on incidence. Several factors contribute to creating opportunities for evading diesel taxes. Due to fixed per firm costs, it is relatively costly to monitor the remittance of the tax when there are many remittors each responsible for a small fraction of total revenue, as when taxes are collected from retail stations. Also, variation in tax rates across jurisdictions and across the uses of diesel create opportunities for misstating the ultimate state of sale or the intended use of a gallon of diesel. Importantly, the opportunities for evasion differ considerably across the stages of the supply chain. For instance, hiding taxed sales is more difficult for prime suppliers because they are relatively less costly to monitor. On the other hand, a gallon of diesel sold at the retail level is usually intended for on-highway use, so retailers will find it more difficult to evade by misstating the intended use or state of sale. Which form of evasion is more important for tax collection is an empirical matter.

We find that the rate of pass-through of diesel taxes to retail prices is dependent on the side of the market that is taxed. Retail diesel prices are higher, and diesel taxes are passed through to retail prices to a greater extent, in states where the point of collection is at the distributor or prime supplier level. Lending credence to this result, we are able to trace the impact of collecting at the prime supplier level through the supply chain. An increase in the tax raises the wholesale price in supplier remitting states, though not in retailer remitting states. Moreover, conditional on the wholesale price, supplier remittance has no effect on pass-through. In other words, the effect of an increase in taxes on retail prices in supplier remitting states can be entirely explained via their effect on wholesale prices.

To examine tax evasion as an explanation for this result, we estimate the response of tax collections to the point of tax collection. We find evidence suggesting that states see less tax revenue when taxes are collected at the retail level. This is consistent with the incidence results, which point to retailers as having more ability to evade taxes than higher levels of the supply chain.

The tax collection regime is unlikely to be randomly assigned and may be chosen in a way that maximizes revenues or minimizes the cost of tax collection. This suggests that we are not estimating average but rather local treatment effects. However, heterogenous treatment effects are less of a concern in this paper, since the null hypothesis we are testing is that the tax collection regime has *no* effect on the pass-through of prices. More importantly, however, is the concern that unobserved variables may influence both evasion and the tax regime. To alleviate such concerns, we exploit the timing of changes in tax collection regime, showing that both incidence and collections change discontinuously at the date of the change in remitting party.

The tax literature has recognized for some time the importance of tax administration and collection, such as Musgrave (1969). Sorensen (1994), Kau and Rubin (1981), and Balke and Gardner (1991) suggest links between the size of government or the structure of tax systems and tax administration. Theoretical work has largely ignored the implications of evasion and tax collection on incidence, with a possible exception being Tanzi (1992). Slemrod (2008) suggests that statutory and economic incidence are not necessarily independent in the presence of evasion.

No prior empirical literature has considered the effect of the point of tax collection on the distribution of the tax burden. The nature of tax enforcement and how it affects parties at different points in the supply chain is considered in the context of the value-added tax (VAT) by De Paula and Scheinkman (2010). They show that the self-enforcing nature of the VAT leads to spillovers in informality between firms at neighboring levels of the supply chain.

A handful of recent studies have estimated the pass-through rate of fuel taxes to retail prices. Doyle and Samphantharak (2008) estimate the effect of gas tax holidays in Illinois and Indiana on retail prices. Marion and Muehlegger (2011) estimate the dependence of the pass-through rate of fuel taxes on a variety of factors related to supply conditions in the fuel market. Other relevant work in the pass-through rate of fuel taxation include Alm et al (2009), Chouinard and Perloff (2004,2007).[1] The literature related to the pass-through rate of retail sales taxes more broadly is more sparse, as suggested by Poterba (1996). Besley and Rosen (1999), who estimate the pass-through rate of city sales taxes to prices for twelve commodoties, is an exception. A number of papers including Sung, Hu and Keeler (1994), Barnett et al (1995), Delipalla and O'Donnell (2001), Harding et al (2009), and Chiou and Muehlegger (2009) estimate cigarette tax incidence. A smaller literature has examined the incidence of labor market taxes, which are often assumed to be fully borne by workers (Fullerton and Metcalf, 2002). Rothstein (2009) finds that the EITC expansion in the 1990s reduced wages among low-skilled workers, leading low-skilled single mothers to to keep only 70 percent of tax credits received, while employers received 0.72 cents for every dollar of benefits due to a reduction in the wages of non-eligible low-skilled workers.

Devereux et al (2007) consider competition between different jurisdictions in setting cigarette and gasoline taxes.[2] They suggest that interstate arbitrage is not important in this market, and find that a weighted average of neighboring states' tax rates has little effect on own-state gasoline taxes. However, they do not consider the method of tax collection, which we show is important in the ability to exploit inter-jurisdictional differences in tax rates.

The rest of the paper proceeds as follows. Section 2 analyzes a model of the evasion decision and describes under what circumstances statutory incidence alters economic incidence. Section 3 provides relevant institutional details. Section 4 describes the data, methodology and results. Section 5 concludes.

2 Incidence and Point of Taxation in Theory

Standard models of tax incidence treat compliance and monitoring as costless activities, which is a simplification that in many circumstances does not hold and could have important implications for the distribution of the burden of taxation. Start by considering the demand and supply sides of a market, where these can either be thought of as consumers and firms, or alternatively two different levels of the supply chain. In equilibrium, price equates demand and supply: $D(p) =$

[1] Early empirical work on incidence includes Due (1954), Brownlee and Perry (1967), Woodard and Siegelman (1967), and Sidhu (1971). Chernick and Reschovsky (1997) consider the distributional impact of the gasoline tax by examining gasoline expenditures across different deciles of the income and expenditure distribution.

[2] A related study by Besley and Rosen (1998) considers externalities between federal and state jurisdictions in setting excise taxes.

$S(p)$. Introducing a quantity tax that must be remitted by suppliers alters this equilibrium to $D(p') = S(p' - t)$. Alternatively, a similar tax that is instead remitted by the demand side of the market results in an equilibrium price p'' such that $D(p'' + t) = S(p'')$. The quantity sold and the pattern of net-of-tax prices must be the same in these two equilibria, where $p'' + t = p''$.

This irrelevance result is driven by demand and supply only depending on the tax-inclusive price. Allowing for differences in either the evasion technology or the cost of monitoring across the demand and supply sides of the market potentially alters this conclusion. Following Slemrod (2008), to generalize the standard model, consider an evasion technology, x, for the demand side and y for the supply side. If the evasion technology enters into either the demand or supply functions, then the equilibrium net-of-tax prices may depend on the side of the market taxed. Collecting from the supply side yields an equilibrium price p' such that $D(p') = S(p', t, y)$, while a tax on the demand side yields an equilibrium price, p'', where $D(p'', t, x) = S(p'')$. The irrelevance law will hold only when x and y are symmetric for demand and supply, respectively.

To show how the market equilibrium can depend on the evasion technology available to remitting firms, we introduce a simple model of tax evasion. Suppose a supplier produces q gallons of diesel on which it incurs a quantity tax of t cents per gallon. Firms can evade the tax using the evasion technology available to them. The amount they evade is represented by the quantity q_e, so that the tax liability is given by $t(q - q_e)$.

The evasion technology is captured by a function representing the private cost of evasion, $\phi(q_e, q)$. This cost can represent the resources expended in concealing tax liabilities, as well as the expected value of penalties by the tax authority.[3] It may be sensible to allow for the cost of evasion to depend on firm size, for instance if large firms are easier to monitor or if a given amount of evasion is less likely to be detected if it is a smaller fraction of the true tax liability. We will maintain throughout the model the assumption that the marginal cost of evasion is positive and increasing in the quantity evaded.

The firm's objective is to maximize profits, which are given by

$$\Pi = pq - C(q) - t(q - q_e) - \phi(q_e, q), \tag{1}$$

where $C(q)$ is the firm's cost of production. There are two potentially important constraints on this problem. Firms must choose a non-negative level of evasion ($q_e \geq 0$), and they cannot

[3] The distinction between resource cost and penalties is important if conducting a full accounting of the welfare effects of evasion, but for the purpose of analyzing the effect of taxes on retail prices the nature of the cost of evasion is not important. Also, we assume that firms are risk-neutral. The nature of penalties implies uncertainty in the returns to evading the tax. If one were to allow for risk aversion, it would become necessary to distinguish penalties explicitly.

evade more gallons than they produce ($q_e \leq q$). The first-order conditions of the firm's profit maximization problem are

$$q: \quad p - t - \phi_2(q_e, q) - C'(q) + \rho = 0 \tag{2}$$

$$e: \quad t - \phi_1(q_e, q) + \lambda - \rho = 0 \tag{3}$$

where λ and ρ are the multipliers on the constraints $q_e \geq 0$ and $q_e \leq q$, respectively.

