Winning at Hide and Seek: The Tax Mix and the Informal Economy

——————————————————————Daniel Brou and Kirk A. Collins*

PRÉCIS

Dans cet article les auteurs élaborent un modèle d'équilibre général pour évaluer les effets que les changements dans la composition des impôts directs et indirects exercent sur l'économie parallèle, qu'ils estiment avoir atteint environ onze pour cent du produit intérieur brut en 1994. Pour évaluer la capacité de chaque méthode d'imposition de générer des revenus, ils évaluent l'effet d'augmentations dans seulement un taux d'imposition. Pour mesurer et comparer les effets de privilégier une méthode d'imposition plutôt qu'une autre, ils analysent également l'effet de changements de la composition de l'assiette fiscale pour un niveau donné de recettes fiscales supplémentaires. Les résultats du modèle d'équilibre général suggèrent que l'imposition directe est préférable à l'imposition indirecte lorsqu'un gouvernement cherche à limiter les activités de l'économie parallèle. Une constatation plus importante peut-être est que lorsqu'on tient compte de l'existence d'un secteur non officiel, les pauvres préfèrent les impôts indirects et les riches les impôts directs. Enfin, les auteurs estiment que les activités de l'économie parallèle font perdre au gouvernement des revenus d'environ 13,6 milliards de dollars.

ABSTRACT

In this article the authors develop a general equilibrium model to evaluate the effects of changes in the mix of direct and indirect taxes on the informal economy, which they estimate was about 11 percent of gross domestic product in 1994. They analyze the impact of increases in only one tax rate in order to assess the revenue-raising abilities of each taxation method. They also analyze the impact of equal-yield changes in the tax mix to measure and compare the

effects of favouring one taxation method over another. Results from the general equilibrium model suggest that direct taxation is preferable to indirect taxation when a government is concerned with limiting informal economic activity. A more important finding, perhaps, is that, in light of the existence of an informal sector, the poor prefer indirect taxation while the rich prefer direct. As a corollary, the authors estimate government revenue lost as a result of informal economic activity to be about $13.6 billion.   **Keywords:** Tax mix; tax policy; tax evasion; tax avoidance; underground economy; Canada.

INTRODUCTION

The informal economy has become a topic of heated debate in Canada. Taxation policy seems to be the main factor inducing informal economic activity. Indeed, recent estimates of the size of the underground economy are based on measures of the "tax-induced" demand for cash. Since the introduction of the goods and services tax (GST), informal sector activity has increased.[1] Recent work also suggests that changes in the tax structure from direct to indirect taxation may be to blame for the upturn in informal activity.[2] We calibrate a general equilibrium model using Canadian data to investigate the effect of the tax mix on the size of the informal economy. In this model, agents have the option of participating in an informal sector, but the government can only tax production and income derived from the formal sector. We analyze changes in the tax mix in terms of their effect on the size of the informal sector and on the welfare of two consumer groups, rich and poor. The model also allows us to estimate the amount of government revenue lost as a result of unreported activity.

The question invariably arises whether there is any justification for reducing informal economic activity.[3] While it is true that the informal economy has many negative aspects, it does have some positive aspects. Usually, workers are driven to informal activities by financial and economic disadvantages in the formal market. By engaging in the informal market, workers can achieve a higher income, which has the effect of reducing existing income inequalities. The informal market is a site of alternative economic activity for people who are not satisfied with regulation or who are victims of social discrimination in the formal market. Informal market activity can also function for the formal market as an indicator of changing economic conditions in the global market, because the informal economy, with its flexibility in production, can adapt more quickly to such changes.

Of the negative aspects of informal, unrecorded economic activity, non-compliance with the tax law is just one. The existence of an informal economy also has notable effects on economic efficiency and the distribution of income. The most obvious justification for reducing informal activity is to raise government revenues through the collection of taxes; Cowell also considers a number

of other reasons.[4] Individuals who engage in informal activity generally are interested in remaining beyond the government's reach and keeping their activity unmeasured. As a result, the redistributive effects mentioned above go undetected, and government statistics do not reflect any reduction in income inequalities. Since legislators base their policy decisions on these statistics, informal activity makes government actions inefficient at best. The informal economy also imposes "hide-and-seek" costs on the economy as a whole: governments spend resources on enforcement and individuals spend resources on avoiding detection.

In terms of production, the informal sector differs from the formal sector in that it typically "involves smaller scale production, less specialization of functions, fewer tools and equipment, and more time wasted between jobs."[5] In short, the informal sector is less efficient at production, and the goods it produces are inferior in quality to those produced in the formal sector. Formal (taxed) and informal (tax-sheltered) outputs are imperfect substitutes, and price distortions between them result in the overallocation of factors toward the less efficient informal sector, which has a negative effect on both efficiency and total welfare.

The existence of an informal economy also unambiguously reduces the optimal level of tax revenues. Individuals engaged in informal activity are able to shelter their income from tax, which has the effect of raising the marginal efficiency cost of taxes.[6] Compounded with the direct loss of revenue from informal activity, this decreased efficiency makes it difficult for governments to collect revenues and carry out socially desirable services.

The importance of including an informal economy in general equilibrium (GE) analysis is most evident in light of the Canadian government's move to the broad-based GST in 1991. Since the implementation of the tax, many studies have noticed a substantial increase in underground economic activity.[7] Armed with this insight, Piggott and Whalley[8] construct a GE model to evaluate tax-base broadening in light of an informal sector and self-supply.[9] In this model, consumption-side gains from the removal of variances in tax rates are counteracted by production-side losses from an increase in tax-sheltered production. These opposite effects do not yield unambiguous theoretical results, but numerical examples imply that the GST is both progressive and welfare-worsening in aggregate.

That the effects of tax reform could be so divergent suggests that more attention should be paid to the informal sector. Policy makers cannot afford to turn a blind eye to unreported economic activity. Informal activity is on the rise and, as individuals become more disenchanted with government tax structures, it is likely to continue growing in importance.

The rest of this article is organized as follows. First, we define what we mean by the informal economy, then outline the different methods used to estimate its size and summarize the results of our estimation. Next, we describe the general equilibrium model we use to test the effects of changes in the tax mix on informal activity. We then present the results of our experiments, and conclude

by summarizing our findings and their implications. In the appendixes, we set out the technical details of our models and variables.

MEASURING THE INFORMAL ECONOMY

Before beginning our analysis of the informal economy, we should specify what we mean by the term. We define the informal economy as comprising all those activities and transactions that would normally be taxed but that are not reported. Our definition thus includes "under-the-table" payments by employers, barter system transactions, rent that is collected (for example, from students) but not recorded as income (for example, by homeowners), underreporting by waitresses and waiters of tips received, and unreported babysitting fees. We do not, however, include activities such as home repairs, gardening, cooking, or other activities that are largely of a self-supply nature, because no transactions take place. We also distinguish between informal economic activity and pure tax evasion. Informal economic activity is characterized by labour-intensive production and inferior quality goods—it is difficult for agents to invest in capital because capital investment increases the likelihood of detection[10]—and exclusion from the National Accounts. In contrast, pure tax evasion occurs when individuals simply lie about their formal sector income to tax authorities, primarily for the purpose of benefit fraud. Since pure tax evasion and benefit fraud are likely to be otherwise captured in the National Accounts,[11] consideration of the effect of tax-mix changes on their incidence is beyond the scope of this study.

