
Policy Forum: Cognitive Bias as a Factor in Determining the Efficiency of Sliding Scales

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PRÉCIS

En droit fiscal, on parle de lignes de démarcation nette lorsqu'un changement minime dans la situation d'un contribuable entraîne un traitement juridique très différent. Les critères de démarcation nette sont critiqués parce qu'ils encouragent les contribuables à modifier leur comportement optimal pour des raisons purement fiscales, ce qui entraîne une perte d'efficacité. Les solutions de remplacement les plus évidentes à ces critères sont les échelles mobiles, qui consistent à imposer un contribuable en fonction de sa position sur un continuum. Des chercheurs, dont Edward Fox et Jacob Goldin, considèrent que l'utilisation d'échelles mobiles au lieu de critères de démarcation nette pour déterminer l'assujettissement à l'impôt pourrait réduire les pertes d'efficacité dans de nombreux contextes. Cependant, l'adoption d'échelles mobiles se fait généralement au prix d'une plus grande complexité, qui peut amener les contribuables à commettre des erreurs systématiques dans leur choix de comportements optimaux ainsi qu'engendrer des biais cognitifs. Cet article soutient que l'assouplissement des critères de démarcation nette existants peut ne pas produire les économies d'efficacité prévues si ces prévisions reposent sur un comportement optimal des contribuables. Au contraire, déterminer avec plus de précision le changement dans la perte d'efficacité occasionnée par le passage de lignes de démarcation nette à des échelles mobiles tiendrait également compte des effets des biais cognitifs. Afin d'illustrer les concepts évoqués ici, cet article présente un exemple simplifié basé sur la résidence fiscale pour expliquer les concepts de perte d'efficacité, de lignes de démarcation nette et d'échelles mobiles dans le contexte de la thèse de Fox et Goldin selon laquelle les échelles mobiles seraient plus efficaces que les lignes de démarcations nettes dans de nombreux cas.

ABSTRACT

In tax law, sharp lines occur where a minimal change in a taxpayer's circumstances results in significantly different legal treatment. Sharp-line tests are criticized because

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they encourage taxpayers to alter their optimal behaviour for purely tax reasons, thereby producing deadweight loss. The most obvious alternatives to sharp-line tests are sliding scales, which operate by imposing tax proportionately on the basis of where taxpayers fall along a continuum. Scholars, including Edward Fox and Jacob Goldin, have suggested that the adoption of sliding scales in determining tax liability as opposed to the use of sharp-line tests could reduce deadweight loss in many contexts. However, the adoption of sliding scales generally comes at the cost of greater complexity, which can lead taxpayers to make systematic errors in selecting optimal behaviours and can also introduce cognitive biases. This article argues that smoothing existing sharp-line tests may not bring about predicted efficiency gains if such predictions rely on taxpayers behaving optimally. Rather, a more accurate determination of the change in deadweight loss occasioned by a shift from sharp lines to sliding scales would also account for the effects of cognitive bias. In order to illustrate the concepts dealt with herein, this article establishes a simplified example based on tax residence to explain the concepts of deadweight loss, sharp lines, and sliding scales in the context of Fox and Goldin's suggestion that sliding scales would be more efficient than sharp lines in many circumstances.

KEYWORDS: ECONOMICS ■ ECONOMIC THEORY ■ RESIDENCE ■ POLICY

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INTRODUCTION

In tax law, sharp lines occur where a minimal change in a taxpayer's circumstances results in significantly different legal treatment.¹ Sharp-line tests are criticized because they encourage taxpayers to alter their optimal behaviour for purely tax reasons, thereby producing deadweight loss. The most obvious alternatives to sharp-line tests are sliding scales, which operate by imposing tax proportionately on the basis of where taxpayers fall along a continuum. Scholars, including Edward Fox and Jacob Goldin,²

1 Sharp lines are sometimes referred to as "bright lines."

2 Edward G. Fox and Jacob Goldin, "Sharp Lines and Sliding Scales in Tax Law" (2020) 73:2 *Tax Law Review* 237-302, at 237.

