SHARP LINES AND SLIDING SCALES IN TAX LAW

Edward Fox and Jacob Goldin*

DRAFT: February 20, 2019

ABSTRACT

The law is full of sharp lines, where small changes in one's circumstances lead to significant changes in legal treatment. In many cases, a sharp line can be smoothed out by replacing it with a sliding scale. Under a sliding scale, small changes in one's circumstances lead to small changes in legal treatment. In this paper, we study the policy choice between sharp lines and sliding scales in tax law, focusing particularly on concerns related to efficiency, complexity, and administration. Sharp lines are dominant in tax law, especially for classifications that depend on factors other income. We argue that this dominance is unwarranted; sliding scales are often feasible in practice and better serve a variety of tax policy goals. We illustrate our claims with examples drawn from diverse areas of tax law.

* **Draft: comments welcome**. Fox: Assistant Professor of Law, University of Michigan Law School. Goldin: Assistant Professor of Law, Stanford Law School.

INTRODUCTION

The law is full of sharp lines, where small changes in one's circumstances lead to significant changes in legal treatment. Tax law is no exception; someone who falls just to one side of a line may be taxed quite differently than someone else who falls just to the other side, even when the two situations are otherwise quite similar. Consider the following examples:

- The sale of a capital asset held for 366 days is eligible for the preferential rate on capital gains but the sale of the same asset held for 364 days is not.
- For certain states, an individual who spends 184 days of the year in the state is considered a resident whereas an individuals who spends 182 days in the state is not.
- An employer with 51 employees is required to offer health insurance coverage to its employees or face a penalty; an employer with 49 employees is not.
- A corporation with 99 shareholders can elect to be taxed as an S-corporation; a corporation with 101 shareholders cannot.
- A child born on New Year's Eve can qualify the parent for the full year's Child Tax Credit; a child born the next day yields no tax benefits for the prior year.

In many cases, a sharp line can be smoothed out by replacing it with a sliding scale. A sliding scale classifies individuals in proportion to where they fall along some continuum. Legal treatment under a sharp line is all-or-nothing; in contrast, under a sliding scale, small changes in circumstances lead to small changes in the legal outcome. To illustrate, a sliding scale might allow taxpayers to claim the Child Tax Credit in proportion to the fraction of the year that elapses after a child's birth. Similarly, a sliding scale for long-term capital gains might gradually phase in the preferential tax rate for sales of a capital asset based on the holding period – say, between 6 and 18 months.[1]

In this paper, we study the policy choice between sharp lines and sliding scales in tax law. Historically, most proposals to convert sharp lines to sliding scales would have foundered over concerns about complexity; in an age when the vast majority of taxpayers or their accountants calculated taxes by paper and pencil, the extra work required to apply a sliding scale would usually have dwarfed any potential benefit. Today, however, over 95% of tax returns are prepared using some form of software; consequently, the computational complexity of a sliding scale is far less of an impediment. Motivated by this development, we explore the relative advantages and disadvantages of the two approaches for classifying tax situations, focusing

[1] Sliding scales could replace each of the other sharp lines listed above as well, although some of these reforms would raise practical challenges. We discuss these issues below.

particularly on concerns related to efficiency, complexity, and administration. We illustrate the principles that emerge from our analysis by applying them to several real-world examples: child tax benefits, long- versus short-term capital gains, conventions for dealing with depreciable property, and state residency rules.

Our main conclusion is that sliding scales deserve consideration in many of the settings in which the tax law currently employs a sharp line. Beginning with an efficiency perspective, we show the relative desirability of sharp lines and sliding scales depends on the pattern of choices that taxpayers would make in the absence of tax considerations. In particular, sliding scales tend to be more efficient, except when most taxpayers behave in ways that place them far from where the sharp line would be drawn.

To illustrate the intuition for this claim, consider an analogy to law school grading practices.[2] Law schools differ widely in the granularity of students' grades. Yale Law School, for example, assigns students one of two grades – H or P – depending on their performance in a class.[3] At the other extreme, The University of Chicago Law School assigns grades on a 31 point scale that ranges from 155 to 186. How does a school's grading system affect law student effort? The answer depends in part on the underlying distribution of student performance in the class. If many students are near the line between H and P, the Yale grading system tends to induce a lot of student effort because small amounts of additional work can affect a student's grade and the consequences of falling on the other side of the line are significant. In contrast, the Yale system provides little incentive for effort to a student who knows she is well below or well above the line.[4] Hence, when few students are located near the H/P line, the Yale system induces relatively little effort. The Chicago system, on the other hand, creates a relatively uniform incentive for students to put forth effort across the distribution of student performance. However, the magnitude of the incentive under the Chicago system is dampened by the fact that crossing the line from one grade to another (say from 158 to 159) has relatively minor effects.

When designing a law school's grading system, inducing student effort is usually thought to be desirable. But policymakers typically have the opposite goal for tax law: they want to avoid causing taxpayers to change their behavior from what they would have chosen to do absent taxes. By not distorting taxpayers' decisions, tax law minimizes deadweight loss. This is why a sharp line (the Yale system) tends to be more efficient when few

---

[2] This example is meant to be illustrative; there are of course many other considerations that should go into the design of a law school grading system.

[3] Technically, law students at Yale may also receive a "low pass" grade or fail a course, but we ignore those possibilities for purposes of illustration, as we suspect most Yale law professors do in practice.

[4] Of course, students may not know where in the distribution they will fall. We discuss how uncertainty affects the efficiency analysis in Section II.G.

taxpayers would locate near the line, and why a sliding scale (the Chicago system) tends to be more efficient when the opposite is true.

Turning from efficiency, we next consider the role of complexity in sharp lines and sliding scales. Although sliding scales make it harder for taxpayers to *compute* their precise tax liability, we argue that this consideration is relatively unimportant today, given the large fraction of taxpayers who prepare their returns using software (either directly, using programs like TurboTax, or indirectly, by hiring an accountant or paid preparer who does so). However, even those using software must keep track of and disclose the information that goes into calculating their tax liability. From this perspective, a downside of sliding scales can be that they require more information than sharp lines. We argue that the importance of this consideration varies greatly by context: a sliding scale for state residency would be informationally complex, for example, because it requires taxpayers to track the precise number of days they spend in a given state. In contrast, a sliding scale for child tax benefits based on a child's date of birth wouldn't impose any new informational costs, because it simply requires taxpayers to keep track of and report their child's birthday.

Next, we consider the suitability of sharp lines and sliding scales from the perspectives of horizontal equity and the accurate targeting of tax policies. We argue that these considerations typically favor a sliding scale. The reason why is that a sliding scale treats like parties in like fashion: two taxpayers who are similarly situated have similar tax liability under a sliding scale. In contrast, a sharp line assigns different tax liabilities to otherwise-similar taxpayers who happen to fall just on opposite sides of the line. Of course, when the location of a sharp line does correspond to a difference in taxpayers' situations that is relevant to the objectives of the policy in question, the discontinuous treatment afforded by the sharp line is desirable. But typically this is not the case. To the extent the choice between sharp lines and sliding scales has been examined in legal scholarship outside of tax, most authors have focused on concerns of these types.[5]

Apart from efficiency, complexity, and equity, the choice between sharp lines and sliding scales implicates several considerations relating to tax administration and the incentives for taxpayers to engage in tax planning. We briefly discuss these issues as well.

Perhaps because the widespread use of sliding scales has, until recently, been limited by the computational burdens they would place on taxpayers, they have not received much attention among academics or policymakers.

---

[5] See, e.g., Leo Katz, WHY THE LAW IS SO PERVERSE (2011); Adam J. Klober, *Smooth and Bumpy Laws,* 102 Cal. L. Rev. (2014). For a version of this argument with examples drawn from tax, see Bradley Borden, *Quantitative Model for Measuring Line-Drawing Inequity*, 98 IOWA L. REV. (2013).

However, a number of strands of the prior literature discuss closely related topics.

One related literature considers the policy choice between standards and rules (or "bright lines", as they are sometimes called).[6] Although superficially related, the question asked in this literature is conceptually distinct from ours. In particular, the policy choice between rules and standards is usually understood to be about the precision and clarity surrounding the location of a line between two legal classifications. In our nomenclature, both policies are examples of sharp lines, in that the consequence of crossing the line, wherever it is located, is assumed to result in a discontinuous change in legal treatment. In our analysis, we will mostly focus on the choice between sharp line rules and sliding scale rules, but one can also imagine choosing between sharp line standards and sliding scale standards, such as the choice between a pure comparative negligence regime and a contributory negligence regime for tort liability. We consider the special issues that arise in the case of sliding scale and sharp line standards in Section VII.A.

A second related literature concerns the choice of where to draw the line that will divide two legal classifications. In an influential analysis, David Weisbach (1999, 2000) considers a similar setting to ours, in which the tax law must distinguish between situations that differ along some dimension, and the question is where the dividing line should be drawn.[7] In Weisbach's analysis, the lines under consideration are all sharp lines. In contrast, our focus is on the antecedent question of whether a sharp line is desirable in the first place.

A third question that is closely related to ours is how tax liability should vary by income, and in particular, the manner in which various provisions should phase in or out by income.[8] In this setting, the conventional wisdom is that sharp lines – or, "cliff effects" as they're often referred to when tax liability depends on income – are undesirable, and should be avoided

---

[6] See, e.g., Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L. J. 557 (1992); Frederick Schauer, *Rules and the Rule of Law*, 14 HARVARD J.L. & PUB. POL'Y 645 (1991); see also Carol Rose, *Crystals and Mud in Property Law*, 40 STANFORD L. REV. 577 (1988).

[7] David A. Weisbach, *Line Drawing Doctrine and Efficiency in the Tax Law*, 84 CORNELL L. REV. 1627 (1998); David A. Weisbach, *An Efficiency Analysis of Line Drawing in the Tax Law*, 29 J. LEGAL STUD. 71 (2000).

[8] For an insightful discussion of this topic, see Manoj Viswanathan, *The Hidden Costs of Cliff Effects in the Internal Revenue Code*, 164 U. PENN. L. REV. (2016). Although Viswanathan's focus is on income-based cliff effects, he claims that "cliff effects in the Internal Revenue Code based on metrics other than income can be reconciled with notions of equity and efficiency." We add nuance to that conclusion by highlighting conditions in which sliding scales are actually preferable to sharp lines on both equity and efficiency grounds, including for classifications based on characteristics other than income.

whenever possible.[9] This setting is mostly outside of our focus because when the tax law takes income into account, it is typically not doing so in order to classify the taxpayer into one category or another. Still, a benefit of our framework is that it allows us to assess sliding scales and sharp lines in both income and non-income settings. In the case of classifications based on income, our results largely support the conventional view that phase-ins are preferable to sharp lines. But in non-income settings, our analysis suggests the proper instrument can vary across contexts.

A fourth related literature focuses on questions of bifurcation. Consider a transaction that can be represented as a combination of two other transactions, each of which would be taxed differently than the other. Under a bifurcation approach, the actual transaction is taxed as if the two constituent transactions had occurred instead. This approach has received the most attention with respect to taxing hybrid financial instruments,[10] but comes up in non-financial contexts as well.[11] Because bifurcation entails treating a transaction in accordance with the degree to which it can be classified as one constituent transaction versus another, it is similar, although not always identical, to a sliding scale.[12]

---

[9] *Id.*; *see also* Joel Slemrod, *Buenas Notches: Lines and Notches in Tax System Design,* 11 EJOURNAL OF TAX RESEARCH 259, 275 (2013) (citing literature and arguing that in absence of administrative costs, a fully flexible optimal tax system would never use sharp lines which depend on income).

[10] *See, e.g.,* Jeff Strnad, *Taxing New Financial Products: A Conceptual Framework*, 46 STANFORD L. REV. (1994); David Weisbach, *Tax Responses to Financial Contract Innovation*, 50 TAX L. REV. (1995).

[11] To illustrate, consider the income tax treatment of a part-gift, part-sale. When the transaction is a sale of property to a charitable organization for below-market price, the transaction is effectively bifurcated, so that it is taxed as if the transferor had sold a portion of the property at fair market value and given the other portion away as a gift to the charity. In contrast, outside of charitable contributions, a part-gift part-sale typically results in the transferor's basis being recovered as if the transaction had been entirely a sale rather than partly a gift.

[12] One important setting in which bifurcation can differ from a sliding scale is when classification of a situation depends on some property that varies over the accounting period, such as the state for which the taxpayer is a resident. To illustrate, consider a taxpayer who made $1M last year and spent 40% of the year in New York and 60% in Florida, while traveling back and forth between the two states. A sliding scale approach might have the taxpayer pay 40% of New York taxes on $1M of income and 60% of Florida taxes on $1M. (The latter part is $0 because Florida does not have an income tax.) In contrast, a bifurcation approach might apportion tax liability on the basis of how much the taxpayer made during the days she was in Florida and how much she made during the days she was in New York. In other words, bifurcation, but not a sliding scale, has the effect of creating two sub-annual accounting periods: the New York portion of the year and the Florida portion of the year.

Finally, across various areas in tax law, others have raised and discussed specific applications of the issue we study, such as in discussions about the definition of a capital asset,[13] the distinction between debt and equity,[14] and apportionment of tax liability across states or countries.[15] Our hope is that approaching such questions through a more general lens will produce lessons that complement the specific insights obtained through study of particular applications.

Outside of tax, a number of authors have noted the sharp line versus sliding scale distinction in diverse areas of law,[16] especially tort and criminal law,[17] as well as in moral theory more generally.[18] As we discuss below, the

---

One potential problem with the bifurcation approach relative to the sliding scale is it creates an incentive for the taxpayer to time the recognition of income to coincide with the lower tax portion of the accounting period, such as her residence in the low-tax state.

[13] Bradley Borden, Nathan Brown, and John Wagner, *A Case for Simpler Gain Bifurcation for Real Estate Developers*, 16 FLORIDA TAX REV. (2014).

[14] G. Mitu Gulati, William Klein, and Eric Zolt, *Connected Contracts*, 47 UCLA L. REV. 887 (2000).

[15] See, e.g., Wolfgang Shön, *International Tax Coordination for a Second-Best World (Part One)*, WORLD TAX J. (2009); Reuven Avi-Yonah, Kimberly A. Clausing & Michael C. Durst, *Allocating Business Profits for Tax Purposes: A Proposal to Adopt a Formulary Profit Split,* 9 Fla. Tax Rev. 497 (2009).

[16] John E. Coons, *Approaches to Court Imposed Compromise—The Uses of Doubt and Reason*, 58 NW. U. L. REV. (1963) (focusing on court's imposing compromise outcomes in the case of an evidentiary tie); Gideon Parchomovsky, Peter Siegelman, and Steven Thel, *Of Equal Wrongs and Half Rights*, 82 NYU L. REV. (2007); Lee Anne Fennell, *Lumpy Property*, 160 U. PA. L. REV. 1955 (2012). For more general treatments of this issue, see Leo Katz, WHY THE LAW IS SO PERVERSE 139-181 (2011) (defending the existence of law's "either/or" treatment partly on the basis of social choice theory); Adam J. Kolber, *Smooth and Bumpy Laws,* 102 CAL. L. REV. (2014) (developing a taxonomy of the relationship between legal inputs and outputs and considering the desirability of the various approaches across legal contexts, including a brief discussion of tax law).

[17] John Makdisi, *Proportional Liability: A Comprehensive Rule to Apportion Tort Damages Based on Probability*, 67 N.C. L. REV. (1989); Jeff Lewin, *Comparative Nuisance*, 50 U. PITT. L. REV. (1989); Saul Levmore, *Probabilistic Recoveries, Restitution, and Recurring Wrongs*, 19 J. LEGAL STUD. 691 (1990); Douglas Husak, *Proportional Defenses*, 11 CANADIAN J. OF L. AND JURISPRUDENCE 167 (1998); Michael Abramowicz, *A Compromise Approach to Compromise Verdicts,* 89 CALIFORNIA L. REV. (2001); Henrik Lando, *The Size of the Sanction Should Depend on the Weight of the Evidence*, 1 REV. OF L. AND ECON. (2005); Sonja B. Starr, *Sentence Reduction as a Remedy for Prosecutorial Misconduct*, 97 GEO. L.J. 1509 (2008); Adam Kolber, *The Bumpiness of Criminal Law*, 67 ALABAMA LAW REVIEW (2016); Lee Anne Fennell, *Accidents and Aggregates,* 59 WILLIAM AND MARY LAW REV. (2018).