The easiest case to analyze is that where $\phi_2(q_e, q) = 0$, or in other words where the private cost of evasion cost is independent of total gallons produced. Start by considering an interior solution to the evasion problem, so that the constraints are not binding. In this case, we can invert equation (3) to obtain $q_e^*(t) = \phi_1^{-1}(t)$. Importantly, since $\phi_2 = 0$, equation (2) reduces to $p - t = C'(q)$, which is identical to the first-order condition for gallons produced if evasion were not possible at all. The solution for total gallons is

$$q = C'^{-1}(p - t), \tag{4}$$

which notably does not depend on the evasion technology available to the firm. In other words, evasion is inframarginal to the production decision. Suppose the number of firms is constant and, without loss of generality, of measure one. This expression will in this case represent industry supply. Since supply is independent of the evasion technology, the implication is that incidence can be independent of the side of the market that is taxed, even if the evasion technology differs substantially between firms at different points in the supply chain.

The baseline model can be extended along several dimensions that break this independence between evasion and the side of the market responsible for remittance. We consider three plausible extensions. First, we allow for firm entry, second we allow for some firms to be at a corner solution, and lastly we will allow the cost of evasion to depend on firm size.

2.1 Case 1: Cost of evasion independent of q, free entry

Allowing for firm entry generates a relationship between industry supply and the evasion technology because firms earn profit in the form of the surplus gained by evading taxes. The surplus associated with evasion is given by $\sigma(t) = tq_e^* - \phi(q_e^*)$. If free entry is allowed, the price of diesel will decline until these excess profits are dissipated.

In the free-entry equilibrium, two conditions will hold. First, firms are maximizing profits such that the first-order conditions will hold. Firm production is therefore given by $q^*(p - t) = C'^{-1}(p-t)$, and evaded quantity $q_e^*(t,\alpha)$ solves $t = \phi'(q_e)$, where α is a parameter that summarizes the firm's cost of evasion. Second, firms earn zero profits. Let firms face a fixed cost of entry, F. Firms have no incentive to enter or exit when

$$(p-t)q - C(q) - F + tq_e - \phi(q_e) = 0. \tag{5}$$

Substituting in the conditions that characterize profit-maximizing production and evasion, we can differentiate (5) to obtain expressions for how the tax-inclusive retail price responds to the cost of evasion, the tax, and the interaction between the two. After applying the envelope theorem, the response of price to tax reduces to

$$\frac{dp}{dt} = \frac{q^* - q_e^*}{q^*} \tag{6}$$

which is less than one. This expression converges to one as the tax approaches zero, which corresponds to the free-entry equilibrium without evasion. Furthermore, pass-through rises as the cost of evasion rises:

$$\frac{d}{d\alpha}(\frac{dp}{dt}) = -\frac{\frac{\partial q_e^*(t,\alpha)}{\partial \alpha}}{q^*}, \tag{7}$$

which is greater than zero since $\partial q_e^*(t,\alpha)/\partial\alpha < 0$. Lastly, the price responds positively to the cost of evasion:

$$\frac{dp}{d\alpha} = -\frac{\partial\phi(q_e^*,\alpha)/\partial\alpha}{q^*}. \tag{8}$$

This is greater than zero because α is a parameter that raises the marginal cost of evasion.

One other result is notable. An increase in the cost of evasion leads to an increase in price, which reduces equilibrium quantity. However, firm production depends positively on the price, which suggests an increase in per-firm production q. So as the cost of evasion rises, the surviving firms grow in size, while at the same time the number of firms falls. This is in a similar vein as Besley (1989), who finds that entry can lead individual firm production to either rise or fall in response to taxes, though industry output always falls.

2.2 Case 2: Fully evading firms

Market supply could depend on the evasion technology, even when entry is unable to dissipate the rents from evasion, if firms are at a corner solution. Suppose firms differ in their evasion cost function via the parameter α.[4] Let the number of firms be of measure 1, and α is distributed $f(.)$ across firms. Provided $\lim_{q_e \to 0} \phi_1(q_e, \alpha) = 0$, the marginal cost of evasion is guaranteed to be below the tax rate for some q_e. Without a fixed cost of evasion, this version of the model therefore rules out fully honest taxpayers.[5]

We therefore focus on the constraint $q_e \leq q$. In the unconstrained case, the desired quantity produced is independent of α and is given by q^*, as shown in equation 4. However, there will exist an α, given a sufficiently large support for this parameter, such that the solution q_e^* will exceed q^*. When this constraint is binding, firms choose to fully evade. That is, they report no taxable sales of diesel.

Consider the first-order condition for evaded gallons at an interior solution: $t = \phi_1(q_e, \alpha)$. Since q^* does not change with α, we would expect that as α falls, the desired level of evasion, q_e, rises until it is just equal to q^*. This defines the cutoff evasion cost, $\widehat{\alpha}$, below which the desired level of evasion exceeds q^*, the constraint that $q_e = q^*$ binds, and the firm reports no taxed gallons. If $\alpha < \widehat{\alpha}$, then combine (2) and (3) to obtain

$$p - C'(q_e) = \phi_1(q_e, \alpha). \tag{9}$$

The solution for q_e $(= q^*)$ here is the optimal production of fully evading firms. Notice that it does not depend on the tax rate because the effective marginal tax rate is zero. Total industry supply is therefore given by

$$S(p, t, \alpha) = \int_0^{\widehat{\alpha}} q_{fe}^*(p, \alpha) f(\alpha) d\alpha + \int_{\widehat{\alpha}}^{\infty} q_{pe}^*(p - t) f(\alpha) d\alpha \tag{10}$$

where q_{fe} and q_{pe} are the quantity produced by full and partial evaders, respectively. Since q_{pe}^* is independent of α, this reduces to

$$S(p, t, \alpha) = \int_0^{\widehat{\alpha}} q_{fe}^*(p, \alpha) f(\alpha) d\alpha + (1 - F(\widehat{\alpha})) q_{pe}^*(p - t). \tag{11}$$

To see the impact of taxes on the observed price, perturb the equilibrium $D(p) = S(p, t, \alpha)$:

$$\frac{dp}{dt} = \frac{q'_{pe}(p - t)}{q'_{pe}(p - t) - \frac{1}{1 - F(\widehat{\alpha})}(D'(p) - \zeta)} \tag{12}$$

[4] For the moment, we continue to maintain the assumption that evasion is independent of firm size.

[5] A fixed cost of evasion could arise for several reasons. For instance, if caught evading taxes, a firm may face a minimum penalty that is independent of the number of gallons evaded.

where $\zeta = \int_0^{\widehat{\alpha}} \frac{\partial q^*_{fe}(p,\alpha)}{\partial p} f(\alpha) d\alpha$. If evasion were not possible, or if all firms are partial evaders, the pass-through rate of taxes to retail prices would be given by $\frac{dp}{dt} = \frac{q'_{pe}(p-t)}{q'_{pe}(p-t)-D'(p)}$. The presence of full evaders tends to lower the pass-through rate of taxes to prices. As evasion becomes more costly through a shift in the distribution of α, the burden of taxes on the consumer grows. Intuitively, taxes shift industry supply by less when fully evading firms are important. As can be seen from equation (9), fully evading firms do not respond to changes in the tax rate. As their share grows, industry supply becomes less tax responsive.

Increasing the tax rate reduces reported taxed gallons to a greater degree than it reduces overall production:

$$\frac{\partial Q_t}{\partial t} = -(1 - F(\widehat{\alpha}))q'(p-t) - \int_{\widehat{\alpha}}^{\infty} \frac{\partial q_e}{\partial t} f(\alpha) d\alpha. \tag{13}$$

The first term is common to both the taxed gallons and overall gallons responses, capturing the industry supply response. The second term captures the substitution toward untaxed gallons and reinforces the production effect. Raising the cost of evasion has two conflicting effects on the taxed gallons response. First, there are fewer full evaders, which implies an increased responsiveness of taxed gallons to the tax rate. On the other hand, there is less substitution from taxed to evaded gallons, which tends to reduce the elasticity of taxed gallons to the tax rate.

2.3 Case 3: Evasion cost depends on firm size

In this section we relax the assumption that firm size does not impact the firm's ability to evade taxes. The impact that relaxing this assumption has on firm supply depends on the extent to which the presence of costly evasion provides a penalty or a subsidy to increasing production. Suppose firms are at an interior solution, and denote the solution to equation (3) as $q_e^*(t,q)$. After substituting this into (2), we can differentiate quantity q with respect to the tax rate to indicate how the response of quantity supplied to the tax can depend on the evasion technology:

$$\frac{dq}{dt} = \frac{\phi_{11} + \phi_{12}}{\phi_{12}^2 - \phi_{11}(C''(q) + \phi_{22})} \tag{14}$$

where ϕ_{11}, ϕ_{12}, and ϕ_{22} represent the second derivatives of $\phi(q_e, q)$. It is reasonable to assume that the marginal cost of evasion is increasing in the amount evaded, i.e. $\phi_{11} > 0$. However, the sign of the other components related to evasion in equation (14) are not clear. For instance, if $\phi_{12} > 0$, or in other words if bigger firms face a greater marginal cost of evasion, then quantity supplied could actually rise when the tax increases.

This has interesting implications for the effect of remittance on tax incidence. As an extreme example, consider moving the responsibility for tax remittance to from a level of the supply chain unable to evade taxes to one that is. In the scenario described in this subsection, if ϕ_{12} is positive and large, supply would potentially shift outward, thereby lowering the price. Furthermore, increases in the tax would actually lead to price declines.

