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Centre Interuniversitaire sur le Risque,
les Politiques Économiques et l'Emploi

Cahier de recherche/Working Paper **07-46**

An Analysis of Effective Marginal Tax Rates in Quebec

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Décembre/December 2007

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Résumé:

Cet article dresse un portrait de la situation des taux marginaux effectifs d'imposition (TMEI) sur le revenu de travail au Québec. Il vise à permettre une meilleure compréhension de l'impact des politiques gouvernementales sur le comportement des agents économiques. À l'aide d'un modèle de microsimulation comptable reproduisant les systèmes d'impôts et de transferts au Québec pour 2002, nous mesurons les TMEI qui résultent de l'interaction des mécanismes de perception et de redistribution. En outre, nous en évaluons la répartition au sein de la population. L'analyse de ces taux démontre, entre autres, que la politique familiale du gouvernement, dont l'aide est ciblée vers les familles à faible revenu, engendre des TMEI élevés attribuables à la réduction généralement rapide des transferts avec le revenu de travail. Ainsi, plus du quart des chefs de famille monoparentale ont un TMEI pouvant atteindre, et même excéder, 80 %. Quant aux familles biparentales, elles font majoritairement face à un TMEI qui approche 50%. Nous montrons l'importance de tenir compte de l'hétérogénéité, à la fois selon les types de familles et selon les niveaux de revenu, de manière à bien évaluer la variabilité des TMEI à travers la population.

Mots Clés: Taux d'imposition, fiscalité, microsimulation, politique familiale

Abstract :

This article draws up a portrait of effective marginal tax rates (EMTRs) on labour income in Quebec. It aims at allowing a better understanding of the impact of tax policy on the behavior of economic agents. Using an accounting microsimulation model that reproduces the system of taxes and transfers in 2002 Quebec, we measure the EMTRs that result from the interaction of the mechanisms of income taxation and redistribution. Moreover, we evaluate the distribution of EMTRs in the population. The analysis of EMTRs shows, *inter alia*, that family policy, whose assistance is targeted towards low-income families, generates high levels of EMTRs ascribable to the generally fast reduction of transfers as income increases. More than a quarter of heads of single-parent households face an EMTR which can reach, and even exceed, 80%. As for the two-parent families, they mostly face EMTRs of around 50%. We show the importance of accounting for EMTR heterogeneity, both with respect of types of families and levels of incomes, as well as evaluating the variability of EMTRs in the population.

Key words : Effective tax rates, taxation, microsimulation, family policy

JEL codes : D31, D63, H21, H24, I38

1. Introduction

Implementation of redistributive policies by the government generally gives rise to the familiar trade-off between efficiency and equity. We say of a tax system that it is efficient when it minimizes the distortions in the behaviour of economic agents for any level of tax revenues. The tax rates implied by a tax system - while necessary to finance wealth redistribution programs designed to increase equity - may indeed create non-negligible inefficiency costs by modifying the environment within which individuals make decisions. Furthermore, the social transfer system introduces tax rates (albeit implicit) to the extent that the level of the transfers falls with increases in individuals' income. In this context, the design of efficient government policies, as well as the analysis of their impact, requires a thorough understanding of the interaction of tax and transfer systems.

This provides the main justification for this article. Its main contribution is to present the results of a simulation model that reproduces the system of taxes and transfers in Quebec so as to better understand the impact of fiscal mechanisms and income support programs on incentives to earn labour income. The simulation model indeed allows a detailed descriptive analysis of effective marginal tax rates (EMTRs) on personal and household income as they result from tax collection and redistribution. These rates depend in a complex and nonlinear fashion on the characteristics of individuals and households as well as on the level and their type of income. We use our model to estimate these EMTRs and describe their distribution and composition within the population of Quebec. We characterize households for which the family structure and the income composition is such that financial incentives are very weak at the margin - in some cases even nil or negative. Within this exercise we pay particular attention to the situation of families with children since these are, a priori, most affected by the complexity of Quebec's tax collection and income redistribution mechanisms.

A recent publication by the OECD, which dealt extensively with the issue of EMTRs, underscores the importance of a thorough understanding of fiscal mechanisms, such as the one our examination of Quebec allows:

> *The analysis of how benefits and taxes depend on work status and earnings levels does not, by itself, tell us how changes in tax-benefit policy will actually influence labour supply or how many individuals live in income poverty and why. It does, however, contribute to a thorough understanding of the mechanics of tax-benefit systems. This understanding of how different tax-benefit instruments interact with each other, as well as with people's particular labour market and household situations, is an essential pre-requisite for identifying tax-benefit reform priorities* [OCDE (2004)].

The originality of our work is that of drawing a rich and original portrait of the distribution of marginal rates throughout the population of Quebec. To the best of our knowledge, only a single Canadian study, that of Macnaughton et al. (1998), has allowed these effective rates and their distribution across the population to be estimated. This latter study does not cover, however, all of the transfer programs we modelled in Quebec, in particular social assistance.

The rest of this article is organized as follows. Section 2 defines the notion of EMTRs

and discusses its implications for computing the marginal cost of public funds. It also presents a qualitative analysis of the impact of family policy, as it has recently been implemented in Canada and Quebec, on EMTRs. Section 3 is devoted to presenting the model and the data used. Section 4 discusses all the results. Here we look at various measures of the joint distribution of EMTRs and the incomes and characteristics of households. We also decompose the mean rates so as to better understand the impact of different measures of taxation and transfer payments. Section 5 concludes.

2. Effective marginal tax rates

2.1 Definition

In a document published by the Commission parlementaire sur la réduction de l'impôt des particuliers[1] in 1999, EMTRs[2] are described as a phenomenon that arises out of two mechanisms, collecting personal income taxes while simultaneously maintaining a policy of income support. Transfer programs are established in order to provide additional income to some citizens. They can take the form of direct social transfers or of tax code provisions that reduce the tax burden (or yield a rebate). The progressive nature of our tax system, combined with the selectivity of transfer programs, means that an increase in household income results in a double jeapordy: transfers are cut at the same time as taxes rise. As a third element, we add payroll taxes[3].

Mathematically, an EMTR is defined as follows. Assume, to simplify, a one-adult household. Let his disposable income be defined with the identity:

$$YD = YL + YO - T + TR,$$

where YD = disposable income;

YL = labour income;

YO = private, non-labour income; \hfill (2.1)

T = income and sales taxes (including payroll deductions);

TR = social transfers;

with $T = T(YL, YO, Z)$ and $TR = TR(YL, YO, Z)$, and where Z is a vector of individual characteristics.

Thus, we have:

$$YD = YL + YO - T(YL, YO, Z) + TR(YL, YO, Z).$$ \hfill (2.2)

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[1] The *Commission parlementaire sur la réduction de l'impôt des particuliers* is not alone in its interest in the issue of EMTRs. Indeed, it follows in the footsteps of several other commissions and studies that have examined this phenomenon, such as the White Paper on the Personal Tax and Transfer Systems (1984), the Commission sur la réforme de la sécurité du revenu (1996), and the Commission sur la fiscalité et le financement des services publics (1996).

[2] The Government of Quebec uses the term "implicit" rather than "effective." We, however, prefer to reserve the expression "implicit rate" for transfer programs and use "effective rate" to capture income taxes and transfers. Thus, we primarily refer to "effective rates" in this text.

[3] We assume in this analysis that payroll deductions paid by the employee are perceived as taxes, and not as a source of future income (*e.g.,* QPP premiums) or as an insurance premium for guarding against a risk such as the future loss of employment (*e.g.*, Employment Insurance premiums).

Differentiating with respect to *YL* (to simplify, we assume that *T*(.) and *TR*(.) are differentiable in *YL*) yields:

$$\frac{dYD}{dYL} = 1 - \left[\frac{\partial T(\cdot)}{\partial YL} - \frac{\partial TR(\cdot)}{\partial YL} \right]. \tag{2.3}$$

Using equation (2.3), we define the EMTR on labour income as follows:

$$EMTR = 1 - \frac{dYD}{dYL} = \frac{\partial T(\cdot)}{\partial YL} - \frac{\partial TR(\cdot)}{\partial YL}. \tag{2.4}$$

The r.h.s. of Equation (2.4) reveals that the EMTR is the product of increases in income and sales taxes combined with decreases in transfers (when applicable) resulting from a marginal rise in income *YL*. The EMTR thus includes an explicit and an "implicit" component. The latter (also called the clawback rate) is defined as the proportion of the amount of transfers forfeited subsequent to a marginal increase in labour income.

2.2 Distortions and the marginal cost of public funds

The EMTRs under investigation create a gap at the margin between the social and private profitability of individuals' behaviour on the labour market. Thus, they are at the root of distortions in many decisions, such as labour market participation, the number of hours worked, the level of work effort, investments in human capital (education, professional training, *etc.*), the geographical mobility of labour, occupational choices, and black-market labour.

The presence of EMTRs also modifies the calculation of the marginal cost of public funds (MCPF), *i.e.*, the cost to society of a one-dollar increase in tax revenues destined to fund public expenditures. In principle, this supplementary cost must be incorporated into any cost-benefit analysis of government programs. Browning (1976) observes that the social cost of financing a marginal dollar of public expenditures is the sum of that dollar, which can no longer be used for private purposes, plus the change in total costs and social welfare caused by the distortions in individual choices created by the increased EMTR imposed when collecting that dollar. This sum is the MCPF, which thus incorporates the direct tax burden as well as the supplementary bonus. It has been demonstrated (*e.g*,. Fortin and Lacroix, 1994) that, in a linear economy of identical individuals in which the individual's only choice is between leisure and consuming a private good, in which taxes are collected from a proportional tax on income (at a rate τ), and in which the public good is separable in the individual's utility function, we have:

$$CMFP = \frac{1}{1 - \frac{\tau}{1-\tau}\eta}, \tag{2.5}$$

where η is the uncompensated elasticity of labour supply with respect to the net wage rate. Equation (2.5) reveals that the MCPF is increasing in the EMTR, at least to the extent that the uncompensated labour supply elasticity is positive. Thus, when η = 0.3 and τ = 0, the MCPF is 1 dollar, while it is $1.43 when τ =0.5. In this latter case, there is an additional cost (= $0.43) at the margin for society to finance one dollar in additional public expenditure, owing to the greater marginal distortion in the hours of work.

More generally, distortions in the number of hours of labour supplied, as measured by the MCPF, depend on a combination of three factors: the level of effective rates of taxation on labour income, the distribution of individuals (or households) across these rates, and the sensitivity of individuals' labour supply behaviour.[4] In this article, it is the distribution of the values of τ that are of particular interest to us. As we have seen, the MCPF increases with τ (assuming that $\eta > 0$), suggesting that the cost of financing public expenditures increases with their aggregate funding levels. However, it is not only the *average* level of τ confronting individuals that matters. It is, in fact, possible to demonstrate that the MCPF is convex in τ. Thus, for a given mean of τ, the greater its variability across individuals, the greater society's MCPF. Consequently, in this article we will closely examine the mean as well as the distribution across individuals of the EMTRs.

2.3 The role of family policy

Family policy, especially when it is targeted at low- and medium-income households, has a particularly pronounced incidence on the level and variability of the EMTR. This policy comprises a series of fiscal measures and transfer programs designed to support family incomes. In Quebec, it involves both levels of government, provincial and federal. Here we will simply provide a brief description of the main modifications to family policy having been implemented during the 15 years preceding 2002,[5] along with their anticipated implications for the EMTR.

In 1993, the federal government abolished two measures with universal coverage, the family allowance and the child tax credit,[6] in order to focus financial assistance on low income families.[7] These programs were replaced with the Canada Child Tax Benefit (CCTB), which includes a supplement to labour income for low-income families on top of a basic transfer. In addition, the federal government opted to grant a GST tax credit which, like the CCTB, is intended to provide a fiscal incentive to work. In 1997, the Government of Quebec also undertook a thorough reform of the assistance given to children. The design of the family allowance has thus been re-examined. In the past, it was simply a universal program whose generosity increased with the number of children. Since the reform, the family allowance has become a package of financial assistance measures targeted exclusively at low-income families. Moreover, the weight of children in social assistance schedules (now called employment assistance) has become an element of the family allowance. Finally, a universal daycare system at $5 per day was established.

At the provincial level, a non-refundable tax credit is extended to taxpayers with

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[4] Dahlby (1998) derived an expression for the MCPF associated with a hike in the tax rate under a progressive tax system that accounts for the distribution of individuals and the different rates they face. Essentially, this is a matter of capturing changes to government revenue from each tax bracket subsequent to a change to the marginal rate of one of the brackets. This can be done with our model.

[5] A complete portrait of the history of the government's participation in assistance to families is found in Rose (2001) and Vincent and Woolley (2001).

[6] The federal government continues to offer a non-refundable tax credit for the first child of a single-parent family.

[7] This support generally provides a level of assistance (in the form of a benefit, an allowance, a credit, etc.) that reaches its maximum for households whose family income varies between $20 000 and $30 000, approximately. As of a certain threshold located between two boundaries, the financial assistance paid out is gradually reduced until it reaches zero for medium- to high-income families.

dependent children. A supplement is added to the base amount in the case of single-parent families as well as for parents whose children are enrolled in postsecondary education. Taxpayers with dependent children are also eligible for a tax cut with respect to the family.[8] Finally, the provincial government continues to provide financial assistance for daycare through the refundable tax credit for daycare expenses incurred by families unable to take advantage of the $5 per day service. The federal government, for its part, has opted for a tax deduction for daycare costs, deeming them to be expenses incurred for employment that reduce parents' ability to pay income taxes.[9]

Overall, both levels of government have chosen to focus on vertical redistribution. This approach seeks to increase the contribution of wealthier families to assisting poorer families (Baril *et al.*, 1997). Universality in assistance to families has thus almost completely disappeared, and higher and more variable EMTRs upon exiting from income support programs are the flipside of the highly targeted policies for which the federal and provincial governments have opted in recent years.