[18] Larry Alexander, *Scalar Properties, Binary Judgments*, 25 J. OF APPLIED PHILOSOPHY (2008); *see also* Derek Parfit, REASONS AND PERSONS 199-350 (1984) (discussing the continuous nature of changes in personal identity over time).

efficiency properties of these instruments raise unique considerations in the tax law setting, where the goal, unlike most other areas of law, is to minimize the effect of the law on individuals' behavior. The same can be said with respect to considerations relating to complexity and other issues that we focus on below.

In the public finance literature, economists have studied the behavioral effects of sharp lines and sliding scales, both as separate instruments, and more generally as a question of optimal taxation.[19] As with legal scholarship, the public finance literature tends to focus on the properties of sharp lines, or notches as they're often referred to in this field, in the context of how tax liability depends on income (although there are exceptions).[20] Separately, a large and growing economics literature exploits notches that exist in an existing tax schedule to empirically estimate various determinants of taxpayer behavior.[21]

The remainder of the paper proceeds as follows. Section I sets out a stylized model that we draw on to illustrate our argument. Section II focuses on the efficiency trade-offs between sliding scales and sharp lines. Section III considers issues relating to complexity. Section IV considers how well sharp lines and sliding scales effectuate the underlying policy goals, as well as differences in horizontal equity. Section V considers tax administration. Section VI considers implications for tax planning. Section VII focuses on several special cases, relating to standards versus rules; classifications based on taxpayer intent; democratic legitimacy; classifications based on income; taxes designed to shape behavior; and multi-factor tests. Section VIII illustrates our analysis with examples relating to child tax benefits, the capital gains holding period, conventions for depreciable property placed in service, and state residency tests. Section IX concludes.

I. MODEL

Consider a situation in which taxpayers must make some decision that can potentially affect their tax liability. We model this decision as choosing a value of x from between 0 and 1. Our focus is on settings in which the tax law seeks to treat taxpayers who select values of x at or near 0 differently from taxpayers who select values of x at or near 1. Hence, x might represent

---

[19] The classic public finance article laying out the behavioral and efficiency tradeoffs between linear tax incentives and sharp lines is Alan S. Blinder & Harvey S. Rosen, *Notches*, 75 AMERICAN ECONOMIC REVIEW (1985). In section 2, we develop these principles in the context of the classification challenges that frequently arise in tax law.

[20] Joel Slemrod, *Buenas Notches*: *Line and Notches in Tax System Design*, 11 EJOURNAL OF TAX RESEARCH (2013).

[21] For an overview, see Henrik Kleven, *Bunching*, 8 ANNUAL REVIEW OF ECONOMICS (2016).

any of a range of decisions that can be represented using this scale and for which the tax law distinguishes between taxpayers falling at opposite ends of the continuum. For example, x might represent the date during the year that taxpayers choose to get married (0 represents January 1; 1 represents December 31); how long to hold a capital asset (0 represents selling immediately after purchase; 1 might represent selling at 10 years or some point after[22]); or the extent to which a taxpayer is motivated by profit to take some activity (0 represents no profit motive; 1 represents complete profit motive). Although we describe x as reflecting a taxpayer's choice, the variable might also represent activities the taxpayer has some influence over, but does not entirely control, such as the date in the year at which to have a child.[23] Because x will determine which tax regime the taxpayer is classified as falling into, we will refer to it as the *classification variable*.

Absent tax considerations, we assume each individual has some ideal value of x she would like to select, which we label x_i^* (the subscript i denotes the individual). All else equal, individuals prefer to select values of x that are as close as possible to their ideal point.

For most of our analysis, we assume the incremental cost of locating further from one's ideal point grows larger as the distance from the ideal point increases. "Convex adjustment costs" of this form are commonly imposed in economic analyses. To illustrate, consider a taxpayer seeking to reduce the number of days she spends in a high-tax jurisdiction.[24] The taxpayer might look at her calendar to identify all the days she had planned to spend in the state; some plans that would take her into the state might be easy to cancel or move to a different location. These would be the first to go. Further reductions would require costlier adjustments to her behavior – perhaps a meeting could be rescheduled, but only at substantial inconvenience. And some adjustments would be so costly that the tax consequences would be unlikely to justify them, such as switching jobs to

---

[22] For our purposes, it will not always be necessary to model each possible decision a taxpayer might make as representing a distinct point between 0 and 1 – e.g., holding periods of 15 years and 16 years might both be represented as $x=1$. In choosing which decisions can be modeled using the same value of x, the key assumption is that all such decisions would receive the same tax treatment. Hence, for treatment of capital gains, the endpoint of our scale should be chosen so that it corresponds to a date for which all subsequent dates would be considered long-term.

[23] The case in which the taxpayer can affect x imperfectly can be modeled as if the taxpayer chooses x with error, which we explore in Section 2.F.

[24] For a vivid illustration of this point, see James Stewart, *Tax Me If You Can,* THE NEW YORKER (Mar. 19, 2012) (discussing taxpayers seeking to avoid New York City residence).

work for an employer in a different state, or ceasing to visit a family member who lives in the high tax jurisdiction.[25]

Let t_i denote i's tax liability. In addition, let $t_i(0)$ denote i's tax liability if the $x = 0$ regime were to apply and $t_i(1)$ denote i's tax liability if the $x = 1$ regime were to apply. We set aside for now the question of why the tax law seeks to treat these two groups of taxpayers differently, taking this constraint as given. Depending on the setting, it may be that one tax regime is more favorable for all taxpayers than the other, or it may be that the relative desirability of the tax regimes differs between taxpayers. To keep things simple, we will focus on the case in which taxpayers do not differ from one another in their liability under the two regimes, $t_i(0) = t(0)$ and $t_i(1) = t(1)$ for all i. Importantly, this simplification implies that one of the two tax regimes is preferred to the other for all taxpayers, and by an identical amount, which we label τ, $\tau = t(1) - t(0)$.

The question we seek to answer is how the tax law should treat individuals with intermediate values of x: for any given x between 0 and 1, should the taxpayer be treated like taxpayers with $x = 1$, like taxpayers with $x = 0$, or somewhere in between?

A sharp line is one way the law might assign tax liability to taxpayers with intermediate values of x. Implementing a sharp line requires selecting the value of x that will serve as the dividing point between classification – we'll refer to this threshold as $\overline{x}$. The key feature of a sharp line is it all-or-nothing nature: taxpayers who select a value of x on the $x = 1$ side of $\overline{x}$ are treated as if they had selected $x = 1$; taxpayers who select a value of x on the $x = 0$ side of $\overline{x}$ are treated as if they had selected $x = 0$. Using our notation, tax liability under a sharp line rule, t^{SL}, is given by:

$$t^{SL} = t(0) + \tau\, I(x)$$

---

[25] As a different example, consider a taxpayer holding a capital asset that she would prefer to sell, but continues to hold in order to obtain long-term capital gains treatment. If the taxpayer would, absent taxes, sell stock A to and buy stock B because she believes B will outperform A, the gap in future expected profits will compound with each additional day of delay, leading to a convex cost function for continuing to hold A. The same is true if the taxpayer would, absent taxes, sell A to better diversify her portfolio; this cost will also compound. *See* Ian Ayres and Edward Fox, *Alpha Duties: The Search For Excess Returns and Appropriate Fiduciary Duties,* TEX. L. REV. (2019) (discussing the tradeoff between capital gains taxes and the costs of under- diversification). As yet another example, businesses are often thought to face convex costs when they adjust their capital by putting depreciable capital in place. *See* Fumio Hayashi, *Tobin's Marginal q and Average q: A Neoclassical Interpretation*, ECONOMETRICA 213 (1982); *see also* Russell Cooper & John C. Haltiwanger, *On the Nature of Capital Adjustment Costs*, 73 REV. ECON. STUD. 611 (2006) (finding empirical evidence of both non-convex and convex costs for businesses adjusting capital).

where $I(x)$ is equal to 1 if $x > \overline{x}$ and equal to 0 if $x \leq \overline{x}$. As noted above, sharp lines are the norm in most (but not all) tax law definitions today.

The other approach we consider for differentiating between taxpayers based on their choice of x is a sliding scale. Under a sliding scale, tax liability is determined by first computing liability under the assumption that the $x = 0$ regime applies; then under the assumption that the $x = 1$ regime applies; and finally, taking the weighted average of liability under the two regimes based on the taxpayer's actual value of x. Using the above notation, we can represent a taxpayer's liability under a sliding scale, t^{SS}, as:

$$t^{SS} = t(0) + \tau\, x$$

In contrast to a sharp line, a taxpayer's liability under a sliding scale varies continuously with the value of x that she selects.[26]

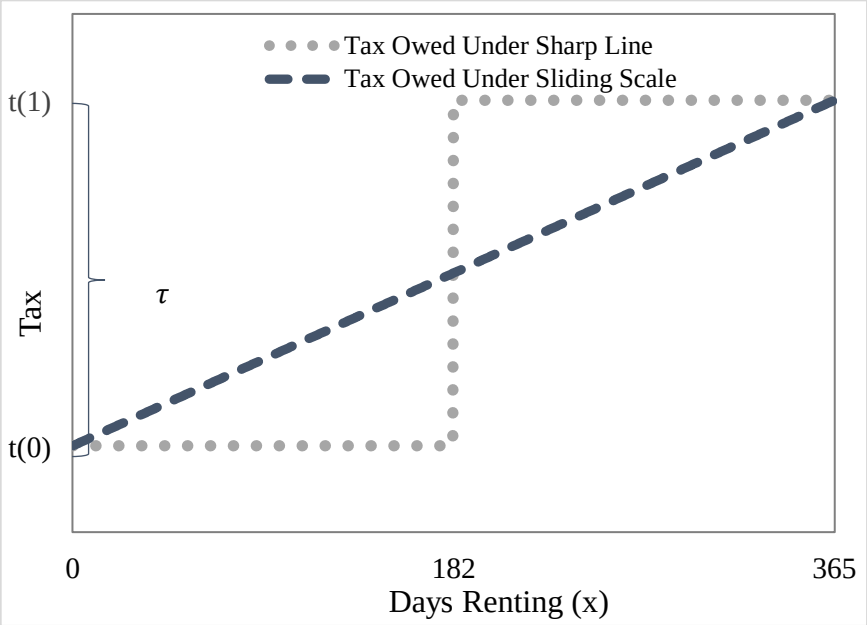
To illustrate the two approaches, consider a hypothetical policy designed to promote home ownership by imposing a $2,000 tax on those who rent their housing. Suppose a taxpayer begins a year renting her home, but buys a home later during the same year. How should the law treat taxpayers when they rent for part of the year and own for part of the year? A sharp line might classify taxpayers as "renters" for the year (and tax them by the full $2,000) if they rent for 183 days in the year or more. In contrast, a sliding scale might impose tax in proportion to the fraction of the year the taxpayer rents. Thus, someone who purchases her first home on March 15 (the 74th day of the year) and does not sell it during the year would face a tax of:

$$\left(\frac{74}{365}\right) \times \$2000 + \left(1 - \frac{74}{365}\right) \times \$0 = \$405$$

These two possibilities – the 183-day sharp line and the sliding scale – are illustrated in Figure 1.

[26] In theory, the choice between sliding scales and sharp lines itself rests along a continuum, in that the classification variable can be measured at differing levels of granularity. For example, in the home ownership tax example described in the next paragraph, a sliding scale version of the credit might be apportioned based on weeks of home ownership, days, or even hours or minutes. We mostly abstract from such considerations here, but note that the optimal degree of granularity for a sliding scale likely differs by setting, potentially balancing tradeoffs between efficiency and complexity, similar to the choice between a sliding scale and sharp line.

Figure 1: Sharp Line vs Sliding Scale



So far, we have assumed that a sliding scale would transition between the two tax regimes gradually over all intermediate values of *x*. In some settings, there will be an advantage to transitioning between the tax regimes over some but not all of the intermediate values. For simplicity, we will refer to both of these approaches as sliding scales, but it is worth noting that the smaller the set of values over which the sliding scale transitions between tax regimes occurs, the more it resembles a sharp line.[27]

Although many sharp lines in the tax law can be smoothed out in theory, some will pose practical challenges. First, consider provisions where the tax outcome is difficulty to apply other than in an all-or-nothing manner. For example, there are many information reporting requirements in the law, such as the requirement that firms provide schedule 1099-K forms on credit card payments to payees whose payments exceed $20,000. If a payee's transactions for the year total $19,500, should the firm be required to report some but not all of the required information? Or similarly, consider the requirement that employers with 50 or more employees provide health insurance. Could an

[27] More generally, a sliding scale is just one example of a continuous function that allocates tax liability based on *x*. In some settings, other (non-linear) transition rules between tax regimes may offer efficiency or other advantages. We limit our focus to sliding scales to highlight the basic trade-offs between sharp lines and other approaches. With sufficient flexibility, any tax function that is continuous in *x* can approximate a sharp line to an arbitrary degree. For a discussion of continuity and linearity in a closely related setting, and the limits to what a linear (i.e., sliding scale) type approach can achieve, *see* Jeff Strnad, *Taxing New Financial Products: A Conceptual Framework*, 46 STANFORD L. REV. 569, 597-600 (1994).

employer with 49 employees be required to provide some partial form of health insurance (e.g., covering some illnesses but not others)?

In such cases, where the targeted behavior is difficult to smooth out, a potential approach for implementing a sliding scale is to instead smooth out the penalty for non-compliance – i.e, by making it proportional to the degree to which the taxpayer performs the targeted behavior. For example, a 49-person firm that decided not to provide health insurance to its employees would owe a fee, but the magnitude of the fee would be slightly smaller than that owed by a 51-person firm making the same decision.[28]

In principle, this approach could also work to varying degrees in settings where the consequence for non-compliance with a requirement is non-monetary, so long as it is scalable. In criminal tax cases, for example, one could scale a convicted taxpayer's prison sentence based on the degree to which the law was violated (or other factors, such as the taxpayer's culpability).[29] Similarly, instead of preventing a taxpayer from recovering any amount on a refund action brought after the expiration of the statute of limitations, the rule might gradually phase-out the amount that can be recovered over some period of time.

Finally, for some provisions, the requirement that follows from applying a test will not lend itself to being smoothed out, and neither will the consequence for non-compliance. In such cases, it is more difficult to imagine ways to convert the sharp line into a sliding scale. Certain procedural requirements fall into this category. For example, the tax court provides taxpayers with the option of arguing their tax deficiency case under a simplified procedure if the total unpaid tax is less than $50,000. It is difficult to imagine smoothing out this line: would a taxpayer alleged to owe $51,000 try the case twice, once under the simplified rules and once under standard rules, and pay some average of the judgments? We acknowledge that settings of this form are outside the scope of our analysis.

In the sections that follow, we consider a number of factors that shape the relative merits between sharp lines and sliding scales.

---

[28] Such an approach would be more difficult when the primary penalty for failing to satisfy the requirement takes the form of a social sanction, the motivational force of the law is primarily expressive, or where the penalty for non-compliance is intended to be punitive. In other words, under a sliding scale approach to a requirement, taxpayers may perceive the rule as a price versus a fine, which can affect its motivational force. See Uri Gneez and Aldo Rustichini, *A fine is a price*, 29 JOURNAL OF LEGAL STUDIES (2000).

[29] Of course, such factors may already be considered in sentencing decisions. See Adam Kolber, *The Bumpiness of Criminal Law*, 67 *Alabama Law Review* (2016). Note that this approach runs into difficulty if a large part of the motivational force comes not from the specific sentence, but from the discrete fact of violating the law or of conviction.

II. EFFICIENCY CONSIDERATIONS

To understand the efficiency properties of the sharp line and sliding scale, we consider how each policy affects the values of x that taxpayers choose. Absent tax considerations, each individual would locate at her ideal point, x_i^*. After taxes are introduced, taxpayers balance the desire to locate near their ideal points with the desire to minimize tax liability. As we will see, the specific values of x that taxpayers choose, as well as the tax's deadweight loss, will depend on which form of rule the law adopts.

Our main conclusion from the analysis in this section is that a sliding scale tends to be more efficient than a sharp line. However, we find that sharp lines can be more efficient in cases in which the distribution of taxpayers' ideal points allows policymakers to draw a sharp line in a location that distorts taxpayer behavior by a relatively small amount. The difference in efficiency between the two types of instrument depends on the difficulty or ease with which taxpayers can adjust their behavior because of a tax, and on how certain or uncertain the relationship is between a taxpayer's choices and her liability.

A. Behavioral Effects of a Sharp Line.

We first consider the behavioral effects of imposing a sharp line rule, with cutoff point $\overline{x}$.[30] To illustrate how this type of rule affects behavior, we will examine how four different taxpayers would respond. The taxpayers are identical to one another except for their ideal points, as indicated in Figure 2.