Previous Methodology

Studies that have examined the informal economy have employed several different methods in an attempt to measure informal activity. These include the household survey method, labour market studies, the tax-auditing method, the monetary aggregates method, and the income-expenditure discrepancy method. Following Mirus, Smith, and Karoleff,[12] we provide a brief description of these methods and some of the problems that abound.

The household survey method analyzes information gathered from individuals by means of tax auditing and/or household sample surveys that have been designed specifically to estimate the informal economy. These studies, which measure consumption of informal sector output, provide a fairly detailed report of informal activity. Problems with the method arise from non-compliance with the survey and individuals' incentives to lie. Labour market studies use estimates of the number of people in the workforce and/or hours worked, based on sample survey results, to obtain an estimate of the informal economy. These studies measure the characteristics of those involved in underground activity. As with the household survey method, people's incentives to lie are a problem with labour market studies.

Lemieux, Fortin, and Fréchette[13] gather data on the Quebec City informal economy using a combination of the household survey and labour market survey

methods to estimate participation in informal activity and labour responses to changes in taxes. They find that informal labour supply is concentrated among people at the low end of the income distribution and that hours worked in the informal sector increase as the wage rate in the formal sector falls. In terms of demand, they find that people at the higher end of the income distribution are more likely to consume informal sector output. The authors assert that these findings are robust to possible biases.

The tax-auditing method uses individual audits in order to discover those people who are underreporting their income. This method is, unfortunately, quite costly to implement, and the validity of audits has recently come into question. They are, however, somewhat more reliable than surveys because people fear the consequences of lying. Those who are caught falsifying information face stiff sanctions and fines by the government, which can act as a deterrent to entry into the informal market.[14]

The income-expenditure approach is an indirect, non-monetary method of measuring the size of the informal market. One form of this approach relies on the accounting relationship that national income must equal expenditures. If inconsistency occurs among the variables, it is attributed to the activities of the informal market. This approach also has its problems, such as timing and sampling errors. Statistics Canada combines this method and the tax-auditing method[15] to produce its measures, and estimates the size of the informal economy at 4.2 percent of gross domestic product (GDP).[16]

The monetary aggregates approach uses indirect methods to estimate the size of the informal economy. It looks for traces left behind by informal activity that would imply the existence of such an economy. Vito Tanzi[17] developed one of the most widely used monetary aggregates methods. It is based on the idea that most informal activity relies on cash purchases in order to avoid detection. If informal activity is largely a response to taxation, then there should be a significant relationship between currency holdings and personal tax burden. Tanzi concluded that "the tax variable is highly significant in all cases. . . . Furthermore it [indicates] that an increase in the tax rate, presumably through an evasion effect, brings about a greater relative use of currency."[18]

In brief, the Tanzi monetary approach compares two estimates of currency holdings over a period of years. One estimate is calculated using all the tax rates that applied over the period, and the other is calculated using just the lowest tax rate that applied. The difference between these two estimates is defined as tax-induced currency holdings, which are assumed to have accumulated as a result of informal activity. This result is then multiplied by a velocity measure to arrive at an estimate of the tax-induced growth of the underground economy. Using the Tanzi monetary approach, Peter Spiro estimates that the informal economy in Canada was in the range of 8 to 11 percent of GDP in 1993.[19] He notes that even if the true size of the informal economy were at the lower end of this distribution, it would still mean that a substantial amount of revenue is being lost through tax evasion. Our study is motivated by this reality.

The Hill and Kabir Model

The size of the informal economy is an important value in the calibration of the general equilibrium model. We update Hill and Kabir's[20] econometric estimation of the size of the Canadian informal economy. Based on a version of Tanzi's earlier monetary aggregates model, this estimation allows us to include more recent data in our general equilibrium model. We must emphasize that the results of this estimation are meant to complement the data used in the general equilibrium model and are not the focus of this study. Our aim is to determine the effects of tax-mix changes on the informal economy.

Hill and Kabir, using a variety of models, estimate that Canada's informal economy grew over the period 1964-1995 by between 3 and 11 percent of GDP. One of their models, using marginal tax rates, is estimated only until 1991 because of limited data (their equations 5B and 6B; see our table B1). We update this model to include a prediction for the period 1992-1994, using marginal tax rates provided by Davies,[21] which update the data from Davies and Zhang[22] used by Hill and Kabir.

It should also be noted that Hill and Kabir do not estimate the absolute size of the informal economy, only changes in its size over time. We construct a size estimate following the approach used by Spiro.[23] By finding the percentage change in the size of the informal economy over the period 1964-1994, we are able to estimate the actual size of the informal economy through the mathematical techniques discussed below, under the heading "Estimated Changes in the Size of the Informal Economy."

Like Spiro, Hill and Kabir suggest that the velocity of M1 (total cash plus chequable demand deposits) is likely to overestimate the velocity of cash in the underground economy, and therefore they advocate the use of a lower velocity in their calculations.[24] The ratio of GDP to M1 has been as high as 16 in the past, but it is unlikely that an informal economy, which is assumed to rely almost entirely on cash, would support such a high velocity. As Spiro shows, the velocity of M1 grew over the period 1926-1993, for a variety of reasons: flexible banking arrangements allowing interest-bearing chequing accounts, higher nominal interest rates, and greater use of credit cards.[25] The velocity of cash in the informal economy is unlikely to change in response to such factors in the formal economy, primarily because of the informal economy's dependence on cash. Both Spiro and Hill and Kabir use a velocity of 5, which represents the velocity of money in the 1930s, when it is assumed that most transactions were carried out in cash.

Hill and Kabir also analyze the choice of tax rates in the monetary aggregates approach. Rather than use a single tax variable in the equation for calculating the demand for currency, they include direct and indirect tax rates separately. Determining the appropriate weight to give different marginal direct tax rates in the currency-demand equation is inherently difficult, so including both kinds of rates improves the accuracy and reliability of the estimates produced from the

equation. Figure 1 shows the trend over time of the direct and indirect tax rates used in our analysis.[26]

Kesselman[27] argues that it is misleading to use only average direct tax rates to explain currency holdings. Such an approach assumes, incorrectly, that decreasing direct taxes and increasing indirect taxes will reduce currency demand. He shows that if people who evade income taxes also evade indirect taxes to a similar extent, and if evasion is concentrated within certain industries, then greater reliance on indirect taxes may lead to greater tax evasion.[28]

The use of a single, broad-based tax rate that includes both average direct and indirect tax rates yields similarly misleading results from the currency-demand equation. Such an approach assumes, for example, that changing the direct-indirect tax mix while leaving overall tax revenues unchanged would have no effect on currency demand or tax evasion.[29] To avoid these problems with previous studies, Hill and Kabir include a separate indirect tax rate in their calculations, which not only helps to explain changes in currency but also enables us not to prejudge the outcome of the different tax rates. They find that changes in the tax mix that increase indirect and decrease direct taxes seem unlikely to "improve tax compliance and decrease the underground economy."[30]

Hill and Kabir discuss both the theoretical appeal of the various tax rates and their significance in econometric estimation. They find that no one measure stands out above the others and that each can be adequately defended, but they note that the results from the currency-demand equation are significantly more sensitive to marginal tax rates. We use a weighted-average marginal income tax rate because this is the theoretically preferred rate for predicting an agent's decision whether to participate in the formal economy.[31] This is also the rate we use in the general equilibrium model.