have suggested that the adoption of sliding scales in determining tax liability as opposed to the use of sharp-line tests could reduce deadweight loss in many contexts. However, the adoption of sliding scales generally comes at the cost of greater complexity, which can lead taxpayers to make systematic errors in selecting optimal behaviours.³ Economists have also shown that complex rate schedules can introduce cognitive biases in individuals, resulting in a phenomenon that Jeffrey Liebman and Richard Zeckhauser refer to as “schmeduling.”⁴ Applying this concept of cognitive bias, in this article I argue that smoothing existing sharp lines may not bring about predicted efficiency gains if such predictions rely on taxpayers behaving optimally. A more accurate determination of the change in deadweight loss occasioned by a shift from sharp lines to sliding scales would also account for these schmeduling effects.

In order to illustrate the concepts dealt with herein, the first part of the article establishes a simplified example based on tax residence to explain the concepts of deadweight loss, sharp lines, and sliding scales in the context of Fox and Goldin’s suggestion that, in many circumstances, sliding scales would be more efficient than sharp lines. The second part of the article expands on the concept of complexity, both generally and in the context of sliding scales, and suggests that determinations of efficiency in deciding between sharp lines and sliding scales could benefit from consideration of how complexity may increase the prevalence of cognitive bias in taxpayers. The third part of the article then identifies two specific biases contemplated by Liebman and Zeckhauser’s concept of schmeduling, as well as their effects. The fourth part applies this concept to the tax residence example established in the first part and demonstrates how the use of a sliding scale in this context could lead biased taxpayers to take actions that would further decrease the deadweight loss resulting from their behaviour.

EXPLAINING DEADWEIGHT LOSS, SHARP LINES, AND SLIDING SCALES USING TAX RESIDENCE

The concepts of deadweight loss, sharp lines, and sliding scales can be easily understood by considering the simplified example below, which I will refer to throughout this article.

Example

Assume that Canada, Ontario, and Quebec adopt the following simple rate schedules for income tax purposes (with no basic credits, etc.):

3 Raj Chetty, Adam Looney, and Kory Kroft, “Salience and Taxation: Theory and Evidence” (2009) 99:4 *American Economic Review* 1145-77, at 1175, discussed further below.

4 See Jeffrey B. Liebman and Richard J. Zeckhauser, “Schmeduling,” unpublished manuscript (2004) (https://scholar.harvard.edu/files/jeffreyliebman/files/Schmeduling_WorkingPaper.pdf).

<i>Taxable income</i>	<i>Rate schedule (%)</i>		
	<i>Federal</i>	<i>Ontario</i>	<i>Quebec</i>
\$0-\$50,000	10	0	5
\$50,001-\$100,000	15	0	10
\$100,001-\$150,000	20	10	15
\$150,001-\$200,000	25	10	20
>\$200,000	30	15	25

Emma is a highly skilled entrepreneur resident in Montreal, Quebec. She recently sold her startup for a significant sum and expects to have taxable income of \$10 million for the year. Although she would prefer to stay in Montreal, where her extensive business connections will help to support her next project, her new-found wealth has made Ontario's lower income tax rates enticing. As a result, she is considering moving to Toronto. Nevertheless, she plans to travel back to Montreal frequently to visit friends, family, and business associates. Emma's accountant has informed her that, under Canadian income tax law, individuals are taxable in the province in which they are resident on the last day of the calendar year. Ignoring Emma's first \$200,000 of taxable income, her accountant uses quick math to work out that Emma will save about \$980,000 in taxes (using her top-rate income of \$9,800,000 multiplied by the 10 percent difference between the top marginal rates for Quebec and Ontario as a proxy)⁵ if she becomes resident in Ontario during this year rather than next year.

However, Emma's accountant warns her that the tax rules might change. Legislators are considering a new regime whereby Emma would be taxed on the basis of the number of days that she spent in each province during the year. For example, if she spent 60 percent of her time in Ontario (219 days in a 365-day year) and 40 percent of her time in Quebec (146 days in a 365-day year), 60 percent of her income would be taxed in Ontario and 40 percent would be taxed in Quebec. Further, the income thresholds for each province's rate schedule would be multiplied by the percentage of time that she spent in the province, so that Emma would not have inappropriate access to the benefit of the lower rate brackets (as explained further below). De minimis periods spent in another jurisdiction or province—Emma is dying to go on a one-month vacation rock climbing in West Virginia—would be allocated to her primary province of residence (that is, Ontario).