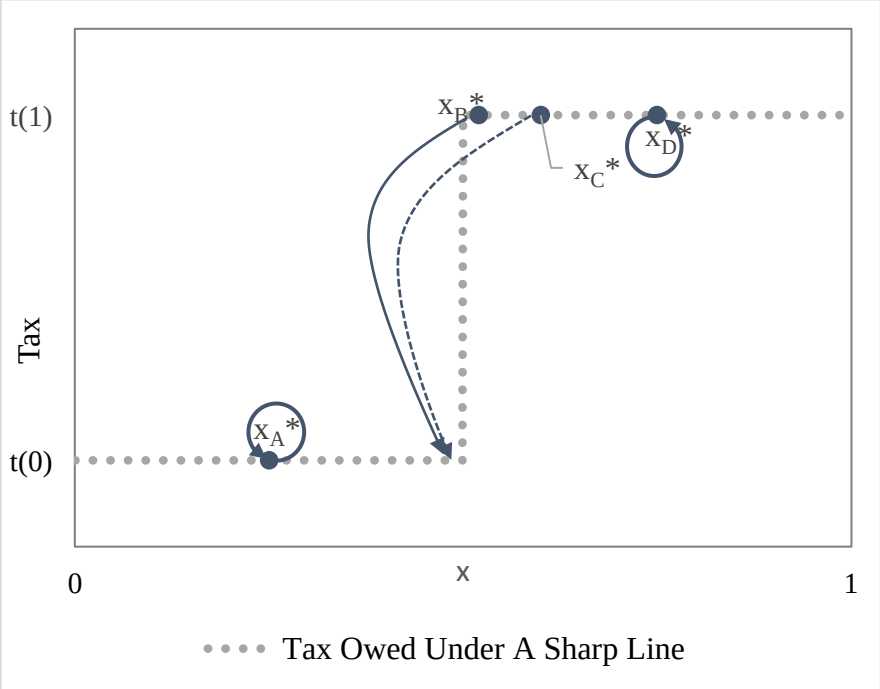
Consider first Taxpayer *A*, whose ideal point is denoted by x_A^*. Because $x_A^* \leq \overline{x}$, choosing her ideal point results in *A* being taxed under the favorable tax regime and yields tax liability equal to $t(0)$. Because there is no way for *A* to reduce her liability by adjusting her choice of x, she will select her ideal point, $x_A = x_A^*$. The same logic holds for other taxpayers with ideal points between 0 and $\overline{x}$.

Next consider Taxpayer *B*, whose ideal point is just to the right of $\overline{x}$. Absent tax considerations, *B* would also select his ideal point. But because a small reduction in x yields substantial tax advantages, *B* will find it worthwhile to choose $x_B = \overline{x}$ instead of x_B^*. Intuitively, *B* is worse off for choosing to locate away from his ideal point, but incurring this cost is worth it for him because locating at the cutoff allows *B* to remain close to his ideal point while also allowing him to significantly reduce his tax liability. Note that *B* would never choose $x_B < \overline{x}$ because he can achieve all of the tax

[30] For a related analysis in a somewhat different setup, see Susan Morse, *Safe Harbors, Sure Shipwrecks*, 49 U.C. DAVIS L. REV. 1385 (2016) (describing the effects on taxpayer behavior induced by safe harbors and their opposite, sure shipwrecks).

benefits by moving to $\overline{x}$, and any point to the left of $\overline{x}$ would be further from his ideal point.

Figure 2: Behavioral Effects of a Sharp Line Rule



Next consider Taxpayer *C*, who, like *B*, has an ideal point to the right of $\overline{x}$, but whose ideal point is further from $\overline{x}$. For *C* to change her behavior because of the tax, it must be that her ideal point is close enough to the cutoff that switching to $\overline{x}$ to achieve the tax savings is worth the sacrifice in terms of selecting a value of x_C away from x_C^* . Suppose that *C* does find it worthwhile to change her behavior in this way. Like *B, C* will choose to locate exactly at $\overline{x}$, since moving further to the left would cause her to be further from her ideal point and would yield no additional tax savings. Note that, all else equal, *C* is worse off than *B* because although both are taxed under the preferable regime, *C* is further from her ideal point.

Finally, consider Taxpayer *D*, whose ideal point is also to the right of $\overline{x}$, but to the right of both x_B^* and x_C^*. Like *B* and *C*, tax considerations would motivate *D* to select $x_D = \overline{x}$, but the utility cost of doing so would be greater than for *B* or *C*, since x_D^* is even further from $\overline{x}$. Assuming that the utility cost from moving to $\overline{x}$ exceed the tax reduction that *D* would achieve from doing so, *D* will remain at x_D^*. Note that there is no benefit to *D* from moving any closer to $\overline{x}$ while still remaining to the right of it, since doing so would not reduce his tax liability.

To summarize the effect of the sharp line on taxpayers' behavior, we can divide taxpayers into three categories, based on their ideal points. Someone

whose ideal point is to the left of $\overline{x}$ will choose $x_i = x_i^*$. Someone whose ideal point is slightly to the right of $\overline{x}$ will choose $x_i = \overline{x}$. And someone whose ideal point is sufficiently to the right of $\overline{x}$ will choose $x_i = x_i^*$. Thus, under a sharp line, some taxpayers adjust their choice of x because of the tax, while others do not. Those who adjust their behavior select $\overline{x}$. Those who do not adjust their behavior select their ideal points.

B. Efficiency Properties of a Sharp Line.

What are the efficiency costs of the sharp line? After adjusting their behavior in response to the tax, *A*, *B*, and *C* each pays a tax of $t(0)$, and *D* pays a tax of $t(0) + \tau$. The deadweight loss of a tax is equal to the amount by which it reduces taxpayer welfare over and above the revenue it collects. Here, each taxpayer is worse off by the amount of tax they pay. In addition, those taxpayers who adjust their choice of x because of the tax are worse off because they are no longer at their ideal point. In Figure 2, therefore, taxpayers *B* and *C* are the ones who generate deadweight loss. Taxpayer *B* generates only a little deadweight loss because $\overline{x}$ (where *B* ends up) is close to x_B^*. Taxpayer *C* generates more deadweight loss than *B*, because the value of x she ends up choosing ($\overline{x}$) is further from her ideal point. Taxpayers *A* and *D* generate no deadweight loss because they are worse off only from the tax revenue they transfer to the government. Thus, the more taxpayers there are near *B*, and especially the more taxpayers there are near *C*, the larger the deadweight loss generated by the sharp line.[31]

We illustrate the efficiency consequences of a sharp line in Figure 3, which simulates the deadweight loss (as a percent of revenue collected) generated as a function of a taxpayer's ideal point. In the Figure, and in subsequent simulations, we assume the sharp line threshold is set to $\overline{x} = 0.5$.[32] The simulation makes several additional technical assumptions, which we describe in the Appendix. As suggested by our discussion above, no deadweight loss is generated by taxpayers with ideal points below the line or taxpayers with

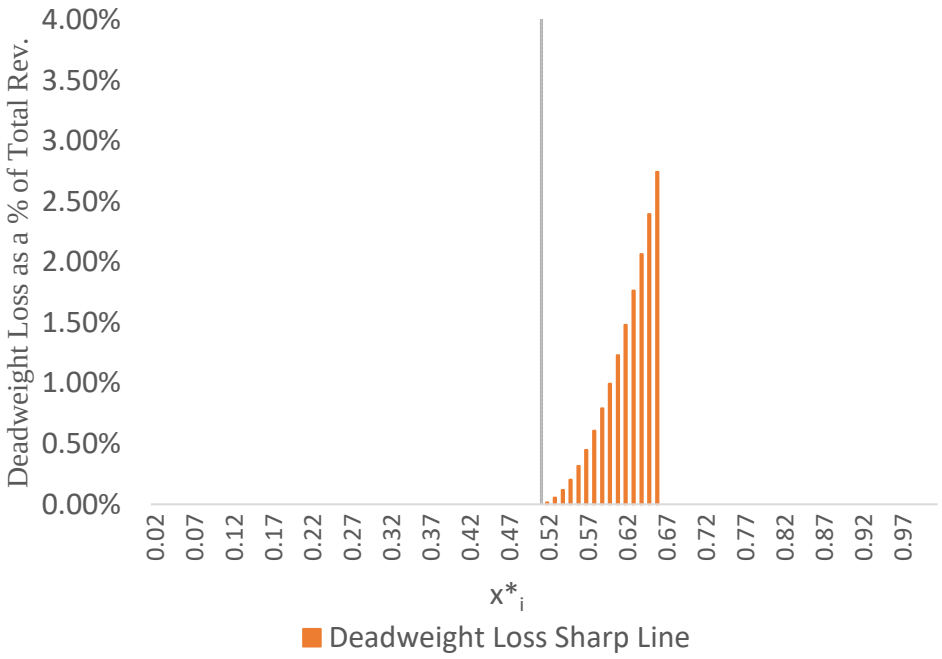
---

[31] Note that the magnitude of the deadweight loss is shaped in part by the costs to taxpayers of deviating from their ideal points, since such costs determine how many taxpayers behave like C versus D in the prior example. In the extreme case, where the costs of deviating from one's ideal point are so great that taxpayers never choose to adjust their behavior in response to the tax, there is no deadweight loss.

[32] As in Weisbach, *supra*, the deadweight-loss-minimizing location for the sharp line can be found by comparing the magnitude of the deadweight loss that results from drawing the line at various possible values of x. In our model, this question turns on the distribution of taxpayers' ideal points. A more fulsome analysis of this issue would need to account for the underlying rationale for differentially classifying taxpayers by x; this is because setting $\bar{x} = 1$ would eliminate all deadweight loss arising from the classification, at the cost of eliminating the classification in the first place.

ideal points sufficiently above the line that their behavior is not affected by the tax. In contrast, the sharp line induces taxpayers with ideal points slightly to the right of the line (between 0.5 and 0.65 in our simulation) to select $x = \overline{x}$. The further from the line a taxpayer's ideal point is, the more deadweight loss the taxpayer's behavior generates.

Figure 3: Deadweight Loss for Taxpayers Facing a Sharp Line

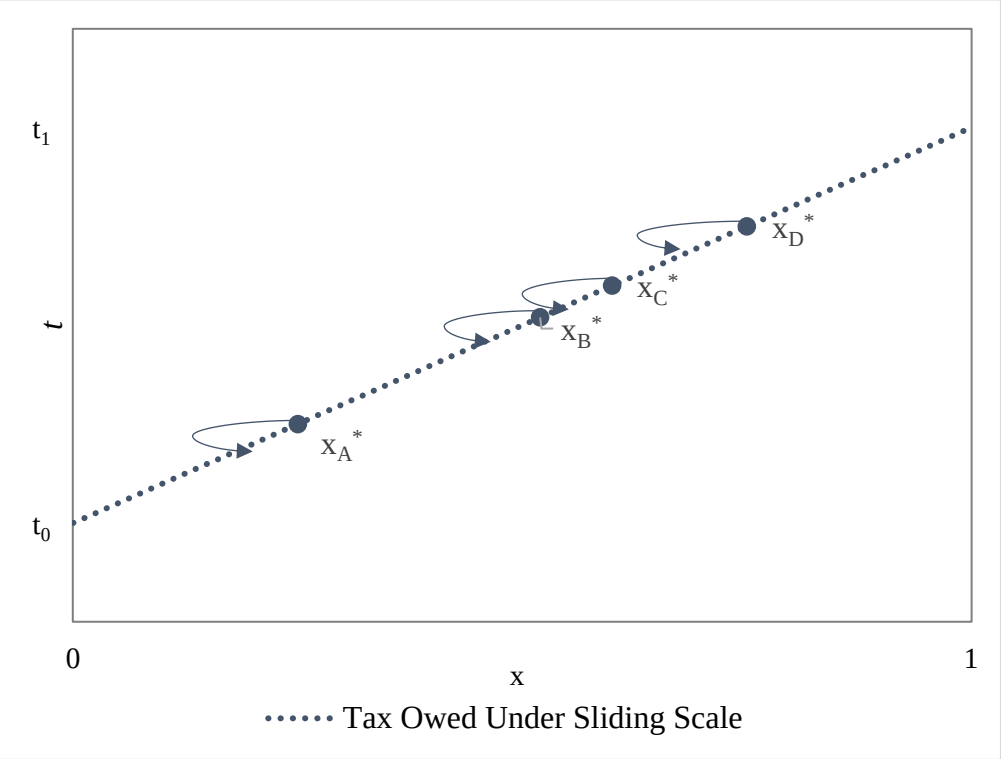


C. Behavioral Effects of a Sliding Scale.

Now consider the behavioral effects of a sliding scale, as illustrated in Figure 4. As in Figure 2, Taxpayers *A, B, C*, and *D* are drawn based on the location of their ideal points. First, consider Taxpayer *A*. Under the sharp line, *A* faced no tax incentive to choose a value of *x* other than her ideal point. Under the sliding scale, if *A* reduces x_A below x_A^*, she will reduce her tax liability as well. However, if she chooses too low a value of *x*, the disutility from locating away from her ideal point will exceed the benefit of

reducing her tax liability. Hence, she will choose some value of x that is less than x_A^*, but she would generally not reduce her choice of x all the way to 0.[33]

Figure 4: Behavioral Effects of a Sliding Scale Rule



The analysis is the same for Taxpayers *B, C*, and *D*. As long as the cost of diverging from one's ideal point is the same for all taxpayers, the tax will cause all taxpayers will reduce their x in a similar manner.[34] For a taxpayer like *B*, the reduction in x induced by the sliding scale will be similar to or might even exceed the reduction in x induced by the sharp-line; this is because a taxpayer whose ideal point is sufficiently close to $\bar{x}$ would adjust her behavior only a very small amount in response to the sharp line but would adjust her behavior by the same amount as everyone else in response to the sliding scale. In contrast, taxpayers like *C* would select a value of x further from their ideal point under the sharp line than under the sliding scale because the potential tax savings from moving to $\bar{x}$, and enjoying the

[33] This follows from the assumption that the marginal disutility of locating further from one's ideal point increases in the distance from the ideal point. Someone with an ideal point close enough to 0 would select $x = 0$, simply because x cannot be reduced below that amount.

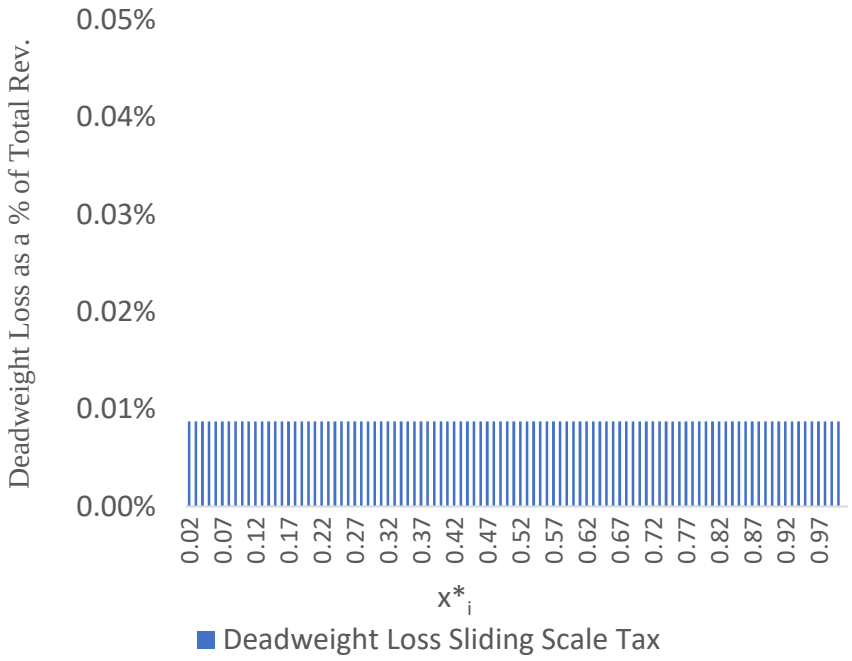
[34] The precise response depends on taxpayers' utility functions. Under the utility function assumed in the Appendix, for example, taxpayers reduce x by a uniform amount.

full savings of the low-tax regime, are more than the potential savings from moving to a lower value of x under the sliding scale.

D. Efficiency Properties of the Sliding Scale.

Figure 5 illustrates the deadweight loss under a sliding scale using the simulation that generated Figure 3. Because all the taxpayers *A, B, C, and D* adjust their behavior by the same amount, they each have the same deadweight loss.[35] As with the sharp line, the magnitude of the deadweight loss associated with the sliding scale depends on the cost to taxpayers of deviating from their ideal points, relative to the tax benefits. When doing so is prohibitively expensive, sliding scales (like sharp lines) do not generate much deadweight loss.