3. The model and the data used

3.1 Structure and assumptions of the model

The type of model we constructed to examine the distribution of EMTRs in Quebec simulates personal income taxes and governmental transfer programs for a sample of individuals, households, and families obtained from survey and administrative data (cf. Gupta and Kapur [2000] for a general presentation of these models). The model we use was initially created at the Ministère de l'emploi, de la solidarité sociale et de la famille du Québec (MESSF). We adapted it to our purposes. This is a static model that performs accounting calculations to reproduce taxes and transfers for the year 2002. On the basis of the information contained in the database, the simulations replicate the income declarations of each household in the sample and account for the various transfer programs to which it has access. A complete description of the measures applied by the governments of Quebec and Canada that are included in our model is provided in Appendix A.

Several assumptions are necessary for performing a full simulation of tax and transfer programs. For example, no information regarding the amounts of daycare costs incurred by households with children is included in the database. Consequently, this had to be estimated. Thus, we let all families benefit from the $5 per day daycare service.[10] In reality, for a number of reasons, not all parents benefit from this government program. Furthermore, we assume that only 50 per cent of the families eligible for the Parental Wage Assistance (PWA) program take advantage of it. It would not be realistic to include them all, since only families

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[8] This tax cut plays a different role than that of the non-refundable tax credit. The non-refundable tax credit is a fiscal measure that benefits all families, i.e., it is not income contingent. The credit corresponds to 20 per cent of an amount that varies with the number of children. The principle of universality no longer obtains in the case of the tax reduction for families, since this measure essentially benefits low income families: the allowable tax deduction is reduced by 3 per cent of the family income exceeding $26,700.

[9] Vincent and Woolley (2001) compare the two levels of government in terms of what is unique in each one's approach to the tax treatment of daycare expenditures.

[10] It is also possible to run all simulations with regular daycare costs. The tax treatment in effect is then that which prevailed prior to the introduction of the $5 daycare service.

that apply obtain this form of income support. According to the MESSF, approximately 47 per cent of eligible families benefited from the program in 2002. A complete description of our various assumptions is included Appendix B.

3.2   Descriptive Statistics

In the literature, the descriptive analysis of EMTRs is based on two different approaches. Most authors resort to representative agents to compare effective taxation on different household categories. This method is widely used, in part because it is relatively easy to implement. The second approach consists of determining the distribution of EMTRs across the population. It allows a much more complete analysis, but also requires the use of a representative database of households. The model we use has the advantage of allowing results from both of these approaches to be generated.

One example of a representative tax profile is shown in Figure 1 for a two-parent family with one income, two children aged 3 and 5, and participating in the PWA program for the tax year 2002. For the calculations we assume a single source of labour income as well as successive $10 wage increments.

Figure 1 : Example of a tax profile (two-parent family)
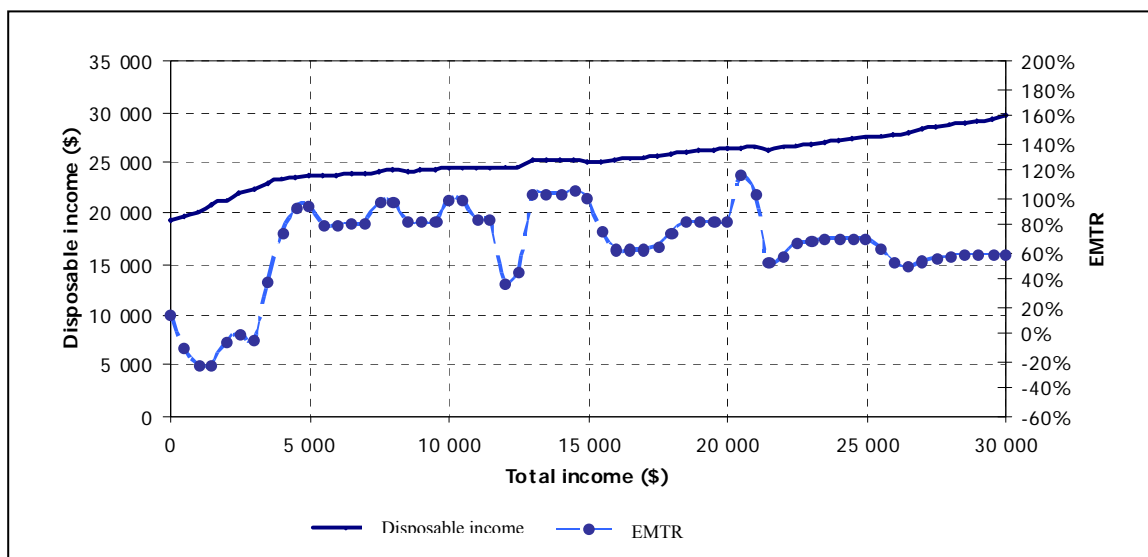
Source: Direction de l'analyse économique et des projets gouvernementaux, MESSF

Figure 1 depicts the evolution of the EMTR as a function of the family's labour income and reveals the zones in which the rates are highest. Quebec's finance ministry also has its own model of disposable income, yielding the implicit marginal rates that are published in Commission sur la réduction des impôts des particuliers (1999) and that underlie the results presented in Ouellet (1998). An analysis of representative tax profiles is also used by Bernier and Lévesque (1995) and Laferrière (2001), who address the programs of the federal and provincial governments, as well as by Davies (1998), who deals exclusively with federal taxes and transfers. Recently, a study by the OECD (2004) also evoked this technique. This study was unique in presenting the budget constraints of different household types for some twenty countries, OECD members and non-members.[11] Three important elements

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[11] Canada was not included in this study.

generally differentiate between studies having been conducted using representative agents: the number of different household types retained, the income intervals considered, and the set of fiscal measures and transfers incorporated into the study. An important finding emerges in most representative agent studies: it is those households that are net beneficiaries of government transfers that confront the highest EMTRs (Government of Quebec, 1999). More generally, it is those with low incomes that are most highly taxed (in effective terms) at the margin (Bernier and Lévesque, 1995; Ouellet, 1998; Davies, 1998; and Laferrière, 2001). This result is not surprising if we examine the structure of governmental transfer policies. In order to target assistance at the most needy households and curb the costs of government programs, transfer measures are indeed accompanied by very high clawback rates (*i.e.*, the level of financial assistance declines very rapidly as family income rises), thus increasing the EMTR.

Nonetheless, there are limitations to the conclusions that can be drawn from an analysis of representative agents. A demonstration that a family with very specific characteristics has an extremely high EMTR within a certain income bracket tells us nothing about how many families are in that position. Therefore, Davies (1998) pushes the analysis a little further, calculating the mean effective rate facing Canadians (51 per cent in 1994). However, this result is based on aggregate data, thus limiting the level of precision of his work.

More detailed studies have been conducted to determine the distribution of EMTRs across the population and to describe the characteristics of individuals facing the highest rates. In 1998, a U.S. study by the Joint Committee on Taxation compared statutory rates (which only reflect the income taxation mechanism) and EMTRs for all households in the country. The study highlighted the fact that 25 per cent of U.S. taxpayers face an EMTR that differs from the official tax rate. In Canada, the corresponding value is 56 per cent[12] for the same fiscal year (Macnaughton *et al.*, 1998). Work by Macnaughton et al. (1998) also revealed that high EMTRs are mostly found amongst taxpayers in the 17 per cent bracket, i.e. those whose incomes are lowest. While only 2 per cent of individuals whose income is in the highest tax bracket are confronted with a different EMTR than that explicitly provided for by the Act, 89 per cent of those taxed at 17 per cent are in that situation. The authors further mention that, aside from income, family characteristics have an impact on the EMTR. Among other things, the effective EMTR increases by two or three percentage points per child - an effect that disappears in the case of families in the highest income brackets. The study by Laroque and Salanié (1999) on the tax and transfer system in France yields results that parallel those generated by Canadian and U.S. simulations.

3.3   The data used

The data we use are from Statistics Canada's Social Policy Simulation Database and Model (SPSD/M). This model was designed to permit the analysis of fiscal policy, transfer programs, and sales taxes for all Canada or for individual provinces. We extract data from

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[12] This is probably a lower bound, since social assistance, which is at issue in the high values of EMTRs, is not included in the simulations of Macnaughton *et al.* (1998).

this microsimulation model and perform calculations with our own model. We proceed in this way because the SPSD/M system is not flexible enough for our purposes and also because some Quebec policies, such as the PWA program, have not been incorporated into it. Nonetheless, we deem the SPSD/M database to best suited to our information needs. It was constructed by combining individual administrative data from personal tax returns and historical data on EI recipients with survey data on family incomes and expenditures.

Five main sources of data allowed the Social Policy Simulation Database (SPSD) to be constructed. The first is the Consumer Finance Survey, which is the principal source of information available to Statistics Canada regarding the distribution of income across individuals and families. Essential information for the simulations we conducted is found in it. A second source of information comes from individual tax returns. These returns provide important information that is complementary to survey data, but is severely handicapped by the absence of detailed information on several aspects of taxation. A sample of historical EI claims represents the third source of microdata. The fourth is the Household Expenditure Survey that is periodically conducted by Statistic Canada. In addition to containing very detailed data on Canadians' incomes and the structure of household expenditures, its main contribution is to supply information on net changes to households' assets and liabilities. Data on savings proved particularly useful during the simulations, for example to determine a family's eligibility for the PWA program (a means test is imposed to determine whether a low-income family qualifies for the transfer). The developers of the SPSD drew on one final source, the Survey of Labour and Income Dynamics. This is a longitudinal survey of households that provides data on income and labour-market experience.[13] The SPSD, containing much more information than a single survey, has all the variables required for the simulations we wish to run.

The data we extracted from the SPSD were initially stored at the level of the individual. We aggregated individuals into a broader grouping, the census family, while retaining the information on each member (for example, labour income of the household head as well as of other family members). The SPSD defines a census family as "a head, their [*sic*] spouse (if there is one), and their children under the age of 25 (including their guardian children), living together in the same dwelling." Thus, two single individuals living under the same roof constitute two census families. Consequently, in the context of our fiscal analysis, these two individuals are considered separately. We also treat an individual aged 18 and over, who is not studying and who earns a taxable income but still lives at home, as single. This processing of the initial database allows us to obtain a sample suitable for tax analysis.

4.   Analysis of the results

Microeconometric studies having examined the impact of government policies on labour supply have generally concluded that the elasticity of labour supply with respect to the net wage rate is relatively low for the population as a whole. However, these elasticities can be greater for specific groups, such as the heads of single-parent families. As a consequence,

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[13] For more information regarding the micro databases and their creation, consult the SPSD/M document *Database Creation Guide*.

it is vital to go beyond the mean impacts that tax and transfer mechanisms might have to analyse their incidence in the framework of specific family situations, in particular at various income levels.

Our microsimulation model makes this possible by measuring EMTRs for a representative sample of the population. Using various tools, such as representative tax profiles and density graphs, we paint a picture of the situation of EMTRs in Quebec. We address the level, distribution, and composition of rates and describe the characteristics of households in the different effective tax brackets. Recall that, as we already mentioned in Section 2.2, the MCPF is convex with respect to the EMTR. Consequently, for a given mean EMTR, the MCPF increases with the variability of the EMTR, and it is thus important to account for this variability.

4.1   Representative tax profiles

As we underlined in Section 3.2, recourse to representative tax profiles is a relatively easy way to compare effective taxation between various household categories. Our presentation differs from that based on representative agents that we generally find in the literature because it is associated with a total EMTR that allows the contribution of each element of the tax and transfer system (income taxes, tax credits, tax rebates, programs to assist families, income supplements, employee payroll taxes such as QPP and EI) to be illustrated. Three tax profiles will be the subject of a brief presentation. For each one, the EMTRs (computed using \$10 increments[14]) are presented for family incomes varying between 0 and \$70 000.[15] We opted for a \$10 increase, at the margin, in order to illustrate more clearly the discontinuities associated with entry and exit thresholds for the various social programs. Furthermore, sensitivity analysis conducted on increments ranging from \$10 to \$1000 reveals that the evolution of the marginal rate in the framework of an analysis of representative tax profiles changes little as a function of the retained income level.

4.1.1 Single individuals

The tax profile of a representative single person is illustrated in Figure 2. Its presentation is relatively straightforward, owing to the limited number of fiscal measures and programs affecting this type of household. We note that the EMTR is initially negative, *i.e.,* the amount received in transfer payments rises following an increase in income. This is because social assistance (also called employment assistance in Quebec) is not affected by the first dollars earned, while the GST credit rises with income. When income exceeds a penalty exemption threshold (\$1200 when the individual is not affected by employment constraints), the presence of social assistance, in conjunction with QPP and EI premiums, pushes the EMTR over 100 per cent. Only when income approaches \$12 000 does the single individual experience a decline in the EMTR. In this situation the concept of a "poverty trap"

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[14] The increase in household income is attributable to a wage raise given to the individual who is considered the "household head" according to Statistics Canada's classifications.

[15] When the family income exceeds \$70 000, the effective marginal tax rate stabilizes at about 45 per cent (depending on the characteristics of the household). With a few exceptions, only fiscal measures on income taxes are imposed on the dollar earned at the margins, while transfer programs generally have no impact on higher income brackets.

truly comes into its own, since we can graphically visualize the presence of a barrier that impedes any incentive to work on behalf of social assistance recipients. Let us also underline the presence of a discontinuity in the rate when income reaches a level that triggers EI premiums (this premium, at 2.20 per cent, applies to the first $2000 earned in excess of this employment income threshold). Finally, we observe that these calculations omit some special benefits accruing to certain social assistance recipients (*e.g.*, the drug insurance plan, dental care, disaster relief, *etc.*) that are terminated when they are no longer in the program. In this case, the EMTR can easily exceed 100 per cent.