Estimated Changes in the Size of the Informal Economy

We estimate two equations for currency demand in the economy.[32] It is evident that increases in marginal and average tax rates after 1964 brought about a sizable increase in tax-induced informal activity. We use the currency-demand equation results to simulate tax-induced informal activity. We do this by freezing direct and indirect tax rates at their 1964 values while allowing all other variables in the equation to take on their actual values. These simulated values are then compared with the values that are predicted when all variables have their actual value. The difference between these two results is assumed to represent the currency required to support tax-induced changes in informal activity.

We then make an assumption about the velocity of money in the informal economy. This value is multiplied by the currency required to support changes in tax-induced informal activity, which yields an estimate of the relative growth in the informal economy since 1964. We employ a sensitivity analysis on the velocity of money in order to judge the reliability of our estimate of the size of

Figure 1   Marginal Direct and Average Indirect Tax Rates, 1964-1994
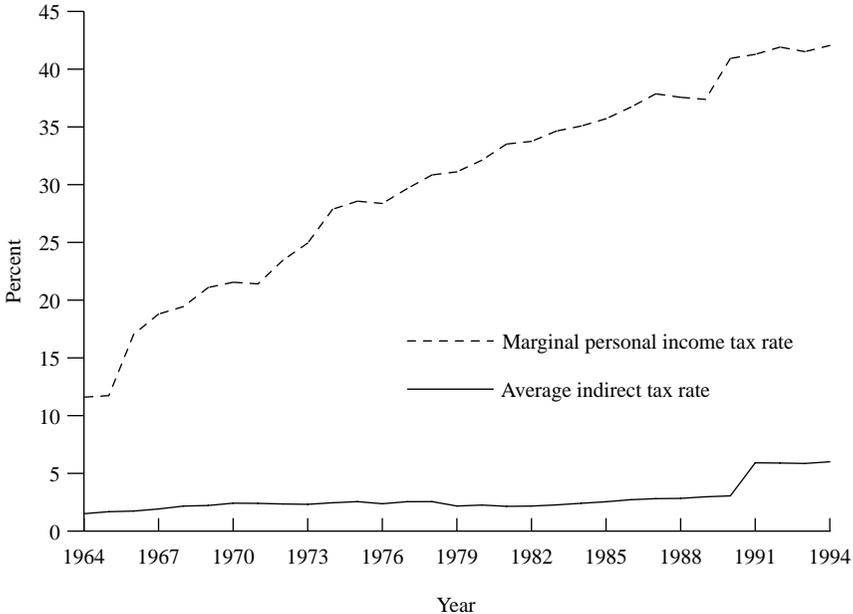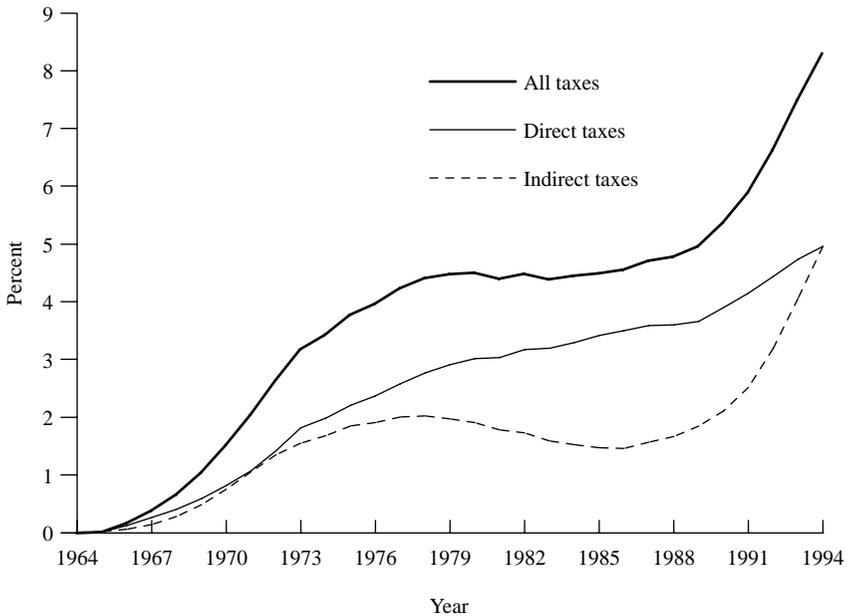

Source: Authors' calculations.

the informal economy as a percentage of GDP. This estimate will be used in our general equilibrium model.

Alternative values for the velocity of money provide a variety of measures of the relative size of the informal economy. Using velocity values from 3 to 8, we estimate the informal economy to be between 4 and 14 percent of GDP. Given this result and the fact that Spiro and Hill and Kabir use a velocity of 5, we narrow the range of our estimate to 7-9 percent of GDP.

To estimate the absolute size of the informal economy, we have to posit an estimate of its size in the base year, 1964. Spiro postulates the size of the informal economy in 1950 as being 0-3 percent of GDP; we conservatively use a lower-end estimate of 3 percent of GDP in 1964. This assumed size, combined with a velocity measure of 5, suggests an informal economy of between 10 and 12 percent of GDP in 1994.[33]

Changes in tax rates play a dramatic role in determining the relative size of the informal economy. Figure 2 suggests that tax policy in the early 1980s, which saw a reduction in indirect taxation that more than offset the steady rise in direct taxation, contributed to a reduction in informal economic activity. This lends credence to our belief that decreasing the tax rate may be all that is required to reduce informal activity.

**Figure 2   Estimated Change in the Informal Economy as a Percentage
of GDP, with a Velocity of 5, 1964-1994
(Weighted by Number of Returns)**

Source: Authors' calculations.

The broad-based GST replaced the hidden manufacturers' sales tax (MST) in 1991. The MST is not included in the measure of tax rates for the period before 1991 because it is not believed to have induced informal economic activity, given its invisibility. As previous studies have shown, the introduction of the GST had a dramatic effect on informal activity. Our results clearly confirm this finding: informal activity increased in 1991 as a result of the new, visible tax.