Figure 5: Deadweight Loss for Taxpayers Facing Sliding Scale



[35] Taxpayers with ideal points sufficiently close to 0 will simply move to 0 itself. Consequently, these taxpayers tend to generate less deadweight loss than others who are not limited in the amount they can adjust their behavior in response to the tax. This is not reflected in Figure 4 because our smallest displayed point ($x_i^* = 0.01$) is not small enough for such taxpayers to want to move all the way to 0 under the utility function we assume.

E. Comparing the Efficiency of a Sharp Line and Sliding Scale

Assessing the relative efficiency of a sharp line and sliding scale requires determining whether the deadweight loss from the change in behavior of taxpayers like *B* and *C* under the sharp line exceeds the deadweight loss from the change in behavior of all taxpayers under the sliding scale. On the one hand, more taxpayers change their behavior under the sliding scale, and hence generate at least some deadweight loss. On the other hand, because the sharp line induces larger changes in behavior for those taxpayers who do respond to it, the overall magnitude of the deadweight loss can be larger in that case.

The question is therefore whether there are relatively more taxpayers like *C* (which favors the sliding scale) or relatively more taxpayers like *A* and *D* (which favors the sharp line). The presence of taxpayers like *B* – who adjust their behavior modestly in response to both the sharp line and the sliding scale – has an approximately neutral effect, since both of these changes are of roughly equal magnitude.

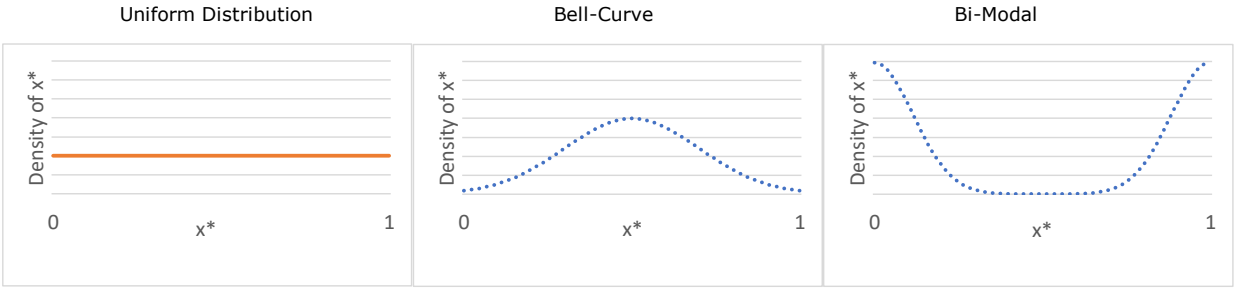
To illustrate this point in more detail, we draw on a simulation exercise to explore the following three possibilities for how taxpayers' ideal points are distributed between 0 and 1:

(1) x_i^* is evenly distributed across each value between 0 and 1;

(2) x_i^* is distributed according to a bell-curve, with a peak at $\bar{x}$; or

(3) x_i^* has a bi-modal distribution, with most ideal points concentrated near 0 or near 1.

Figure 6: Potential Distributions of Taxpayer Ideal Points

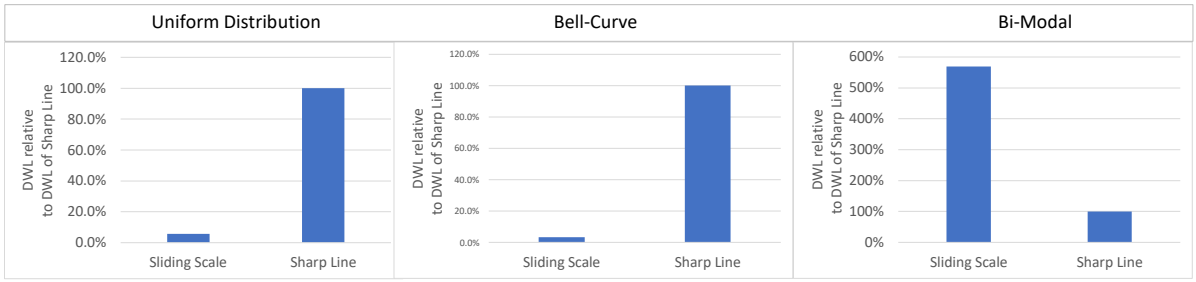


Our first result is that when ideal types are evenly distributed across each value of *x*, a sliding scale tends to be more efficient than a sharp line. The intuition for this result is that although the sliding scale causes more people to change their behavior than the sharp line, the magnitude of the adjustments under the former is smaller than the magnitude of the adjustments under the latter. Because of the convexity of adjustment costs – i.e., the idea that incremental deviations away from one's ideal point generate more disutility the further away from the ideal point one starts out – those taxpayers who change their behavior by a lot in response to the sharp line

generate much more deadweight loss than those taxpayers who adjust their behavior by a little in response to the sliding scale. Using the language of our previous example, although there are more *A's* and *D*'s than *C*'s when there is a uniform distribution of ideal points, this ratio—of (*A*+*D*) to *C*— is not large enough to account for how much extra deadweight loss each *C* adds.[36] Our simulation analysis illustrate this result in the first panel of Figure 7.

Likewise, if taxpayers' ideal points follow a normal distribution around the threshold ($\bar{x}$), the efficiency advantage of the sliding scale is even greater. Intuitively, the normal distribution guarantees that more taxpayers have ideal points just to the right of the threshold, and hence, adjust their choice of x by a substantial margin in response to the tax.

Figure 7: Relative Deadweight Loss by Ideal Point Distribution



Last, if the x_i^*'s have a bi-modal distribution, and are concentrated around 0 or 1, the sharp line can be more efficient. The reason why is that this distribution ensures that not many taxpayers have ideal points near to the threshold, reducing the amount of deadweight loss the sharp line generates. In the language of our earlier illustration, the bi-modal distribution guarantees that there are relatively few taxpayers in categories B or C, which limits the deadweight loss generated by the sharp line. More generally, this example highlights that if there is a "dip" in the distribution of taxpayer ideal points, such that the line can be located in a way that will not distort most taxpayers' behavior, adopting this approach can be even more efficient than the sliding scale.

Given that the efficient choice between sharp lines and sliding scales depends on the distribution of taxpayers' ideal types, a reasonable question to ask is how might a policymaker learn about the distribution of ideal types in any practical application? The key question is whether the distribution contains a sufficiently large "dip" so that a sharp line could be drawn in a

[36] In contrast, if the disutility from deviating from one's ideal point was linear, rather than convex, the relative efficiency of the two policy types would depend simply on which induced a larger total change in taxpayer behavior, regardless of whether individual taxpayers changed their behavior by a lot or a little.

relatively non-distorting manner. In some cases, policymakers may be able to answer this question by examining the distribution of ideal points directly, such as by using data about the values of x chosen by taxpayers before the tax was implemented or chosen by a control group of taxpayers for whom the choice of x does not affect tax liability. Alternatively, policymakers might rely on survey data, asking taxpayers the value of x they would choose if no tax was in place.

In many cases, however, data on the distribution of x^* will not be directly observable, or will be unreliable. In those instances, policymakers will usually have to rely on the next best thing, which is data on actual choices made subject to the tax, and attempt to back out the distribution of x^*. For example, as discussed above, a sharp line would be expected to distort behavior so that more taxpayers select values of x just below the line, and relatively few taxpayers select values of x just above the line. Thus, observing the after-tax distribution of x can allow one to draw conclusions about the distribution of taxpayers' ideal choices. For example, if under a sharp line tax, one observes no dips in the distribution of x other than just above the line, one would usually not expect the distribution of x^* to contain any such dips either.[37]

Overall, we conclude that efficiency considerations typically favor sliding scaled. The efficiency benefits of the sliding scale are strongest when taxpayers are likely to have ideal points near the dividing point for the sharp line, and weakest (or even negative) when taxpayers' ideal points are distributed in such a way that they are unlikely to move to the tax-minimizing side of the sharp line.

Finally, in addition to knowing whether a sharp line or sliding scale is more efficient in a particular context, it is also important to know *how much* more efficient one approach is than the other, especially in cases where the more efficient approach is less desirable on other grounds, such as complexity. As indicated in the above discussions, the deadweight loss generated by both a sharp line and sliding scale depend not only on how much taxpayers adjust their behavior in response to the tax, but also on how costly it is for them to do so. Thus, in settings in which it is relatively costless for taxpayers to choose values of x that are far from their ideal points, the deadweight loss generated by either the sharp line or the sliding scale will tend to be small. In contrast, when it is costly for taxpayers to adjust their behavior, but the incentives generated by the tax instrument are strong enough that taxpayers still do so, the amount of deadweight loss will be larger, and hence, the importance of accounting for efficiency in the choice between policy instruments will be greater as well.

---

[37] When the observable distribution of x comes from decisions made under a sliding scale, backing out the underlying distribution of x^* typically requires stronger assumptions.

F. Uncertainty

Thus far, we have assumed that a taxpayer's liability is a deterministic (i.e., non-random) function of her choice of x. In practice, even after selecting x, taxpayers may be uncertain about what their liability will be. In some settings, for example, the classification variable cannot be measured objectively so that the tax authority observes the taxpayer's choice of x with error. This might arise, for instance, when the law turns on the taxpayer's motivation for taking some action, such as whether the primary purpose in incurring an expense was business or personal. In other cases, uncertainty might arise because the applicable law takes the form of a standard rather than a rule, in which tax liability is determined by applying some general principle to the situation at hand, such as whether an employer-provided meal is incurred "for the convenience of the employer," or whether a particular transaction will be characterized as a "sham." In such cases, taxpayers may be uncertain as to the tax liability they will face based on their choice of x.

To apply our model to the case of uncertainty, suppose the tax authority observes the value of $\boldsymbol{x}$ that the taxpayer selects with error. Using the notation of the model, the taxpayer continues to select $\boldsymbol{x}$, but tax liability under the sharp line with uncertainty (t^{SLU}) and sliding scale with uncertainty (t^{SSU}) each depend on $\tilde{x}$, where $\tilde{x} = x + \epsilon$, and where ϵ is a normally distributed error term with mean zero:

$$t^{SLU} = t(0) + \tau\, I(\tilde{x})$$

$$t^{SSU} = t(0) + \tau\, \tilde{x}$$

Altering the model in this way reveals that uncertainty tends to reduce the importance of the efficiency differences between sliding scales and sharp lines. The reason why is that the uncertainty between a taxpayer's choice of x and ultimate tax liability effectively smooths out the taxpayer's *expected* tax liability as a function of x, making the taxpayer's incentives under the sharp line resemble the incentives created by a sliding scale. With uncertainty, a taxpayer who selects a value of x just below the line may still be treated by the tax authority as having selected a value of x that is above the line. Conversely, a taxpayer who selects a value of x just above the line may end up being treated by the tax authority as having selected a value of x that is below the line. Thus, uncertainty reduces taxpayers' incentives to make drastic changes to their behavior to locate on the tax-minimizing side of a sharp line.[38]

---

[38] This point is related to the classic result by John Calfee and Richard Craswell, *Some Effects of Uncertainty on Compliance with Legal Standards,* 70 VA. L. REV. 965 (1984) and Richard Craswell and John Calfee, *Deterrence and Uncertain Legal Standards*, 2 J. OF L. ECON. AND ORG. 279 (1986), that legal uncertainty has an ambiguous effect on a deterrence policy's behavioral effects. The similarity is due to the fact that uncertainty converts a sharp line into an instrument with similar incentive properties

Figure 8 illustrates expected tax liability as a function of x under both a sharp line and a sliding scale in the case of uncertainty. The greater the uncertainty (i.e., the larger the standard deviation in the distribution of ϵ), the more the expected tax liability schedule for the sharp line resembles that of the sliding scale, and hence, the smaller the efficiency benefits of either policy tool will be. Thus, in Figure 8, when the standard deviation (SD) of ϵ is small, the sharp line regime (the orange dashed line) continues to look roughly similar to the situation without uncertainty, but with some smoothing out of expected liability around the threshold. By contrast, when the degree of uncertainty is large, the sharp line regime (the orange dotted line) more closely resembles the sliding scale.[39]

The simulation analysis presented in Figure 9 compares sharp lines and sliding scales in the case in which x_i^* is uniformly distributed, first without uncertainty and then in the presence of uncertainty. As illustrated in the Figure, the sliding scale continues to generate less deadweight loss relative to the sharp line in the presence of uncertainty, but the efficiency properties of the two instruments are more similar than when no uncertainty is present.

In the remainder of the paper, we consider how the choice between sharp lines and sliding scales affects tax policy considerations apart from efficiency.

---

as a sliding scale (at least in expectation). *See also* Emily Cauble, *Safe Harbors in Tax Law*, 47 CONN. L. REV. 1385, 1420 (2015), who compares the distortive effects of a safe harbor (i.e., a sharp line rule) with an uncertain standard (i.e., an instrument that generates similar incentives to a sliding scale); Alex Raskolnikov, *Probabilistic Compliance*, 34 YALE J. ON REG. 491 (2017) (studying how uncertainty affects decisions by the taxpayer about the degree to ensure compliance with a legal standard). Some of these points also arise in David Weisbach, *Formalism in the Tax Law*, 66 U. CHICAGO L. REV. 860, 872-75 (1999), in his comparison of (sharp line) rules and standards.

[39] The sliding scale in Figure 8 is no longer exactly a straight line because around 0 errors can only push up $\tilde{x}$, resulting in slightly higher expected tax liability for taxpayers choosing $x = 0$ than in the case without uncertainty. The reverse is true around 1: errors can only push down $\tilde{x}$.

Figure 8: Expected Tax Liability under a Sharp Line and Sliding Scale with Uncertainty

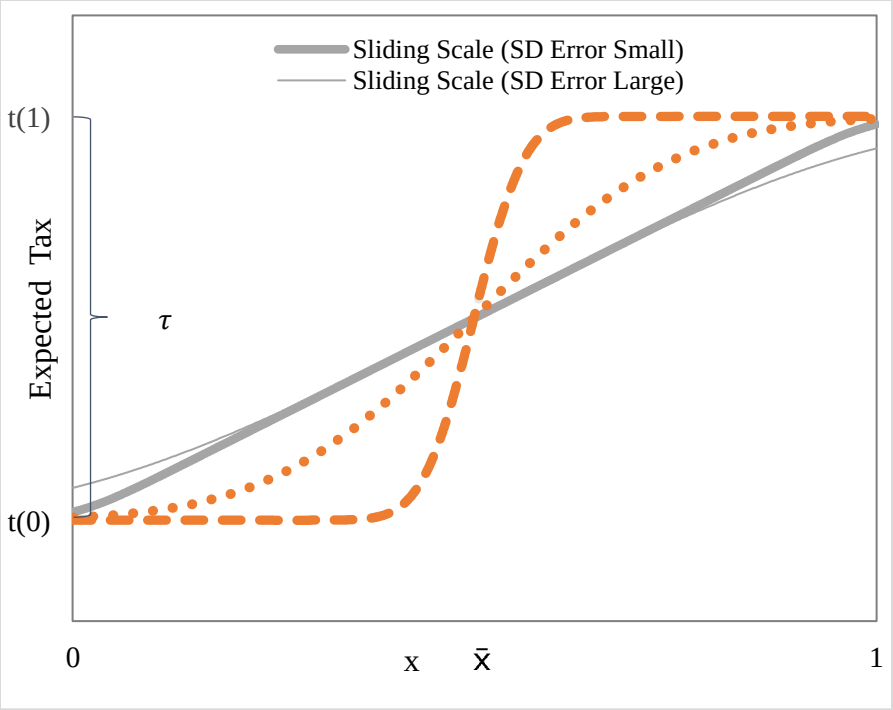
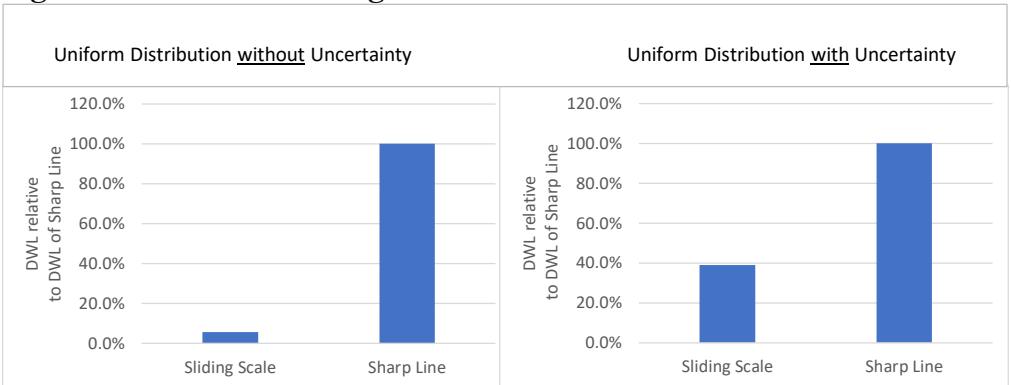


Figure 9: Relative Deadweight Loss



III. COMPLEXITY CONSIDERATIONS

In addition to differing in the way they affect taxpayer behavior, sliding scales and sharp lines can differ greatly in their complexity. A particular test for classifying taxpayers between tax regimes may be complex in some dimensions and simple in others.[40] In this section, we consider both the

[40] *See* David F. Bradford, UNTANGLING THE INCOME TAX, 266-67 (1986).

computational and informational complexity of sliding scales and sharp lines, and the implications of each for the complexity of tax filing and tax planning.[41]

Our main conclusion is that sliding scales can complicate the tax filing process relative to sharp lines, but the difference in complexity between the instrument types differs greatly by setting. Our conclusion is similarly nuanced with respect to tax planning: sliding scales are more complex in some dimensions and less complex in others. Below, we outline the main considerations that determine which approach is more complex in a particular context.