Sharp Lines and Sliding Scales

As Emma's accountant has noted, Canadian income tax law currently uses a sharp-line test to determine tax residence. Because taxing authority is allocated to the province in which the taxpayer is resident at the end of the year, a minimal change in Emma's circumstances (becoming resident in Ontario on December 31 instead of January 1) can result in significantly different tax treatment.

⁵ For readers who believe that a 10 percent difference in top combined marginal rates between two provinces is farfetched, note that there is a difference of 10.3 percent between the top combined marginal rate for Newfoundland and Labrador for 2023 (54.8 percent) and the rate for Nunavut (44.5 percent).

The obvious alternative to a sharp-line test is a sliding scale, which is represented by the hypothetical proposals set out in the example above. Under this regime, Emma would be taxed proportionately on the basis of where she falls along a continuum (that is, the number of days spent in each province during the year).

Deadweight Loss in the Context of Sharp Lines and Sliding Scales

The deadweight loss of a tax is the amount by which the tax reduces taxpayer welfare other than through the burden of taxation. A taxpayer who chooses a course of action other than the optimal action in a non-tax world is worse off because of the utility loss from not being able to choose the optimal behaviour. In the example above, Emma's time spent in Toronto represents deadweight loss; by spending time in Toronto, Emma is sacrificing the benefit of her business connections who will help her next project to succeed.

In deciding which type of tax law produces more deadweight loss, it is important to consider both the number of taxpayers who are likely to change their behaviour and the amount by which these taxpayers would alter their behaviour. Emma has an extremely high income for the year and is therefore more motivated to change her behaviour under the sharp-line test compared to someone who earns less. For example, if Remi is a resident of Quebec and earns \$75,000 of taxable income in the year, he will see tax savings of only \$5,000 from moving to Ontario. Although this amount might not be substantial enough to justify moving five hours away from Montreal to Toronto, it could justify moving 10 minutes away from Gatineau to Ottawa. On the basis of these criteria, a tax will be more inefficient if it causes many taxpayers to experience larger utility losses solely for tax-motivated reasons and less inefficient if it causes fewer taxpayers to experience smaller utility losses solely for tax-motivated reasons.

In their article, Fox and Goldin demonstrate that taxpayers who are subject to a sharp line and incur tax liability under optimal behavioural conditions are generally more willing to make larger utility sacrifices to attain favourable tax outcomes because of the benefit of escaping liability completely.⁶ On the other hand, more taxpayers are motivated to alter their behaviour under a sliding scale.⁷ However, these taxpayers may be less likely to make large utility sacrifices to attain favourable tax outcomes because, after a certain point, the disutility of altering their behaviour will exceed the benefits of reducing their liability.⁸ In the example above, Emma should be willing to experience large utility losses to ensure that she moves to Ontario before the end of the year and escapes Quebec tax liability entirely under the sharp-line test. By contrast, more people (such as Remi) should be willing to experience small utility losses under the proposed sliding scale. Further, Emma may find that she will eventually become

6 Fox and Goldin, *supra* note 2, at 257.

7 *Ibid.*

8 *Ibid.*, at 258-59.

less likely to sacrifice days spent in Montreal under the proposed sliding scale because the sacrifice is not worth the smaller tax benefit available to her.

Fox and Goldin go on to show that the deadweight loss arising under sharp lines is generally greater than the deadweight loss resulting from sliding scales. While this proposition does not hold in all situations, Fox and Goldin identify numerous factors “that tend to make sliding scales more efficient than sharp lines for raising revenue—at least when the distribution of taxpayer preferences does not make it possible to draw the sharp line in a non-distorting way.”⁹ This leads Fox and Goldin to conclude that policy makers should start their decision-making process with the presumption that sliding scales will be more efficient.