Figure 2 : Representative tax profile for a single individual
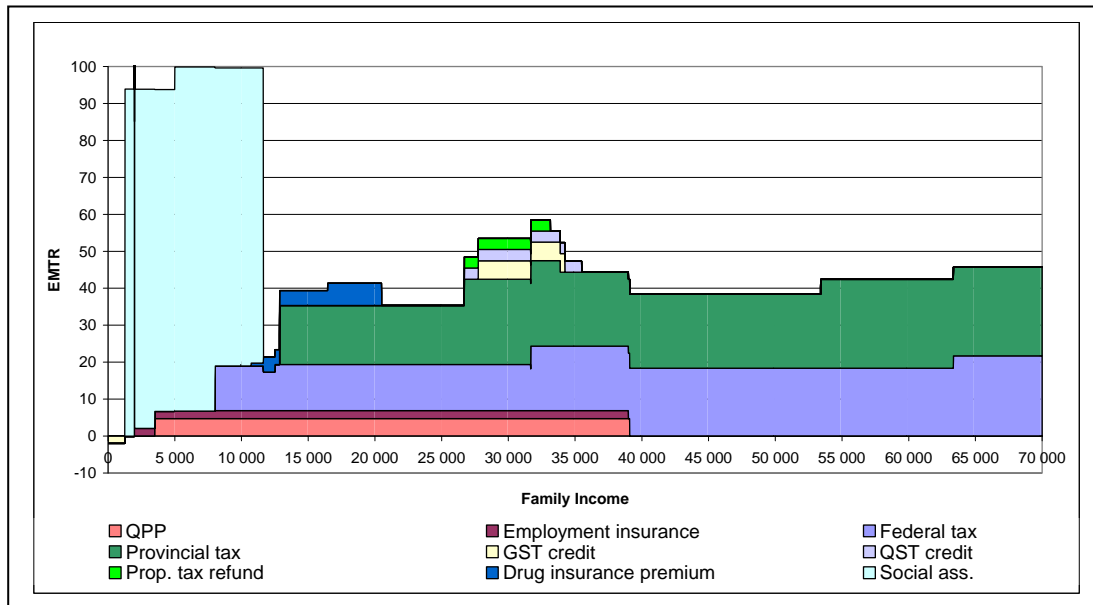
Let us now observe the evolution of the EMTR after leaving social assistance. The conjunction of federal and provincial income taxes, premiums (QPP, EI, and the drug insurance plan), credits (GST and Quebec Sales Tax, QST), and property tax refunds causes the EMTR to vary between 35 and 58 per cent. Aside from the previously mentioned elements, an individual living alone receives an income tax credit. In the graphical representation reproduced above, this credit is included in the category "provincial income tax." Above $26 700, the reduction in the credit results in an increase in 3.1 per cent in the marginal rate attributable to provincial income tax. When single individuals earn over $70 000, their EMTRs stabilize at 45.7 per cent, then at 48.2 per cent at $103 000.

4.1.2 The single-parent family

Overall, the EMTR of the single-parent family is higher and more variable than that of the single individual, owing to its eligibility to a greater number of transfer programs. One example is the National Child Benefit Supplement offered by the Government of Canada, with a rate reduction of 32.1 per cent for families with three children. Figure 3 illustrates the tax profile of the single-parent family.

As is the case for single individuals, we point out that the EMTR can be negative for very low income families. This situation is possible because of the PWA program.[16] Figure 3

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[16] A basic income is necessary to qualify for the PWA program ($1200 annually). The amount required is less

illustrates how the PWA program cuts the EMTR, as the hatched section represents the progression of the rates in its absence. Thus, we see that this government measure partially "breaches" the barrier formed by the reduced social assistance benefits following from a rise in income. Comparable results are obtained from the analysis of representative agents conducted by Bernier and Lévesque (1995), as well as from the Commission parlementaire sur la réduction de l'impôt des particuliers (1999). Conversely, once the single-parent family leaves social assistance, the PWA benefit, along with its supplement (which subsidizes fees for daycare services), are gradually reduced, triggering an increase in the EMTR that may reach 154.6 per cent[17] at the $15 000 to $18 000 level.

Note that the rate is relatively low between $23 000 and $25 000, an income level as of which transfers and credits begin to decline, bringing the EMTR to 80 per cent for the single-parent family (with an income between $28 000 and $36 000, approximately). Notice that the category "provincial income tax" includes the income tax abatement for families. As it is cut (following the increase in income), the marginal rate attributable to provincial income taxes rises by 3 per cent. Also note the presence of high clawback rates, especially for family allowances (35 per cent between $15 340 and $21 200), the CCTB (22.5 per cent between $25 150 and $35 700), and the PWA program with its supplement (43 per cent between $15 340 and $18 460). As of $70 000, the EMTR of single-parent families stabilizes at approximately 50 per cent.

Figure 3 : Representative tax profile for a single-parent family
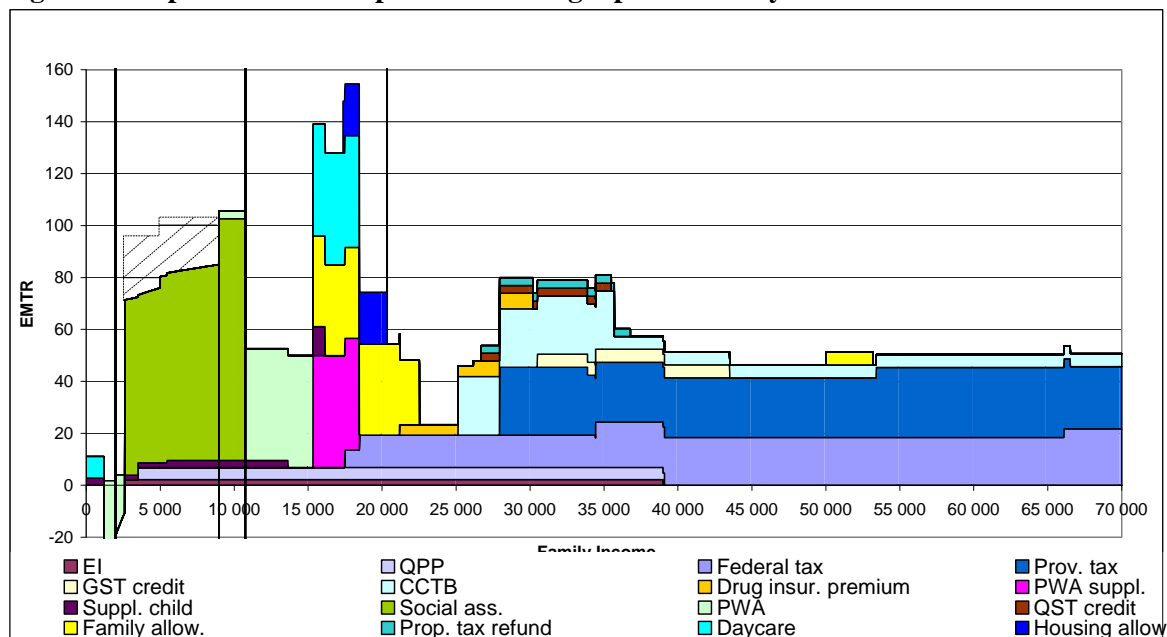
4.1.3 The two-parent family

Figure 4 illustrates the representative tax profile for a family consisting of two children and two adults with a single source of employment income. Note the absence of

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than the threshold below which social assistance benefits begin to decline for the single-parent family ($2400). Consequently, an income supplement is dispensed without the social assistance transfer being affected, which explains why the rate moves below zero before rising.

[17] This rate is reached when we consider the rise in childcare fees confronting the heads of single-parent families when their presence on the labour market increases.

daycare costs and the PWA program supplement, since we assume that one of the two parents remains at home. As we pointed out in the case of the single-parent family, the hatched area represents the rates that would obtain in the absence of the PWA program. We observe that the taxation rate attributable to this program becomes positive (*i.e.*, the amount of the benefit decreases) while social assistance is still received, bringing the marginal rate to over 100 per cent between \$12 500 and \$16 000 (this situation was also observed in the case of the single-parent family). Thus, the PWA program, which is supposed to provide an incentive to participating in the labour market, only partially achieves this goal. We note that the clawback rate (up to 43 per cent) contributes to maintaining the EMTR at over 60 per cent, even when the household ceases to be a net beneficiary of social assistance. Finally, we note that combining it with the Shelter Allowance program brings the total rate to more than 80 per cent for a family whose income is approximately \$20 000.

Figure 4 : Representative tax profile for a two-parent family
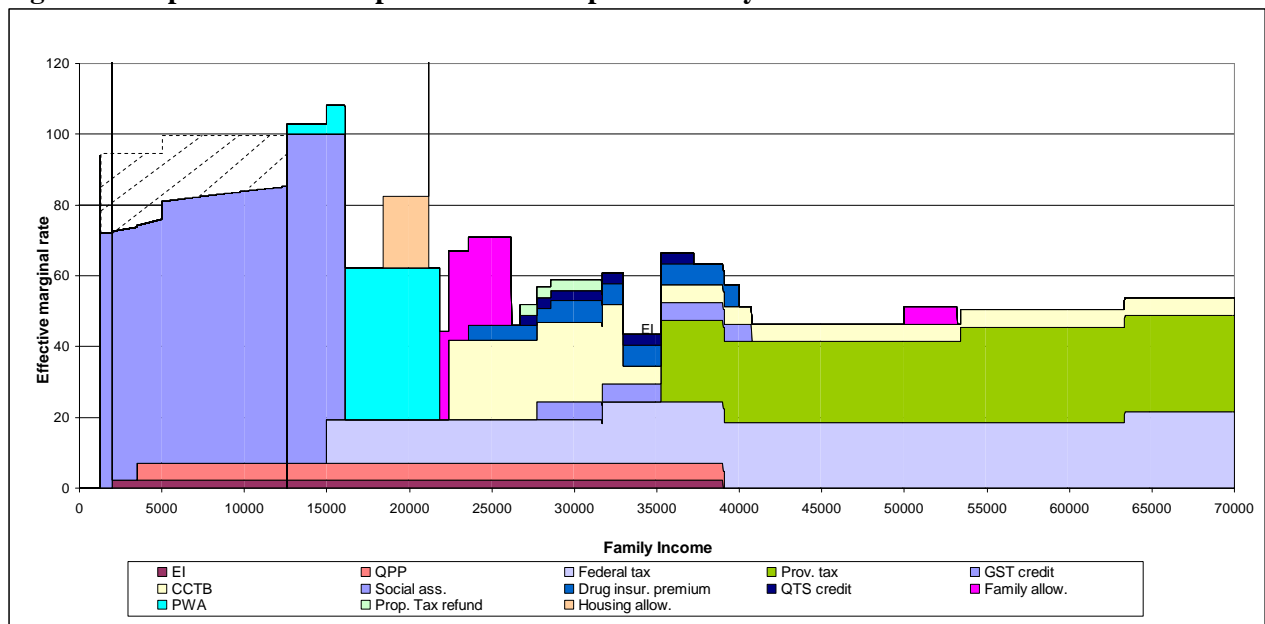
Despite the fact that tax profiles provide a relevant illustration of the evolution of the EMTR, it must be borne in mind that they are only valid for the specific cases that were simulated. Since households are heterogeneous, a representative tax profile cannot be generalized to represent effective taxation of an entire population. Only application of the system of income taxes and transfers to a representative sample of a population can allow the distribution of the EMTR across that population to be examined.
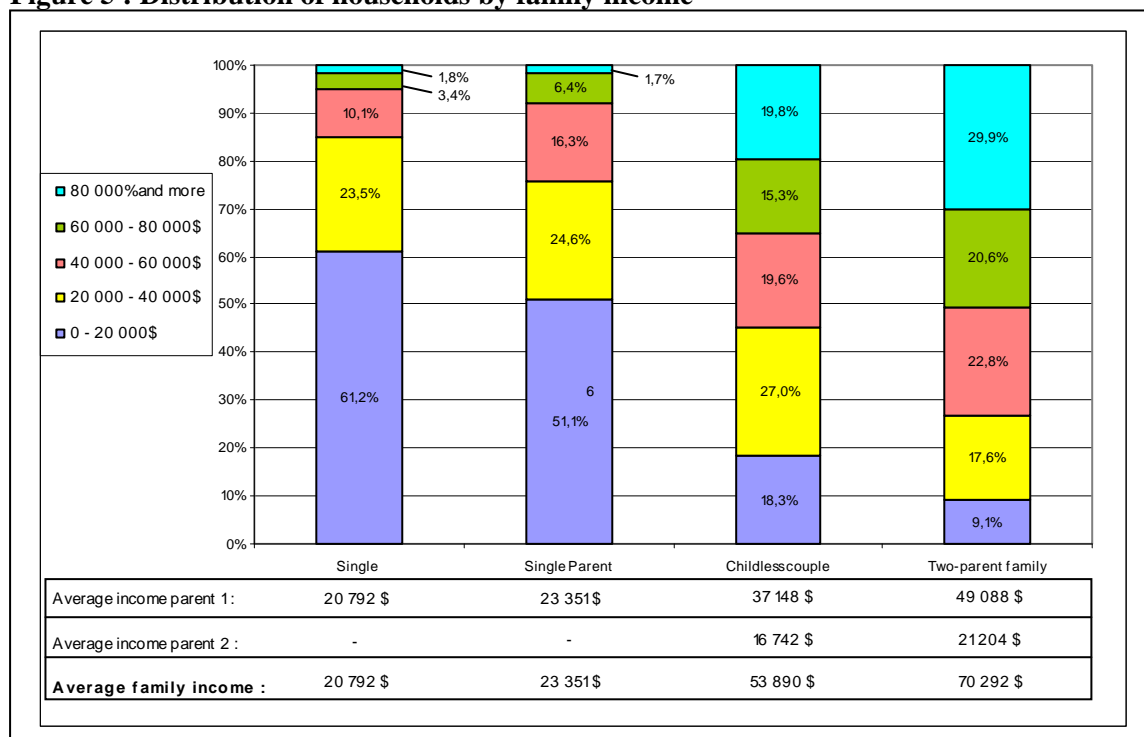
4.2   Simulation from a sample

Table 1 presents the distribution of the four household types studied after the sample has been weighted. According to our sample, 2.9 million households are childless and slightly over 850 000 have children.