3 Institutional Details

3.1 The Diesel Supply Chain and Tax Remittance

Crude oil is distilled into its constituent products at the oil refiner level. After the distillation process, No. 2 distillate, the general term describing diesel fuel, is further processed to meet regulatory standards dictating sulfur content, which differs depending on location of eventual sale, season, and intended use.[6] The final product is held by prime suppliers at bulk terminals. There it is purchased by regional wholesale distributors, sometimes called "jobbers," for eventual delivery to retail outlets or directly to generally larger end-users such as trucking companies. No. 2 distillate for use in home heating and industrial processes is referred to as fuel oil, while that used in vehicles is referred to as diesel. The two types are chemically equivalent aside from the potentially different regulated sulfur content.

Diesel intended for highway use is subject to federal taxes of 18.4 cents per gallon and state taxes that currently range from 8 to 35.1 cents per gallon. Federal fuel taxes are the primary source of revenue for the Federal Highway Trust, which funds infrastructure investment.

The responsibility for the remittance of federal taxes has over time moved up the supply chain. Federal tax collection traditionally occurred at the retail level. In 1988, the point of taxation was moved to the wholesale distributor level, and in 1994 the responsibility for remittance was shifted again to its current location at the prime supplier level. There has also been considerable variation in the point of collection for state diesel taxes, both across states and over time that we exploit in our empirical analysis that follows.

[6] From October 1993 to August 2006, the allowable sulfur content for on-highway diesel fuel was 500 parts per million. Federal regulations did not constrain the sulfur content of diesel intended for other uses. Beginning September 1, 2006, the EPA began phasing in Ultra Low Sulfur Diesel Fuel requirements, requiring that sulfur content not exceed 15 ppm. By 2010 all diesel sold for on-highway use met this standard. Non-road diesel was required to move to 500 ppm in 2007, and the 15 ppm standard is currently being phased in.

3.2 Opportunities for Evasion and Avoidance

Several characteristics of the market for diesel, and the method of tax collection, create opportunities for tax evasion. It is important to understand how these methods work, and how they interact with the point of tax collection, to understand how remittance can impact tax incidence. With a few exceptions, evasion can generally be grouped into one of three categories: the misreporting of the intended use of fuel, not remitting owed taxes, and bootlegging.

3.2.1 Misreporting the intended use

While diesel for highway use is subject to state and federal taxes, it is compleetly untaxed if used for home heating, industrial processes, or in agricultural vehicles. The differential tax treatment of diesel depending on use creates a significant opportunity for wholesalers and prime suppliers to engage in tax evasion. Because both taxable and non-taxable uses are significant sources of demand for diesel,[7] the firm responsible for tax remittance may be able to credibly misreport the sale of a gallon of diesel as being for an untaxed use.

Beginning in October 1993, terminals were required to add red dye to diesel fuel sold for untaxed off-highway use. This allowed for a simple visual inspection to verify that taxes had been paid on a particular gallon – if a truck has red diesel in its gas tank, tax evasion has occurred. As found by Marion and Muehlegger (2008), this led to a substantial improvement in tax compliance. Reported sales of on-highway diesel rose by 25-30 percent, with a corresponding decline in reported sales for untaxed uses. This startling impact on compliance suggests that, at least pre-1993, there was substantial evasion in this market.[8]

The misreporting of the intended use is likely to be a particular problem when the point of taxation is above the retail station, as untaxed uses are not typically distributed via retail outlets, with the exception of some agricultural sales. This may help explain why the federal point of taxation was moved to the terminal level only after the dye program was instituted.

3.2.2 Failure to remit

A second form of evasion involves a tax liability being incurred, which is nonetheless not ultimately remitted to the government. This most likely to occur at the retailer or distributor

[7]In 2004, 59.6 percent of distillate sales to end users were retail sales for on-highway use.

[8]Although the dye program was initially highly successful at curtailing this form of evasion, several new techniques have been employed by evaders to skirt the dyeing regulations. In particular, evaders have been found offloading fuel without injecting dye, removing dye from the fuel, and masking the dye's color. Also, misreporting the fuel's intended use may still be an issue in some circumstances, as states allow for refunds of the tax paid if the user later claims the fuel was used for untaxed purchases. This is often true in agriculture uses.

level. Simple underreporting is one possible issue. Another classic example is the "daisy chain," which is sometimes observed when the distributor is responsible for remitting the tax. A gallon of diesel is sold by the prime supplier to the wholesale distributor, who then sells it to other dummy distributors in a series of (likely paper-only) transactions. At some point the gallon is sold to a retail station, and the party responsible for remitting the tax disappears.

Moving the point of taxation up the supply chain reduces the number of parties with a tax liability. According to the Internal Revenue Service, there are 1,343 active bulk fuel terminals in the United States compared with around 855,915 retail gasoline station establishments, according to data in the County Business Patterns. Monitoring and identifying underpayment of tax liabilities is therefore thought by tax enforcement authorities to substantially easier when the tax is remitted by parties higher in the supply chain, simply by virtue of there being fewer parties to monitor. (Baluch, 1996)

3.2.3 Interjurisdictional evasion

A third type of evasion exploits differential rates of taxation across different jurisdictions. Bootlegging is one example, where purchases are made by a distributor in a low-tax state, and then sold to retailers in a neighboring high-tax state at a higher price that reflects the tax rate in place. A second example involves a distributor that purchases fuel from a supplier claiming it is intended for export to another state and thereby not subject to the state tax. Rather than exporting, the firm then sells it to a within-state retail station.

Interjurisdictional evasion also arises through Native American reservations in a variety of ways. Due to the sovereignty of the reservations, foreign imports to a reservation are not tracked by the federal government or state governments. Imported gallons can then be diverted to retail stations outside the reservation.

Finally, it is also possible to illicitly import untaxed fuel from abroad, subsequently selling the fuel to retail stations. Each of these interjurisdictional methods for evasion would seem to be curtailed if the point of collection is the retail station.

4 Data and Methodology

To this point we have argued that the pass-through rate of a tax to the retail price can depend on the side of the market responsible for tax remittance in a setting where tax evasion is important. We now proceed to examine the evidence for this hypothesis in the diesel fuel market.

4.1 Data

We collected data on the point of tax collection from successive annual issues of "Highway Taxes and Fees: How They Are Collected and Distributed," published by the Federal Highway Adminstration. For each state and year, the Federal Highway Administration contacts state tax authorities and collects data on the point of collection for diesel and gasoline taxes.

In Figure 1, we display the variation in the point-of-taxation over time. In the mid-eighties, the majority of states collected taxes from distributors. At the beginning of our sample in 1986, distributors were responsible for remittance in 37 states, with the balance of states collecting from retailers. The early nineties saw a trend toward collecting taxes from higher points in the supply chain, in particular from the prime supplier. In January 1993, Michigan became the first state to do so, and by the end of 2006 twenty states collected taxes from prime suppliers. While a plurality of states still collect from wholesale distributors, the practice of collecting from retailers has almost entirely been phased out, with only New Jersey and Oregon collecting tax from retailers at the end of our sample.[9]

In Figure 2, we present a map of the variation in the point of tax collection across states for 1990, 1997, and 2004. In 1990, the entire eastern section of the U.S. collected taxes from the distributor. The collection of taxes at the retail level was concentrated in midwestern and western states. Panels B and C describe the geographic characteristics of the transition to taxing at higher levels of the supply chain. During this time, the West, Midwest, and mid-Atlantic transitioned largely toward collecting diesel taxes from terminal operators. Collection at the distributor level was concentrated in the northeast, south, and mountain states. An interesting observation from this figure is that the point-of-collection policy seems to be spatially correlated, which suggests that there are spillovers across states in tax collection.

In Table 1, we further describe the nature of the variation in tax collection by showing the matrix of changes in point of collection. We observe 29 changes in the point of tax collection. Eight of these are changes from retailer collection to distributor collection, five are retailer to supplier shifts, and fifteen are distributor to supplier shifts. In only one instance did a state move the point of collection down the supply chain, in this case from collecting at the distributor level to collecting from retail outlets.

Several diesel price series are available at the state level from the Energy Information Administration. The EIA collects diesel prices for select states, mostly comprising states in the

[9] Oregon is a special case. There, diesel used for trucking is not taxed directly, and instead a levy on weight-miles driven within the state is collected. Given the importance of trucking in the diesel market, we will in general exclude Oregon from the analysis.

Northeast, Mid-Atlantic, Upper Midwest and a handful of Northwestern states with relatively high use of home heating oil. Beginning in 1983, the EIA reports the average price of No. 2 distillate, which includes taxed diesel fuel, untaxed diesel fuel, and heating oil. It distinguishes between diesel sold through retail outlets and that sold for resale. The resale price can include sales by prime suppliers to local distributors, or from local distributors to retail stations. This will make the resale price undesirable in assessing how tax collection affects how retail stations share the tax burden with distributors, or distributors with primes suppliers. Furthermore, prior to 1994, the resale price of No. 2 distillate also included untaxed sales of diesel.