COMPLEXITY UNDER SLIDING SCALES

Fox and Goldin address complexity by introducing the concepts of computational and informational complexity. Computational complexity refers to the complexity of determining an individual’s tax liability “given all of the relevant information about the individual.”¹⁰ Informational complexity refers to “the difficulty in obtaining the information upon which the determination of one’s tax liability depends.”¹¹ Fox and Goldin recognize that sliding scales tend to be more complex, both computationally and informationally, than sharp lines. For example, in determining residence, it is informationally simpler to identify where Emma is resident on the last day of the calendar year than it is to calculate the ratio of days that she has spent in Toronto and Montreal. It is also computationally simpler to figure out her tax liability under a single province’s rate schedule than it is to determine her liability under two provinces’ rate schedules.

As Fox and Goldin note, tax software may be able to address the impact of the additional computational complexity occasioned by smoother tax laws. A computer program can make short work of calculating the tax liability of an individual subject to numerous tax regimes provided that it has the necessary inputs. And data suggest that Canadian taxpayers (and/or their tax preparers) are currently willing to use the electronic systems offered by the Canada Revenue Agency (CRA) to complete and file their tax returns: in 2023, 93 percent of all individual income tax and benefit returns were filed electronically with the CRA.¹² However, it is not clear that software has the capability to address informational complexity in the same manner. While it should be simple for Emma to ensure that she is resident in a certain province on the last day of a calendar year, it will be much more difficult for her to predict the exact number

9 Ibid., at 299.

10 Ibid., at 265.

11 Ibid., at 267.

12 Canada Revenue Agency, “Individual Income Tax Return Statistics for the 2023 Tax-Filing Season” (www.canada.ca/en/revenue-agency/corporate/about-canada-revenue-agency-cra/individual-income-tax-return-statistics.html).

of days that she will spend in each jurisdiction during a taxation year in order to calculate her tax liability in advance.

Fox and Goldin recognize that a shift from sharp lines to sliding scales would make tax laws more complex. The notion of complexity relates to that of salience in situations where taxpayers, even though they may be aware of a tax, fail to account for it when making decisions.¹³ Chetty, Looney, and Kroft¹⁴ conducted a study on salience in which price tags that included or excluded sales tax were posted on cosmetics, hair-care accessories, and deodorants. They observed that demand was reduced when sales taxes were more salient (visible). In contrast, when sales taxes were not visible on the price tag, consumers did not fully account for the tax when purchasing a product. Chetty et al. concluded that individuals “appear to be well informed about commodity taxes when their attention is drawn to the topic, suggesting that *salience* is an important determinant of behavioral responses to taxation.”¹⁵ Interestingly, they went on to link salience with complexity, positing that the failure to fully account for a simple, linear tax demonstrates that taxpayers tend to make “systematic optimization errors” even in non-complex situations.¹⁶ If this is the case, it suggests that more complex regimes (such as an income tax with a progressive, graduated-rate schedule) could generate behavioural responses that do not align with standard models.

For Fox and Goldin, complexity is most important in the context of tax planning. Given sufficient complexity, the costs of engaging in tax planning may become high enough relative to the benefits of doing so that few taxpayers find it worthwhile to account for tax. Although Fox and Goldin recognize how this tradeoff relates to the notion of salience, they generally limit themselves to considering the behaviour of rational taxpayers: the potential tax planner forgoes that role where the cost of planning would outweigh the resulting benefits. However, the complexity occasioned by a shift to a sliding scale has the potential to increase the likelihood of taxpayer bias, which could also affect the amount of deadweight loss arising from taxpayer behaviour.¹⁷

13 David Weisbach, “Is Knowledge of the Tax Law Socially Desirable?” (2013) 15:1 *American Law and Economics Review* 187-211. Note that this definition is different from that found in certain studies on sales tax salience. While there are overlaps, the definition in the sales tax studies is less generalized than that in studies that examine salience in the income tax setting. See, for example, Jacob Goldin, “Optimal Tax Salience” (November 2015) 131 *Journal of Public Economics* 115-23, at 1 (defining the term with respect to the prominence of after-tax price). For more research on the concept of salience, see also Amy Finkelstein, “E-Z Tax: Tax Salience and Tax Rates” (2009) 124:3 *Quarterly Journal of Economics* 969-1010; and Charles A.M. de Bartolome, “Which Tax Rates Do People Use: Average or Marginal?” (1995) 56:1 *Journal of Public Economics* 79-96.