A. Computational Complexity

Computational complexity refers to the complexity of determining an individual's tax liability given all of the relevant information about the individual (e.g., income, family size, etc.). It is easy to see that sliding scales are more computationally complex than sharp lines. Under a sharp line, a taxpayer determines her liability by first, determining which tax regime applies, and second, calculating her liability under that regime. Implementing the first step simply requires assessing whether the classification variable (x) is above or below the threshold $\overline{x}$. Under a sliding scale, in contrast, the taxpayer must compute her tax liability under *both* regimes, and then take a weighted average of the two resulting liabilities based on x. For most people, calculating a weighted average based on x will be more difficult than comparing x to $\overline{x}$, and it is obviously more work to calculate one's liability under two different tax regimes than under one.[42]

To illustrate, consider the choice of rules for whether a taxpayer can claim a child on her return, based on the child's birth date. Under a sharp line, the taxpayer simply determines whether the child's birthdate falls before or after

---

[41] For an extended discussion of computational versus informational complexity, see Jacob Goldin, *Tax Benefit Complexity and Take-Up: Lessons from the Earned Income Tax Credit*, TAX L. REV. (Forthcoming).

[42] With multiple sliding scale rules in place, the number of calculations a taxpayer must perform can increase exponentially. For example, if both marital status (M) and state residency (R) depend on sliding scale rules, the taxpayer must calculate tax liability under four scenarios: married resident ($M = 1, R = 1$), married non-resident ($M = 1, R = 0$), single resident ($M = 0, R = 1$), and single non-resident ($M = 0, R = 0$). Tax liability is a function of both M, and R, $t(M, R)$. Tax liability under a sliding scale is then be given by:

$$t^{ss} = t(0,0) + x_M\,[t(1,0) - t(0,0)] + x_R\,[t(0,1) - t(0,0)] + x_M x_R\,[t(1,1) - t(1,0) - t(0,1) + t(0,0)]$$

where x_M and x_R denote the number of days during the tax year that the taxpayer was married, and the number of days the taxpayer was in the state, respectively. Note that when the tax consequences of marriage and state residency are independent, the last term of this equation is equal to zero.

the cutoff, and then calculates her liability once, either claiming or not claiming the child based on when the child was born. Under a sliding scale, the taxpayer would calculate her liability twice, once assuming she claims the child and once assuming she does not, and then takes a weighted average of the two results based on the date the child was born. The sliding scale calculation is more complicated, since it requires calculating liability twice, and entails the additional step of taking the weighted average.

In some cases, the computational complexity of a sliding scale is more extreme. For example, the choice of applicable tax regime may have implications not only for determining the tax consequences of a particular transaction, but also of subsequent transactions or events. One example, is the 80% control requirement for § 351 exchanges in corporate taxation. Smoothing out the test for a non-recognition provision of this form has implications not only for the transaction itself (i.e., how much tax is recognized), but also for subsequent transactions that depend on the corporation's basis of the contributed property or the taxpayer's basis in the received stock.

The additional computational complexity from smoothing out a sharp line may be even worse in settings where the outcome of the test determines which of two very different tax regimes applies. To illustrate, consider the 100-shareholder limitation for S-corporations. In theory, one might smooth this requirement out as follow: over some range of shareholders, say from 90 to 110, the entity would be taxed partly under subchapter C and partly under subchapter S. For example, if the entity had 95 shareholders, it would be taxed 75% as an S-corporation and 25% as a C-corporation. How might this be implemented? One option would be to pretend there were in fact two corporations, an S-corporation that earned 75% of the income (and incurred 75% of the expenses, etc), and a C-corporation that earned 25% of the income. This approach would smooth out the shareholder requirement, but would generate substantial computational complexity for taxpayers – who would have to compute taxes under two entirely different regimes.[43] A different example that illustrates a similar challenge are the tests that determine whether an entity qualifies for tax-exempt status, such as the requirement that a 501(c)(4) not be engaged primarily in political activity. In theory, these tests can be smoothed out, but the computational complexity that doing so would cause is likely not worth the effort.

[43] It would also generate many other complexities, such as how to treat entities where the number of shareholders change during the tax year (perhaps the maximum, or a weighted average, could be used), or challenges related to consistency in treatment across years.

B. Informational Complexity

Informational complexity refers to the difficulty in obtaining the information upon which the determination of one's tax liability depends. As with computational complexity, a sliding scale tends to be more informationally complex than a sharp line. There are two reasons for this. First, a sliding scale requires more granular information on the classification variable than does a sharp line. To determine the applicable tax regime under a sharp line, the taxpayer must know only whether x exceeds the threshold $\overline{x}$. Under a sliding scale, the taxpayer must know the precise value of x, since that value determines the relative weighting between the two tax regimes.

The second reason a sliding scale tends to be more informationally complex than a sharp line is that determining liability under the second potential tax regime – the one that would not apply under a sharp line – might require additional informational inputs. Consider the residency requirement a child must meet to qualify a taxpayer for the Earned Income Tax Credit (EITC). Under the current sharp line rule, the child must reside with the taxpayer for 183 days or more during the year. Under a sliding scale version of this rule, a taxpayer might qualify for a credit amount that varies in proportion to the number of days the child spends with the taxpayer. Under the sharp line, a taxpayer who lived with the child for fewer than 183 days would not be able to claim the child for the credit, and hence would not have to provide the other information required to determine the allowable EITC (at least assuming the taxpayer doesn't qualify on some other grounds). In contrast, under the sliding scale, the taxpayer would have to provide other potentially relevant information for determining EITC, such as the breakdown between earned and unearned income.[44]

Finally, the above discussion indicates that the informational complexity of a sliding scale depends in part on the granularity of the classification variable. When the classification variable is coarser than a pure sliding scale (but still less coarse than a sharp line), the informational complexity can be alleviated. Considering the child residency example described above, a version of a sliding scale that would be less informationally complex would be to apportion the EITC based on the number of months during the year in which the child primarily lived with the taxpayer. This could reduce the amount of information a taxpayer would have to keep track of: if a child spent most of a month with the taxpayer, the taxpayer would not have to keep track of the precise number of days of shared residence.[45]

---

[44] See Jacob Goldin, *Tax Benefit Complexity and Take-Up: Lessons from the Earned Income Tax Credit*, _ TAX L. REV. (Forthcoming) (discussing the informational complexity of the EITC).

[45] An example of a coarse sliding scale currently in the tax code is the formula for the dividends received deduction, which allows corporations a deduction for dividends they receive based on the degree to which they control the issuing corporation. That sliding scale is quite coarse because there are only three categories for the degree of control.

C. Implications for the Complexity of Tax Filing

Although sliding scales tend to be complex than sharp lines (both computationally and informationally), the overall effect on the complexity of tax filing varies dramatically by context. Given that 95% of taxpayers rely on assisted preparation, computational complexity is not a substantial drawback to using sliding scales today. Even if the tax law imposed a large number of sliding scales, the required calculations are trivial given the computing power of modern computers and even most smartphones.

In contrast, even with assisted preparation methods, the role of informational complexity remains important.[46] Recall that sliding scales are more informationally complex because they require more granular information on x and because the additional tax regimes a taxpayer must apply might require additional information. The importance of both of these factors for tax filing varies significantly by setting. For most sharp lines that depend on the date of an event – such as childbirth, marriage, or the capital gains holding period – the extra informational complexity from converting a sharp line to a sliding scale is trivial or non-existent, since the single date already contains all of the information required to calculate x. In other settings, where determining a taxpayer's value of x requires keeping track of many events—e.g., days spent in a state during a year, or days a child resides with a taxpayer—the additional complexity of a sliding scale relative to a sharp line can be substantial.[47] Cutting against this, however, is that taxpayers who are close to the threshold under a sharp line would already need to keep track of the classification variable with a high degree of precision.[48]

Finally, in cases when a sliding scale does increase the complexity of the filing process relative to a sharp line, the overall effect on social welfare depends in part on whether the additional complexity deters taxpayers from filing a return in the first place. For most taxpayers with a filing requirement, we suspect this possibility is remote, since failing to file is often detectable by the IRS (at least for taxpayers with income reported on information returns), and the penalties for failing to file are non-trivial. However, for taxpayers without a filing requirement and who are owed a refund, it is possible that the additional informational complexity of a sliding scale will deter some

---

[46] *See* Lawrence Zelenak, *Complex Tax Legislation in the TurboTax Era*, 1 COLUMBIA J. TAX L. (2010).

[47] Technological improvements might lessen these record-keeping costs in the future, for example if more taxpayers use smartphones that can automatically record the taxpayer's time spent in various states over the course of the year. See generally, Kathleen Thomas, *User-Friendly Taxpaying*, 92 INDIANA L. J. 1509 (2017).

[48] See James Stewart, *Tax Me If You Can,* THE NEW YORKER (Mar. 19, 2012), for an extreme example of the record-keeping requirements a sharp line rule can impose on taxpayers.

taxpayers from filing, making them worse off by causing them to miss the refund they would otherwise receive.[49]

D. Implications for the Complexity of Tax Planning

In addition to affecting the complexity of preparing one's taxes, the policy choice between a sharp line and sliding scale also affects the complexity of tax planning – i.e., the process by which individuals take taxes into account when determining their behavior. In general, tax planning grows more complex as it becomes more difficult for taxpayers to account for and predict how potential decisions would affect their tax liability. As with tax filing, the difficulty of making these determinations under a sharp line or sliding scale depends on both computational and informational complexity.

First, to the extent a sliding scale is more informationally complex than a sharp line, tax planning under the former may be more difficult than under the latter. By increasing the information on which tax liability depends, switching from a sharp line to a sliding scale would make it harder for taxpayers to predict their exact tax liability under various choices of x, even if they are using tax software for assistance. For example, consider the problem faced by a taxpayer attempting to estimate her marginal tax rate when the state residency rule is a sliding scale, and when the taxpayer splits the year between states with different tax rates. The taxpayer might expect with high confidence to spend less than half of the tax year in a particular state (simplifying the task of predicting her marginal tax rate under the sharp line), but not be able to predict with confidence exactly how many days she will spend in each state, and hence, the degree to which each state's tax rate will apply. In other cases, such as when selecting a date to get married or when to sell a stock, the additional informational complexity of a sliding scale is unlikely to make tax planning more difficult.

Turning to computational complexity, the question of whether a sharp line or sliding scale better facilitates tax planning is ambiguous. On the one hand, the higher computational complexity of a sliding scale makes it more difficult for taxpayers to calculate their precise tax liability under any potential choice of x. However, the practical importance of this concern is mitigated by the fact that estimating one's tax liability ahead of time with any degree of precision is already quite difficult, even when only sharp lines are involved. Taxpayers who care about making an accurate prediction would probably rely on software, even absent a sliding scale. And as discussed above, sliding scales do not meaningfully increase the computational complexity

[49] One way to avoid this outcome could be to offer taxpayers an election between selecting the sliding scale and being taxed under the less advantageous regime. This would alleviate some of the welfare costs for taxpayers who would suffer most from the complexity of a sliding scale.

experienced by taxpayers who use software. Hence, smoothing a sharp line into a sliding scale would not usually make tax planning much more complex.

In addition, a sliding scale could actually simplify tax planning in some cases, by making it easier for taxpayers to understand the tax implications of the choices they make. In particular, it is often easier to understand how changes in x affect tax liability under a sliding scale, because understanding the relationship between tax liability and x does not require predicting whether x will cross a particular threshold. For example, under the sliding scale approach to the EITC child residency requirement, it is easy for taxpayers to understand – in general terms – that the more days the child lives with the taxpayer, the larger the taxpayer's EITC. In contrast, understanding the tax implications of the taxpayer spending one more or one less day with a child under the sharp line version of the rule requires the taxpayer learning both where the line is (i.e., at 183 days), as well as predicting the number of other days during the year the child will spend with the taxpayer.[50]

Apart from differences in the cost of tax planning associated with a sharp line and sliding scale, the two instruments also differ in the incentives they generate for taxpayers to undertake tax planning in the first place. We return to these consideration in Section VI, below.

IV. FAIRNESS AND CLASSIFICATION CONSIDERATIONS

In this section we focus on considerations related to horizontal equity, and more generally, the rationale for imposing different taxes on individuals with different values of the classification variable. Because the rationales for differential taxation can vary dramatically across contexts, our discussion in this section is necessarily general.

Our main claim is that when there is there is a reason to differently tax individuals with $x = 1$ versus $x = 0$, it will usually be the case that the same reason implies that taxpayers with intermediate values of x (between 0 and 1) should be taxed somewhere between those with $x = 0$ and those with $x = 1$. This issue has been discussed outside of the tax context,[51] and its application to tax is straightforward. As one influential treatment of the subject has put it: "smooth relationships often do a better job of preserving morally relevant information than do bumpy relationships."[52]

---

[50] Put differently, to the extent taxpayers make tax planning decisions on the margin, a sliding scale will likely be easier for taxpayers to understand than a sharp line because the marginal effect of a change in x does not depend on the level of x relative to $\overline{x}$.

[51] See, e.g., Larry Alexander, *Scalar Properties, Binary Judgments*, 25 J. OF APPLIED PHILOSOPHY (2008).

[52] Kolber, *supra*, at 657.

There are two steps to our argument. First, note that most reasons for differently taxing differently situated taxpayers have to do with considerations that vary in degree, rather than in kind. For example, taxpayers might be treated differently by the tax law because they differ in their ability to pay. Ability to pay exists upon a continuum; someone who earns $10,000 a year has less ability to pay a $1000 tax than someone who is otherwise identical but earns $20,000 a year, and the latter has less ability to pay the tax than someone who earns $30,000 a year. Similarly, under a Mirleesian optimal tax, otherwise identical individuals may be taxed at different rates based on the elasticity of their labor supply, and the elasticity of labor supply falls along a spectrum.

The second step of the argument is to note that when taxpayer characteristics can be ordered along a spectrum (i.e., when they can be represented by a variable like x in our model), the relationship between the characteristics and the underlying objective is typically continuous. That is, small changes in the characteristic translate into small changes in the degree to which the underlying objective is satisfied. For taxes that vary based on ability to pay, small changes in income would typically translate into small differences in ability to pay. For taxes that vary based on the elasticity of labor supply, small differences in elasticities would typically translate into small differences in tax rates.

These claims suggest that if tax liability is to depend on a classification variable, the relationship should typically be continuous – i.e., small changes in the classification variable should translate into small changes in tax liability. A sharp line fails this requirement: near the line, small changes in the classification variable imply large changes in tax liability. Away from the line, small changes in the classification variable do not result in any change in tax liability at all. In contrast, the sliding scale maps small changes in the classification variable to small changes in tax liability.

The arguments in this section imply that tax liability should depend continuously on the classification variable, but do not necessarily imply the relationship should be linear (as under a sliding scale). In theory, if the relationship between the underlying classification rationale and the classification variable is highly non-linear, a sharp line might do a better job approximating this relationship than a sliding scale. To take a stylized example, note that under current law, a taxpayer whose vision in her better eye (after correction) is 20/200 or less, or whose field of vision is 20 degrees or less, is eligible for an expanded standard deduction. Suppose the costs of deteriorating eye-sight increase rapidly once one's corrected vision falls below 20/200. Someone with 20/180 vision may then bear much lower costs than someone with 20/220 vision. If this is the case, a sharp line at 20/200 for determining eligibility for the expanded standard deduction may be preferable to varying the tax benefit for blindness smoothly based on differences in taxpayers' vision. Although it is possible to imagine other examples along this line, it is difficult to think of many practical applications in which this is likely to be the case.