From 1994 on, the EIA also reports the average retail and resale prices specifically of No. 2 diesel. This distinction is irrelevant for sales through retail outlets, as only diesel fuel is sold through retail outlets. During the period of time where the series overlap (1994 on), the retail prices for No. 2 distillate and diesel fuel are identical. On the other hand, resale of No. 2 distillate can include transactions for on-highway diesel, heating oil, or other uses of distillate. Therefore, the series describing the resale prices of No. 2 distillate and No. 2 diesel are not perfect substitutes. The two series move in lock-step ($\rho = 0.994$), but the resale price for No. 2 distillate averages 1.4 cpg less than the resale price for diesel fuel. For these reasons, we focus our attention in this paper on the retail price of No. 2 diesel.

We have argued that how remittance affects incidence depends on its affect on tax evasion. To measure how tax remittance may effect tax collection and evasion opportunities, we also obtain data on the quantity of diesel sales from two sources. The most accurate measure of diesel tax collections comes from the Federal Highway Administration, which reports in the Highway Statistics Annual, Table MF-2, the annual quantity by state of special fuels on which taxes were collected. Taxed special fuels are almost entirely diesel fuel. The EIA also collects quantity data at the state level. Beginning in 1983, the EIA reports monthly data from a survey of prime suppliers, who report sales of No. 2 diesel and heating oil by state. What level of the supply chain the EIA treats as the prime supplier for the purposes of reporting depends on whether the fuel is imported from another jurisdiction. For fuel produced in the state of eventual sale to the end user, the prime supplier is the bulk terminal. For fuel imported from another state or country, the prime supplier is considered to be the first distributor within the state who receives the fuel. We obtain information about the federal and state on-road diesel tax rates from 1981 to 2006 from the Federal Highway Administration Annual Highway Statistics.

We also collect data on state-level covariates. Population, per capita income and mean family size are from the Census Bureau. Urbanization and educational attainment are from the

Bureau of Economic Analysis. Information about drivers, vehicle registration, vehicle usage and state tax rates are successive issues of the Federal Highway Adminstration, Highway Statistics Annual.

An advantage of studying fuel markets is the ability to measure prices at multiple points in the supply chain. Doing so allows us to evaluate the incidence of taxes on various parties in the market. To this end, we calculate an estimate of margins at different points in the supply chain from average price data from the EIA. For diesel, we subtract the tax-exclusive retail price from the average price of diesel sold for resale as an estimate of the combined retailer / distributor margin. For gasoline, we subtract the tax-exclusive retail price from the dealer tank wagon (DTW) price as an estimate of the retail margin and subtract the DTW price from the rack price as an estimate of the distributor margin.

It is unlikely that the choice of the point of taxation is chosen randomly. In Table 2, we present the differences in mean of a variety of demographic characteristics between retailer, distributor, and supplier remitting states. Each column in a particular panel shows a regression of the stated variable on distributor and supplier remit dummies, as well as year fixed effects.[10]

In general, the point-of-taxation is correlated with few of the covariates. Compared with retailer remitting states, those that tax at the supplier level tend to be less educated and are less conservative politically. Those taxing at the distributor level are also somewhat less educated than retailer remitting states, and have a smaller budget surplus, and both the state senate and house of representatives have a have slightly higher portion of democrats. Income, unemployment, population, urbanization, family size, and vehicle miles traveled per capita are all similar between the three collection regimes.

We also conduct two other exercises examining the potential endogeneity of remittance policy. First, in Table 3 we examine whether states that change the point of collection at some point in the sample are different than those who leave the point of collection unchanged. Only a state's mining share of GSP and the conservative values score of the state house of representatives are significant at the 10 percent level.

Second, we wish to consider which covariates may be contemporaneously correlated with changes in either the point of tax collection or the diesel tax. In four separate specifications, we regress the change in the distributor remit, retailer remit, and supplier remit dummy variables, and the change in the state diesel tax, on a set of covariates. The results are presented in

[10]Many of the variables in this table are not included in the set of covariates in the regression specifications later, as variables such as population, average family size, percent of population that are BA graduates, and the like will be slow-moving, and most of their variation will be captured by state fixed effects.

Table 4. As with the results shown in Table 2, few variables are correlated with the tax regime. Population is positively related with supplier remittance, though negatively correlated with distributor remittance. Increases in the fraction of adults with a college degree is associated with less likelihood of moving the point of collection to the supplier level. A greater share of high school graduates is associated with a less likelihood of taxing at the distributor and a greater likelihood of moving the point of collection to the prime supplier. Increases in gross state product are associated with relative declines in the state diesel tax. Also, average family size and the fraction of adults with a high school degree are negatively associated with the tax rate.

4.2 Methodology

4.2.1 Point of taxation and incidence

We examine the degree to which diesel taxes are passed through to retail prices using variation across states and over time in state diesel tax rates and the point of tax collection. Ideally, we would observe the price charged by bulk terminals to wholesale distributors, and by wholesale distributors to retail stations; this would allow for a direct evaluation of the burden of taxation across different levels of the supply chain. Unfortunately, data limitations preclude this level of analysis, and so we must rely on an analysis of retail prices, which we argue reflects changes in incidence higher up the supply chain. For instance, if changing the point of tax collection raises the price that wholesalers charge retailers, then this higher cost for retailers will be reflected in the price they charge to consumers in the retail price.

We estimate a specification of real tax-exclusive retail diesel prices at the month level, deflated using the consumer price index.

$$p_{it} = \beta_0 + \beta_1 \tau_{it} + \beta_2 regime_{it} + \beta_3 \tau_{it} * regime_{it} + BX_{it} + \epsilon_{it} \tag{15}$$

where $regime_{it}$ represents the indicator variables for the point-of-collection regime employed by state i in month t, and X_{it} is a vector of covariates including state economic conditions, state and year*month effects, the tax rate in neighboring states, household use of fuel oil for home heating, and weather. We use the real diesel price to allow for the possibility that the resource cost of evasion or penalties rise with inflation.

One extension to the primary specification given by (15) is to allow for the coefficients in the model to vary over time. It is possible that the elasticity of demand for diesel fuel changes over time in an unobservable way, which would alter the predicted degree of pass-through. Since the point of collection has moved up the supply chain over time, this could lead us to mistakenly attribute changes in incidence to the point of taxation that are actually due to shifts in demand elasticity. Similarly, changes in regulations or refinery capacity over time could alter supply elasticity in a manner correlated with trends in the point of taxation. To correct for this, we will also estimate a version of (15) that allows for a time varying value of β_1 by controlling for a full set of year-tax interactions.

4.2.2 Remittance, evasion, and tax collections

We use the data on taxed quantities from the FHWA to evaluate the impact of point of tax collection on tax evasion. If changing the point of tax collection affects evasion, then ceteris paribus tax collections should change as more or less taxable gallons are reported. We examine the contemporaneous correlation between three types of regime changes and the change in taxed gallons. In particular, we estimate an equation of the form

$$\Delta ln(q_{it}) = \alpha_0 + \alpha_1 \Delta ln(p_{it}) + \alpha_2 \Delta ln(1 + \tau_{it}/p_{it}) + \sum_j \alpha^j d_{it}^j + A\Delta X_{it} + \rho_t + \epsilon_{it}. \qquad (16)$$

where j indexes the three types of transitions witnessed in the data: retailer-to-distributor collection, retailer-to-supplier, and distributor-to-supplier. The dummy variable d_{it}^j indicates that transition j took place in state i in time t. We model the log of taxed gallons as a function of the log of the tax inclusive price, $ln(p+t)$. To separately identify the response of taxed gallons to the tax rate from the response to the price, we factor out the price from this expression. The parameter α_2 need not equal α_1. As pointed out by Kopczuk (2005) and Slemrod and Kopczuk (2002), the size of the tax base as well as the degree of enforcement can both influence the elasticity of tax collections to the tax rate. As in the price specification, the vector of covariates in X_{it} includes state economic conditions, the tax rate in neighboring states, and the weather and its interaction with household use of fuel oil for home heating. The variable ρ_t represents common year effects.

To examine pre-existing differences between the different tax regimes, and to verify that any changes in tax collections correspond to the regime change, we will also examine graphically the coefficients β^k_{t-j} from the following regression:

$$ln(q_{it}) = \beta_0 + \sum_k \sum_{j=-2}^{2} \beta^k_{t-j} I(d^k_{i,t-j}) + \phi_t + \rho_i + \epsilon_{it}. \tag{17}$$

where k indexes the type of transition and $I(d^k_{i,t-j})$ is an indicator for whether the type of transition k occurred in year $t-j$. This exercise will yield the average residual tax collections in the periods before and after each type of regime transition that we observe in the data.

5 Results

5.1 Tax Incidence Results

In this section, we present estimates of the effect of the point of tax collection on retail diesel prices. In Table 5, we show the results of estimating equation (15). As mentioned previously, the dependent variable is the real retail price, excluding taxes. In column 1 of this table, we include only the diesel tax and control variables, excluding any information about the party responsible for tax collection. The coefficient on the diesel tax variable suggests that the net-of-tax retail price falls 0.86 cents for every ten cent increase in the diesel tax. The interpretation of this coefficient is that nearly all of the tax burden is born by consumers, and the amount suppliers received per gallon from consumers falls little as taxes rise. Other coefficients are similar to those found in Marion and Muehlegger (2011). Prices rise as the tax rate in neighboring states increase, and prices are higher in cold months where households tend to use diesel for home heating. Lastly, economic activity is correlated with prices, as the unemployment rate has a negative association with prices.