Figure 2 also demonstrates how average indirect and marginal direct tax rates have affected informal activity over the years. It shows that a steady growth in the direct tax rate has contributed to a steady increase in the size of the informal sector. Changes in the indirect tax rate, in contrast, have led to relatively greater changes in the level of informal activity. Most noticeably, the upward swing in values beginning in 1991 indicates that the introduction of the GST resulted in a dramatic increase in informal activity.[34]

THE GENERAL EQUILIBRIUM MODEL[35]

The GE model is a simple two-good, two-factor tax model. Two consumer groups (representing the rich and the poor) have initial endowments of the two factors of production, labour and capital. Consumers earn income from using

these factors to produce outputs in either the formal or the informal sector. Demand for these outputs is derived from utility maximization subject to the consumers' budget constraints. Supply is derived from firms' profit-maximizing behaviour given the technology available in each sector.[36] A third sector of the economy taxes incomes (through a direct tax) and the sale of goods (through an indirect tax) only in the formal sector and distributes revenue to consumers. We refer to this third sector as the public sector.

The two consumer groups differ in important ways. Aside from having a greater endowment of both factors, the rich are capital-abundant; the poor, in contrast, are more dependent on labour income. Individuals do not, however, differ in the quality of the factors they possess. A key assumption of this model is that agents are free to allocate their endowments between the formal and the informal sectors. A consumer can work or invest in both sectors at the same time and, in equilibrium, each factor will earn the same after-tax return, irrespective of the sector. This implies that the two forms of taxation, direct and indirect, will affect the endowment allocation decision of both consumer groups.

The informal sector differs from the formal sector in that it is not subject to any form of taxation, and informal production uses a different technology from that used in formal production. In particular, informal production is labour-intensive and is less flexible in substituting between capital and labour. For consumers, informal sector output is not a perfect substitute for formal sector output. This assumption prevents the undesirable result that price is the sole determinant of consumption levels. A more general way of thinking about this assumption is that formal and informal outputs differ in quality, warranty, and/or reliability.

Tax policy affects the size of the informal economy in several ways. In-creases in taxation have direct effects on the costs and benefits of participating in the informal sector. On the demand side, higher indirect taxes increase the price of formal sector goods relative to informal sector goods; as a result, consumers will tend to demand higher informal production. On the supply side, higher direct taxes increase the cost of production in the formal sector relative to the informal sector; a lower return on production in the formal sector will therefore increase the supply of informal production.

The structure of the model suggests that increasing either the direct or the indirect tax rate, while holding the other rate constant, will result in substitution of activity from the formal to the informal sector. We also consider equal-yield (revenue-neutral) changes in the tax mix. The effect of such changes on the size of the informal sector depends on demand-side elasticities because "there are both substitution and income effects, which work in opposite directions."[37] The need to consider equal-yield changes arises from the presence of an untaxed sector, which introduces theoretical ambiguity. Equal-yield changes in the tax mix must be of opposite signs (for government revenue to remain constant, an increase in one tax rate must be countered by a decrease in the other). Policy changes of this kind have competing effects on the size of the informal sector.

An example will help to clarify. Consider an equal-yield change in the tax mix that makes income taxes higher and indirect taxes lower. The increase in income taxes induces agents to produce more in the informal sector because factors are now relatively cheaper in this sector. The decrease in sales taxes, however, results in greater demand for formal sector output, which is now somewhat less expensive. Numerical evaluation of a model calibrated to Canadian data will determine which of these effects is stronger.

The model allows us not only to estimate the size of the informal sector but also to evaluate the welfare effects of policy changes. Consumers' welfare will change, for a variety of reasons, in response to a rebalancing of the tax mix. First, individuals tend to substitute one type of good for another in response to changes in the relative price of outputs. A rebalancing of the tax mix that favours indirect taxation will make formal sector output relatively more expensive, forcing consumers to substitute toward consumption of informal sector output. Since formal and informal goods are imperfect substitutes, consumers may be worse off. Second, consumers' budgets will be affected by changes in the price of capital relative to labour. In particular, the poor will benefit from a higher price of labour, while the rich will benefit when capital becomes more expensive.

To measure the change in individual welfare arising from a change in the tax mix, certain effects must be taken into account. Policy changes result in different levels of economic activity as well as in new equilibrium prices. An increase in income may not result in improved welfare if, for example, price increases force consumers to substitute away from their preferred goods. Hence, income alone is an imprecise measure of welfare. Armed with this insight, we use a money-based measure of changes in welfare. When the tax mix changes, consumers' level of utility also changes. We measure the change in welfare as the amount by which a consumer's income would have to be increased, or decreased, under the original tax mix in order to achieve the new level of utility.[38] A positive number suggests that the change in tax policy has made the consumer better off, because it is equivalent to simply giving him a higher income under the original tax policy. A negative number, conversely, suggests that the change has made the consumer worse off.

We calibrate this model to a 1994 benchmark equilibrium data set constructed for Canada. The calibration process uses the structural model to generate underlying parameter values for preferences and technology consistent with the data. We then consider changes in the tax structure to create counterfactual equilibria, which compare with the base case equilibrium in order to perform welfare and efficiency analyses. Specifically, we are interested in the effects of tax policy changes on the size of the informal sector, government revenue, and individual as well as aggregate welfare. Levels calibration yields the required non-elasticity parameters (for example, scale and distribution) that allow us to measure welfare and distributional impacts.[39]

On the supply side, formal sector output is measured as GDP at market prices from the National Accounts. Labour usage in the formal sector is determined on

the basis of estimated wages, salaries, and supplementary labour income. A percentage of this figure is subtracted because it incorporates self-employment income, some of which accrues to capital. Capital usage is the residual necessary to satisfy equilibrium conditions.[40]

Marginal tax rates from Davies and Zhang[41] are used to obtain net-of-tax values for inputs and outputs. The marginal income tax rate for individuals in Canada is estimated to be 20.8 percent and is applied equally to labour and capital income. The marginal sales tax rate is estimated to be 13.4 percent. We assume that the government is efficient in the redistribution of income and that the poor receive 64 percent of government expenditures. This figure may seem high in light of empirical work that suggests that most government transfers are disbursed among the middle class. However, if we consider direct cash transfers, which play a more significant role in agents' decisions, the figure seems acceptably accurate.

As explained earlier, we update Hill and Kabir's estimate of informal activity using data to 1994. Using a value of 5 for the velocity of money in the informal sector, we estimate the size of the informal economy in 1994 to be between 10 and 12 percent of GDP. A base case estimate of 11 percent is used in our general equilibrium calculations.

To obtain a figure for labour usage in the informal sector, we must make some assumptions. Dividing GDP (net of indirect taxes) by the formal labour force, we obtain a rough estimate of the value added per person in the formal economy. We then assume that each labourer in the informal economy has an identical value added. Next, we turn to Statistics Canada[42] for an estimate of labour participation in the informal sector. Statistics Canada considers the possibility that money-demand estimates are correct and that the size of the informal economy can be placed at 10 to 15 percent of GDP. This implies that 1.8 million full-time or 3.7 million full- and part-time workers are currently participating in the informal economy.[43] We construct labour usage in the informal sector as the product of labour's value added and Statistics Canada's estimate of informal labour participation. Capital usage is, again, the residual. The resulting figures coincide with our prior belief that the informal sector is labour-intensive relative to the formal sector. The capital-labour ratio in the informal sector is 0.56, significantly lower than that in the formal sector (0.75).