A related consideration is that sharp lines tend to violate basic notions of fairness and horizontal equity by treating differently taxpayers who happen to fall on opposite sides of the line, but who are otherwise quite similar. For example, under the sharp line in current law, a child born at 11:59pm on December 31 can qualify the parent for the full year's Earned Income Tax Credit (up to $3,400 in 2017 for a parent with 1 child); but if the child is born just a few minutes later, the parent would, at most, qualify for the childless EITC, with a maximum credit of only $510. Because two otherwise identical parents, with children born only minutes apart, appear alike in all normatively relevant dimensions (such as ability to pay), it seems arbitrary and unfair for their tax liabilities to differ by thousands of dollars.[53] In contrast, under a sliding scale, in which each parent could claim the credit in proportion to the fraction of the tax year that elapses after the child is born, each parent could claim a similar amount of EITC for the year. Finally, note that the unfairness of a sharp line can be exacerbated in its effect on welfare through individuals' psychological aversion to "near misses," which sliding scales tend to avoid.[54]

V. TAX ADMINISTRATION CONSIDERATIONS

This section considers the relative ease of administering a sharp line versus a sliding scale. By administrative costs, we mean costs incurred by the taxing authority – unlike complexity costs, which are borne by individual taxpayers.

One type of administrative cost associated with sliding scales is their enhanced informational requirements relative to sharp lines. In this respect, the considerations parallel the difference in informational complexity between sharp lines and sliding scales; the latter require the taxing authority to collect more granular information about the classification variable, and may also require additional information be collected for purposes of calculating a taxpayer's liability under a second tax regime.

How do these additional informational requirements affect administrability? As with informational complexity, the practical importance of these considerations varies greatly by setting. If an information reporting regime is already in place, there may be little incremental cost to expanding the system to cover additional taxpayers (although there may be costs on other parties, like employers, from expanding such a system). Similarly, the finer granularity of the information required under a sliding scale will not much increase administrative costs when the information can be derived

---

[53] Of course, the parent of the child born in the new year might qualify for an extra year of EITC 19-24 years later, when the older child has aged out. This later benefit is reduced by the time value of money and the possibility that the parent's income will have changed by the later date so that he or she no longer qualifies for the credit.

[54] *See* Adam J. Hirsch & Gregory Mitchell, *Law and Proximity,* 2008 U. OF ILLINOIS L. REV. (2008) at 588-89.

from other information that is easily available. For example, Form 1040 already asks for the birthdays of children claimed on the tax return, even though all that is technically required by any provision is whether the child's age is above or below some threshold.

A second consideration for assessing administrative costs under the two types of instrument is that sliding scales can reduce the stakes of many enforcement determinations, and correspondingly, the amount of taxpayer pushback such determinations provoke. To illustrate, consider an analogy from a very different context. In soccer, a foul committed just outside the penalty box has a much lower likelihood of leading to a goal than a foul committed just inside the penalty box. Because of this large discontinuity in the location of where the foul occurred, soccer referees have turned to video assisted review, which has slowed down the pace of the game. If the rule for assigning penalty kicks was replaced by a sliding scale, there would be less pressure on referees to determine exactly where the foul occurred and video replay as to the exact location of the foul would not be necessary.

Finally, a sliding scale rule might make it harder for the taxing authority to target enforcement efforts where they are most likely to be effective. With a sharp line, there is typically little revenue to gain by auditing taxpayers' reported values of x for taxpayers who are far from the line (in either direction), at least in cases where it is more difficult to cheat by a lot than it is to cheat by a little.[55] In contrast, with a sliding scale, there will generally be some incentive for all taxpayers to cheat, making it harder for the tax authority to identify high potential situations to audit.

VI. TAX PLANNING CONSIDERATIONS

This section considers how the choice between sliding scales and sharp lines affects taxpayers' propensity to engage in tax planning. By tax planning, we mean the process by which the taxpayer accounts for taxes in deciding on her behavior. From a societal perspective, tax planning is generally undesirable for two reasons. First, to the extent it is costly for taxpayers to engage in, it diverts resources that could have gone to other productive uses. Second, when taxpayers adjust their behavior to reduce their tax liability, they generate deadweight loss, which reduces the efficiency of the tax. Against these factors, failing to plan causes taxpayers to make privately suboptimal decisions, which also factors into social welfare.[56]

To understand how sharp lines and sliding scales might affect tax planning, we employ a "bounded rationality" model of decision-making.

---

[55] Or similarly, taxpayers may have a disproportionately stronger moral aversion to understating their tax liability by a lot as opposed to cheating a little.

[56] For a discussion of related issues, *see* Jeffrey Liebman and Richard Zeckhauser, *Schmeduling,* Unpublished Manuscript (2003); Jacob Goldin, *Optimal Tax Salience*, J. PUBLIC. ECON. (2015).

Specifically, we assume that it is costly for the taxpayers to account for the tax when making their decision about x. These costs may be financial – such as the opportunity cost of time spent thinking about tax considerations or the fees charged by tax lawyers or accountants – or non-financial – such as the unpleasantness of engaging in difficult calculations or thinking about taxes in the first place. We assume taxpayers decide whether to engage in tax planning by comparing the expected benefits of accounting for the tax in their decision-making to the costs of doing so. As we describe below, the choice between sliding scales and sharp lines can potentially affect both the benefits and costs side of this equation.

With respect to the cost side of the equation, our discussion in Section III indicates that either a sharp line or a sliding scale can make tax planning more costly. Sharp lines are less computationally complex – making it easier for taxpayers to estimate their precise tax liability – but the question of how changes in one's behavior affect tax liability may be easier to answer under a sliding scale. Hence, depending on the situation, smoothing a sharp line into a sliding scale may either increase or decrease the costs of tax planning.

In addition, the choice between sharp lines and sliding scales also affects the benefits of engaging in tax planning. Again, however, which approach produces a larger benefit depends on the setting. Consider for example an individual whose ideal value of x is just to the right of the sharp line cutoff $\overline{x}$. Under the sharp line, such an individual faces a large incentive to take taxes into account when choosing a value of x. For this taxpayer, the sharp line creates a large benefit to tax planning. In contrast, taxpayers who are confident that their value of x is far from the cutoff will have little reason to account for the tax under a sharp line, because considering taxes is unlikely to cause them to change their behavior.

Under the sliding scale, the incentive to engage in tax planning is evened out among taxpayers. For taxpayers who were confident they were far from the cutoff under a sharp line, the incentive to account for the tax is increased under a sliding scale. In contrast, taxpayers who were near the line under a sharp line face a much smaller incentive to account for the tax under the sliding scale because there is less scope for them to reduce their tax liability by adjusting their behavior. As with efficiency, therefore, the question of which type of instrument results in a net increase in the benefits of tax planning depends in part on the distribution of taxpayers' ideal points.

Overall, it is difficult to draw general conclusions about whether the sharp line or sliding scale results in more tax planning. Depending on the situation, either instrument may increase or decrease the costs of tax planning, and similarly, either instrument may increase or decrease the benefits. The net effect of these considerations is therefore likely to vary based on the setting.

VII. ADDITIONAL CONSIDERATIONS

This section considers a range of additional considerations that affect the policy choice between sharp lines and sliding scales.

A. Standards versus Rules

Up to this point, we have focused on the choice between sharp lines and sliding scales in the case of rules, where the legal outcome is a known, determinative function of a set of specified conditions. In this section, we extend our analysis to the case of standards, where the legal outcome follows from applying a general principle. To preview our results, we argue that the case for sharp lines is stronger when the test under consideration is a standard. In such cases, the efficiency differences between sharp lines and sliding scales tend to be less pronounced, and the administrative and complexity advantages of sharp lines tends to be more extreme.

Like rules, standards can be designed either as sharp lines or as sliding scales.[57] The reasonable person concept underlying negligence torts is a classic example of a sharp line standard. Consider a defendant whose actions cause damage to a plaintiff. If the defendant's level of care even slightly exceeds that of a reasonable person, she is not negligent, and therefore has no tort liability. If the defendant had been slightly less careful, however, she could face liability for the full amount of the plaintiff's damages. In contrast, a sliding scale version of the negligence standard might assign liability to the defendant for the plaintiff's damages based on the degree to which the defendant took care.

Turning to tax law, it is easy to imagine possibilities for smoothing out some of the sharp line standards in place today. For example, to determine whether a transfer between taxpayers constitutes a gift, the key question is whether the transferor's motivation was sufficiently "detached and disinterested." If so, the recipient of the transfer must include it in income; if not, the recipient can exclude it. In theory, the current rule could be replaced by a sliding scale, so that if the transferor's motivation was, say, 70% detached and disinterested, the recipient would include 30% of the transferred amount in income. Similarly, the sharp line test that currently divides employees from independent contractors could be replaced by a sliding scale, in which treatment would depend on the degree to which a work relationship satisfies the various factors that form the current test.

In considering the choice between sharp line standards and sliding scale standards, several aspects of the analysis are worth keeping in mind. First, as

---

[57] Seemingly against this claim, David Weisbach, *Formalism in the Tax Law*, 66 U. CHICAGO L. REV. 860, 872-75 (1999) argues that rules create discontinuities in the law whereas standards generate continuous legal treatment. From his discussion, however, it is clear that the only form of rule that Weisbach is considering are sharp lines. Our analysis builds on his by allowing for classification tests that provide certainty to taxpayers while also being continuous in the incentives they generate.

mentioned above, standards often generate ex ante uncertainty for taxpayers, in the sense that taxpayers cannot predict with complete accuracy how their choices will shape their tax liability. As discussed in Section II.E, in settings with uncertainty, the behavioral incentives generated by sharp lines more closely resemble those generated by sliding scales.[58] Hence, efficiency considerations tend to be less important when choosing between sharp lines and sliding scales in the case of a standard relative to a rule.

Another relevant consideration is that the factors that determine how taxpayers are classified under a standard can be difficult to quantify.[59] This matters because under a sliding scale, tax liability depends on the exact value of the classification variable, not simply on whether it exceeds a particular threshold. For example, in considering whether a transfer should be considered a "sham" for tax purposes, how would a taxpayer or the tax authority attempt to quantify the degree to which it was or was not a sham? Of course, this quantification problem also arises under a sharp line, since one must compare the classification variable to the relevant threshold, but the additional demands of the sliding scale to precisely quantify the classification variable for all taxpayers can exacerbate these difficulties.

B. Intent-Based Classifications

One special category of rules and standards that are prevalent throughout the tax code are those that turn on an individual's intent or purpose in undertaking some activity. Some prominent examples include the "primary business purpose" test for certain allowable business expense deductions, the "detached and disinterested generosity" motivation for classifying a transfer as a gift, and the subjective intent prong of the "economic purpose" test.

---

[58] Similarly, this perspective suggests modeling settings characterized by both a standard and a safe harbor and/or sure shipwreck as a 'Z'-shaped expected liability function, where expected liability rises smoothly over intermediate values of x, but jumps discretely at the level of the classification variable that the safe harbor or sure shipwreck kicks in. For an analysis of the incentives faced by taxpayers in such settings, see Susan Morse, *Safe Harbors, Sure Shipwrecks*, 49 U.C. DAVIS L. REV. 1385 (2016), especially Figure 1 and the related discussion. *See also* Alex Raskolnikov, *Probabilistic Compliance*, 34 YALE J. ON REG. 491, 509-510 (2017) (discussing the behavioral effects of settings characterized by changes in the slope of the relationship between taxpayer behavior and expected tax liability).

[59] Indeed, part of what makes a standard a standard is the law's unwillingness to specify ex-ante what the dispositive factors will be. Examples like this are common in tax. For example, the Ninth Circuit applies a non-exclusive, unweighted, eleven-factor test for distinguishing debt and equity for tax purposes. One court there recently observed that "while this free-floating inquiry is hardly a paragon of judicial predictability it's the necessary evil of a tax code that mistakes a messy spectrum for a simple binary, and has repeatedly failed to offer the courts statutory or regulatory guidance." *Hewlett-Packard Co. v. Commissioner*, 875 F.3d 494, 498 (9th Cir. 2017).

Each of these classifications is currently structured as a sharp line; treatment is all-or-nothing depending on whether the requisite test is satisfied.

As with other classifications, one could imagine smoothing out the sharp lines governing intent-based classifications by replacing them with sliding scales. For example an otherwise-deductible business expense that was 49% motivated by business considerations cannot not be deducted at all under current law, since the business motivation was not the taxpayer's primary purpose, but 100% of the expense would be deductible if instead 51% of the its purpose was business-related. Under a sliding scale, one would treat these cases similarly, with 49% of the expense being deductible in the first instance and 51% in the second.

In thinking about the choice between sharp lines and sliding scales in the context of intent-based classifications, some but not all of the previously discussed considerations apply. On the one hand, the rationale underlying the classification, as well as fairness considerations, will typically support the sliding scale, as they do in other areas of the law. Someone who undertakes an expense that is 51% business-motivated is similarly situated to someone who undertakes the same expense, but who is slightly more motivated by non-business considerations. The sliding scale respects this similarity whereas the sharp line does not.

On the other hand, some of the sliding scale's chief advantages are lessened in the case of intent-based classifications. First, because the tax authority cannot directly observe a party's true intent with certainty, there will typically be substantial uncertainty between a taxpayer's choice of x and their tax liability. As discussed in Section II.E, the efficiency difference between a sliding scale and sharp line is muted in such settings. More fundamentally, the variable underlying intent-based classifications is, by definition, not about the taxpayer's behavior. That is, consider a taxpayer who undertakes an expense for 51% personal reasons. To reduce her tax liability, she would prefer to reduce the personal motivation to only 49%, but unlike the other settings we have considered, she does not have the ability to do so. Put differently, a taxpayer cannot adjust the motivation with which she does something to recognize a tax benefit – otherwise, every taxpayer would simply choose the tax-preferred motivation!

Finally, as with standards, intent-based classifications are challenging to implement as sliding scales because the classification variable (i.e., the taxpayer's purpose) is difficult to quantify. What does it mean for a taxpayer's purpose in taking some action to be 49% personal versus 51% personal? Although it might be possible to develop an approach for quantifying motivations in such a way that would allow a sliding scale, doing so would likely be costly for taxpayers and the tax authority to implement. A more practical alternative to a sharp line in this setting might therefore be a

granular sliding scale, with multiple discrete categories (e.g., one's purpose might be mostly business, mostly personal, or both business and personal).[60]

C. Democratic Legitimacy

Some might object to sliding scales on the ground that they make the tax system less transparent, and that a transparent tax system is important for democratic legitimacy. We think this concern is misplaced. Practically speaking, the relationship between taxpayers' decisions and their tax liability is already quite obscure, even under the current sharp line-dominated system. It seems unlikely that switching to a sliding scale would further reduce transparency in any meaningful sense. Second, if anything, a sliding scale might actually be more transparent because it makes the relationship between taxpayers' decisions and their liability more intuitive. Even if taxpayers do not know the precise amount by which slightly increasing x will affect their tax liability, they can understand the qualitative relationship under a sliding scale, and at least the direction of the effect. In contrast, under a sharp line, taxpayers must understand where they fall relative to the line to understand how their choices will affect their liability.

D. Classifications Based on Income

This subsection briefly considers special issues that arise with respect to classifications based on income. In most areas of tax law where liability varies by income, the conventional wisdom is that gradual phase-ins and phase-outs are preferable to sharp lines (or cliffs, as they're often referred to in this setting) because of the high marginal tax rates generated by the latter. The tax code mostly reflects this conventional wisdom – provisions that depend on income typically do so in a smooth manner – but there are exceptions.[61]

---

[60] One way to think about the problem here is that sometimes it is not actually sensible to treat the underlying classification variable as continuous between 0 and 1. That is, it might be possible to determine that some activities have more business-purpose motivation than others, but still be unable to assign each activity a precise fraction for how much business purpose it had, at least in any meaningful way.

[61] Most importantly, the tax rates imposed by section 1 impose tax liability as a continuous function of taxable income, although frequent confusion by elected officials and the media about the difference between marginal and average tax rates suggests this point is not always appreciated. In a different context, the industry and wage limitations for the new §199A deduction phase-in gradually by income. In contrast, the unearned income limitation on EITC recipients operates as a sharp line. For many more examples, and an insightful discussion of these issues, see Manoj Viswanathan, *The Hidden Costs of Cliff Effects in the Internal Revenue Code*, 164 U. PENN. L. REV. (2016).