In the specification shown in column 2, we include indicators for whether the state collects at the distributor level or at the bulk terminal. The excluded category are states collecting the diesel tax from retail outlets. Compared to states collecting at the retail level, states in which the party responsible for remitting the tax is the prime supplier have a retail price that is 2.88 cents higher, and those taxing the wholesale distributor are 1.38 cents higher. Both of these coefficients are consistent with the hypothesis that retail stations are difficult for tax authorities to monitor and that the relatively small number of bulk terminals make evasion costly for these firms.

In column 3 of Table 5, we show results of estimating a specification including interactions between the remittance regime dummy variables and the tax rate, which allows the pass-through rate of diesel taxes to prices to depend on the point of collection. The coefficient on the interaction between diesel taxes and the collect from the distributor and terminal indicators are 0.10 and 0.21, respectively, both statistically significant though the former only marginally so (p-value=0.073). This suggests that the pass-through rate rises as the tax collection point is moved up the supply chain. Furthermore, the pass-through rate is highest when collecting from the bulk terminal, as the coefficient on the interaction between the tax rate and the supplier collection dummy is higher than the coefficient on the similar interaction with the distributor collection dummy (p-value=0.081). This again is consistent with the observation that this prime supplier is the easiest point in the supply chain to monitor.

It is worth noting that the sum of the main effect and the interaction in the case of taxing the bulk terminal leads to an estimated pass-through rate of greater than 100 percent. The estimates suggest that the *tax-inclusive* retail price rises by 1.089 cents for each 1 cent increase in the diesel tax. However, this is not statistically distinguishable from merely full pass-through (p=0.14), which is a reasonable baseline, as it is the upper bound of the pass-through rate in a competitive model.

Finally, the specification displayed in column 4 includes a full set of year by diesel tax interactions, which allows the rate of tax pass-through to vary over time. This is reasonable due to the time trend in the point of taxation, and that factors that influence the elasticity of supply and demand, such as environmental regulations and the demand for untaxed uses of diesel, may have shifted over time. Allowing for time varying pass-through rates has little effect on the estimated parameters of interest. The direct effect of the point of tax collection is small and indistinguishable from zero, and the interaction terms between the diesel tax and the indicators for the collection point being the terminal and the distributor are 0.16 and 0.14, very little changed from the primary specification.

In Figure 3, we present these same results graphically. In this figure, we present the average price in twenty bins of a measure of the residual tax. This measure is formed by taking the residual of a regression of the diesel tax on month-year and state effects. In Panel A, we show the results for all states, regardless of tax collection regime. Here we see the price-tax gradient, which aside from the lowest bin, presents an apparently linear relationship between the net-of-tax retail price and the diesel tax. The tax-exclusive price declines slightly as the tax rises, again suggesting almost complete pass-through.

Panel B of Figure 3 displays the results of a similar exercise as that shown in Panel A, where states are divided into the three categories of tax collection regimes. The difference in prices between the different tax regimes, as documented in Table 5, is apparent. Extraordinarily low tax rates are not observed in states that tax the prime supplier. However, in overlapping portions of the diesel tax rate support, the price level is almost uniformly higher in states taxing the prime supplier compared with states taxing the distributor or the retailer. For low tax levels, the price of diesel is similar for states collecting the tax from the distributor compared with those taxing the retailer. However, for higher levels of the residual diesel tax, the price in distributor collection states is typically higher that in states collecting from retail outlets. This is true for all but one positive bin of the residual diesel tax, and suggests a greater rate of pass-through in distributor remitting states.

5.1.1 Accounting for trends in pass-through

The above approach compares the pass-through rate in a state after a change in the point of collection with the pass-through rate experienced prior to the shift. Therefore, unobserved characteristics affecting pass-through in a state that are fixed over time will not affect our results. However, our estimates will be biased if unobserved variables that alter rates of tax-pass through are moving over time in a way that is correlated with the change in tax collection regime. For instance, if the number of bulk terminals changes over time in a state, the tax authorities may find it more desirable to collect the tax from the prime supplier owing to the number of parties. Such a change may also alter the rate of tax pass-through by changing the elasticity of supply with respect to price.

To address this concern, we exploit the timing of the change in remitting party. We account for trends in pass-through relative to the date of the regime change, examining whether pass-through changed discontinuously at the date of the regime change. This is conceptually similar to a parametric regression discontinuity design, whether the running variable is time, and the threshold is the date of the policy change.

We consider states that undertook a particular regime change, either shifting from retailer to distributor collection or from distributor to prime supplier.[11] We center the data such that the date of the state i's regime shift is t_i^0. We then estimate our standard pass-through specification, adding an interaction term $\tau_{it} * (t - t_i^0)$ as well as the direct effect $t - t_0^i$. This allows the estimated pass-through rate to differ in a linear fashion over time, and we can therefore examine the post-regime difference in pass-through relative to this trend.

We present the results in Table 7. Columns 1 and 2 contain estimates from estimating the

[11] The other transitions witnessed in the data are retailer-to-supplier, of which there have been five during our sample. We are unable to specifically use these in this exercise as we observe price for only two of these transitions.

pass-through equation for states moving the point of collection from the wholesale distributor to the prime supplier. Pass-through is greater after the move to the supplier level, as seen in column 1. Furthermore, the results in column 2 indicate that there is not a trend in pass-through relative to the date of the regime change nor does including this interaction term alter the coefficient on the variable of interest. A similar story emerges when we examine retailer-to-distributor regime changes, as shown in columns 3 and 4.[12] The pass-through rate is higher when the state requires the tax to be remitted by the distributor compared to when it requires the tax to be remitted by the retailer. Furthermore, this set of states do not experience a trend in incidence relative to the date of the regime change, nor does allowing for such a trend alter the primary coefficient of interest.

5.1.2 Price for resale

In this section we describe estimates of the effect of the point of collection on the wholesale price of diesel, and we examine how taxes work through to retail prices via the wholesale price when the tax is collected from the prime supplier. In column (1) of Table 6, we present estimates of our base incidence specification, with the real resale price as the dependent variable. We see that the price for resale is around two cents higher when the tax is collected from the prime supplier, and 0.7 cents higher when collected from the distributor level, compared to when the tax is collected at the retail level. On average, the tax has virtually no effect on the net of tax resale price. In the specification shown in column (2), we include the interaction between the tax and indicators for collecting from the distributor and the prime supplier. When the tax is collected from the prime supplier, an increase in the tax leads to an increase in the wholesale diesel tax. A ten cent per gallon tax increase leads to a 2.4 cent increase in the resale price in supplier remitting states relative to retailer remitting states. Conversely, tax changes have virtually no affect on the resale price in distributor remitting states or retailer remitting states. This will be true if sales by prime suppliers make up the bulk of the sales used to calculate the price of diesel for resale.

We are able to show what implications this has for retail price incidence. In column (3) of Table 6, we restate the results of column (3) of Tabletab:incidence, which shows that a ten cent tax increases the retail price by 2.1 cents in a supplier remitting state relative to a similar tax change in a retailer remitting state. In column (4), we show the results of estimating a similar specification, where we also include as control variables the concurrent and lagged price of diesel

[12]There are only two retailer-to-supplier transitions in states where the diesel price is observed, so we exclude this type of transition in this table.

for resale. Controlling for resale price, the coefficient on the tax*supplier remittor interaction is now small and statistically insignificant. This suggests that the differential effect of tax on retail prices in supplier remitting states is entirely explained by the effect on the wholesale price, just as one would expect if our results are valid.

This narrows down the set of alternative explanations for our results. For the relationship between pass-through and tax collection regime to be explained by changes in unobserved variables, they must be ones that affect the resale price alone and have no independent effect on the retail price of diesel.

5.2 Tax Collection Results

We now examine how the number of gallons on which a state collects taxes responds to the point of taxation. As the state adjusts the point of tax collection, we interpret corresponding observed changes in tax collections as evidence of a change in tax compliance. This will provide a link between the empirical results discussed in section 5.1 and the theoretical predictions in 2.

In Table 8, we present estimates of equation (16), which relates changes in taxed gallons to specific changes in the point of tax collection. The specification shown in column (1) includes only the variables indicating the stated shift in regime. Changes in the point of taxation from the retailer to the distributor are associated with similar improvements in collections as retailer to supplier changes, with the former yielding a 7.3 percent improvement in collections (p-value=0.102) while the latter yields a 7.8 percent improvement (p-value=0.050). When the point of remittance is moved from the distributor to the prime supplier, tax collections rise by only 1.5 percent, an effect that is small and statistically insignificant.

In Column 2, we display results of a specification with a variety of covariates, including log price, the log tax rate, state macroeconomic conditions as captured by log GSP and unemployment, weather, and and home heating use. The estimated effects of the three types of tax collection regime changes are virtually unchanged, which is not surprising in light of the fact that none of these variables are correlated, at least contemporaneously, with states' decision regarding where in the supply chain to collect the tax.