On the demand side, households are divided into rich and poor. The rich own a large portion of the capital in the formal sector and receive most of the labour income. Following Piggott and Whalley,[44] we define the poor as the bottom 30 percent of households, who account for 10 percent of formal sector labour income. Both rich and poor consumers face the same average marginal tax rates but the poor receive roughly two-thirds of government transfers. The poor receive little income from the formal economy; their income is supplemented by government transfers and by income earned in the informal economy.

Using Lemieux, Fortin, and Fréchette's[45] finding that poor households account for most of the labour supplied to the informal sector, we assume that

these households receive all of the income generated by labour and a large portion of the income generated by capital in the informal sector. Although most production in the informal sector is carried out by the poor, Lemieux et al.'s data show that high-income individuals account for the majority of purchases from the informal sector. Together with public sector redistribution, this results in a substantial transfer of wealth from the rich to the poor.

For consumption figures, we use ratios of consumption found in the benchmark data set constructed for the same year by Piggott and Whalley.[46] They find that the rich account for the greater part of total consumption by a ratio of approximately 5:2. To achieve this ratio in our data set, we assume that the poor consume 30 percent of formal output and 15 percent of informal output. The elasticity of substitution in consumption is also taken from Piggott and Whalley, who use a recent estimate of 0.8 for the United States.[47]

From this point on, the model calibrated to the data described above and the central elasticity values will be referred to as the base case.

RESULTS

We test various changes in the tax mix to gauge their effect on the level of underground activity. Since our model assumes that governments are concerned with the happiness of their citizens, we also analyze tax-mix changes with regard to their effects on individuals' welfare. A summary of our findings is presented in table 1.

Our results differ from the results of much of the previous work. In particular, Kesselman[48] finds that if participants in the informal sector can fully avoid the income tax (as well as the sales tax), then tax-mix changes should have no effect on informal activity. In the Kesselman model, individuals consume both formal and informal outputs but can only participate in either one or the other sector. It is shown that, in this context, producers in the formal sector fully bear the incidence of a sales tax increase; consumer prices are not affected. By assumption, participants in the informal sector do not face the income tax either. A change in the tax mix does not affect the proportion of workers in the informal sector (and hence the size of the informal sector) because informal workers are entirely unaffected by the change.[49] In our model, producers in the formal sector do not fully bear increases in sales tax and all consumers pay (some) income tax. As a result, tax-mix changes do affect the size of the informal sector. A further difference between the two models is that our model introduces a second factor of production. In the Kesselman model, individuals are endowed only with labour. As Kesselman notes, "the possibility that tax mix changes can have stronger effects on avoidance or evasion of taxes on capital-source incomes" is not ruled out.[50]

Table 2 presents the results of our three key experiments. Panel A shows the various cases in which either the income tax rate or the sales tax rate is increased by 1 percent while the other rate is held constant. An increase in either rate

Table 1   Summary of Tax Policy Changes and Their Effects on Relevant Variables

Policy	Aggregate welfare	Rich welfare	Poor welfare	Government revenue	Size of informal sector
Increase income tax	Negative	Negative	Positive	Positive	Positive
Increase sales tax	Negative	Negative	Positive	Positive	Positive
Equal yield (increase income tax and decrease sales tax)	Positive	Positive	Negative	No change	Negative
Equal yield (increase sales tax and decrease income tax)	Negative	Negative	Positive	No change	Positive

increases informal activity and reduces aggregate welfare as consumers and producers turn to the relatively inefficient informal economy. As government revenues increase through the taxing of predominantly rich incomes, transfers to the poor increase. As economic activity is pushed into the labour-intensive informal sector, labour demands a higher wage, further benefiting the poor. An increase in the income tax rate yields better results than an increase in the sales tax: a 1 percent increase results in higher revenue than a comparable increase in the sales tax rate; at the same time, it causes a smaller aggregate welfare decrease and a smaller increase in informal activity. Our findings therefore suggest that a government concerned with both revenue and aggregate welfare should prefer to raise revenues through direct taxation.

Increases in tax revenues favour the poor at the expense of the rich. To isolate the effect of a change in the tax mix from this revenue effect, we consider equal-yield changes in the tax mix. Panel B of table 2 shows the effects of revenue-preserving increases in the income tax rate (that is, decreases in indirect taxes), and panel C shows the effects of opposite movements in these rates. As discussed in the previous section, the effects of equal-yield changes in the tax mix on the size of the informal sector are theoretically ambiguous, because there are opposite effects on the demand for and the supply of informal output. As can be seen from table 2, numerical evaluation suggests that the demand effect outweighs the supply effect. For example, when income taxes are increased and sales taxes are decreased, the use of factors in the formal sector is expected to decrease because they are now relatively more expensive. However, demand for formal sector output increases in response to a lower sales tax rate and the formal sector grows while the informal sector shrinks.[51]

A key conclusion of the equal-yield experiment is that a shift toward sales taxation is progressive while a shift toward income taxation is regressive. A move from indirect to direct taxation induces informal activity and, as a result, the poor benefit from a larger informal sector. It is generally believed that income taxes are mildly progressive. These beliefs are overturned by the inclusion of an

Table 2 Changes in the Tax Structure, Base Case Elasticity and Size Estimates

	Income tax rate change (%)		Sales tax rate change (%)		Change in informal activity[a]	Change in welfare[b]			Change in revenue[c]
	From	To	From	To		Rich	Poor	Total	
A	20.8	21.8	13.4	13.4	0.95	−0.36	0.84	−0.02	3.30
	20.8	20.8	13.4	14.4	0.60	−0.39	0.88	−0.02	3.14
B	20.8	22.0	13.4	12.1	−0.29	0.08	−0.15	0.01	0
	20.8	30.0	13.4	4.5	−1.84	0.40	−0.75	0.07	0
	20.8	35.3	13.4	0.0	−2.80	0.59	−1.11	0.11	0
C	20.8	19.3	13.4	15.0	0.32	−0.07	0.14	−0.01	0
	20.8	14.9	13.4	20.0	1.33	−0.31	0.58	−0.05	0
	20.8	0.0	13.4	40.3	5.06	−1.14	2.08	−0.22	0

[a] Change in the size of the informal sector as a percentage of the original size of the informal sector. [b] Money-equivalent change in welfare as a percentage of the consumer's original income. [c] Change in revenue as a percentage of original total revenue.

Source: Authors' calculations.

informal (and untaxable) sector. This result can be explained on intuitive grounds. The rebalancing of the tax mix in favour of the sales tax results in substitution of demand from formal to informal output. Both rich and poor consumer groups suffer from this substitution because both prefer to consume formal sector output. However, since informal production is labour-intensive, the demand for labour is pushed up. As a result, labour becomes relatively more expensive than capital. For the poor, the increase in labour income more than compensates for the decrease in capital income. Furthermore, a higher income also compensates the poor for the undesirable substitution in consumption. The rich suffer both from the relative cheapening of capital and from the rearrangement of their consumption bundle.