For the most part, our analysis supports the conventional wisdom that sharp lines in income are undesirable. From an efficiency standpoint, our results imply that a sharp line is less distortive than a sliding scale only when there is a dip in the distribution of taxpayers' ideal, pre-tax incomes near the point that the sharp line is drawn.[62] Although it is possible that social or regulatory factors might produce such a dip in the distribution (because of a minimum wage law, for example), this seems unlikely in most cases.

Along the same lines, the factors that sometimes make a sliding scale more informationally complex than a sharp line do not apply when the classification variable is income. Even without the sliding scale, taxpayers must already keep track of and report their precise income (down to the nearest dollar) to the tax authority for purposes of computing their tax liability. Hence, converting an income-based sharp line into a sliding scale would not require any new information.

Finally, because the role of income-based requirements in tax law is often to track ability to pay, and because ability to pay usually varies smoothly in income, the underlying goals of the provision would also typically support sliding scales when it comes to income-based classifications.

E. Taxes Designed to Shape Behavior

A variety of real-world tax provisions are designed to deter behavior which has negative externalities, and similarly various credits and deductions are intended to promote behavior with positive externalities. For example, Section 162 denies deductions for the cost of lobbying to help prevent the "spread [of] insidious influences through legislative halls."[63] The ban on such deductions applies even when the lobbying expenses are solely for the production of income and can be thought of as equivalent to a special tax on lobbying expenses levied at the taxpayer's marginal tax rate.

Our efficiency analysis applies differently to situations like this. If every dollar spent on lobbying creates the same harm—say $H—to the political process, then a sliding scale tax on lobbying expenses equal to $H per dollar of lobbying will *not create any deadweight loss*. Instead, while firms and individuals facing this tax will cut down on the amount of lobbying they do relative to their private ideal points, the tax will make them account for the marginal social harm of such lobbying and will lead to the most efficient outcome.[64]

---

[62] By "ideal", recall from Section II that we are referring to the amount of income the taxpayer would choose to earn absent tax considerations.

[63] *Textile Mills Sec. Corp. v. Comm'r*, 314 U.S. 326, 338 (1941)

[64] The analysis is more complicated if the social harm differs depending on how much lobbying a taxpayer does or other taxpayer attributes. In that case a sharp line may be more efficient than a (linear) sliding scale if the former more closely resembles the optimal non-linear pigouvian tax schedule.

A sharp line generally cannot achieve an outcome with no deadweight loss in this situation.[65] Even if the sharp line is set so that the same amount of lobbying in total is done by taxpayers, it will usually create some deadweight loss. The intuition here is that efficiency requires that each taxpayer account for the social costs and benefits of their behavior when choosing x, but only some taxpayers are induced to do so under the sharp-line.[66]

F. Multi-Factor Tests

In some cases a tax classification depends on multiple factors. The form of a multi-factor test affects the range of possibilities for sharp lines versus sliding scales.

First, consider a multi-factor test where some or all of the individual factors are themselves binary. In such cases, it might be possible to smooth out the underlying factors themselves. For example, one of the factors in the test for characterizing an individual as an employee versus an independent contractor is the amount of control the individual has over how she performs her work. Suppose an individual exercises just enough control that the factor comes out in favor of independent contractor status. Alternatively, suppose the individual exercises near-total control over how she performs her work. Under a sharp line, these two cases would equally support the conclusion that the individual should be classified as an independent contractor rather than an employee. In contrast, a sliding scale would treat this factor as more strongly supporting independent contractor status in the second case than in the first.

A second possibility for smoothing out a multi-factor test is to smooth out the relationship between the individual factors and the legal result that they determine. Suppose classification depends on two factors, y and z. Let u represent an aggregation of y and z with weights corresponding to the multi-factor test, such that u is increasing in y and z and $u > \overline{u}$ if and only if the high tax regime applies. Note that as described, this multi-factor test

---

[65] Observe that there is actually a miniature sharp-line in the lobbying context. Taxpayers may deduct up to $2,000 of in-house lobbying expenses, but if the taxpayer spends $2,001 on in-house lobbying expenses, none of its expenses are deductible. *See* Section 162(e)(5)(B)

[66] Those taxpayers who jump to $\overline{x}$ are in a sense over-compensating for the harm of lobbying and the remainder who don't move in response to the sharp line do not account enough for the harm they are causing. Formally there is deadweight loss because taxpayers who jump to $\overline{x}$ could engage in a Pareto improving trade: those at $\overline{x}$ would pay the non-movers to slightly decrease their lobbying and allow those at $\overline{x}$ to lobby a bit more. The total amount of lobbying would be unchanged, but the additional amount of lobbying is far more valuable to those at $\overline{x}$ because they are far from their private ideal point. Such a Pareto improving trade cannot be made under the sliding scale.

implements a sharp line based on u, and therefore based on y and z as well, where the location of the line for one factor depends on the value of the other factors as well. As with single-factor tests, this multi-factor test can be smoothed out by assigning tax liability in proportion to u, rather than based on whether or not u crosses the stated threshold. One simple version of this, when the factors that enter into the test are binary, is to assign tax liability in proportion to the number of individual factors that are satisfied.

How do the efficiency properties of sharp lines and sliding scales differ in the context of multi-factor tests? First consider the question of whether to smooth out an individual factor that enters into a larger test. The behavioral consequences of a sharp line here are similar to those in the single-factor test setting; the main difference is that the tax implications of crossing the line for one factor hinge on the resolution of the other factors. When the factor in question is determinative, the tax implications of crossing the line – and hence the deadweight loss generated – will be particularly large. When the factor in question is unlikely to be determinative, the incentives to account for the line will be muted. Hence, the efficiency gains or losses from smoothing out the sharp line are the same as in the single-factor case, but the stakes vary depending on how likely it is that the factor in question will be determinative.

Turning to the question of whether to smooth out the relationship between the factors and tax liability, consider how the smoothness of this relationship affects taxpayer decisions that relate to the factors. Under a sharp line, the incentives to adjust one factor depend on the resolution of the other factors as well. For example, when a taxpayer's ideal values of y and z imply a value of u that is just above $\overline{u}$, the taxpayer would face strong incentives to adjust y and z to lower u. The deadweight loss that results would depend on which factor the taxpayer adjusts, and the costs of making that adjustment.[67] Under the sliding scale, in contrast, all taxpayers face an incentive to reduce u by adjusting y and z, but these incentives are smaller than those faced by taxpayers near the cutoff under the sharp line. Hence, determining whether the sliding scale or sharp line is more efficient for the multi-factor test is similar to the analysis for a single-factor test, but the key question concerns the distribution of u^*, which in turn is based on the distribution of taxpayers' ideal points for the underlying factors.

The analysis thus far has assumed that taxpayers and the tax authority know the aggregation of individual factors demanded by the multi-factor test, so that both sides can calculate u. In practice, multi-factor tests are usually quite vague about how to aggregate individual factors into an overall legal determination. Thus, in the presence of such tests, the relationship between taxpayer behavior and tax liability can be characterized by substantial

[67] Note that this analysis holds when the factors are binary, in addition to when they are continuous; when they are binary, adjusting behavior so that u falls below the line may be more costly because the change is more significant.

uncertainty. As with single-factor tests in the presence of uncertainty, the efficiency consequences of the choice between sliding scale and sharp lines for multi-factor tests are therefore somewhat muted.

From a complexity and administration perspective, one potential upside to a sharp line approach for multi-factor tests is that it sometimes allows taxpayers and the tax authority to ignore those factors that are not determinative. For example, if, under a sharp line multi-factor test, the value of one factor is so extreme that the overall test is likely to come out in a particular direction, determining tax liability does not require resolving the remaining factors. In contrast, under a sliding scale, calculating tax liability requires resolving each of the potentially relevant factors. Similarly, determining liability under a sliding scale can require a more precise specification of how different factors are aggregated to reach a particular result than under a sharp line, which can be costly for the tax authority to articulate and complicated for taxpayers to learn about and apply.

VIII. EXAMPLES

This section applies our analysis to a number of examples from different areas of tax law.

A. Child Tax Benefits

The first example we consider relates to child tax benefits, such as the Child Tax Credit, the Earned Income Tax Credit, the Child and Dependent Care Credit, Head of Household Filing Status, and until recently, the Child Deduction. For each of these provisions, the basic definition of a qualifying child comes from section 152(c) of the Internal Revenue Code, which has been interpreted to encompass children born at any during the tax year.[68] This rule creates a sharp line: a child born on December 31 of a tax year can qualify the taxpayer for the child tax benefits for the tax year, but a child born the next day, on January 1, cannot. The stakes of crossing this line are significant; for low income taxpayers who qualify for the EITC and Child Tax Credits, it could mean a difference of $5000 or more in one's tax refund for the year.[69]

Transforming the child birth sharp line into a sliding scale would be straightforward: a child born during the tax year would qualify for the child

---

[68] Pub. 501, Rev Rul. 73-156

[69] The actual change in economic position is somewhat smaller, since the parents of the child born on January 1 will qualify for an additional year of tax benefits in the year the child would have otherwise aged out of eligibility. However, that payment could be 19-24 years in the future, and may not occur if the parent's financial position changes in such a way that they no longer qualify.

tax benefit in proportion to the days during the year that occur after the child is born. For example, a child born on January 20 in a non-leap year would qualify for 345/365 of the benefit, since 345 days elapse during the year after the child's birth. A child born on December 31 would qualify for 1/365 of the benefit. Note the sharp line is smoothed out under this reform, since the taxpayer whose child is born on January 1 of the subsequent year would qualify for 0/365 of the benefit.[70]

Consider the effects of smoothing out the child birth requirements along the dimensions discussed in the earlier sections. With respect to efficiency, the concern with the sharp line is that individuals would try to change the timing of when their children are born to achieve tax savings. Whether tax incentives affect parents' behavior in this dimension is an empirical question, but at least some evidence suggests that they do.[71] Of course, parents do not have perfect control over the dates that their children are born, but for many parents, there is some potential to adjust around the margins, such as by choosing the date to schedule an induction or a planned C-section. The deadweight loss from this type of behavior change is unlikely to be large, however, since most parents would presumably be unwilling to speed up their delivery dates by more than a couple of weeks at most, out of concern for the child's well-being, even if the tax benefits were substantial.

However, a different possible source of deadweight loss could occur under the sharp line if parents take tax incentives into account in deciding which month to start trying to become pregnant. For example, taxpayers might decide to time the pregnancy to increase the chances of a December birth.[72] In theory, if there are sizable non-tax reasons for preferring a delivery date in a later month, but the parents plan for an earlier birth for tax purposes, this difference in timing could generate a less trivial amount of deadweight loss. On the other hand, because the relation between the variable under the taxpayer's control (the date at which the taxpayer starts trying to have a child) and the variable that determines tax liability (the date of delivery) is so uncertain, the deadweight loss from strategically planning the timing of pregnancy are likely to be reduced.

---

[70] Presumably, this reform would be implemented alongside a reform to the age-out requirements, under which a child would qualify the taxpayer for a fraction of the otherwise-allowable benefit in the year the child aged out of eligibility.

[71] The existence and magnitude of such effects have been studied and debated in the literature. See Sara LaLumia, James Sallee, and Nicholas Turner, *New Evidence on Taxes and the Timing of Birth,* 7 AMER. ECON. J.: ECON. POLICY (2015); Stacy Dickert-Conlin and Amitabh Chandra, *Taxes and the Timing of Birth,* 107 J. OF POL. ECON. (1999).

[72] This type of behavioral response to the tax is more difficult to assess empirically because of the challenge of separating out the tax-induced effects from other reasons taxpayers may prefer their child to be born at one point in the year versus another.

To the extent that the current sharp line creates deadweight loss, switching to a sliding scale would likely reduce it. Considering the pre-tax distribution of ideal dates that parents would like their children to be born, there is little reason to expect a dip in the distribution around December 31. Intuitively, the sliding scale would create a general incentive for all children to be born slightly earlier in the year, but would dramatically lessen the incentive that exists under current law to hasten delivery for children who would otherwise be born just after the start of the new year. Because the potential tax savings from shifting the date by a couple of days or even weeks is relatively small, we would not expect the sliding scale to generate much in the way of deadweight loss. Hence, we conclude the sliding scale would be more efficient, but the likely efficiency gains would be small.

Turning to classification considerations, here the case for a sliding scale is much stronger. The most frequently cited rationale for the child tax benefits is the taxpayer's ability to pay, and a taxpayer with a child born on December 31 has a very similar ability to pay as a taxpayer with a child born on January 1. Hence, smoothing out the tax benefit in proportion to the fraction of the year that the taxpayer supported a child will better track this objective.

Finally, although sliding scales can be more complex than sharp lines, the complexity of the two designs for the child tax benefits is likely to be similar. The extra computational complexity is unimportant, since it is easy for tax software to scale the size of the benefit based on the child's birthday. Similarly, a sliding scale would not increase informational complexity because the extra information (the child's birthdate) is probably (hopefully) easy for parents to provide.

Overall, our arguments support smoothing the child tax birth requirement from a sharp line into a sliding scale. There is little downside in terms of additional complexity, some modest but uncertain benefits in terms of efficiency, and a substantial upside in terms of furthering the ability to pay goals that underlie the provisions.

B. Long-Term Capital Gain Holding Period

Current law distinguishes between the sale of "long-term" versus "short-term" capital assets, with gains from the former subject to a preferential tax rate. When the taxpayer has held the asset for over one year, it is long-term; otherwise it is short-term. Under current law, the maximum tax rate on long-term gains is 20%, whereas the maximum tax rate on short-term gains is 37%, as with ordinary income. This rule is a sharp line: gains from the sale of an asset held for exactly one year are taxed at a much higher rate than gains from an asset held one day longer.[73]

---

[73] Under significantly older law there was something closer to a sliding scale: "In 1934, for instance, Congress provided for a decreasing percentage of gain to be

Here we consider the costs and benefits of converting this sharp line into a sliding scale. Because assets can be held indefinitely, a sliding scale would operate over a subset of possible holding period lengths, such as a 6 month transition period (say between 9 months and 15 months), or a one-year transition period (say between 6 months and 18 months).

Beginning with efficiency, the concern with a sharp line is that it provides a large incentive for taxpayers to avoid selling marginal assets when they have held the asset for slightly less than a year. The simple model we proposed in Section I does not entirely fit this example, since taxpayers do not decide a holding period for their assets at a single point in time, but rather make sequential decisions about whether or not to hold or sell the asset on any given day. On any day, taxpayers will consider whether to hold or sell an asset based in part on their expectations about its future performance, i.e., its risks and whether they expect it to increase or decline in value, and by how much. If a taxpayer is considering whether to sell some asset after, say, an 11 month holding period, under the sharp line she will consider not only the expected future changes in its value, but also the probability that if she does not sell the asset, that she will continue to hold it until the 12 month mark, at which point she secures the favorable tax treatment. The closer in time to the 12 month mark, the greater the tax incentive to continue holding the asset. In contrast, the sharp line may distort behavior to a lesser degree further from the 12-month mark, because the expected benefits from continuing to hold the asset are smaller, since there is a relatively higher probability that the taxpayer will decide to sell the asset at some future point in time before the one-year threshold.

In terms of magnitude, we expect the deadweight loss from the sharp line to be moderate. On the one hand, many capital assets are sold well before one year or well after the one year mark, even with the tax incentive. On the other hand, because the difference in tax rates between short- and long-term gains is substantial, the pressure to hold assets near the one-year mark is significant.

Empirically, economists Timothy Dowd and Robert McClelland have found that taxpayers do respond to the sharp-line:[74] As their data (reprinted here as Figure 10) suggests, U.S. taxpayers realize gains at nearly 5 times the rate just after the one-year line compared to the months leading up to it.