Lastly, the specification shown in column (3) includes a control for the lagged dependent variable. The lagged change in taxed gallons are significantly negatively correlated with the current change in taxed gallons. The data suggests that this is likely to be a reporting phenomenon, as states will at times have unusually high (low) tax collections in one year, followed by unusually low (high) tax collections the next year. Regardless, the coefficients of interest are unaltered by the inclusion of this variable.

The regression results, since they are estimated in first-differences, capture the contemporaneous response of tax collections to changes in the point of tax collection. We now further explore the timing of the response of tax collections to the change in the collection regime, as well as consider any pre- or post-change trends in tax collections. In Figure 4, we plot the average residual taxed gallons, taking out year and state effects, in each year from two years before the change in the collection regime to two years after.

Compared to states that move the point of collection from the distributor to the supplier, and hence are already collecting the tax above the retail level, tax collections are initially lower in states who move the point of collection away from the retail level. This is true regardless of whether the state will ultimately move the collection point to the distributor or the prime supplier. As suggested by the regression results presented in Table 8, states moving the point of collection away from the retailer experience a jump in collections in the year of the policy change. Importantly, average tax collections were similar in all three cases after the change in collection regime. Despite the fact that states that initially collected from the distributor had tax collections around 3 percent higher, the average of the post-reform coefficients for each of the three types of regime changes are within 0.7 percent of one another.

6 Conclusion

The independence between equilibrium tax inclusive prices and the side of the market taxed is a widely accepted "law" of tax incidence and is often the first thing a student of public finance learns in the study of tax theory. This paper presents the first estimates of how prices may in fact respond to the identity of the tax remittor and provides evidence that the source of this result is variation in the ability to evade taxes between the two sides of a market. This result has potentially important implications in understanding the distributional impact of taxation in markets where evasion prevalent.

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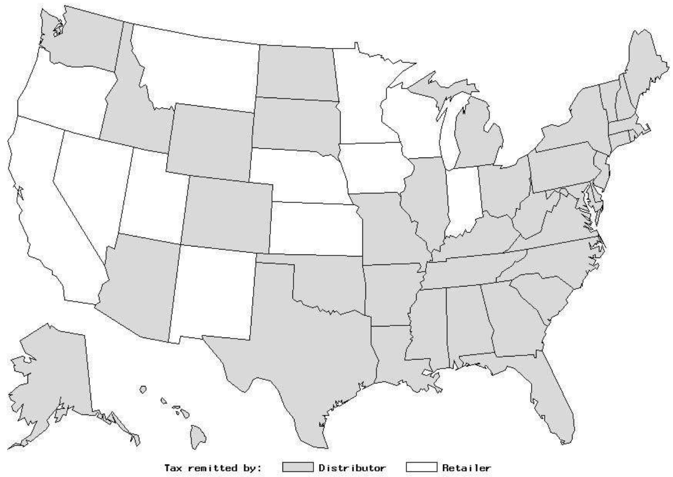
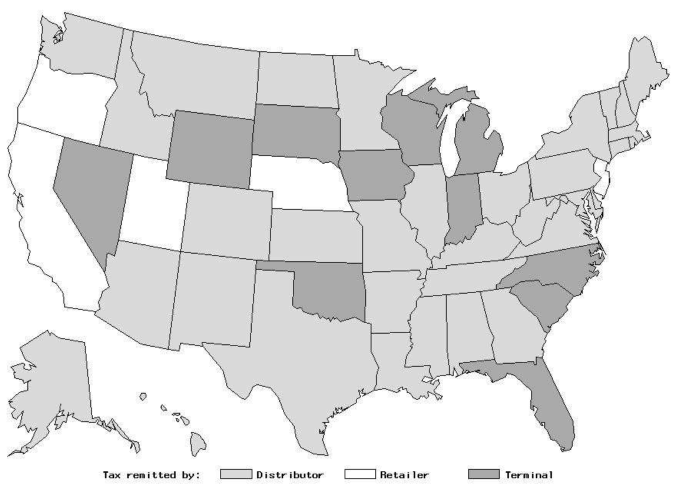
Figure 1: Tax remittance liability over time

Figure 2: Tax Collection By State

Panel A: 1990



Panel B: 1997



Panel C: 2004

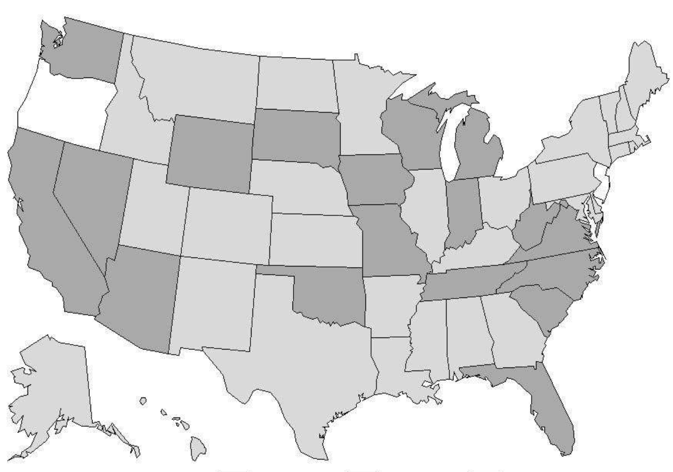
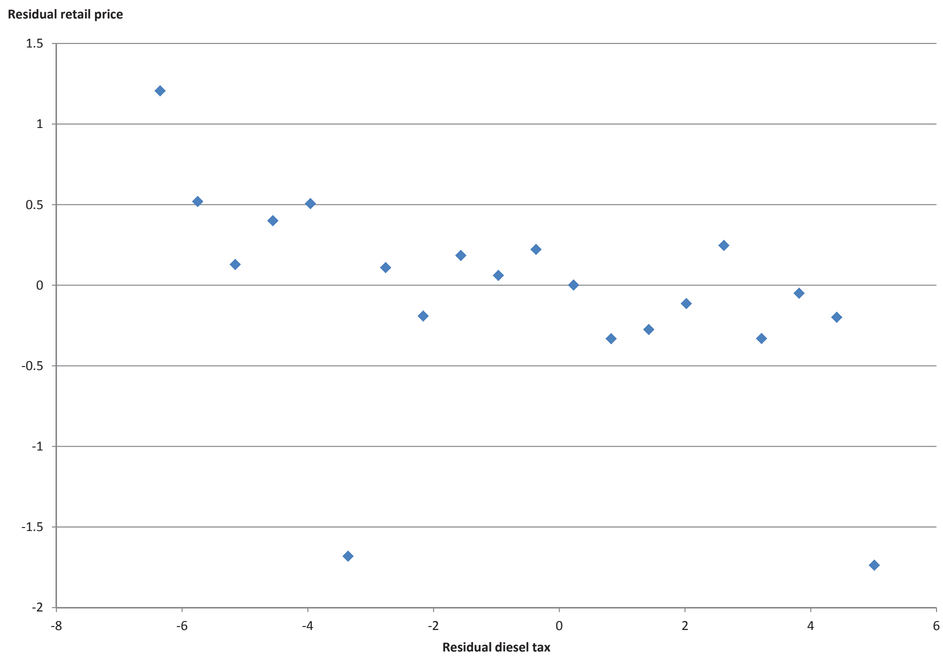