A rather unsatisfying result of our model is that even large shifts in the tax mix do not significantly affect the size of the informal economy. Although a lower rate of indirect taxation may be more effective than a lower rate of direct taxation in discouraging participation in the informal economy, it may be that the present size of the informal economy is due to the total tax burden (the level of government revenue). In other words, the choice of tax mix may affect informal participation on the margin, but the absolute level of taxation may determine the bulk of this activity.

A significant concern with the existence of an unrecorded sector of the economy is lost government revenue. Spiro[52] suggests that all levels of government in Canada together lost approximately $2.3 billion in revenue in 1992, mostly through the avoidance of indirect taxes. However, lost revenue cannot be estimated simply by applying tax rates to current estimates of the size of the underground economy. We use the general equilibrium model to measure uncollected taxes. This approach allows us to model the effects of taxing both income and outputs (that is, applying both direct and indirect taxes) in the informal sector and to consider the effects of corresponding changes in relative prices.

Table 3 presents the results from the taxation of all informal activity. We estimate that government revenue increases by $13.6 billion in the base case. Sensitivity analysis on the current size of the informal sector and on demand elasticities suggests lost government revenue of between $4.3 and $40.9 billion. These results imply that the Canadian government, at all levels, is forgoing as much as 20 percent of current revenue. These estimates of lost government revenue are substantially higher than Spiro's because we consider direct as well as indirect taxes. Taxing the informal sector is found to be welfare-improving in the aggregate. Taxation favours the poor because they receive a large portion of increased government revenues.

It is also important to note that pricing incentives are but one aspect of informal activity; other aspects are likely to be important. For example, losses due to inefficient production and costs incurred to avoid detection are aspects of informal activity that are likely to play a role in the decision whether to participate in the informal economy. Unfortunately, these are beyond the scope of the current analysis.

Table 3 Taxing the Informal Economy, Base Case and Sensitivity Analysis

Estimated size of informal sector	Change in revenue[a]	Change in welfare[b]		
		Rich	Poor	Total
11% of GDP (base case)	6.78	−3.10	9.66	0.54
5% of GDP	2.11	−1.44	4.49	0.25
20% of GDP	20.37	−5.56	17.34	0.96

[a] Change in revenue as a percentage of original total revenue. [b] Money-equivalent change in welfare as a percentage of the consumer's original income.

Source: Authors' calculations.

CONCLUSIONS

This study has attempted to measure the impact of the tax mix on the size of the informal economy in Canada. In a simple model of tax evasion, Boadway, Marchand, and Pestieau[53] show that a tax mix is favourable to other methods of taxation when individuals are able to evade certain taxes.[54] Although their paper provides theoretical guidance toward an optimal direct-indirect tax mix, it also goes some way to substantiating our conclusions, because it advocates the use of the tax mix as a whole, not just direct or indirect taxation, in accounting for evasion characteristics.

With an update of the Hill and Kabir model, our study shows that the informal economy is indeed sizable. There is strong evidence that tax rates have played a significant role in influencing currency demand, and presumably tax-evading informal activity, in Canada over the past 30 years. As a result of policy changes that have favoured indirect taxation, the informal economy seems to have grown quite rapidly over the past 10 years. These implications emphasize the relevance of the tax mix as a possible means of reducing the informal economy.

By developing a general equilibrium model and incorporating the results discovered through regression analysis, we show that there are some interesting issues that need to be considered when formulating a tax structure. Specifically, the tax mix has important effects on the amount of informal activity, and simply including an informal sector in economic analysis alters some of the previously held beliefs about tax policy. For example, income taxes, commonly thought to be progressive, can become regressive in the presence of an informal sector.

A government interested in reducing informal economic activity will find it better to raise revenue through direct rather than indirect taxation. Higher indirect taxes will increase price distortions between the formal and informal sectors and encourage consumption of informal production. In the breakdown of direct taxes, lower taxes on labour than on capital will shrink the informal sector, because giving labour a tax break reduces the incentive to participate in the labour-intensive informal market.

We show that previous estimates have understated lost government revenue from undetected economic activity. Our model places this figure between $4.3 and $41 billion. Even if we assume that the lower estimate is correct, changes in

the current tax structure would produce significant results. Reducing informal activity by means of an efficient tax structure would benefit not only the formal sector of the economy, through increased labour participation, but also the economy as a whole.

APPENDIX A: TECHNICAL DETAILS OF THE GE MODEL

Consumers

Two agents consume the final output of both the formal and the informal sectors. Their preferences are characterized by a constant elasticity of substitution (CES) utility function:

$$
U_j = \left[\alpha_{jF}^{\frac{1}{\sigma_j}} x_{jF}^{\frac{\sigma_j-1}{\sigma_j}} + \alpha_{jI}^{\frac{1}{\sigma_j}} x_{jI}^{\frac{\sigma_j-1}{\sigma_j}} \right]^{\frac{\sigma_j}{\sigma_j-1}} \quad ; j = \text{R,P} \tag{A1}
$$

where α_{ji} is the jth consumer's distribution parameter for output from the ith sector; x_{ji} is the jth consumer's demand for output from the ith sector; and σ_j is the elasticity of substitution for consumer j. The consumer index j takes the values R for rich and P for poor. The sector i takes the values I for informal and F for formal.

Utility is maximized subject to the consumer's budget constraint. The first-order conditions can be manipulated to obtain the consumer's demand for each good as a function of final good prices and his or her own income:

$$
x_{ji} = \frac{\alpha_{ji} \cdot Y_j}{(1+t_i^S) P_i^{\sigma_j} \sum_i \alpha_{ji} \cdot (1+t_i^S) P_i^{1-\sigma_j}} \quad ; i = \text{I,F}; j = \text{R,P} \tag{A2}
$$

where Y_j is the jth consumer's income; t_i^S is the sales tax rate on output from the ith sector; and P_i is the consumer price of output from the ith sector:

Producers

Firms in each sector have access to a constant-returns-to-scale production technology characterized by a CES production function. Use of this functional form allows us to specify different parameters in production for each sector:

$$
Q_i = \phi_i \left[\delta_i \cdot L_i^{\frac{\sigma_i-1}{\sigma_i}} + (1+\delta_i) \cdot K_i^{\frac{\sigma_i-1}{\sigma_i}} \right]^{\frac{\sigma_i}{\sigma_i-1}} \quad ; i = \text{I,F} \tag{A3}
$$

where Q_i represents output in the ith industry; ϕ_i is a scale parameter; δ_i is a distribution parameter; and σ_i is the elasticity of substitution between factors.