14 Chetty et al., *supra* note 3.

15 *Ibid.*, at 1175.

16 *Ibid.*

17 Similar to complexity, taxpayer astuteness—that is, the taxpayer’s understanding of tax legislation and the economy—should not be overlooked. Joseph Stiglitz observed that the occurrence of individuals who do not “take full advantage of the limitations on interest

Liebman and Zeckhauser rely on empirical data to demonstrate how individuals often misperceive complex schedules—a phenomenon that they refer to as “schmeduling.” According to the data, certain kinds of complexity relate to the prevalence of cognitive biases in dealing with rate schedules. Complexity may arise from non-linear pricing because taxpayers may potentially confuse average and marginal prices.¹⁸ Another type of complexity is found in situations where “there are more rates in the schedule or if the consumer is operating on two or more schedules simultaneously.”¹⁹ Returning to the example of a sliding-scale residence test, we see that both of these types of complexity arise. Canadian taxpayers must calculate their tax liability under a progressive, graduated-rate schedule, meaning that there is potential for taxpayers to confuse their final marginal rate with their average rate. Moreover, a taxpayer facing a sliding-scale residence test might have to deal with a greater number of potential outcomes if income is subject to tax by multiple jurisdictions.

Another condition that can provoke cognitive biases in taxation systems is the element of delayed payoffs. Liebman and Zeckhauser assert that individuals are more likely to misperceive schedules where the consequence of a decision is discontinuous from the time of consumption.²⁰ For example, in any given year, taxpayers who spend significant time in multiple provinces will make decisions about where they will spend their time, early in the year. Although taxpayers might make these decisions in January or February, they will not have to face the consequences of their choices until much later. Therefore, the more complex rate schedule under a smooth determination of residence may work in tandem with the delayed-payoff feature to increase the prevalence of bias. Thus, it is easy to see how the increasing complexity introduced by sliding scales may make taxpayers more likely to misperceive rate schedules.

SPECIFIC BIASES AND THEIR EFFECTS

Liebman and Zeckhauser highlight two specific biases: “ironing” and “spotlighting.”²¹ Ironing occurs where “people smooth over the entire range of the schedule.”²² The essential element of ironing is the confusion of average and marginal rates. A simplistic example assumes a two-bracket income tax schedule where income of \$10,000 or less is subject to a zero percent tax rate and income above that level is subject to a

deductibility” can partly be ascribed to lack of astuteness. We cannot assume that a taxpayer splitting his time between different tax jurisdictions fully understands how his time is best divided given the applicable tax legislation. See Joseph E. Stiglitz, “The General Theory of Tax Avoidance” (1985) 38:3 *National Tax Journal* 325-37.

18 Liebman and Zeckhauser, *supra* note 4, at 4.

19 *Ibid.*

20 *Ibid.*, at 5.

21 Like Liebman and Zeckhauser, I will not deal with the bias that they call “ostriching,” which occurs when individuals are so overwhelmed by a rate schedule that they ignore it completely. See *ibid.*, at 13, note 20.

22 *Ibid.*, at 14.

10 percent tax rate. A taxpayer who has income of \$20,000 and who is ironing will consider future earning options on the basis of the additional income being subject to a 5 percent (average) rate rather than the marginal rate of 10 percent. This type of bias has been shown to exist in both humans and pigeons.²³

Spotlighting occurs when taxpayers respond to “the instantaneous payoff in the current sub-period without considering effects for the remainder of the accounting period.”²⁴ Irresponsible spenders will be quite familiar with this bias: after payday, they spend as if there were no tomorrow, and then run out of funds well before the next payday comes around. Again, this bias has been observed in humans, pigeons, and other animals.²⁵ Delving deeper into these biases, we see how they can result in suboptimal resource budgeting and affect deadweight loss.