Table 1: Distribution of households by family status

	Number of households	Proportion of total population
Childless households	**2 899 201**	**77%**
Single	1 830 259	49%
Childless couple	1 068 942	28%
Households with children(s)	**854 594**	**23%**
Single parent	148 719	4%
Two-parent family	705 875	19%
All households	**3 753 795**	**100%**

Figure 5 : Distribution of households by family income

	Single	Single Parent	Childlesscouple	Two-parent family
Average income parent 1 :	20 792 $	23 351 $	37 148 $	49 088 $
Average income parent 2 :	-	-	16 742 $	21204 $
Average family income :	20 792 $	23 351 $	53 890 $	70 292 $

It is of some use to briefly examine the distribution of households by family income. Figure 5 illustrates this distribution for each of the four groups. The proportion of low-income households is higher among single individuals (61.2 per cent earning between $0 and $20 000) and single-parent families (51.1 per cent earning between $0 and $20 000) than among households with two adults. The group of two-parent families contains the highest proportion of households whose incomes exceed $40 000, 73.3 per cent (54.7 per cent for childless couples, 24.4 per cent for single-parent families, and 15.3 per cent for singles). Figure 5 also shows mean incomes, by parent and for the entire household - again, by family status. In Quebec's fiscal system, income taxes are assessed on an individual basis that partially accounts for the income of the family to which the person belongs. Since we shall pay particular attention to examining EMTRs for families, we note that a gap of a little more than $25 000 separates the mean income of the head of a two-parent family from that of a single-parent family. This gap will have a significant impact on the distribution of the

EMTRs facing these families.

4.2.1 The distribution of the EMTRs

Using our model, we measure EMTRs for $1000 increments in household incomes.[18] Various density measures were invoked to examine their distribution throughout the population. These allow us, for example, to determine the percentage of the population facing an EMTR that exceeds 60 per cent, or to characterize households for whom we find the highest effective rates. To do this we used nonparametric kernel estimation techniques (Fournier, 2005).

4.2.1.1 Marginal rates for the entire population: three peaks

Figure 6 presents the distribution of the population according to the values that the EMTR can assume. Three peaks characterize this distribution: zero EMTR, the 35 to 50 per cent tax bracket, and effective taxation at 100 per cent. With regards to the first peak, we first observe that 11 per cent of households benefit from a negative EMTR, *i.e.*, marginal increase in their income will yield an additional net transfer. If we include, in this first group, all households for whom the effective rate of taxation is below 20 per cent, then one household in five benefits from a negative or relatively low rate.

Figure 6 : Density of the EMTR for the entire population
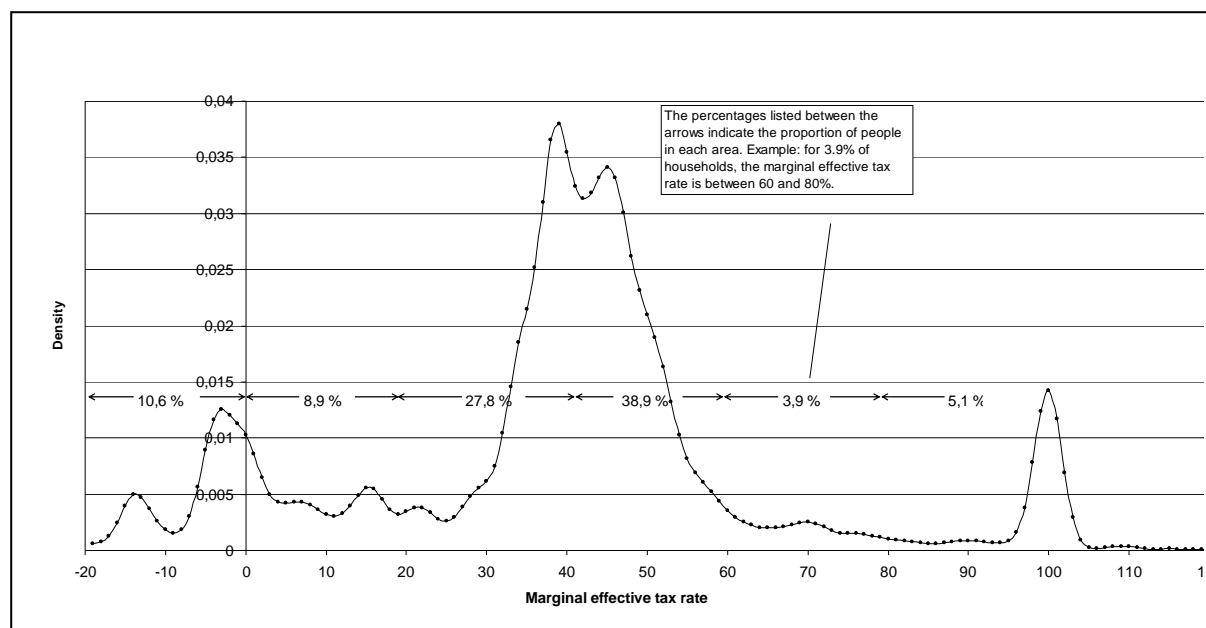
For nearly half of households (46 per cent), the EMTR falls between 35 and 50 per cent. For this second peak, in the centre of the graph, we distinguish between two sub-peaks, at 39 and 45 per cent. These two effective rates essentially correspond to the marginal rate of

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[18] The representative tax profiles we presented previously were based on a $10 increase, at the margin, in order to illustrate more clearly the cuts associated with entry and exit thresholds for the various social programs. In order to analyse EMTRs across the population, we opted for a greater increase that probably better captures the situation of an individual receiving a wage raise. Furthermore, the $1000 raise is commonly used in the literature, especially by the Commission parlementaire sur la réduction de l'impôt des particuliers (1999) and by Laferrière (2001), making it easier to compare results. As for the representative tax profiles, the increase in household income is attributable to a wage raise given to the individual who is considered the "household head" according to Statistics Canada's classifications.

income taxation of the two levels of government: 20 and 24 per cent provincially, and 22 and 26 per cent federally.[19] Households finding themselves in this situation are mainly those whose family income exceeds $40 000 and who are, at the margin, relatively unaffected by government programs.

Finally, for 8 per cent of households, the EMTR is greater than 80 per cent. Indeed, for most of them it reaches 100 per cent, corresponding to the loss of one dollar of transfers for each additional dollar earned. With a mean family income of $6779,[20] it is essentially households receiving social assistance that we find in this category (households whose benefits are amputated by one dollar for each additional dollar in labour income). Households whose EMTR is nil also benefit from financial support from social assistance. However, the family income of these latter is so low that, when we increase it by $1000 in our simulations, it remains below the threshold for exemption from penalties under social assistance (meaning that an additional dollar of income will not result in an equivalent reduction in the transfer). Within the group of households whose marginal tax rate is 100 per cent, we find 5 per cent of single-parent families, compared with 1 per cent of two-parent families. Also, 10 per cent of single individuals are in this situation. The following figures and tables allow us to better grasp the characteristics of the households that cluster around the three main taxation peaks.

In order to extend our analysis and elaborate on the results mentioned above, a second graph allows us to study the distribution of the population as a function of two variables, the EMTR and family income. This graph is yielded by the estimation of a bivariate density. Observe Figure 7, in which we again find the three peaks that characterize the distribution of the population as a function of the tax rate. This new figure adds some information to our analysis. We see that households confronting rates that are either nil or 100 per cent are clearly concentrated in the lowest income brackets (i.e. between $0 and $20 000). In addition, rotating the graph (see the lower pane in Figure 7) reveals the presence of a single peak for medium- and high-income households. To verify this, we estimated the density of the EMTR conditional on income. This measure can be seen as a cross-section of the graph of the bivariate density at a given level of income. These results are presented in Figure 8. In the case of households whose family income is $10 000, we identify three zones of concentration at 0, 40, and 100 per cent, while those whose family income is $80 000 are all clustered around a single peak.

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[19] At the provincial level, the marginal rate of taxation on incomes between $26 701 and $53 405 is 20 per cent, rising to then 24 per cent above $53 405. Federally, it is 22 per cent between $31 678 and $63 345, and then 26 per cent above $63 345. For the sum of the rates of the two levels of government to be 39 and 45 per cent, it is necessary to account for the Quebec tax abatement that reduces federal taxation.

[20] This mean family income was measured for households whose marginal rate is between 95 and 105 per cent.

Figure 7 : Joint density of EMTRs and incomes for the entire population
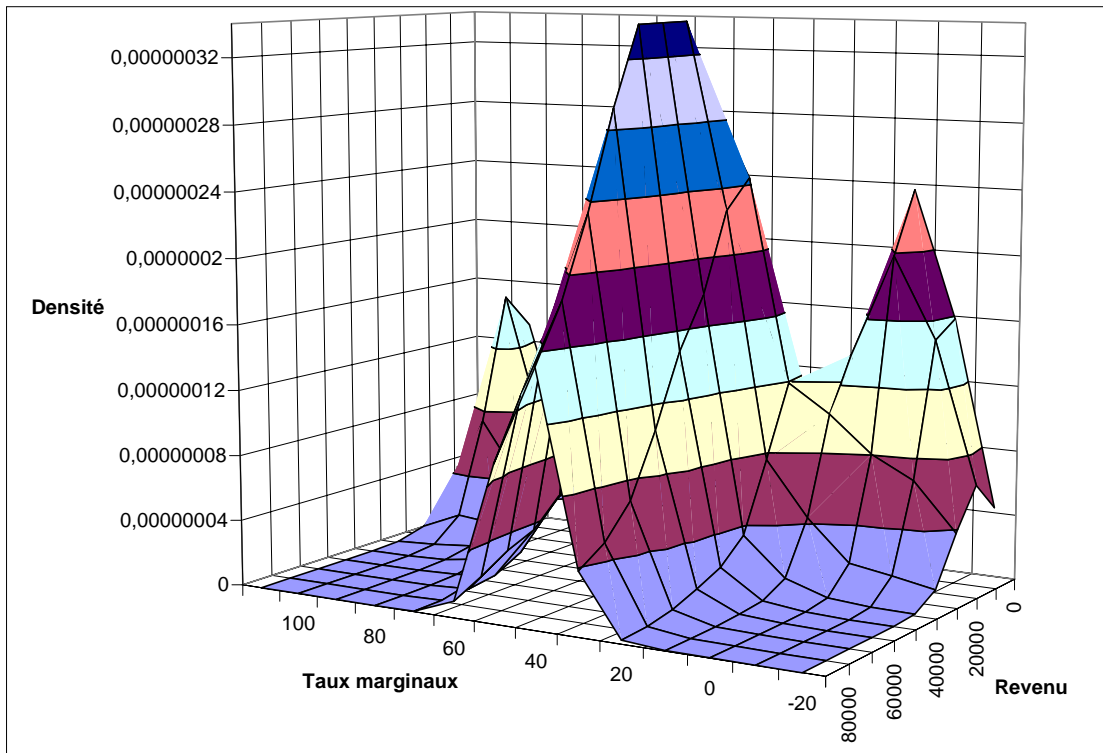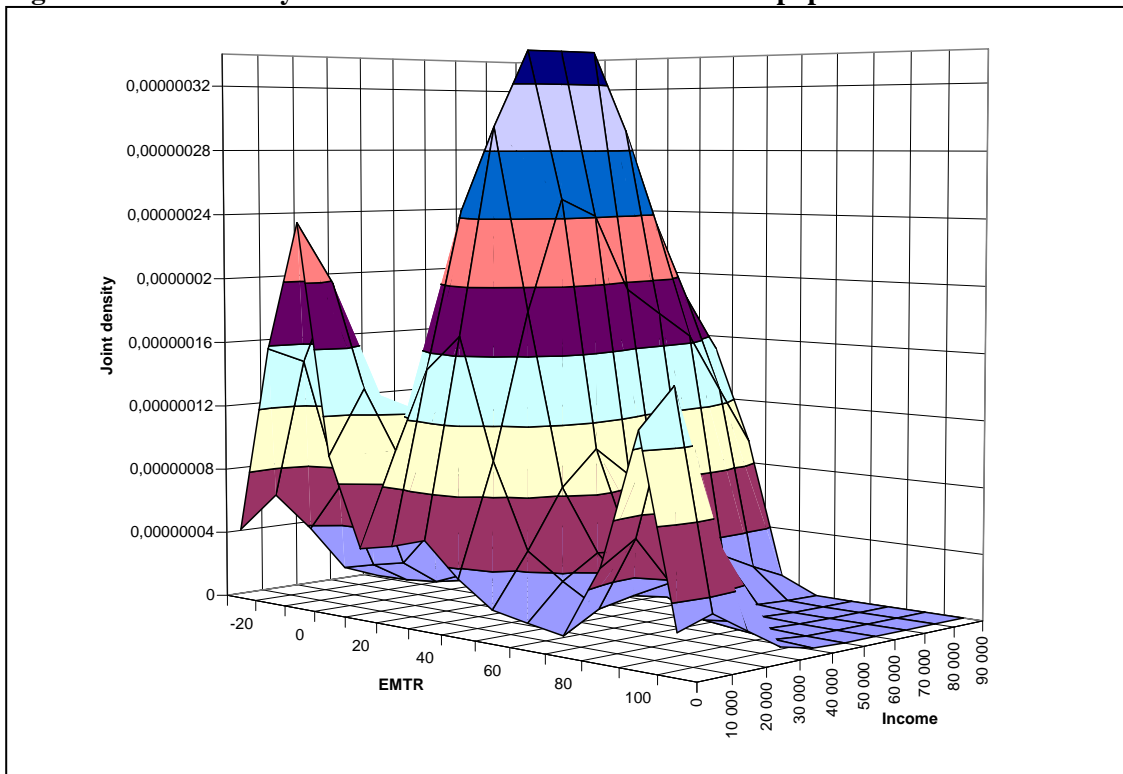
Figure 8 : Density of EMTRs conditional on income being $10 000 and $80 000

Density of EMTRs at an income of $10 000

Density of EMTRs at an income of $80 000
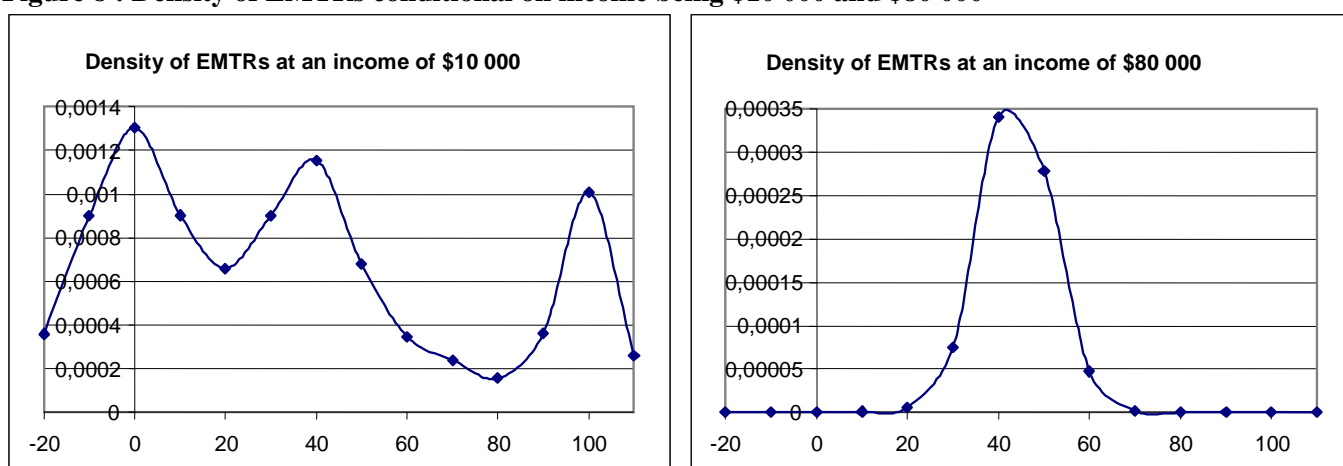
4.2.1.2   *Marginal rates by family status: the impact of the income distribution*

The four graphs presented in Figure 9 take our analysis yet further. They present the distribution of households as a function of EMTRs and income, by family status.