Figure 3: Average price by residual diesel tax bins

Panel A: All observations



Panel B: By point of tax collection

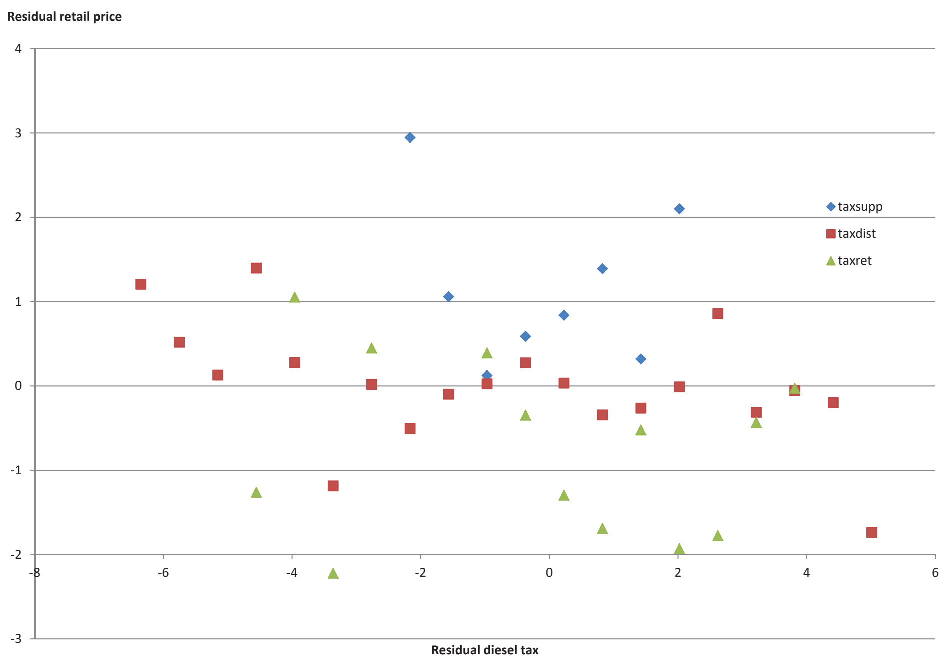
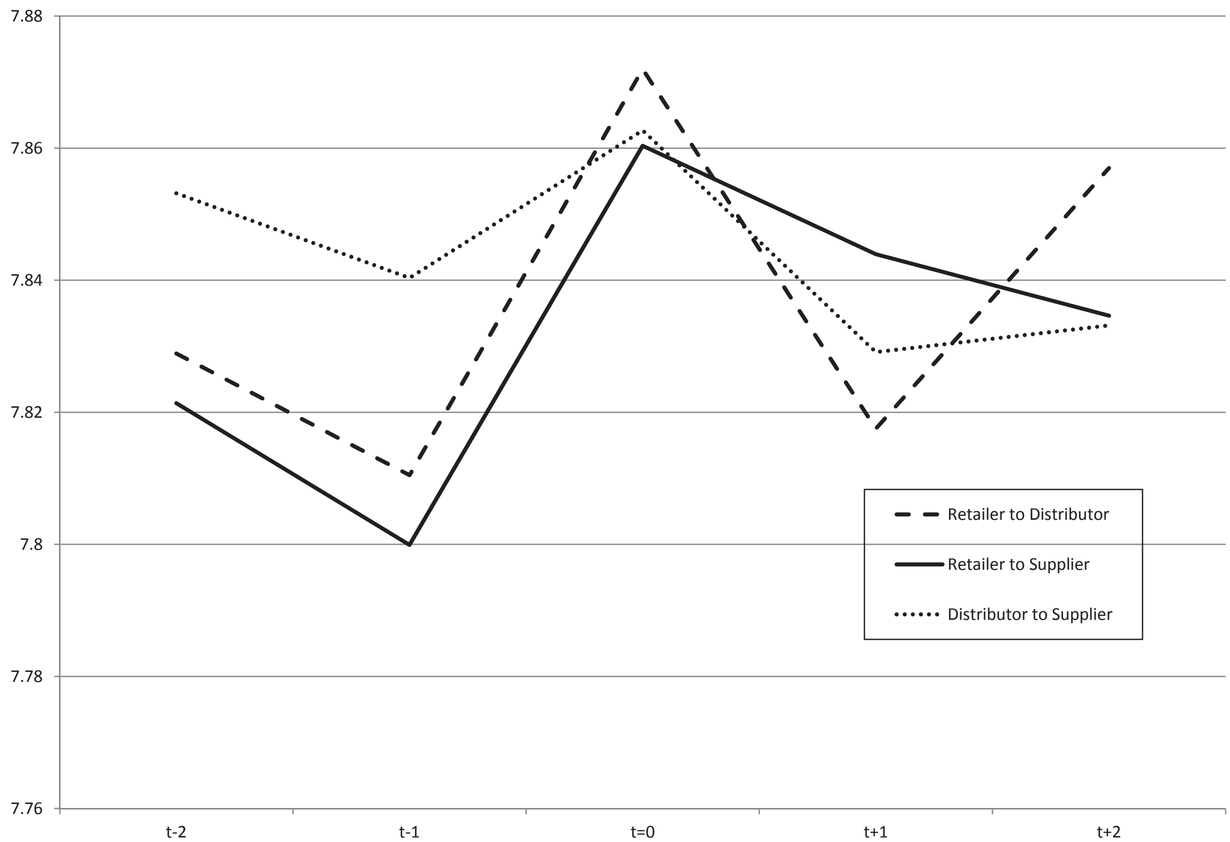


Figure 4: Collection regime shifts and taxed gallons



Average log taxed gallons of diesel by year relative to collection regime change. Year and state effects removed.

Table 1: Transitions in the point of tax collection

		To: Retailer	Distributor	Supplier
	Retailer	-	8	5
From:	Distributor	1	-	15
	Supplier	0	0	-

Table 2: Demographics and the Point of Tax Collection

Panel A	Tax-Exclusive Diesel Price ($/gal)	State Diesel Tax (cpg)	GSP per capita ($)	Unemployment Rate (%)	Manufacturing GSP Fraction	Mining GSP Fraction
Distributor Remit	2.965*	-0.829	-871.0	0.523	0.0111	0.0105
	(1.722)	(1.254)	(1170.7)	(0.369)	(0.0193)	(0.0103)
Supplier Remit	-1.612	-1.641	-1432.5	0.314	0.0398*	0.0138
	(2.469)	(1.705)	(1515.1)	(0.393)	(0.0219)	(0.0193)
Constant	133.3***	20.16***	30337.2***	4.889***	0.144***	0.0154**
	(1.596)	(1.138)	(1064.5)	(0.310)	(0.0166)	(0.00632)
Observations	6090	13536	13248	13536	13536	13536
R-Squared	0.990	0.207	0.709	0.311	0.198	0.0165

Panel B	Adult Population	Urban Pop % of Total	Average Family Size	Percentage BA graduates	Percentage HS graduates	Vehicle Miles Per Capita
Distributor Remit	-0.940	-0.0347	-0.0994	-0.796	-4.086***	0.000430
	(1.843)	(0.0549)	(0.0735)	(1.006)	(1.181)	(0.000436)
Supplier Remit	0.486	-0.0291	-0.107	-3.522***	-4.056***	0.00124
	(1.413)	(0.0697)	(0.0848)	(0.884)	(1.432)	(0.000805)
Constant	4.686***	0.750***	3.257***	23.56***	83.07***	0.0128***
	(1.718)	(0.0485)	(0.0723)	(0.741)	(0.866)	(0.000394)
Observations	13248	13248	13248	13248	13248	13248
R-Squared	0.0205	0.00524	0.138	0.333	0.462	0.196

Panel C	State Budget Surplus	Senator LCV Score	Representative LCV Score	Democrat Governor	Democrat Fraction State Senate	Democrat Fraction State House
Distributor Remit	-0.0284*	-5.872	-1.142	0.0316	0.100***	0.0804**
	(0.0147)	(7.455)	(5.586)	(0.126)	(0.0343)	(0.0334)
Supplier Remit	-0.0112	-8.150	-12.78*	0.191	0.0339	0.0190
	(0.0215)	(10.13)	(7.592)	(0.162)	(0.0392)	(0.0356)
Constant	0.113***	52.56***	48.23***	0.414***	0.476***	0.492***
	(0.0120)	(6.595)	(4.892)	(0.112)	(0.0258)	(0.0222)
Observations	12672	13248	13248	13440	13020	12984
R-Squared	0.475	0.0201	0.120	0.0539	0.132	0.105

Retailer-remittance is the omitted category. All regressions include year fixed effects. Standard errors clustered by state.

Table 3: Summary Statistics By Change in Point of Diesel Tax Collection

	Full Sample	States Not Changing POT	States Changing POT	Difference
Tax-Exclusive Diesel Price	95.97	97.88	93.20	-4.67*
	(43.77)	(44.22)	(42.97)	
State Diesel Tax	19.12	19.24	19.03	-0.21
	(5.026)	(5.278)	(4.828)	
GSP per capita	28153.9	28392.8	27983.3	-409.5
	(8784.1)	(9560.0)	(8181.5)	
Unemployment Rate (%)	5.307	5.255	5.346	0.091
	(1.555)	(1.487)	(1.602)	
Manufacturing Share of GSP	0.162	0.166	0.158	-0.008
	(0.0677)	(0.0640)	(0.0702)	
Mining Share of GSP	0.0235	0.0103	0.0333	0.23*
	(0.0499)	(0.0241)	(0.0607)	
Population (millions)	4.135	3.179	4.817	1.638
	(4.377)	(2.776)	(5.120)	
Urban Population Share	0.722	0.719	0.725	0.006
	(0.188)	(0.194)	(0.183)	
Family Size	3.184	3.143	3.213	0.071
	(0.194)	(0.151)	(0.214)	
Percent of Adults with BA	22.09	22.92	21.50	-1.42
	(4.755)	(5.483)	(4.055)	
Percent of Adults Graduating HS	79.30	79.12	79.44	0.31
	(6.127)	(6.470)	(5.866)	
Vehicle Miles Traveled Per Capita (000s)	13.2	12.9	13.4	0.5
	(2.33)	(2.22)	(2.38)	
Percent State Budget Surplus	0.0953	0.09	0.10	0.01
	(0.109)	(0.105)	(0.112)	
Senator LCV Score	46.96	51.87	43.45	-8.41
	(31.03)	(33.23)	(28.86)	
Rep LCV Score	44.58	53.15	38.47	-14.68**
	(24.61)	(26.38)	(21.25)	
Democrat Governor	0.457	0.484	0.437	-0.046
	(0.497)	(0.499)	(0.495)	
Democrat Fraction of State Senate	0.546	0.576	0.522	-0.054
	(0.168)	(0.183)	(0.152)	
Democrat Fraction of State House	0.546	0.568	0.528	-0.040
	(0.162)	(0.192)	(0.132)	

Standard errors for difference column clustered by state.