Ironing gives rise to both of these consequences. First, suboptimal resource budgeting occurs under the assumption that taxpayers may reach a point where the marginal utility of earning more income is offset by various factors such as the competing utility of leisure and the greater tax liability resulting from progressive marginal rates. As David Weisbach succinctly puts it, “[s]omeone deciding whether to work more cares about the tax on the marginal dollar.”²⁶ If taxpayers assume that their marginal rate is equal to their average rate, because they are “ironers,” they will be unable to

23 See, for example, de Bartolome, *supra* note 13 (who demonstrates that humans generally rely on average tax rates as opposed to marginal rates in determining their liability). As Liebman and Zeckhauser point out, behavioural theory prefigures ironing in the concept of melioration. Melioration was developed from Herrnstein’s “matching law,” which arose from experiments involving pigeons beginning in the 1960s. Some of the works in this literature include R.J. Herrnstein, “Relative and Absolute Strength of Response as a Function of Frequency of Reinforcement” (1961) 4:3 *Journal of the Experimental Analysis of Behavior* 267-72; R.J. Herrnstein and William Vaughan Jr., “Melioration and Behavioral Allocation,” in J.E.R. Staddon, ed., *Limits to Action: The Allocation of Individual Behavior* (New York: Academic Press, 1980), 140-76; Richard J. Herrnstein, “Melioration as Behavioral Dynamism,” in Richard J. Herrnstein, Howard Rachlin, and David Laibson, *The Matching Law: Papers in Psychology and Economics* (New York: Russell Sage Foundation, 1997), chapter 4; and J.E. Mazur, “Optimization Theory Fails To Predict Performance of Pigeons in a Two-Response Situation” (1981) 214:4522 *Science* 823-25.

24 Liebman and Zeckhauser, *supra* note 4, at 14.

25 As Liebman and Zeckhauser point out, spotlighting is figured in the behavioural economics literature on time-inconsistent preferences and self-control. See, for example, Richard H. Thaler and H.M. Shefrin, “An Economic Theory of Self-Control” (1981) 89:2 *Journal of Political Economics* 392-406; David Laibson, “Golden Eggs and Hyperbolic Discounting” (1997) 112:2 *Quarterly Journal of Economics* 443-47; and B. Douglas Bernheim and Antonio Rangel, *Addiction and Cue-Conditioned Cognitive Processes*, NBER Working Paper no. 9329 (Cambridge, MA: National Bureau of Economic Research, November 2002). Liebman and Zeckhauser rely primarily on data from the San Diego food stamp cashout experiment, as detailed in James C. Ohls, Thomas M. Fraker, Alberto P. Martini, and Michael Ponza, *The Effects of Cash-Out on Food Use by Food Stamp Program Participants in San Diego* (Princeton, NJ: Mathematica Policy Research, 1992).

26 Weisbach, *supra* note 13, at 196.

properly calculate the point at which it becomes irrational to work further. This realization is related to the effect that ironing can have on deadweight loss. Under a progressive, graduated-rate income tax, taxpayers who iron underestimate the tax on the next dollar that they earn; as a result, they will work more hours than is optimal. However, although their misperceptions of the tax schedule distort their labour decisions, it is equally true that their labour decisions become less distorted owing to their misperception of the tax system; that is, they will not stop working solely for tax reasons.²⁷ Therefore, some of the deadweight loss that is produced by the tax system is counteracted by the taxpayer who falls victim to ironing.

Spotlighting also results in suboptimal resource budgeting and affects the amount of deadweight loss arising from taxpayer behaviour. The effects of spotlighting are best understood through positing the existence of irrational price setting for the same goods in a number of subperiods. In order to elaborate on their theory, Liebman and Zeckhauser use data from the San Diego food stamp cashout experiment.²⁸ In this experiment, one of two groups of food stamp recipients were given cheques instead of food stamps. Liebman and Zeckhauser import the study's findings into a spotlighting model by looking at the difference in food consumption over the span of the month, breaking down the days in the month into subperiods. They determine that the amount of food consumption by those who received the stamps decreased by about 24 percent over the month. For Liebman and Zeckhauser, this result shows how consumers misperceive the value of their food stamps in the earlier subperiods of the month, leading to suboptimal resource budgeting:

[D]uring the early period of the month, they [food stamp recipients] fail to realize that the cost of a marginal dollar of food consumption is one dollar. Then, after they have exhausted their food stamps and must spend cash for food, they perceive the true marginal cost of their food.²⁹