Although we do observe some occurrences amongst single-parent families, the majority of households facing a 100 per cent EMTR are those with no children (single individuals and childless couples). This is an interesting point, and merits that we pay some attention to the underlying explanations. At first blush, it appears plausible that the PWA program is a factor since, as we stated when presenting the representative agents, it contributes to lowering the marginal rate in the zone in which households are the beneficiaries of social assistance. After further investigation, however, it seems that the PWA program is not the reason for this result. In fact, we tested the sensitivity of our results for families by varying participation in the PWA program, from complete non-participation to full participation. Our results showed little sensitivity to these changes. While the PWA program has a significant impact on reducing the EMTR for some household types, as we saw before and as discussed in the literature by Bernier and Lévesque (1995), its impact remains minor in terms of the distribution of EMTRs amongst all families. Rather, the fact that households that are taxed at 100 per cent at the margin tend not to be families is explained as follows. Those for which we have a 100 per cent EMTR are largely those whose income is greater than $0 and less than $10 000 (households with one adult) or $15 000 (households with two adults). This applies to 26 per cent[21] of single individuals, explaining their prevalence in the 100 per cent EMTR group.

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[21] The proportion of single individuals whose income is greater than $0 and less than $10 000.

Figure 9 : Joint density of EMTRs and incomes, by status

Single

Childless couple

Single parent
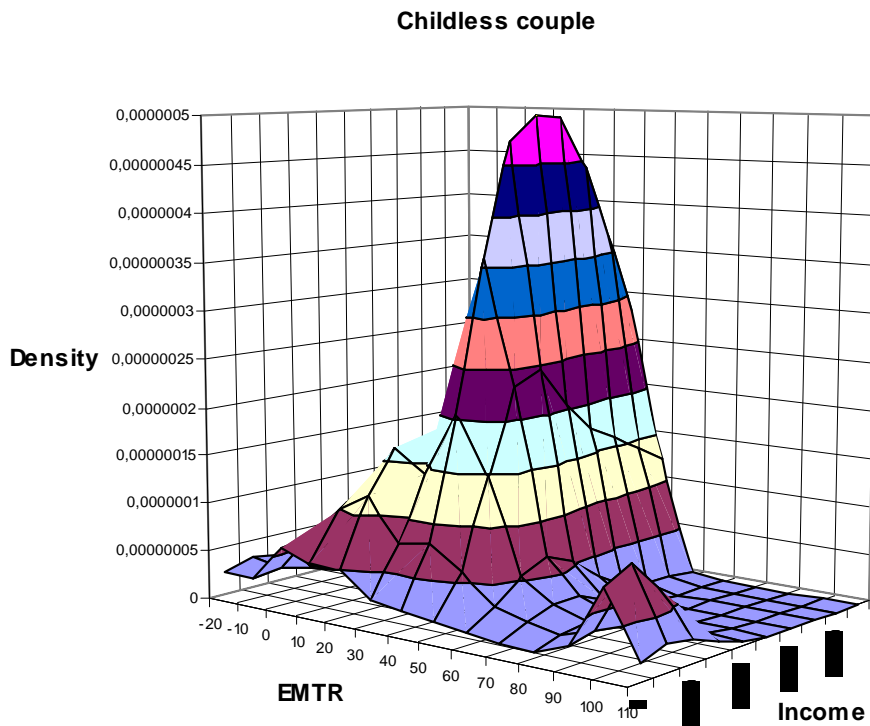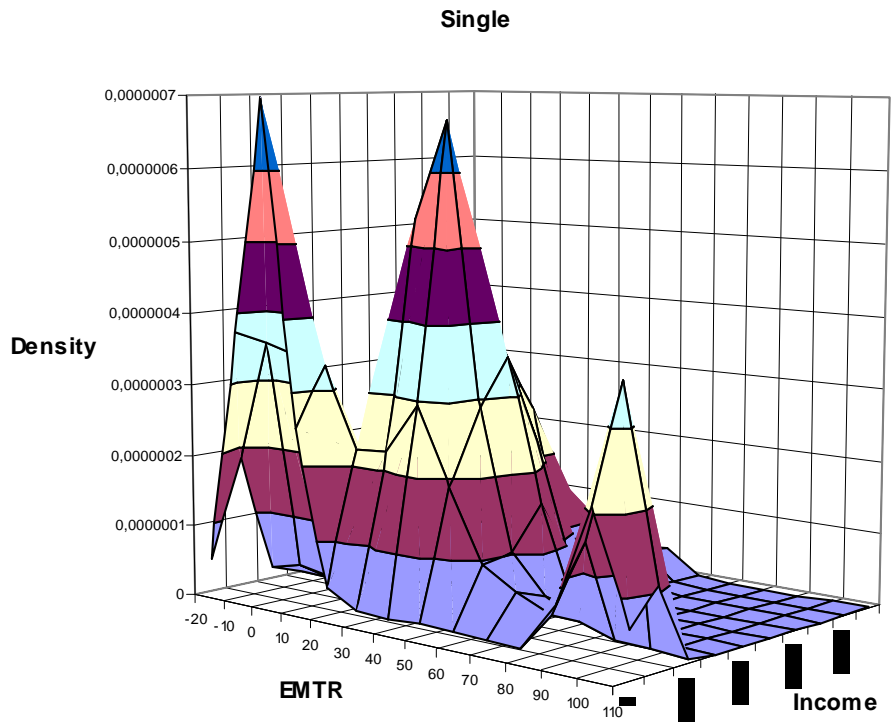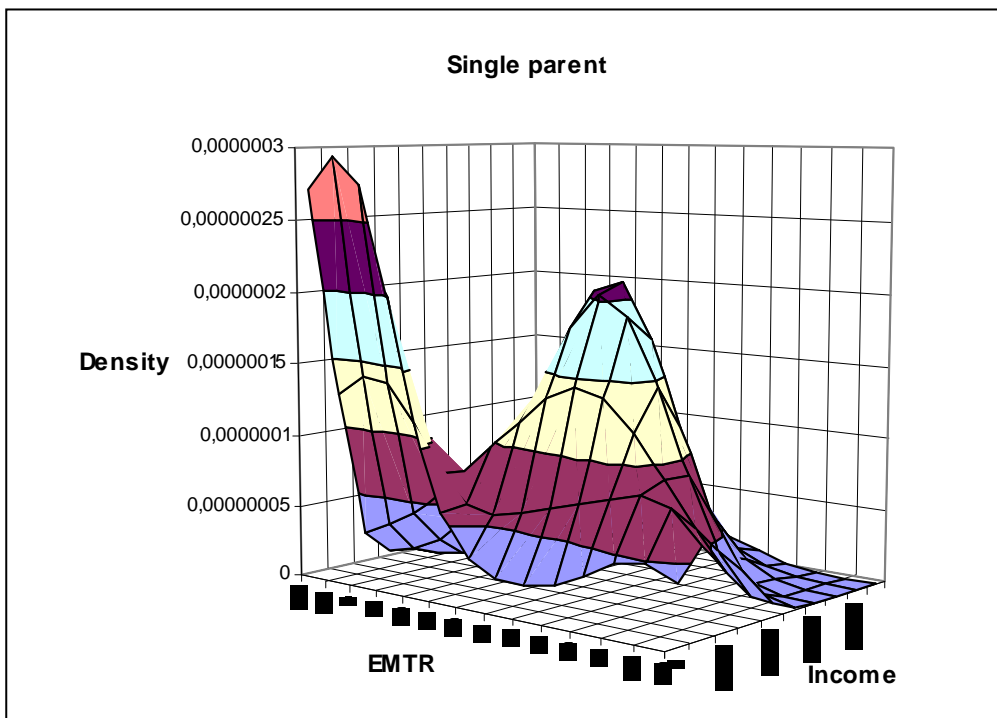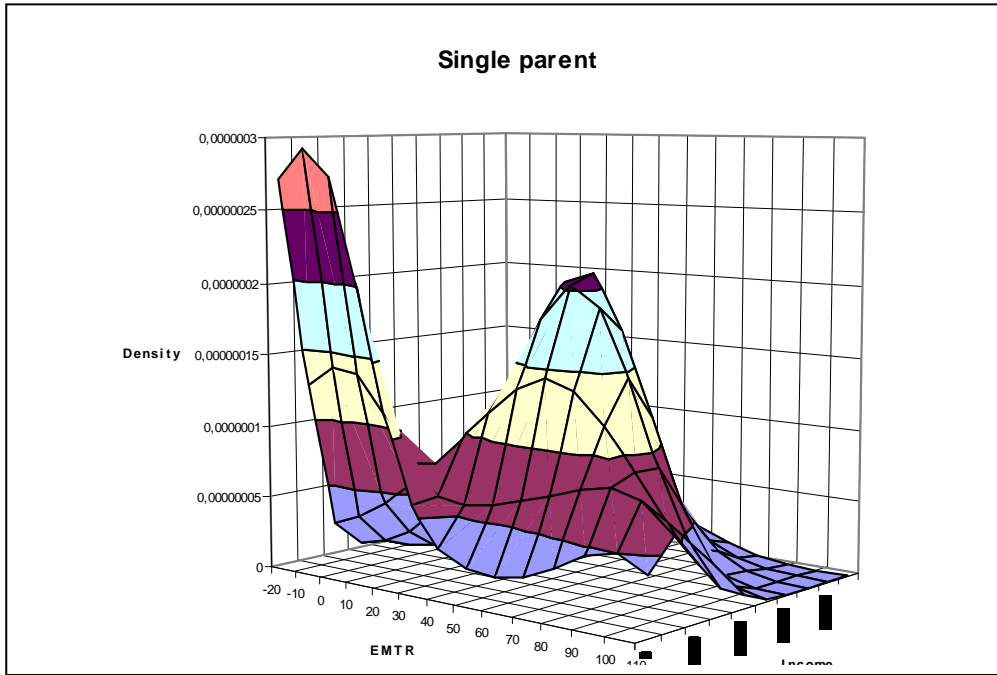
Single parent

Amongst single-parent families, 15 per cent are in this situation, while 24 per cent have a family income that is nil. For these latter, the maximum income allowed by social assistance is not reached when a $1000 rise in income is simulated. Consequently, their marginal rate is nil, or even negative, when the family qualifies for the PWA program but does not surpass a threshold beyond which it is penalized. Also, for single-parent families that are penalized (by the loss of some of the social assistance benefit), the PWA program effectively lowers the marginal rate to approximately 80 per cent.[22] As to two-income

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[22] It is important to recall that we assumed that only 50 per cent of families participate in the PWA program.

households, fewer of them have an income below $20 000 (9 per cent), which explains the low percentage among them with a marginal rate of 100 per cent. In summary, it is primarily the distribution of incomes unique to each group that explains why households with children are not typically taxed at a marginal rate of 100 per cent. Moreover, we should not forget that a hike in income of $5000 would leave over 80 per cent of families in a situation in which their effective tax rate, for a $1000 raise, would be nil.

We have mentioned that a significant proportion of single-parent families benefit from an EMTR equal to zero. We also find a significant concentration amongst single individuals. Once again, these households are generally those with zero family income. The greatest proportion is in households with a family income equal to zero among singles (10 per cent) and single-parent families (24 per cent). We also note that low income taxes are levied on youths aged 18 and plus who are not enrolled in post-secondary studies and live with their parents. With a mean EMTR of 25 per cent, these youths contribute to raising the proportion of single individuals faced with low EMTRs.

For the four household types, we observe significant clustering in the central zone of the graphs. However, close examination reveals that this clustering occurs around a different rate for each of the four groups. For single individuals and childless couples, the centre is at an EMTR of 40 per cent. For families, the greatest concentrations are at higher rates, 50 per cent for two-parent families and nearly 60 per cent for single-parent families. This result reflects the presence of many transfer programs that directly affect the family. We will discuss this in greater detail when we analyse the different components of the EMTR. When we examine the graph of the density of the marginal rates for the entire population, the zones of highest concentration are located around 39 and 45 per cent, *i.e.,* below the levels that characterize families. This is because single individuals and childless couples represent 75 per cent of the weighted sample.