Cost minimization by the producers results in the following derived-demand equations, where P_L and P_K are per unit factor costs and t_i^D is the tax rate on income in sector i:

$$L_i = \frac{1}{\phi_i} Q_i \left[\delta_i + (1-\delta_i) \left(\frac{\delta_i (1+t_i^D) P_L}{(1-\delta_i)(1+t_i^D) P_K} \right)^{1-\sigma_i} \right]^{\frac{\sigma_i}{1-\sigma_i}} \quad ; i = \text{I,F} \tag{A4}$$

$$K_i = \frac{1}{\phi_i} Q_i \left[\delta_i \left(\frac{(1-\delta_i)(1+t_i^D) P_K}{\delta_i (1+t_i^D) P_L} \right)^{1-\sigma_i} + (1-\delta_i) \right]^{\frac{\sigma_i}{1-\sigma_i}} \quad ; i = \text{I,F} \tag{A5}$$

Equilibrium

We assume perfect competition in all sectors. The equilibrium conditions arising from this model are:

Demands equal supplies in the factor markets
$$\overline{K} \equiv K_R + K_P = K_I + K_F \text{ and } \overline{L} \equiv L_R + L_P = L_I + L_F \tag{A6}$$

Demands equal supplies for all goods
$$Q_F = x_{RF} + x_{PF} \text{ and } Q_I = x_{RI} + x_{PI} \tag{A7}$$

Zero profit conditions hold in both sectors
$$(1 + t_i^D) P_K K_i + (1 + t_i^D) P_L L_i = (1 + t_i^S) P_i Q_i; i = \text{I,F} \tag{A8}$$

The equations in A2 and A4 to A8 fully characterize the economy. We calibrate this model to a 1994 benchmark equilibrium data set constructed for Canada. Calibration generates underlying model parameter values for preferences and technology consistent with the data. We then consider changes in the tax structure to create counterfactual equilibria, which we compare with the base case equilibrium in order to perform welfare and efficiency analyses. Equal-yield changes in the tax structure are changes that do not alter the level of government revenue. These changes require an alteration in the solution procedure. Government revenue must be made exogenous to the model in order to keep it constant. One of the two tax rates is prespecified at the desired level and the other rate is determined endogenously in order to satisfy equilibrium conditions. Because alterations in the tax regime lead to changes in the pricing structure, revenues must be adjusted by a price index so that they can be compared across equilibria. We adjust revenue with a Laspeyres price index.

A detailed discussion of data sources appears in the main text. Table A1 summarizes the benchmark equilibrium data set, with accompanying notes.

Table A1   1994 Canadian Benchmark Data (Billions of 1994 Dollars)

Production data	Capital	Labour	Output
Formal sector	282.601	376.358	747.26
Informal sector	29.356	52.843	82.199
Total	311.957	439.201	**829.459**

Consumption data	Rich	Poor	Total
Formal sector	523.082	224.178	747.26
Informal sector	69.869	12.330	82.199
Total	592.951	236.508	**829.459**

Household budget constraint	Income from capital	Labour	Transfers	Total
Rich	239.692	280.400	72.859	592.951
Poor	23.605	83.998	128.905	236.508
Total	263.297	364.398	201.764	**829.459**

Notes:

1) Formal sector capital and labour figures include 20.8% income tax.

2) Formal sector labour from wages and salaries, and supplementary labour income less allowance for self-employment capital.

3) Formal sector output includes 13.4% sales tax.

4) Informal sector output is 11% of GDP.

5) Informal labour is arrived at as described in the text.

6) Consumption figures reflect ratios of consumption found in Piggott and Whalley. The rich account for five-sevenths of total consumption.

7) Capital income for the poor is 80% of informal sector capital.

8) Labour income for the poor is 10% of formal sector labour and 100% of informal sector labour.

9) We assume that the poor receive 64% of government transfers.

Source: Authors' calculations.

APPENDIX B: ECONOMETRIC ESTIMATION

All of the variables employed in our estimation of the currency-demand equation are set out below. Explanations of the results and where the data can be located are also provided.

The currency-demand function is:

$$\Delta c = a_0 + a_1 \Delta y_t + a_2 \Delta R_t + a_3 \Delta DT_t + a_4 \Delta IT_t + e_t$$

where

Δc =   the change in the natural log of desired currency holdings;

Δy_t = the change in the scale variable (the natural log of consumer expenditure in this case, which reflects both changes in prices and real incomes);

ΔR_t = the change in nominal after-tax interest rate that measures the opportunity cost of holding currency;

ΔDT_t = the change in the direct tax rate variable;

ΔIT_t = the change in the indirect tax rate variable; and

e_t = an error term.

Hill and Kabir's sample covers the years 1964-1995, with 1991 being the last year in which all variables are compared. Our updated version of the model employs estimates of the marginal tax rates to 1994. This also allows for a better understanding of the impact of the GST on the informal economy.

The data are drawn from a variety of sources, such as the Statistics Canada CANSIM Mainbase, *Historical Statistics of Canada*,[55] and from calculations done by Davies and Zhang for marginal, direct, and indirect tax rates. The data and their sources are as follows (parenthetical accounts refer to CANSIM data):

- *Currency* (B2001) Refers to monthly observations of currency outside banks. The data were averaged to obtain annual results and are in nominal dollars.
- *Marginal direct tax rates* Taken from Davies.[56] He updates versions of the rates weighted both by number of tax returns and by income. These figures are augmented using payroll tax payments taken from CPP Contributions (D20246); QPP Contributions (D20249); UI Contributions (D11241); and Employers' Contributions to Workers' Compensation (D11246).
- *Average indirect tax rate* Calculated using general provincial sales tax revenues (D464273), with data prior to 1965-66 being taken from *Historical Statistics of Canada*; and GST revenues (D459307).
- *Other data* Personal expenditures on goods and services (D10113); gross domestic product (D20011); and the interest rate on 90-day treasury bills (B14007).

The model is estimated using first differences of all variables to avoid spurious regression problems. Spurious regression problems are regression results, involving economic time series, that have high R^2 values and significant *t*-statistics but that fail to have any real meaning. Spiro[57] and Hill and Kabir[58] use seven lags to capture the assumption of sluggish or partial adjustment to changes in taxation structure. In these studies, the interest and expenditure variables are lagged only twice. Results from the regression analysis are presented in table B1.

Hill and Kabir dismiss the inconclusive results from the Durbin-Watson tests because of the use of first differences in their regression. Autocorrelation is "not likely to be a serious problem."[59] It was shown that the models forecast quite well when the last five observations were removed and re-estimated.

Table B1   Comparison of Regression Results for Currency-Demand Models Between Hill and Kabir (1964-1991) and Updated Model (1964-1994)[a]

Model	Constant	Direct tax rate	Indirect tax rate	Consumer expenditure	Interest rate	Adj. R^2	DW[b]
Marginal direct tax rates weighted by income, 1991	−0.048 (−2.6)	1.22 (1.68)	13.16 (2.16)	1.15 (5.59)	−0.009 (−3.25)	0.82	2.8
Marginal direct tax rates weighted by income, 1994	−0.053 (−3.21)	0.817 (1.32)	16.64 (4.08)	1.214 (6.72)	−0.01 (−3.54)	0.82	2.73
Marginal direct tax rates weighted by number of returns, 1991	−0.054 (−3.3)	1.57 (1.45)	16.39 (2.99)	1.17 (6.62)	−0.008 (−2.74)	0.82	2.8
Marginal direct tax rates weighted by number of returns, 1994	−0.05 (−3.36)	1.4 (1.42)	15.21 (4.05)	1.14 (7.24)	−0.008 (−2.83)	0.88	2.66

[a] *t*-statistics are in parentheses. [b] Durbin-Watson test results.