Spotlighting can also create deadweight loss. Assuming that the demand curve for food is identical in each subperiod, consumers who spotlight essentially set an irrationally low price for the goods being purchased. This misperception will cause consumers to purchase more food than they should, skewing consumption away from the baseline of a free market with rational actors.³⁰

27 Liebman and Zeckhauser, *supra* note 4, at 21-23.

28 Ohls et al., *supra* note 25.

29 Liebman and Zeckhauser, *supra* note 4, at 39.

30 *Ibid.*, at 23-24.

SCHMEDULING UNDER SMOOTHER RESIDENCE LAWS

The complexity arising from Fox and Goldin's implementation of smoother scheduling should produce the effects of schmeduling. This phenomenon can be appreciated through the example of a smoother determination of residence for income tax purposes. This smoother determination would operate as outlined above: the amount of income allocated to each province's taxation regime would be determined by the percentage of time that the taxpayer spent in that province.

Let us return to the example of Emma. It is two years after the sale of her business, and the proposed sliding scale outlined in the example has been implemented. Emma continues to live in Toronto and to visit Montreal for significant periods of time, but has less taxable income. She has decided to work as a consultant for other startups while she bides time trying to find her next big project, and she would like to make an after-tax income of \$250,000 for the year. (After working extremely hard to build and sell her business, Emma has decided that personal time is more valuable to her than money after a certain point.) Emma spends the first 30 days of the year rock climbing in West Virginia. She then spends 120 days working in Toronto and 120 days working and visiting friends and family in Montreal over the next 240-day period. There are 95 days left in the year, and Emma has earned \$300,000 of pre-tax income so far.

In terms of ironing, it will be extremely difficult for Emma to predict when she should stop working under the sliding scale. She will inevitably have to make an assumption about how much time she will spend in Toronto and Montreal for the year. For example, if she assumes that she will spend 60 percent of the year in Toronto and 40 percent in Montreal for tax purposes, she will need to spend 69 more days in Toronto and 26 more days in Montreal. Recall that time spent in another jurisdiction—the 30-day vacation in West Virginia—counts as time spent in the primary province of residence, so that Emma will be considered to spend 219 days in Ontario (30 + 120 + 69). She will then have to calculate her income on the basis of that assumption, beginning by multiplying the standard income thresholds for each provincial rate schedule by the (assumed) percentage of time that she will spend in each province. The result is as follows:

<i>Income threshold</i>	<i>Adjusted income threshold</i>	
	<i>Ontario (multiply by 60%)</i>	<i>Quebec (multiply by 40%)</i>
\$50,000	\$ 30,000	\$20,000
\$100,000	\$ 60,000	\$40,000
\$150,000	\$ 90,000	\$60,000
\$200,000	\$120,000	\$80,000

Emma must then calculate her current tax liability (as shown in the appendix to this article), determining that she still requires another \$50,000 of after-tax income to meet her desired goal. In order to arrive at the amount of pre-tax income that she

will need to earn to reach her goal, Emma will have to figure out her true marginal rate—49 percent (calculated using the following formula: $[(1 \times 0.3) + ((1 \times 0.6) \times 0.15) + ((1 \times 0.4) \times (0.25))]$)—before dividing \$50,000 by that rate. If we accept Liebman and Zeckhauser's findings, it seems safe to assume that this level of complexity could be sufficient to cause Emma to iron over her true rate schedule. If she did this, she would use some average rate of tax as a proxy to assess her tax liability. As noted above, this could reduce deadweight loss through suboptimal resource budgeting; Emma would miscalculate the point at which it was irrational to work further, dampening the effect of the tax schedule on her labour options.