In conclusion, we point out that the distribution of rates is particularly smooth in the case of two-parent families. Since 73 per cent of them have a family income that exceeds $40 000, they are, for the most part, taxed at a rate of approximately 50 per cent at the margin. This rate is broken down into two components: income taxes levied by the two levels of government (45 per cent) and the CCTB (5 per cent). This reveals that, at the margin, the burden on two-parent families is already quite high. For the most part, their situation is such that only one half of income earned at the margin is available to them. Consequently, a reform of the tax and transfer systems that would increase the effective tax burden on medium- and high-income households would raise the EMTR, which is already high, on two-parent families.

4.2.2 The expected marginal rate as a function of income: an overview for each group

At this point, we are principally interested in the expected marginal rate as a function of family income. This allows a more targeted assessment of the impact a wage raise may have given a specific financial starting position. While the density measures we have already

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Thus, some families receiving social assistance may be taxed at a 100 per cent rate.

looked at shed light on the *distribution* of rates, estimating expected marginal rates reveals the expected *level* that the EMTR can attain for a given income level.

The first conclusion that arises when we observe the expected marginal rate for each of the four household groups is that, for some income brackets, families (whether headed by one or two parents) may be confronted with a marginal rate that exceeds the 50 per cent bar. This is not the case for singles and childless couples, as we see in Table 2.

Table 2: Expected marginal rate as a function of income, by family status

	0 $ - 10 000 $	10 000 $ - 20 000 $	20 000 $ - 30 000 $	30 000 $ - 40 000 $	40 000 $ - 50 000 $	50 000 $ - 60 000 $	60 000 $ - 70 000 $	70 000 $ - 100 000 $
Single	27.3	34.8	41.0	46.0	40.3	40.5	43.1	45.3
Single parent	14.9	49.7	57.3	59.6	53.4	49.1	49.4	48.9
Childless couples	41.8	36.0	36.6	42.1	40.0	39.3	40.2	41.3
Two-parent family	17.0	36.7	51.4	53.4	47.6	46.4	47.7	45.4
Total population	**28.6**	**35.9**	**41.5**	**46.6**	**42.5**	**42.1**	**43.9**	**43.5**

Overall, families face the highest average tax rates. Conversely, when household income is below $10 000, the expected rate on families is lower than that on childless households. It is within the group of single-parent families that the highest expected EMTR is observed. Between $15 000 and $45 000, the expected rate for this group remains above the 50 per cent threshold, reaching 62 per cent at $35 000 (cf. Figure 10).

As a rule of thumb, the expected rate varies significantly with the family status when income is below $50 000, while it converges to 45 per cent for all higher-income households.

Figure 10 : Expected marginal rate as a function of income, by family status
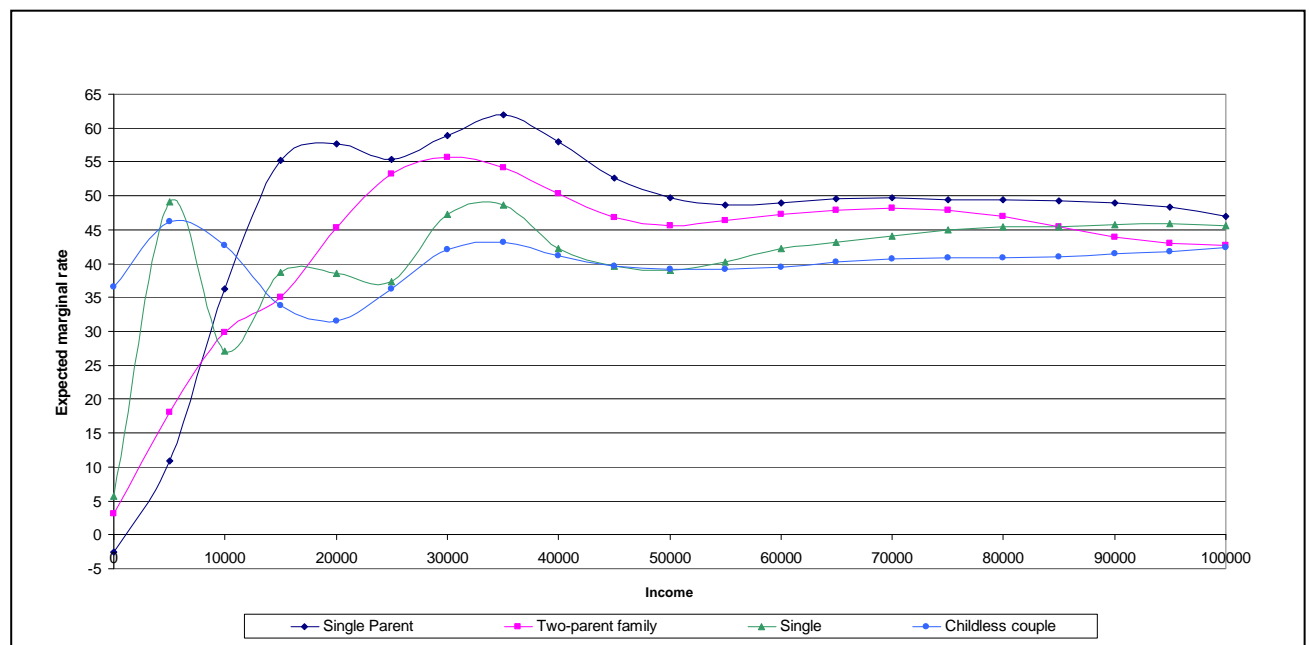
4.2.3 The decomposition of the marginal rates and the impact of governmental assistance programs

In this section we present the decomposition of the expected EMTR for each of the four household types that we are interested in. This new phase of our analysis will yield the weight of each program and tax measure in the composition of the total rate.

The same EMTR for two different households does not necessarily imply an identical fiscal situation. For example, in Table 3 we see a single individual and a single-parent family both facing the same expected EMTR, 35 per cent. For the single individual, income taxation represents nearly 60 per cent of the mean marginal rate, while this share is 50 per cent for the single-parent family. Though the share of the marginal dollar earned that must be remitted in taxes is smaller than for the single person, the single-parent family loses out on transfer payments it had been receiving. In fact, on an additional \$1 in labour income, it will pay \$0.17 in income taxes on average (\$0.21 for a single individual), \$0.03 in various premiums (\$0.04 for singles) and forfeit \$0.13 in transfers (\$0.11 for singles), yielding the same marginal rate for both groups.

Table 3: Decomposition of the mean effective rate, by family status

	Single		Single parent		Childless couple		Two-parent family		All households	
	Decompo-sition of the total rate	Proportion of the total rate	Decompo-sition of the total rate	Proportion of the total rate	Decompo-sition of the total rate	Proportion of the total rate	Decompo-sition of the total rate	Proportion of the total rate	Decompo-sition of the total rate	Proportion of the total rate
Fédéral tax	10,6	30%	8,7	25%	14,2	36%	15,6	35%	**12,5**	**33%**
Provincial tax	10,3	29%	8,6	25%	15,0	38%	16,1	36%	**12,6**	**33%**
Dues (1)	3,8	11%	3,4	10%	3,6	9%	3,9	9%	**3,7**	**10%**
Income assistance programs (2)	10,5	30%	5,9	17%	6,1	15%	3,0	7%	**7,7**	**20%**
Children related programs (3)	0,0	0%	7,4	21%	0,0	0%	5,1	11%	**1,3**	**3%**
Tax credits and refunds (4)	-0,3	-1%	0,8	2%	1,0	3%	1,4	3%	**0,5**	**1%**
TOTAL	35,0	100%	34,7	100%	39,9	100%	45,0	100%	**38,2**	**100%**

(1) Employment-insurance, QPP and drugs insurance
(2) Social assistance, PWA, PWA supplement and housing allowance
(3) CCTB, supplement for young child, family allowances, daycare and credit for childcare expenses
(4) GST credit, QTS credit and property tax refund

Compared to the household consisting of a single adult, the mean marginal rate on a childless couple and a two-parent family is higher by 5 and 10 per cent, respectively. Also observe that marginal income tax rates are higher for households headed by two adults. Furthermore, marginal income taxation distinguishes the single-parent family from the two-parent family. The clawback rate on transfer programs is less for the latter. It is the greater wealth, on average, of families with two adults that explains the different composition of the mean marginal rate (recall from Figure 5 how the average income of the head of a single-parent family is lower than that of a two-parent family). With a mean income level near \$25 000 (earned by the head of a single-parent family), the income tax rate for both levels of

government is relatively low (amounting to 50 per cent of the global rate for a single-parent family), but the implicit rate on several income and family support programs starts to make itself felt (accounting for 41 per cent of the total rate on the single-parent family). At the other extreme, when income is approximately $50 000 (earned by the head of a two-parent family), income tax rates are higher (accounting for 70 per cent of the global rate confronting the two-parent family), while the clawback rate on government programs is nearly nil (accounting for 21 per cent of the overall rate for the two-parent family).

As to the 5 per cent difference between the marginal rate on childless couples and two-parent couples, it is primarily explained by the presence of children. These make it possible for parents to access assistance programs whose payoffs decrease with rising family income, resulting in an implicit tax rate of 5 per cent. Aside from this difference, which explains the gap between the total rate, we also note that the composition of the mean rates is not exactly the same. Since the income of both members of childless couples is below that of the parents of two-parent families (cf. Figure 5), the implicit rate on income assistance programs is greater for the former, while the rates associated with income taxation are greater for the latter.

4.2.4 The variability of EMTRs

The variability of EMTRs can be analysed from several perspectives. First, we observe this variability of rates within our household groupings (by family status). Is there uniformity in marginal taxation, or do we find some types of inequality between households in the same group? Subsequently, we also analyse the degree of variability of EMTRs across the four groups. With all income categories considered, is there a form of inequality between these groups? Finally, we address the disparity of implicit rates within various groupings of programs and fiscal measures (for example: all income support measures, all programs targeted at children, etc.), as well as the interactions between these groupings.

To analyse the variability of the EMTRs we use a generalized entropy index (cf., Fournier [2005] for more information on the indices used). An entropy index is a measure of dispersion or distance with respect to a centre (or mean). It captures the degree of disorder or inequality that reigns in a system. Thus, the entropy index will be zero if the EMTR is the same for everyone and high if differences between the rates and their means are large. Furthermore, a decomposition of the generalized entropy index allows inter-group inequality to be distinguished from intra-group inequality.[23]

Table 4 presents the principal entropy measures we estimated. The first column shows the entropy estimate for each household type. The second column provides the normalized mean, which is the ratio of the mean of the marginal rate within the group to the mean rate for the entire population. The third column is the share of each group in the total population. The fourth and fifth columns summarize the decomposition of total inequality by indicating, in absolute and relative terms, the contribution of each group (as well as between-group

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[23] Estimates of the entropy measures and other computations were generated with the software DAD (for Distributive analysis/Analyse distributive). DAD was designed to facilitate the analysis and comparisons of social welfare, inequality, poverty, and equity across various population distributions. For more information regarding DAD, as well as equity and poverty measures, consult Duclos and Araar (2006).

inequality) to total inequality. We first observe the value assumed by the entropy index for each of the four groups. This index is highest for the group of single-parent families (0.805). Thus, it is within this group that the greatest variation in EMTRs is found. Recall that single-parent families are distributed between two main peaks. Many of them are in a situation of zero marginal taxation, while we also find a significant concentration around 60 per cent. The considerable distance between these two points of concentration explains the high entropy index. Single individuals occupy second place (0.578) in terms of an unequal distribution of rates. We can also explain this result by their distribution between effective marginal tax rates of zero and of 40 and 100 per cent. Finally, childless couples (0.195) and two-parent children (0.157) are in third and fourth place, respectively, in terms of the dispersion of tax rates. Density graphs for these two groups support this result (cf. Figure 9).

Table 4: Entropy measures and decomposition of the inequality of the EMTRs

Groups	Estimate of entropy	Normalised mean	Proportion	Absolute contribution	Relative contribution
Single	0,578	0,954	0,488	0,269	68,0%
Single parent	0,805	1,021	0,040	0,033	8,2%
Childless couple	0,195	1,007	0,285	0,056	14,1%
Two-parent	0,157	1,097	0,188	0,032	8,2%
Between-group inequality	-	-	-	0,006	1,4%
Total inequality				0,395	100,0%

The wide variability of the rates and the distribution of the households between very distant peaks of taxation for single individuals and single-parent families can be explained by the high proportion of low-income households we find in these two groups, compared to households with two adults. For each of those two groups we also computed the entropy index for family income. We observe that the groups with the greatest income disparity are also those in which we find the greatest disparities in the EMTRs.

The inequality index for the whole population is 0.395. This index is the sum of two components: within-group and across-group inequality. Beginning with the first component, we first determine the relative contribution of each group in the population to the total inequality index. Single individuals have an index rate dispersal that is relatively high compared to the others. Since they also include 49 per cent of households, they contribute most to the variation in the rates. Single-parent families—the group within which disparities are greatest—contribute very little to the total inequality index owing to the small percentage of the population they represent (4 per cent). The second component is the share of the inequality attributable to the variation in the rates between groups. We observe that this component only contributes 1.4 per cent of total inequality. The fact that the normalized means are very near to one (1) also attests to the absence of inter-group inequality. In comparison, income disparity across groups contributes 26.2 per cent to the total income inequality within the population. Thus, while the distribution of mean incomes between groups presents a certain degree of inequality, it appears that, on average, the EMTRs vary very little across groups.

Finally, we note that, while two-parent families face expected marginal rates that are relatively high compared to the other groups, it appears that there is little variation in the marginal rates confronting these families. Conversely, it is within this group that the variance in the marginal rate is greatest in the case of low incomes. This is what we see in Figure 11, which illustrates the standard deviation of the conditional marginal rates for a given income and family status.