Under a sliding scale, the tax-induced pressure to hold assets would be less extreme at any particular date, but present for a larger range of dates. In particular, there would be tax pressure to hold assets at dates after the one-

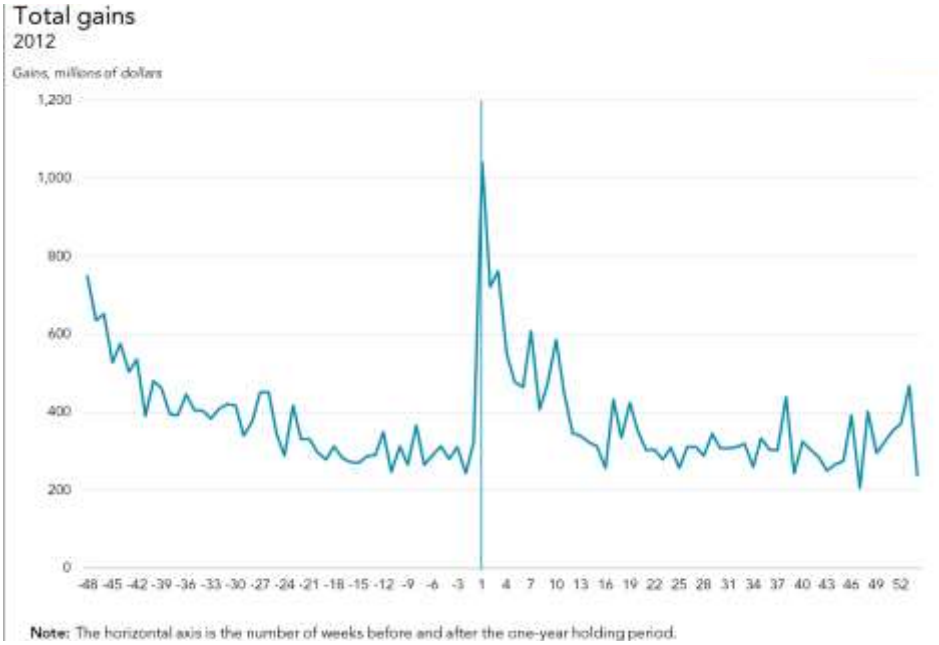
---

taxable the longer the asset was held, ranging from 100 percent if the asset were held a year or less to only 30 percent of the gain if the asset had been held for more than 10 years." Michael Graetz, Deborah Schenk, and Anne Alstott, FEDERAL INCOME TAXATION: PRINCIPLES AND POLICIES 8TH ED., 559-560 (2018).

[74] Dowd, Tim, and Robert McClelland. *The Bunching of Capital Gains Realizations*, (2017), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2899093

year mark, until the long-term classification was fully phased in. For dates well before the one-year mark, there would be more pressure to hold the asset than under the sharp line because the probability of achieving tax saving from continuing to hold would be greater (and the longer one continued to hold, the greater the tax savings would be). For dates right before the one-year mark, there would be less pressure to hold under a sliding scale, since the tax benefit from surpassing the one-year mark would be smoothed out.

Figure 10



Source: Dowd & McClelland (2017)

It seems likely that smoothing the sharp line into a sliding scale would reduce the deadweight loss associated with the difference in treatment. Recall that the sliding scale tends to be more efficient if there is not a particular dip in the distribution of taxpayers whose ideal holding period would be around one-year. That seems likely to be the case, since apart from tax purposes, we are not aware of many other considerations that would tend to make investors want to sell their assets after exactly one year. Likewise, Dowd and McClelland's figures do not suggest such a dip exists.

The longer the holding period over which the sliding scale is phased in, the smaller the tax incentive faced at any individual point in time to continue holding the asset. In contrast, when the sliding scale is phased-in over a narrow range around the one-year mark, the behavioral effects (and deadweight loss) resemble that of the sharp line. The distribution of ideal holding periods for many assets is relatively high right above zero,[75] so one

[75] *Id.*

consideration in deciding when to begin the sliding scale is to avoid distorting the behavior of that group. A reasonable approach would be phasing it in between 6 months and 18 months; for someone whose ideal point is 1 month to reach the tax benefits, they would have to hold for an additional 5 months to begin getting any benefit at all.

Turning to classification considerations, it seems likely that a sliding scale would better achieve the purpose of classifying short-term from long-term gains, but it is difficult to say for certain given that the purpose behind the policy is unclear. Congress has mentioned concerns about the potential bunching of gains in a given tax year absent the policy, as well as rewarding investors, but not speculators. Both of these concerns would seem to scale with time.[76] Likewise other justifications for preferential long-term capital gains preferences, like reducing lock-in and reducing the tax on nominal gains due to inflation over the holding period, also scale with time. These considerations thus support a sliding scale as well.

Turning to complexity considerations, the additional informational complexity associated with a sliding scale would be minimal in this context. The major informational input required to determine one's liability under this regime would still be the holding period, which, as under current law, can be determined based on the date of acquisition; no new informational inputs would be required.

With respect to computational complexity, the challenges appear manageable here as well, although there are some more difficult issues. For sales of a single asset that produces a capital gain, one would simply calculate the weighted average of the long- and short-term rates, as described above. If multiple assets are sold during the year, each gain or loss might be bifurcated into a long term and short term component based on the sale date. So an asset sold after exactly 1 year that produces a $100 gain would be treated as if the taxpayer had realized $50 of long-term gains and $50 of short-term gains (assuming one year was the midpoint of the sliding scale transition range).

Overall, we conclude that switching to a sliding scale for capital gains holding period would be mostly beneficial, with likely gains from efficiency, the underlying policy goals, and very little downside in terms of complexity.

C. Depreciable Property Placed in Service During the Year

When a taxpayer places a depreciable asset in service during the year, how much of a depreciation deduction should the taxpayer be allowed? The current rule differentiates between personal property and most forms of real property. For most forms of personal property, a half-year convention is employed, meaning that the taxpayer treats property placed in service at any

[76] HR Rep. No. 658, 94th Cong., 1st Sess. (1975), reprinted in 1976-3 CB (vol. 2) 695, 1033.

point during the year as if it had been placed in service at the midpoint of the year, entitling the taxpayer to 50% of the otherwise allowable depreciation deduction for property that was in service during the entire year. If more than 40% of the taxpayer's property is placed in service during the final quarter of the tax year, however, a mid-quarter convention is used instead. In contrast, the rule for real property is to apply a mid-month convention, treating the property as if it had been placed in service at the midpoint of the month. An analogous set of rules govern property that is disposed of during the tax year.

Formally, the rules for determining the allowable depreciation deduction resemble a sliding scale, in the sense that a taxpayer is entitled to a depreciation deduction in proportion to the amount of the year that transpires after the property was placed in service. In effect, however, the use of conventions converts the sliding scale into a system that more closely resembles a sharp line, or at least a hybrid of the two approaches. In particular, a half-year convention on its own would be entirely identical to a sharp line: a taxpayer who places her property in service on the last day of year 1 would be entitled to 50% of the deduction for year 1, and 100% for year 2. If the taxpayer had instead placed her property in service a few days later, after the start of year 2, she would not qualify for any deduction for year 1, and would instead be allowed a 50% deduction for year 2.

The mid-month convention retains more of the sliding scale character, but, by treating the classification variable as quite coarse, embodies some of the properties of a sharp line as well. Specifically, it creates a number of sharp lines (between each calendar month), but the importance of these lines is diminished relative to the sharp line between tax years in the half-year convention. For example, a taxpayer who places her property in service on January 30 would qualify for 23/24 of the deduction, whereas a taxpayer who places her property in service on February 2 would qualify for 21/24 of the deduction. Thus, the amount at stake is 1/12 of the deduction – far less than under the half-year convention. On the other hand, treating the day as the level of granularity for the sliding scale would mean the consequences of moving from one day to the next would only be 1/365 of the deduction.

We can apply our framework to provide some sense of the costs and benefits of various conventions. First, consider the choice between sharp lines and a pure sliding scale (which we will think of here as a sliding scale defined at the daily level). With respect to the efficiency properties of the two approaches, the key question concerns the timing of when taxpayers would want to place their property in service, absent tax considerations, as well as the intensity of those preferences and the likelihood that taxpayers will adjust their timing decisions based on tax considerations. In general, a sharp line at the year level (such as a half-year convention) would be preferable on efficiency grounds if taxpayers tended not to want to place their property in service near the end of their tax year. Apart from variation in customer demand and the availability and timing from suppliers, there may well be seasonal fluctuations, or motivations to accelerate or slow down placed in

service decisions for non-tax accounting purposes. These patterns could well vary among different types of firms in different industries, and may also vary between firms in the same industry that define their tax year as the calendar year versus the fiscal year. Overall, we see little reason to expect that taxpayers would be particularly reluctant to move their place in service decisions to before the tax year's end, so we conclude that a sliding scale is likely to be more efficient than a sharp line.

A sliding scale would probably not add much informational complexity because most businesses would already be keeping track of the date they placed property into service for accounting purposes, or at least would already have records of doing so, at least for moderately sized businesses. This concern might vary across categories of property; it is probably easier to keep track of when a building was first placed into service than a small machine used by a business.

A related consideration is that under a sliding scale, all taxpayers would have to determine the precise date at which property is placed in service for tax law purposes. Most businesses would be able to rely on an accountant to apply this definition, but very small businesses might experience costs in having to undertake this legal research themselves.[77] In contrast, under a sharp line, the only taxpayers who will need to apply this standard are those near the line, where different potential interpretations of placed in service would yield different tax years.

A related consideration from a tax administration angle is that either the sliding scale or the sharp line might put more pressure on the legal definition of "placed in service." With the sliding scale, many taxpayers will be applying the test, and it will be difficult for the IRS to focus its enforcement efforts. However, the stakes would generally be fairly low. In contrast, under the sharp line, the stakes for taxpayers near the line will often be quite high. This is good for the IRS in terms of having a better idea of where to target its enforcement efforts, but perhaps worse for the IRS in that taxpayers may be more aggressive in challenging adverse determinations by the agency, potentially diverting resources from other uses.

Finally, consider the tradeoffs between a day-by-day sliding scale, and a coarser sliding scale such as the one created by the mid-month convention. From an efficiency perspective, we would typically expect the day-by-day approach to offer some advantages, since there is little reason to expect taxpayers to systematically tend not to want to place property in service towards the end of the month. On the other hand, the efficiency stakes between these options is probably much lower than with respect to the year-

---

[77] An additional factor exacerbating the computational complexity of a sliding scale is that there is actually legal uncertainty over the precise requirements for when an asset has been placed in service, such as whether a building that had received a certificate of occupancy and was in a condition of readiness could be considered placed in service, even though it was not yet open to the public.

by-year sharp line, since the tax incentive of moving from the end of one month to the start of the next, while present, is much smaller in magnitude than the incentive to shift the timing of when property is placed in service between tax years. On the other hand, the monthly approach may offer some advantages in terms of informational complexity (it may be easier for some businesses to keep track of which month property was placed in service than the particular day), as well as limit the need for some taxpayers to learn and apply the details of legal definition (assuming, that is, that most reasonable interpretations would agree on the month). Because these considerations may vary by type of property, one can imagine a rationale for applying a combination of sharp lines and sliding scales of various degrees of coarseness, as the law currently does, although of course that difference in treatment can introduce its own lines (such as between personal and non-personal property) that create their own distortions and complexity.

D. State Residency Rules

A recurring challenge in tax law is allocating a taxpayer's income between multiple jurisdictions, such as when someone spends significant time in multiple states, countries, or even, in some cases, cities. Most jurisdictions take the approach of taxing residents differently from non-residents. Generally, jurisdictions tax non-residents only on income that has its "source" (i.e., originates) there. For residents, however, the jurisdiction typically taxes all income, regardless of source, although it would usually offers a credit for taxes paid by residents to other jurisdictions on foreign-source income.

In many cases, the test for whether an individual is a resident of a jurisdiction depends at least in part on the fraction of the year the taxpayers spends there. Such tests often revolve around a sharp-line. For example, someone who owns property in New York City is a resident of the city (and thus subject to its income tax) if she spends 183 days or more in the city limits. In a different context, European Union law has been interpreted to require that a country provide a non-resident earning 90% or more of their income in the country the same tax exemptions that are available to a resident. These are both sharp line rules, but a sliding scale approach is also possible, and has been implemented in the context of formulary apportionment. In such cases, the degree to which a jurisdiction treats a taxpayer as a resident varies continuously based on the fraction of the year the taxpayer spends in the jurisdiction. Thus, income sourced to a particular jurisdiction would continue to get taxed to that jurisdiction, but other income would be allocated proportionally among those jurisdictions for which a taxpayer is treated (at least to some degree) as a resident.

There is a large literature on apportionment approaches of this sort, and we will only discuss the basics of how our framework might shed light on the subject.

First, consider the efficiency trade-off between a sharp line and a sliding scale in this setting. A sharp line can generate intense incentives for taxpayers to adjust where they spend their time, especially for those who are near the 183-day threshold. The great lengths that taxpayers might go to avoid being characterized as a resident constitute deadweight loss to society. On the other hand, although the incentive effects from a sharp line can be large, they are limited to the relatively few taxpayers who are near the sharp line cutoff. A sliding scale, in contrast, would generate a smaller incentive for many more taxpayers. The simplest sliding scale, in which each additional day in a jurisdiction affects the taxes owed to it, would affect virtually everyone who is mobile between jurisdictions. For example, a high-income taxpayer from a high-tax state would face a large incentive to spend a few extra days on vacation in a low-tax state, say Florida, to reduce her overall tax liability for the year. Similarly, tourism in high-tax states would likely suffer. Because there are so many more people who spend a small share of the year travelling between states than there are who spend near-equal amounts of the year traveling between states, a sharp line is probably more efficient than this pure form of a sliding scale.

On the other hand, a sliding scale with a de minimis exception could well be more efficient than either a pure sliding scale or a sharp line. Under this approach, a taxpayer would be treated as a part-year resident of any state in which she spent more than, say, 90 or 120 days during the tax year. Income would then be allocated among the states in which the individual was at least a part-year resident, in proportion to the days above the de minimis threshold spent in the state. Depending on the distribution of taxpayers' ideal points above the de minimis threshold, this modified sliding scale could well be more efficient than the sharp line: its distortionary effect for any given taxpayer would be smaller than under the sharp line, and it would still be limited to a relatively small number of taxpayers whose days in another state exceeded or could plausibly be altered to exceed the de minimis threshold.

Informational complexity is another important concern with a sliding scale approach to state residence determinations. It would be quite burdensome for taxpayers to keep track of the precise number of days they spend in any particular state. Of course, taxpayers near the line already have to keep track of this information, but again, that requirement affects a small share of taxpayers. Again, however, a modified version of the sliding scale could alleviate some of the comlexity costs, so that the only taxpayers who would need to keep track of their dates would be those who spend a significant fraction of the year in multiple jurisdictions. In addition, it is possible that new technology, such as location-tracking capabilities on one's smart phone, could ease the record-keeping costs of determining one's location over the course of the year. In addition, to the extent the jurisdictions require different information because they use different definitions of the tax base this will also add to informational complexity.

With respect to tax planning, a sliding scale could actually reduce the computational challenges associated with tax planning about residency

decisions, since taxpayers would not need to have to spend as much effort predicting the precise number of days in the year that they will be in the jurisdiction. That is, under a sharp line, the costs of spending an extra day in a jurisdiction hinge on the likelihood and importance of spending future days in that jurisdiction during the tax year. Under a sliding scale, in contrast, the tax implications of spending time in the jurisdiction do not vary in this way.

IX. CONCLUSION

Based on our analysis, we conclude that a sliding scale tends to be more efficient than a sharp line rule in many settings, unless the distribution of taxpayer preferences is such that there would be a good place to draw the line that would not yield many distortions. Thus, we think it makes sense to start from the presumption that a sliding scale would be more efficient. In some cases, there might be good reasons to suspect the distribution of taxpayer preferences is such that a sharp line would be more efficient, thus overturning the presumption. And in other cases, a sliding scale will be much more complex than a sharp line, undermining the case for its adoption. Ultimately, the determination as to which type of instrument is best should be made setting by setting, but we hope the general principles outlined here can help guide that analysis.

APPENDIX

This appendix briefly describes the assumptions that underlie the simulation results we present in the main body.

The simulations assume taxpayers face a quadratic cost to adjusting their behavior from their ideal point and linear disutility from paying tax. Utility thus takes the form:

$$U_i = -\alpha(x_i - x_i^*)^2 - T(x_i)$$

The simulations presented in the body of the paper assume $\alpha = 3$. We obtain qualitatively similar results for $\alpha \in \{0.5, 1, ,3,5,10\}$.

To compare the efficiency of sharp lines and sliding scales, the simulations adopt the following procedure. First, we select a tax rate τ and compute the amount of tax revenue generated by that τ under the sliding scale ($\overline{R}$), using the assumed utility function. Second, we compute the value of t that generates $\overline{R}$ under the sharp line. Third, we compare the deadweight loss generated by the sliding scale with rate τ to the sharp line with tax liability jump of t. Throughout, we assume the sharp line is placed so that $\bar{x} = 0.5$. The simulations presented in the body of the paper assume $\tau = 0.05$. In unreported analyses, we obtain qualitatively similar results for $\tau \in \{0.005, .01.03,0.05, .07,0.1\}$.