The complexity of calculating tax liability could also lead to the increased prevalence of spotlighting. Because it is much more difficult for Emma to calculate the tradeoff between the utility of spending any given day in the province of her choice and the tax liability arising from this decision, Emma may be more likely to misperceive the relative utility value of spending a day in Quebec (her province of choice) early in the year. This outcome may occur because of the amplification effect that the complex rate schedule could have on the delayed-payoff feature of the tax. As noted by Liebman and Zeckhauser, "schmeduling will arise more often and in more extreme forms when more of the conditions [giving rise to schmeduling] occur."³¹ The presence of spotlighting, however, would probably have different implications than it did in the food stamp experiment. The added layer of taxation could reverse the consequences of spotlighting with respect to deadweight loss. If a taxpayer (Emma) prioritizes the immediate consumption of days spent in a higher-tax jurisdiction (Quebec) to the extent of misperceiving the marginal liability arising from that decision, a taxpayer (Emma) might end up spending more time in a place (Quebec) than is rational on the basis of tax liability. This outcome is more intuitive when one creates a comparison between price and tax liability. The tradeoff for acquiring food involves sacrificing currency or food stamps, but the tradeoff for Emma in spending more days in Quebec is the potential for increased tax liability. Spotlighting taxpayers may underestimate the liability arising from their decisions. In a way then, spotlighting could have the same result as ironing: a reduction in deadweight loss. If taxpayers decide to spend an irrational amount of time in their (higher-tax) jurisdiction of choice, their decision will be less distorted by the taxation system than it would otherwise be. Thus, Fox and Goldin's proposal has the capacity to be even more efficient than suggested.

CONCLUSION

I believe that it would be premature to jump to the conclusion that the reduction in deadweight loss outlined above would necessarily be the effect of employing a sliding scale to determine residence or employing sliding scales in other settings in the tax system. What I do think that this exercise has demonstrated is that the notion of

31 Ibid., at 4.

saliency should be further developed in considering the potential benefits of adopting sliding scales as opposed to sharp lines. It is clear that the choice to employ sliding scales will be accompanied by greater complexity in certain contexts. What is more relevant is that the types of complexity created by sliding scales may be the ones that increase the likelihood of schmeduling. If taxpayers are more likely to iron and spotlight under a sliding scale, there is the possibility that deadweight loss might be reduced to an even greater extent than imagined by Fox and Goldin. However, this effect might not arise in the way that Fox and Goldin supposed—through the conscious efforts of rational actors to weigh the costs and benefits of tax planning. Instead, the reduction of deadweight loss would result from taking advantage of the bias of taxpayers. This realization should give rise to further questions. For example, is it ethical to benefit from taxpayer bias? One might assume that lower-income taxpayers without the means to obtain expert advice would be more likely to fall prey to such biases. If this were true, it might cast doubt on the ethics of adopting sliding scales. However, these are important questions that are best left to further research on the choice between sharp lines and sliding scales.

APPENDIX
TABLE A1 Detailed Calculation of Tax Liability and Income Requirements^a

Panel A Federal and provincial tax calculation									
Federal tax brackets	Federal tax		Ontario tax			Quebec tax		Quebec tax rates	
	(%)	(\$)	tax rates (%)	tax brackets	tax (\$)	tax rates (%)	tax brackets	(%)	tax (\$)
\$0-\$50,000	10	5,000	0	\$0-\$30,000	na	0	\$0-\$20,000	5	1,000
>\$50,000-\$100,000	15	7,500	0	>\$30,000-\$60,000	na	0	>\$20,000-\$40,000	10	2,000
>\$100,000-\$150,000	20	10,000	10	>\$60,000-\$90,000	3,000	10	>\$40,000-\$60,000	15	3,000
>\$150,000-\$200,000	25	12,500	10	>\$90,000-\$120,000	3,000	10	>\$60,000-\$80,000	20	4,000
>\$200,000	30	30,000	15	>\$120,000	9,000	15	>\$80,000	25	10,000
		65,000			15,000				20,000

Panel B Calculation of income required										
Income allocation					Additional income calculation					
Percentage of time in Ontario					60	Total tax payable				\$100,000.00
Percentage of time in Quebec					40	After-tax income				\$200,000.00
Total taxable income					\$300,000.00	Further after-tax income required				\$ 50,000.00
Taxable income allocated to Ontario					\$180,000.00	Marginal tax rate				49%
Taxable income allocated to Quebec					\$120,000.00	Further pre-tax income required				\$102,040.82

^a Based on the example presented in the text of this article.