Figure 11 : Standard deviation of the marginal rates, conditional on a given income, by family status
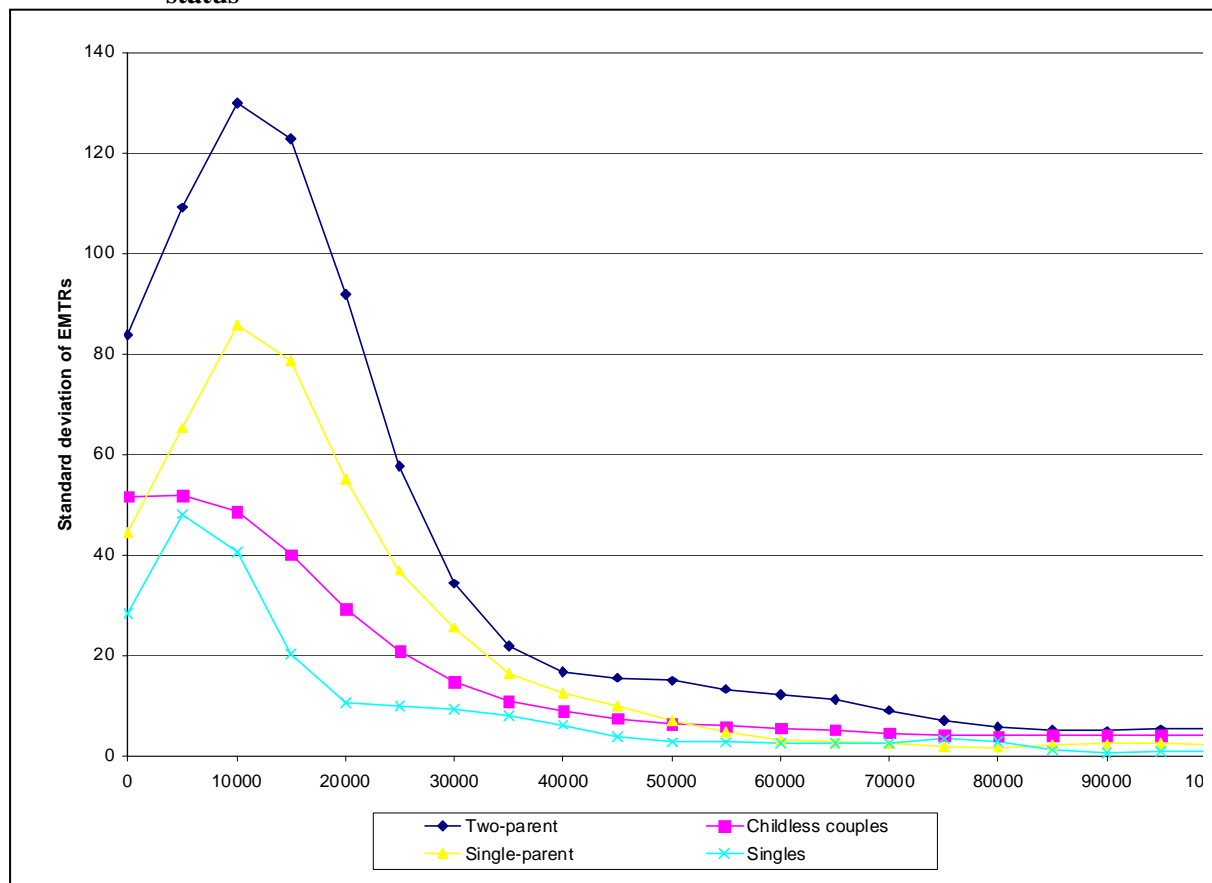
Figure 11 also shows the variability of EMTRs for low-income single-parent families. Compared to childless households, the fiscal situation of families is more variable in the lower income brackets in terms of marginal taxation for a given income. Overall, the reduced disparity amongst two-parent families is primarily attributable to the fact that they are richer than single-parent families. Finally, Figure 11 presents the relative invariability of EMTRs for medium- and high-income households.

It is instructive to analyse the variance of rates within various groupings of programs and fiscal measures. We created six groups:

1) programs pertaining to children (including the CCTB, the federal government's young child supplement, as well as family allowances from the provincial government);

2) income support programs (including social assistance, the PWA[24] program, and housing allowance, all of which are administered by the provincial government);

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[24] Including the supplement to the PWA program for childcare expenses.

3) tax credits and rebates (the QST rebate and the provincial government's reimbursement for property taxes as well as the GST rebate from the federal government belong to this category);

4) premiums (including contributions to the EI and the QPP regimes);

5) federal income tax;

6) provincial income tax.

In Table 5 we present the variance measured for each of these groups, as well as the covariance between them.

It is the implicit tax rate associated with income support programs that varies most between households and thus contributes the most to global variability in the EMTRs. This result is not in the least surprising, since this implicit rate can be nil for some households and extremely high for others. Next, we observe that rates of income taxation by the two levels of government vary more than those of programs pertaining to children. Conversely, when we measure the variance of the rate for families only, we see that the variance of the implicit rates on programs for children is greater than that of income taxation. As to rates associated with premiums, they vary very little, being relatively low for working individuals (2.2 per cent for EI and 4.7 per cent for the QPP), and nil for those who are either not working or who have reached the ceiling on contributions.

Table 5: Variance and covariance for groups of transfer programs and fiscal measures

	Programmes relative to children	Programmes of income support	Tax credits and refunds	Contributions	Federal tax	Provincial tax	EMTR
Programmes relative to children	**47.36**	-5.73	5.89	3.03	2.88	-2.58	53.65
Programmes of income support		**835.03**	4.92	-6.03	-71.43	-97.05	672.05
Tax credits and refunds			**87.86**	5.48	10.60	23.37	142.95
Contributions				**11.04**	-1.14	-0.12	14.14
Federal tax					**68.04**	52.26	60.91
Provincial tax						**99.04**	72.76
EMTR							**1050.62**

As to the covariance, it is strongly negative between taxes and income support programs, indicating that households confronting high recovery rates for transfer programs benefit from low income tax rates. Moreover, there is a strongly positive correlation between provincial and federal income taxation, which is not surprising in light of the similarity between the taxation modes of the two governments. There is a negative, but relatively weak, correlation between programs for children and income support programs. This relationship can be explained by recalling that the premium clawback zones for these two groups of programs do not coincide perfectly. In the group of income support programs, most of the

rate is attributable to social assistance. The highest level of implicit taxation associated with this program kicks in below the $15 000 income bracket (approximately, according to family type). As to child-related programs, the recuperation rate is triggered at incomes above $15 000. Consequently, it is reasonable that we find a weak negative correlation between two groups of programs that are effective for different income levels in the fiscal profile of households.

Finally, we note that the interactions between programs, *i.e.,* the covariance between various groups of fiscal measures and transfers, contribute to reducing the global variability of the EMTR. In other words, the variance of the EMTR is less than the sum of the variances of its individual components. It is primarily the strong negative covariance between support programs and income taxation that contributes to this result.

5.   Conclusion

Using a simulation model that reproduces Quebec's taxation and transfer system almost in its entirety, this article completely characterizes the distribution of EMTRs in Quebec in 2002. In addition to presenting a detailed sketch of three representative tax profiles, we have generated a descriptive analysis of EMTRs for all households from various estimations, paying particular attention to the determinants of the means and the variability of these EMTRs as well as the situation of the families.

We were able to observe that the households for which we find the highest EMTRs are primarily single, childless individuals, many of which face an EMTR in excess of 100 per cent. Though the simulations we ran revealed that this situation is less common among single-parent families, we were able to establish that over one-quarter of them confront an EMTR that can reach, or even exceed, 80 per cent. Mostly recipients of social assistance, these families must overcome a substantial hurdle to break free of the poverty trap, which income supplement programs, such as PWA, are not able to bridge. The situation of two-parent families, whose mean income is higher, is quite different. The majority of them face an EMTR that approaches 50 per cent that is largely attributable to income taxes and programs for children that are phased out with rising income. Throughout the analysis, we have observed how government policies that are targeted to poorer families impose EMTRs on those with higher incomes that exceed those facing childless households and add a considerable burden at the margin. We have also observed that it is the implicit tax rate associated with income support programs that varies most between households and that thus contributes the most to global variability in the EMTR. Similarly, even if the distribution of average incomes across groups presents some inequality, average EMTRs differ little between groups; it is their variability within groups that largely explains the global variability of EMTRs in the population.

The characterization of EMTRs we have been able to present also provides a useful tool for a broader contemplation of the possibilities of tax reform. Among other things, the particular attention paid to the current situation of families in the analysis of the results makes possible a critical reflection on the solution paths for reducing the effective taxation on families that have been put forward in the literature. Thus, abandoning the current selective

family income security plan in favour of a universal recognition of the cost or raising children is a first possibility for reducing effective rates. This solution is proposed in Poschmann and Mintz (1999), Lefebvre (1999), and Poschmann and Richards (2000). Universalization could take the form, for example, of the introduction (among other things) of a non-refundable tax credit for dependent children at the federal level, which would be similar to the one in Quebec, and which would have the benefit of raising the threshold above which a family begins to pay taxes. This return to universality could, however, result in higher tax rates on individuals with medium or high incomes [Kesselman (1999)]. Thus, while the non-refundable tax credit is an interesting option in and of itself, how it is financed requires careful attention.

Finally, recourse to programs that top-up labour income, making the labour market more attractive to non-participants, is a solution that already existed on a small scale in 2002 (with the PWA program) and that could be expanded (Lefebvre, 1999). During the analysis of the tax profiles of single- and two-parent families we saw that the PWA program did not fully achieve its purpose in 2002, as the barrier formed by an effective taxation rate of 100 per cent was only partially eliminated. Thus, we observe that 5 per cent of single-parent families face a marginal rate of 100 per cent. In 2005, the Government of Quebec launched a working bonus program ("prime au travail"), leading to the elimination of the PWA in favour of an income supplementation program accessible to all low-income households. This bonus takes the form of a refundable tax credit. It is paid out to household with a minimum monthly income. This measure could improve incentives to households facing a high marginal rate and that were not eligible to the PWA (*i.e.*, single individuals and childless couples), or that did not participate in that program. Conversely, it remains to be established how the negative impact of increasing labour income on benefits will affect these households' EMTR in the phasing-out of this working bonus.

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Appendix A. Description of the fiscal measures and social transfer programs of the provincial and federal governments

This appendix describes the principal governmental measures having an impact on EMTRs and that were included in our microsimulation model.[25] The measures are categorized into two broad groupings: those of the Government of Quebec and those of the federal government.

1.   Measures of the Government of Quebec

1.1   Taxation

Taxation in Quebec comprises a tax table, tax credits, and payroll deductions. Not all tax credits and deductions were retained;only those having an impact on the fiscal situation of Quebec families will be described.

-        Tax table

The tax table allows the amount of income payable to the Government of Quebec to be determined on the basis of the taxpayer's taxable income. It is divided into three brackets that vary with the amount of taxable income (Table I).

Table 1: Tax Table

Taxable income	Marginal rate
From $0 to $26 700	16 %
From $26 701 to $53 405	20 %
$53 406 and over	24 %

-        Credit for an individual living alone

A non-refundable tax credit is given to an individual living alone (or exclusively with one or several dependant children). The credit may be as much as $224, or 20.75 per cent of a maximum amount of $1080. This maximum amount is reduced by 15 per cent of net household income in excess of $26 700. Thus, the credit becomes nil when income reaches $33 900 (on the assumption that the age credit and pension income credit are not claimed).

Table 2: Credit of a an Individual Living Alone

Maximum amount	Conversion rate	Fiscal value	Clawback threshold	Income at which the credit is nil	Clawback rate
$1080	20.75 %	$224	$26 700	$33 900	15 %

-        Spousal credit

A non-refundable tax credit is given to taxpayers who cared for their spouses for some period during the tax year. This credit may reach $1258, or 20.75 per cent of a maximum amount of $6060. Notice that the maximum amount of the spouse's income for the tax year must be subtracted, reducing the fiscal value of the tax credit.

-        Credit for dependant children

A non-refundable tax credit is granted to taxpayers with dependant children. The base amount is $2670 for one child and $2465 for each additional child. In a single-parent family,

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there is an additional $1335 for the first child registered. It should be noted that an amount for postsecondary studies ($1694 per term completed, up to two terms per dependant child) can be added to the calculation of the amount for dependant children—though the child's income must be deducted from the base amount. Retaining the conversion rate of 20.75 per cent, Table 3 presents the maximum fiscal value the credit can reach in some family situations.

Table 3: Maximum Value of the Non-Refundable Tax Credit for Dependant Children[1]

Two-parent family			Single-parent family		
1 child	2 children	3 children	1 child	2 children	3 children
$554	$1066	$1577	$831	$1343	$1854

[1]. The credit is computed on the assumption that that the child's income and the amount for postsecondary studies is nil.

- Income tax reductions affecting families

Taxpayers with dependant children are eligible for a tax cut with respect to the family. The purpose of this tax measure is to raise the income threshold above which the family begins to pay income tax to the Government of Quebec. The reduction of the tax burden imposed on the family contributes to better integrating the provincial income tax regime with transfers. The maximum this tax cut can reach is $1500 for a couple with children and $1195 for a single-parent family. These amounts are reduced by three per cent of net family income in excess of $26 700.

Table 4: Tax Reduction with Respect to Families

	Maximum amount	Clawback threshold	Clawback rate	Maximum family income
Couple with children	$1500	$26 700	3 %	$76 700
Single-parent family	$1195	$26 700	3 %	$66 533

- Refundable tax credit for childcare expenditures

Childcare services that are paid by the taxpayer qualify for a refundable income tax credit. It is important to note that the parental contribution of $5 per day per child established by the Government of Quebec in its new family policy is not eligible for the tax credit.

The tax credit is a function of family income, and the allotted compensation ranges between 26 and 75 per cent of eligible daycare fees. The limit of daycare expenditures admissible is determined by the child's age, and can be $4000 or $7000.

Moreover, families receiving last resort assistance are eligible for free educational childcare services (up to 100 days per year).