Notes

1   Peter S. Spiro, "Evidence of a Post-GST Increase in the Underground Economy" (1993), vol. 41, no. 2 *Canadian Tax Journal* 247-58.

2   Roderick Hill and Muhammed Kabir, "Tax Rates, the Tax Mix, and the Growth of the Underground Economy in Canada: What Can We Infer?" (1996), vol. 44, no. 6 *Canadian Tax Journal* 1552-83.

3   We are concerned with the welfare issues that arise due to distortions in the tax structure, as opposed to efficiency issues.

4   Frank A. Cowell, *Cheating the Government* (Cambridge, MA: MIT Press, 1990).

5   Jonathan R. Kesselman, *Policy Implications of Tax Evasion and the Underground Economy*, Discussion Paper 95-10 (Vancouver: University of British Columbia, Department of Economics, March 1995), 6.

6   Ibid.

7   See, among others, Spiro, supra note 1, and Kesselman, supra note 5.

8   John Piggott and John Whalley, *VAT Base Broadening, Self-Supply, and the Informal Sector*, NBER Working Paper no. W6349 (Cambridge, MA: National Bureau of Economic Research, January 1998).

9   Bob Hamilton and John Whalley ("Reforming Indirect Taxes in Canada: Some General Equilibrium Estimates" (1989), vol. 22, no. 3 *Canadian Journal of Economics* 561-75) also perform a beforehand analysis of tax reform in Canada, using a large dimensional GE model in which they consider several changes to the tax structure. Their results indicate that a shift to a broad-based sales tax yields modest, but significant, positive welfare effects for the entire

economy and small, regressive distributional effects. Hamilton and Whalley do not consider the possibility of tax-induced movement of market activity into an informal or underground economy.

10 Kesselman, supra note 5.

11 Ibid.

12 Rolf Mirus, Roger S. Smith, and Vladimir Karoleff, "Canada's Underground Economy Revisited: Update and Critique" (1994), vol. 20, no. 3 *Canadian Public Policy* 235-52.

13 Thomas Lemieux, Bernard Fortin, and Pierre Fréchette, "The Effect of Taxes on Labor Supply in the Underground Economy" (1994), vol. 84, no. 1 *The American Economic Review* 231-54.

14 It is the deterrent to lying, in the face of positive probability of being caught or audited, which is of interest in the present study.

15 Gyllian Gervais, *The Size of the Underground Economy in Canada*, Statistics Canada catalogue no. 13-603E, no. 2, June 1994.

16 Of this total, 1.5 percent is already included in the National Accounts.

17 Vito Tanzi, "Underground Economy and Tax Evasion in the United States: Estimates and Implications," in Vito Tanzi, ed., *The Underground Economy in the United States and Abroad* (Lexington, MA: Lexington Books, 1982), 69-92.

18 Ibid., at 80.

19 Peter S. Spiro, "Estimating the Underground Economy: A Critical Evaluation of the Monetary Approach" (1994), vol. 42, no. 4 *Canadian Tax Journal* 1059-81.

20 Supra note 2.

21 James B. Davies, *Marginal Tax Rates in Canada: High and Getting Higher*, C.D. Howe Institute Commentary no. 103 (Toronto: C.D. Howe Institute, March 1998).

22 James B. Davies and Junsen Zhang, "Measuring Marginal Income Tax Rates for Individuals in Canada: Averages and Distributions over Time" (1996), vol. 29, no. 4 *Canadian Journal of Economics* 959-75.

23 Supra note 19.

24 Ibid., at 1065; supra note 2, at 1573.

25 Supra note 19, 1065.

26 The methodology used in calculating the two curves in figure 1 is identical to that of Hill and Kabir, supra note 2. A description of the methodology is presented ibid., at 1564-67 and the appendix.

27 Jonathan R. Kesselman, "Evasion Effects of Changing the Tax Mix" (1993), vol. 69, no. 205 *The Economic Record* 131-48.

28 Ibid.

29 Hill and Kabir, supra note 2, at 1576.

30 Ibid., at 1577.

31 Davies and Zhang, supra note 22.

32 For a detailed description of the methodology, see Hill and Kabir, supra note 2, appendix, at 1578ff. For a less rigorous explanation, see appendix B of this article.

33 This translates roughly into an informal economy of between $74.7 and $89.7 billion in 1994 dollars.

34 Our analysis produces the same conclusions when tax rates are weighted by income instead of by number of returns.

35 For a detailed technical description of the model, see appendix A.

36　The assumption of constant returns to scale in production allows us to consider each consumer as a separate firm.

37　Spiro, supra note 19, at 1067.

38　This welfare measure is called the Hicksian equivalent variation (HEV). An alternate measure, the Hicksian compensating variation (HCV), yields similar results.

39　We acknowledge the lack of availability of reliable data on the informal sector. The values used in constructing the data set are rough at best.

40　For the actual values, see appendix A.

41　Supra note 22.

42　Supra note 15.

43　These numbers are sometimes criticized because they represent a large percentage of the current labour force and the implied time demands on workers are unrealistic. However, we consider these to be realistic estimates because a majority of full-time workers in the informal sector would not be counted in the labour force survey.

44　Supra note 8.

45　Supra note 13.

46　Supra note 8.

47　Since the elasticity of substitution in consumption is a key parameter, sensitivity analysis was performed around the central estimate. Results are similar for alternative values of the parameter.

48　Supra note 27.

49　In fact, the only agent who matters is the marginal agent deciding in which sector to participate. Agents also face a cost (real, psychic, and/or expected) to working in the informal sector. We assume this cost to be zero. See Kesselman, supra note 27, for details.

50　Ibid., at 146, note 27.

51　We also investigate the possibility of applying different tax rates to labour and capital income. Our prior belief is that since the formal sector is more capital-intensive, decreasing the rate on capital income may favour firms in this sector. Results from the model contradict this hypothesis: labour, facing a higher tax rate, moves to the informal sector, and only small quantities of capital from the informal sector are moved to the formal. Hence, relaxing the taxation of labour in favour of capital income taxes is more effective in reducing informal activity.

52　Supra note 1.

53　Robin Boadway, Maurice Marchand, and Pierre Pestieau, "Towards a Theory of the Direct-Indirect Tax Mix" (1994), vol. 55, no. 1 *Journal of Public Economics* 71-88.

54　In Boadway, Marchand, and Pestieau individuals are only able to evade the income tax.

55　F.H. Leacy, ed., *Historical Statistics of Canada*, 2d ed., Statistics Canada catalogue no. 11-516E (Ottawa: Statistics Canada, 1983).

56　Supra note 21.

57　Supra note 19.

58　Supra note 2.

59　Ibid., at 1579, note 57.