Table 4: Predictors of Tax Changes and Changes in Point of Taxation

	Dependent Variable:			
	Δ Distributor Remit	Δ Retailer Remit	Δ Supplier Remit	Δ State Diesel Tax
Retail Gasoline Price	-0.000729	-0.00316	0.00389	-0.00587
	(0.00221)	(0.00223)	(0.00298)	(0.0139)
GSP per capita	-0.00474	-0.00788	0.0126	-0.147**
	(0.00666)	(0.00605)	(0.00909)	(0.0555)
State Unemployment Rate	0.0159	-0.0101	-0.00578	0.0861
	(0.0132)	(0.00859)	(0.00958)	(0.0713)
Manufacturing Fraction GSP	0.307	-0.162	-0.145	3.722
	(0.577)	(0.410)	(0.627)	(3.047)
Mining Fraction GSP	-0.996*	0.422	0.574	8.393
	(0.533)	(0.377)	(0.715)	(6.457)
Population	-0.146*	-0.0137	0.160*	-0.548
	(0.0778)	(0.0768)	(0.0815)	(0.607)
Urban Fraction of Pop	5.901	-2.108	-3.793	-19.55
	(3.451)	(1.933)	(3.970)	(22.14)
Average Family Size	0.121*	0.0270	-0.148*	-0.973**
	(0.0652)	(0.0397)	(0.0800)	(0.416)
Fraction of Adults with BA	0.0644	0.0273	-0.0917**	-0.328
	(0.0412)	(0.0260)	(0.0370)	(0.480)
Fraction of Adults	-0.0594**	0.0268*	0.0325**	-0.449**
Graduating HS	(0.0231)	(0.0137)	(0.0148)	(0.212)
Vehicle Miles	0.00245	0.00219	-0.00464	0.435
per Capita	(0.00642)	(0.00523)	(0.00626)	(0.349)
Percent Budget Surplus	0.0458	0.0169	-0.0627	-0.0331
	(0.0430)	(0.0237)	(0.0499)	(0.504)
Senate LCV Score	-0.0000403	-0.0000276	0.0000679	-0.00271
	(0.000366)	(0.000127)	(0.000376)	(0.00292)
House LCV Score	0.000148	-0.000259	0.000111	0.00311
	(0.000337)	(0.000235)	(0.000289)	(0.00280)
Democrat Governor	-0.00216	-0.00846	0.0106	0.0839
	(0.00572)	(0.0108)	(0.00944)	(0.223)
Fraction Democrat	0.0978	-0.0818	-0.0160	-0.225
State Senate	(0.0914)	(0.0867)	(0.0603)	(0.579)
Fraction Democrat	-0.0149	-0.0855	0.100	-0.433
State House	(0.129)	(0.0725)	(0.131)	(1.196)
Observations	831	831	831	831
R-Squared	0.0525	0.0712	0.0782	0.110

Standard errors clustered by year are in parentheses.
*,**,*** denote significance at the 10%, 5%, and 1% level, respectively.
All dependent and independent variables are first-differenced. All specifications include year fixed effects.

Table 5: Point of Tax Collection and Incidence

	(1)	(2)	(3)	(4)
Real diesel tax	-0.086	-0.025	-0.120	-0.098
	(0.021)***	(0.022)	(0.055)**	(0.071)
Collect tax from terminal		2.875	0.445	0.824
		(0.268)***	(0.604)	(0.658)
Collect tax from distributor		1.378	0.192	-0.308
		(0.188)***	(0.626)	(0.656)
Real tax * Collect from terminal			0.209	0.162
			(0.052)***	(0.057)***
Real tax * Collect from distributor			0.100	0.139
			(0.056)*	(0.057)**
Real neighbor's tax	0.080	0.275	0.276	0.249
	(0.046)*	(0.051)***	(0.050)***	(0.051)***
Degree days	0.087	0.094	0.095	0.078
	(0.066)	(0.063)	(0.062)	(0.061)
Degree days * HH Fuel oil frac	0.468	0.460	0.460	0.459
	(0.085)***	(0.080)***	(0.079)***	(0.078)***
Unemp. Rate	-0.064	-0.128	-0.135	-0.132
	(0.061)	(0.062)**	(0.063)**	(0.062)**
Real diesel tax * year dummies				X
Observations	5435	5435	5435	5435
R-squared	0.98	0.98	0.98	0.98

Standard errors clustered by year*month are in parentheses.
*,**,*** denote significance at the 10%, 5%, and 1% level, respectively.
The dependent variable is the real tax exclusive retail price of number 2 diesel.
Each specification includes state fixed effects and year*month effects.

Table 6: Point of Tax Collection and Wholesale Prices

	Dependent variable:			
	Resale price		Retail price	
	(1)	(2)	(3)	(4)
Real diesel tax	-0.002	-0.024	-0.120	-0.098
	(0.017)	(0.038)	(0.055)**	(0.092)
Collect tax from terminal	1.959	-0.803	0.445	0.987
	(0.259)***	(0.404)**	(0.604)	(1.785)
Collect tax from distributor	0.686	0.575	0.192	-0.296
	(0.163)***	(0.408)	(0.626)	(1.323)
Real Tax * Collect from supplier		0.240	0.209	0.028
		(0.037)***	(0.052)***	(0.164)
Real tax * Collect from distributor		0.001	0.100	0.099
		(0.039)	(0.056)*	(0.153)
Real Price for Resale				0.535
				(0.057)***
Lag Real Price for Resale				0.240
				(0.033)***
R2	0.99	0.99	0.98	0.99
N	5,427	5,427	5,435	5,349

Standard errors clustered by year-month are in parentheses.
*,**,*** denote significance at the 10%, 5%, and 1% level, respectively.
The price for resale is a measure of the wholesale price, as it is the price charged for diesel that will be resold to another party. The other included controls correspond to those in the specification shown in column (4) of Table 5.

Table 7: Point of Tax Collection and Incidence

	States shifting point of taxation from:			
	Distributor to supplier		Retailer to distributor	
	(1)	(2)	(3)	(4)
Real Diesel Tax	-0.149	-0.150	-0.319	-0.315
	(0.100)	(0.140)	(0.089)***	(0.085)***
Real tax * Post reform	0.227	0.229	0.677	0.677
	(0.090)**	(0.151)	(0.087)***	(0.088)***
Post reform	-1.555	-1.583	-5.363	-5.400
	(0.986)	(1.765)	(0.943)***	(1.003)***
Real tax*months relative to change		-0.00002		0.0001
		(0.001)		(0.001)
Months relative to regime change		0.070		0.161
		(0.010)***		(0.012)***
R2	0.98	0.98	0.99	0.99
N	1,004	1,004	751	751

Standard errors are in parentheses.
*,**,*** denote significance at the 10%, 5%, and 1% level, respectively.
The dependent variable is the real tax exclusive retail price of number 2 diesel.
The other covariates are identical to those included in the specification shown in Column (3) of Table 4.
Months relative to regime change is a variable equal to the number of months prior to or after the stated regime change. Specifications (1) and (2) include all observations from states that experienced a shift in the point of collection from the wholesale distributor level to the prime supplier level. Specifications (3) and (4) likewise include all observations from states that experienced a shift in the point of collection from the retail level to the wholesale distributor level.

Table 8: Point of Tax Collection and Taxed Gallons

Dependent variable: Change in log gallons of taxed diesel

	(1)	(2)	(3)
Retailer to Distributor	0.073	0.081	0.080
	(0.044)	(0.050)	(0.051)
Retailer to Supplier	0.078	0.072	0.069
	(0.039)**	(0.035)**	(0.030)**
Distributor to Supplier	0.015	0.009	0.005
	(0.033)	(0.033)	(0.030)
Log price		-0.384	-0.459
		(0.161)**	(0.170)***
Log (1 + tax rate)		-0.456	-0.625
		(0.269)*	(0.306)**
Log GSP		0.430	0.531
		(0.144)***	(0.154)***
Unem. Rate		-0.010	-0.013
		(0.005)*	(0.005)**
Log Minimum neighbor tax		-0.103	-0.112
		(0.056)*	(0.056)*
Log degree days		-0.029	-0.023
		(0.038)	(0.031)
Log degree days X HH Oil Use		0.014	0.014
		(0.078)	(0.084)
Lagged change in collections			-0.351
			(0.035)***
R2	0.10	0.14	0.25
N	960	940	940

Standard errors clustered by state are in parentheses.
*,**,*** denote significance at the 10%, 5%, and 1% level, respectively.
The dependent variable is the change in the log of the number of gallons of special fuel on which state taxes were collected. The log tax rate is defined as $ln(1 + t/p)$. The other independent variables are all first-differenced. Each specification includes year effects. If a regime change occurred mid-year, the regime change dummy is apportioned into the year of the reform and the year after the reform. For instance, shifting to taxing the supplier from the retailer in July of 2005 would cause the variable "Retailer to supplier" to take on a value of 0.5 in 2005 and 0.5 in 2006.