Table 5: Schedule for the Refundable Tax Credit for Childcare Expenses

Family income ($) greater than	less than or equal to	Rate of tax credit (%)	Family income ($) greater than	less than or equal to	Rate of tax credit (%)	Family income ($) greater than	less than or equal to	Rate of tax credit (%)
0	27 730	75	44 160	45 185	58	61 620	62 645	41
27 730	28 755	74	45 185	46 215	57	62 645	63 675	40
28 755	29 785	73	46 215	47 240	56	63 675	64 700	39
29 785	30 810	72	47 240	48 270	55	64 700	65 725	38
30 810	31 835	71	48 270	49 295	54	65 725	66 755	37
31 835	32 865	70	49 295	50 320	53	66 755	67 780	36
32 865	33 890	69	50 320	51 350	52	67 780	68 810	35
33 890	34 920	68	51 350	52 375	51	68 810	69 835	34
34 920	35 945	67	52 375	53 405	50	69 835	70 860	33
35 945	36 970	66	53 405	54 430	49	70 860	71 890	32
36 970	38 000	65	54 430	55 455	48	71 890	72 915	31
38 000	39 025	64	55 455	56 485	47	72 915	73 945	30
39 025	40 055	63	56 485	57 510	46	73 945	74 970	29
40 055	41 080	62	57 510	58 540	45	74 970	75 995	28
41 080	42 105	61	58 540	59 565	44	75 995	77 025	27
42 105	43 135	60	59 565	60 590	43	77 025	and more	26
43 135	44 160	59	60 590	61 620	42			

- Refundable income tax credit for Quebec's provincial sales tax (QST)

Family income dictates whether taxpayers and their spouses qualify for a refundable income tax credit for the PST, a fiscal measure targeted at low-income households. The maximum amount is $158 per adult. A person living alone is allotted an additional $106. The amount of the QST credit is reduced by 3 per cent of family income exceeding $26 000.

Table 6: Refundable QST Credit

	Ceiling	Clawback threshold	Maximum family income	Clawback rate
Individual not living alone	$158	$26 700	$31 966	3 %
Individual living alone	$264	$26 700	$35 500	3 %
Couple	$316	$26 700	$37 233	3 %

- Property tax rebate

The property tax rebate is targeted at homeowners, tenants, and sub-tenants and is designed to partially offset property taxes (including school and municipal taxes). The maximum amount that can be obtained corresponds to 40 per cent of property taxes in excess of $880 in the case of a taxpayer with spouse and $440 in the case of a taxpayer living alone. This rebate is reduced by 3 per cent of income in excess of $26 700. Table 7 presents the maximum family income eligible for a rebate by family status and the level of property taxes.

Table 7: Maximum Family Income by the Situation of the Family and the Level of Property Taxes

Couple			Individual living alone		
Property taxes ($)		Family income	Property taxes ($)		Family income
from	to	maximum ($)	from	to	maximum ($)
880	980	28 033	440	540	28 033
981	1080	29 367	551	640	29 367
1081	1180	30 700	641	740	30 700
1181	1280	32 033	741	840	32 033
1281	1380	33 367	841	940	33 367
1381	1480	34 700	941	1040	34 700
1481	1580	36 033	1041	1140	36 033
1581	1680	37 367	1141	1240	37 367
1681	1780	38 700	1241	1340	38 700
1781	1880	40 033	1341	1440	40 033
1881	1980	41 367	1441	1540	41 367
1981	2080	42 700	1541	1640	42 700
2081	2180	44 033	1641	1740	44 033
2181	and more	44 300	1741	and more	44 300

- Québec Pension Plan contributions

The QPP is a public, mandatory insurance plan. Its goal is to provide workers with basic financial security at retirement or in the event of death or disability. Premiums paid by employees and employers finance the plan.

The employee benefits from a general exemption of $3500 and pays no premiums on income exceeding the threshold of $39 100. The premium, applied to the portion of the wage between the general exemption and the maximum, is 4.7 per cent for the employee (9.4 per cent in total, with the employer matching the employee's contribution).

- Contribution to the Quebec Drug Insurance Plan

The Quebec Drug Insurance Plan was set up to ensure a minimum of protection to the entire population. Since its creation in January 1997, every individual must be ensured, either by a group drug insurance plan or by the public plan, which is managed by the Régie de l'assurance maladie du Québec. Individuals insured by the public plan must pay a premium that may reach $460 per adult per year. This amount is fixed as a function of net family income.

- Tax treatment of spousal support

New measures regarding the tax exemption of spousal support payments entered into effect on May 1, 1997 (they apply to support payments made under a written agreement or a court ruling dated after April 30, 1997). In general, payments are no longer deductible by the person making them, and they are no longer included in the income of the recipient. Nonetheless, payments received under an agreement or a ruling predating May 1, 1997, must be declared, and the person making them can deduct them from income.

1.2   Transfer programs

Income support policies of the Government of Quebec were once known as income security or social assistance benefits. Adopted in 1998, the *Act respecting Income Support, employment assistance, and social solidarity* inaugurated a new income support regime that

incorporated several programs, two of which are presented below: last resort assistance and Parental Wage Assistance (PWA).

We next describe the family allowance, which is part of the family policy of the Government of Quebec, and the shelter allowance program.

- Last resort assistance

This program strives to provide financial assistance of last resort to individuals who are capable of working to motivate them to undertake or pursue efforts to integrate, or reintegrate, into the job market, and to support them during those steps. It is also designed to provide last resort assistance to those suffering from certain limitations in their ability to work.

To qualify for financial assistance, a household must demonstrate that its resources and revenues are below the level necessary, as determined by regulation, to provide for its basic needs (housing, food, etc.). The level of support given includes a base amount that varies with the family composition. Furthermore, supplementary adjustments for employability constraints and dependant children are also provided.

Table 8: Employment Assistance Program[1] (in dollars per year)

	Base benefit	Permitted labour income	Clawback rate	Maximum income
Single-parent family	$6180	Up to $2400	100 %	$8580
Couple	$9564	Up to $3600	100 %	$13 164

1. Amounts in effect on January 1, 2002.
2. Depending on the individual's situation (the income allowed without penalty for a single, able-bodied person $1200 per year).

- PWA program

The PWA program offers financial assistance to low-income workers with dependant children to provide them with an incentive to enter, or remain in, the labour market. It inflates the gap between income from labour and from social assistance. The PWA allows families to obtain monthly assistance, $3 per day for daycare costs (for each child enrolled in a $5 per day daycare service, except in the case of two-parent families in which one of the parents is not working), and payments based on forecasts of the refundable income tax credit for childcare services. For families receiving Employment Assistance and having income that is admissible to the PWA program, the PWA benefit is added to Employment Assistance payments.

To be eligible for the PWA program, the total of a two-parent family's gross income must be less than $21 820. In the case of a single-parent family, the upper income threshold was established at $15 530. The maximum PWA benefit increases by 35 per cent of labour income exceeding $1200 (a minimum labour income of $100 per month is required to be eligible for the program). Furthermore, it is clawed back at the rate of 43 per cent of total excess income and at an additional rate of 23 per cent for replacement income (*e.g.*, CSST benefits). The PWA benefit is computed on the basis of the income the family expects to earn. Thus, at the end of the year it is necessary to compute the balance so as to pay out the benefits due or to recover excess amounts disbursed.

- Family allowance

A part of the Government of Quebec's family policy, the family allowance seeks to subsidize the basic needs of children and low-income families while accounting for the federal government's Canada Child Tax Benefit. The level of the family allowance varies with the family status (single-parent or two-parent), the number of dependant children under 18 years old, and family income. The maximum benefit is $975 per child, and it is clawed back as a function of net household income during the previous tax year.

Table 9 presents the principal elements of the calculation of the allowance, depending on whether family income falls below or exceeds $50 000.

Table 9: Quebec Family Allowance[1]

Family income of $50 000 or less		Family over $50 000	
Initial amount		Initial amount	
First child	$625	First child	$80
Second child	$625	Second child	$80
Third child and more	$625	Third child and more	$975
Supplement for single-parent families			
	$1300		
Clawback threshold		Clawback threshold	
- Single-parent family		- 5 % clawback rate	$50 000
35 % clawback rate	$15 332		
25 % clawback rate	$21 214		
- Two-parent family			
25 % clawback rate	$21 825		
Minimum guaranteed amount			
First child	$80		
Second child	$80		
Third child and more	$975		

1. For the period from August 2001 to July 2002.

- Shelter allowance

The shelter allowance program, which is targeted at both owners and tenants, provides financial assistance to low-income families who devote too much of their budget to housing (i.e. over 30 per cent of their income). The level of the allocation takes into consideration the family type and the number of occupants, income, and the monthly rent. The financial assistance can reach as much as $80 per month.

2. Measures of the federal government

2.1 Taxation

This section contains descriptions of the federal government's tax measures, i.e. deductions (only one will be presented, covering childcare expenditures), its tax table, its income tax credits, and its payroll deductions. Not all tax credits and deductions were retained, but only those having an impact on the fiscal situation of Quebec families will be described.

- Deduction for childcare expenses

When computing the net income of a household, provision is made for a deduction for childcare expenses. This deduction may rise as high as $7000 per dependant child.

- Tax table

The tax table allows the amount of income to be paid to the federal government to be determined on the basis of the taxpayer's taxable income. It is divided into four brackets that vary with the amount of taxable income (Table 10).

It should be noted that residents of Quebec benefit from a refundable tax abatement. The federal government provides this abatement in lieu of participating in shared-cost programs in the framework of federal-provincial agreements. This abatement, corresponding to 16.5 per cent of the base federal income tax, reduces federal income taxes levied on residents of Quebec (and may even yield a reimbursement).

Table 10: Tax Table

Taxable income	Marginal rate
From $0 to $31 677	16 %
From $31 678 to $63 354	22 %
From $63 355 to $103 000	26 %
$103 001 and over	29 %

- Spousal credit

A non-refundable tax credit is given to taxpayers who cared for their spouses for some period during the tax year. This credit may reach $1037, or 16 per cent of a maximum amount of $6482. Notice that the maximum amount of the spouse's income for the tax year must be subtracted, reducing the fiscal value of the tax credit. If the spouse's income is $7131 or more, no spousal credit will be paid out.

- Credit for an eligible dependant

An individual applying for this non-refundable income tax credit must be single, divorced, separated, or widowed. Thus, a single-parent family can benefit from this credit, which can reach $1037, or 16 per cent of a maximum of $6482. As in the case of the spousal credit, the taxpayer must subtract the income of the dependant from the maximum amount.

- Refundable tax credit for the goods and services tax (GST)

The GST tax credit, like the PST credit, is designed to help low-income families by partially or fully compensating for the GST they must pay. The maximum of the refundable tax credit for the GST is $213 per adult and $112 for each dependant child. In addition, a single-parent family receives a supplement of $112 (single-parent families receive the full amount of the supplement, while single, childless individuals receive the lesser of $112 or 2 per cent of net income in excess of $6911). The income tax credit is clawed back at a rate of 5 per cent of the difference between the household's net income and $27 749 and is based on income in the previous fiscal year.

Table 11: Refundable GST Credit

	Ceiling	Clawback threshold	Maximum family income	Clawback rate
Single-parent family				
- one child	$437	$27 749	$36 489	5 %
- two children	$549	$27 749	$38 729	5 %
- three children	$661	$27 749	$40 969	5 %
Two-parent family				
- one child	$538	$27 749	$38 509	5 %
- two children	$650	$27 749	$40 749	5 %
- three children	$762	$27 749	$42 989	5 %

- Employment Insurance premiums

EI provides temporary financial assistance to an unemployed person during a period of job search or training, pregnancy, while caring for a newborn or an adopted infant, or during illness. This plan is financed by premiums paid by employees and employers.

The rate of EI premiums paid by employees was 2.20 per cent during the fiscal year 2002. This rate applies to the portion of the annual wage that is equal to, or less than, insurable earnings of $39 000 (thus, the maximum premium was $858 in 2002). Furthermore, for an employee whose total insurable earnings are $2000 or less, the premium is fully refundable.

- Tax treatment of spousal support

The tax treatment of spousal support by the federal government is essentially the same as that of the provincial government (cf. Section 1.1, Tax treatment of spousal support).

2.2   Transfer programs

- Canada Child Tax Benefit (CCTB)

The CCTB is paid to eligible families to help them meet the needs of their children. It consists of two elements: the CCTB base benefit and the CCTB supplement. The base benefit is $1117 per child, and provision is made for a supplement for children under seven years of age as well as for families with three children or more. It should be noted that the benefit is a function of net family income during the previous year. It is clawed back at a rate of 2.5 or 5 per cent (2.5 for families with one child and 5 for families with two or more children) from the portion of the family's net income exceeding the threshold of $32 000.

The CCTB supplement, which varies with the number of children, is targeted at low income families. The maximum amount is clawed back at a rate of 12.2, 22.5, or 32.1 per cent (depending on the number of children), as a function of the household net income over $21 744).

Table 12: Canada Child Tax Benefit ((July 2002, by income during the year 2001)

	Ceiling	Clawback threshold	Income at which the benefit is nil	Clawback rate
CCTB				
- one child	$1117	$32 000	$76 680	2.5 %
- two children	$2234	$32 000	$76 680	5.0 %
- three children	$3429	$32 000	$100 580	5.0 %
CCTB supplement				
- one child	$1255	$21 744	$32 031	12.2 %
- two children	$2310	$21 744	$32 011	22.5 %
- three children	$3290	$21 744	$31 993	32.1 %

Appendix B.   Assumptions formulated for realizing the three representative tax profiles

	Single person	Single-parent family	Two-parent family
Welfare allowance	No work handicap	Temporary handicap	No work handicap
Age of child	--	3 years	3 years
Age of child 2	--	5 years	5 years
Income sharing	100% of parent 1	100% of parent 1	100% of parent 1
Daycare expenses	--	5$	None (only one parent work)
Employment expenses	0$	0$	0$
PWA	--	Yes	Yes
Drug insurance	Public	Public	Public
Drug expenses	0$	0$	0$
Alimony	0$	0$	0$
Rent	Fixed to 428$	Fixed to 554$	Fixed to 554$