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Tax Policy Studies

Using Micro-data to Assess Average Tax Rates

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

This study is the eighth in a series of Tax Policy Studies produced by the Centre for Tax Policy and Administration (CTPA) with the aim of disseminating work undertaken by the OECD Secretariat in the areas of tax policy and administration. The current study presents findings drawn from country examples of the use of micro-level data (that is, data measured at the taxpayer level) to measure various effective average tax rates.

Measuring effective tax rates using tax revenue data is attractive, given that revenues collected capture the net effect of tax provisions and taxpayer behaviour that are difficult to model. Yet reliance on aggregate tax and income data requires restrictive assumptions and significantly limits the scope of analysis. This study considers advantages of relying on micro-data to assess average tax rates on labour, capital and transfer income and presents some illustrative results. The analysis emphases the importance of matching taxpayer-level information to income flows, and notes difficulties in interpreting tax rates that average over all taxpayers. It also illustrates the importance of loss adjustments in measuring effective tax rates on capital income, and reports evidence of significant variation in corporate average tax rates by sector and firm size.

This study has been prepared by W. Steven Clark, Head of the Tax Policy and Statistics Unit, CTPA, drawing on contributions by Delegates for Austria, Belgium, Canada, Denmark and Norway to Working Party No. 2 (WP2) on Tax Policy Analysis and Tax Statistics of the OECD Committee on Fiscal Affairs. Comments were received from WP2 delegates, the Economics Department of the OECD, and participants of the CESifo 2002 Venice Summer Institute Workshop on *Measuring the Tax Burden on Capital and Labour*, held 17-18 July 2002. The study is published under the responsibility of the Secretary-General.

TABLE OF CONTENTS

List of Tables

List of Figures

EXECUTIVE SUMMARY

This study presents findings drawn from country examples of the use of micro-level data (that is, data measured at the taxpayer level) to measure various effective average tax rates. The work was carried out by Delegates for Austria, Belgium, Canada, Denmark and Norway to Working Party No. 2 (WP2) of the OECD Committee on Fiscal Affairs. The study may be seen as a follow-up to analysis provided in OECD Tax Policy Studies No. 4, *Tax Burdens – Alternative Measures*, which reviews relative strengths and weaknesses of a number of measures found in the literature to gauge tax burdens of households and firms.

Rather than elaborating possible applications of average tax rates derived from micro-data to address various tax policy questions, the study only briefly reviews a subset of applications while focusing mainly on the diversity in tax burden results across different taxpayer groups, uncovered in the country work. In identifying this diversity, questions are raised over the informational content and policy relevance of "implicit tax rates", which are average tax rates based on aggregate tax revenue and income data as reported in OECD *Revenue Statistics* and *National Accounts*. Indeed, throughout the study, many comparisons are drawn between the two approaches, one relying on aggregate data and the other on micro-level data, to highlight the relative precision and guidance offered by the latter. The basic implicit tax rate approach is briefly summarised in annexes to the study, with the interested reader directed to OECD Tax Policy Studies No. 4 (noted above) and OECD Tax Policy Studies No. 5, *Tax Ratios – A Critical Survey*, for further discussion and review of this particular approach.

The average tax rates reviewed in this study rely on actual tax revenues. Relying on actual revenue data (rather than modelling tax parameters) to measure effective tax rates on labour, capital and other types of income holds out the advantage of incorporating the actual net effect of a complex set of factors that determine tax liabilities and are difficult to model. This stands in contrast to other approaches that attempt to model these factors (or a subset of them) or more generally rely on notional estimates or proxies of tax burdens.

In using actual tax revenue figures, an important distinction can be drawn between approaches relying on aggregate tax revenue data which sum across all taxpayers in a given country, and approaches relying on disaggregate or micro-level tax data. As argued throughout the study, reliance on *aggregate* tax revenue and income or profit data, as under the implicit tax rate approach, to measure effective average tax rates requires restrictive assumptions and significantly limits the scope of analysis. In contrast, the use of micro-level data permits the analysis of tax burdens for individual taxpayers or taxpayer groups, providing a basis for tax policy analysis.

Indeed, the main advantage of micro-data is that it allows one to measure various average tax rates separately for various taxpayer groups with different taxpayer characteristics relevant to policy analysis (for example, for individuals: income level and mix, household structure; for firms: profit level, asset size, industry sector, ownership structure). This is critically important when attempting to assess, for example, the degree of "fairness" or progression in a personal income tax system, or the tax burden on families with children compared to the tax burden on those without. Interest may also exist in comparing tax burdens on small *versus* large firms, or on firms in one industry *versus* another. Differences in tax burdens across taxpayers get lost in figures that sum across all taxpayers, leaving the analyst unsure about the degree of dispersion of tax burdens for different taxpayer groups around a single

economy-wide average. This in turn makes it difficult to assess how representative an economy-wide tax rate is, and how that rate should be interpreted, tending to limit its policy relevance.

In addition to helping address questions over the sharing of tax burdens across different taxpayers groups, taxpayer level data may be applied to analyse the impact of taxation on employment incentives, or investment incentives, or other incentives for different taxpayer groups. Micro-based average tax rate measures are particularly useful where one has evidence that the behavioural response to a given tax distortion (or "tax wedge") differs depending on the taxpayer group. Tax-related disincentives to enter the labour force may be stronger, for example, for individuals with a working spouse, as compared to single individuals. Where such differences exist, gauging taxpayer responses may require grouping taxpayers by household structure, for example, measuring average tax wedges for the different groups, and applying different elasticity estimates to those groups. Such a targeted approach at assessing behavioural responses to tax policy reforms is generally not possible when working with aggregated data alone.

Work by Austria illustrates the difficulties met in interpreting a single average tax rate derived from aggregated data, given the variability in average tax rates across income levels observed in the Austrian data. In particular, the overall average tax rate on wage income in 1999 was found to be nearly double that applicable to workers at the average production wage, half that applicable to top wage earners, and roughly triple that applicable to the lowest-skilled workers. Given this variability, the interpretation to be given to the overall average tax rate computed for all wage earners combined is not clear, making it difficult to infer possible labour market implications. Moreover, taking the overall average rate as an estimate of the tax burden on "labour" to be compared with that on "capital" is difficult, given the variability in observed results across income levels.

While stressing the ability of micro-data to assess tax burden measures for various taxpayer groups, and arguing that micro-level analysis is required to address many (if not most) tax-policy questions, the report acknowledges interest in economy-wide average tax rates (*e.g.* derived for labour or capital income) for certain purposes. Because micro-level data can be grouped at various levels of aggregation including full aggregation, micro-data may be used to derive economy-wide average tax rates with a relatively high degree of precision. Such rates may be needed in macro-models that admit only a single "representative" average tax rate, for example to account for the possible impact of taxation on aggregate unemployment, or aggregate investment. While the ability of an overall rate to properly capture overall tax effects may be questioned, certain models may nevertheless require a single summary measure.

The study reviews work by Norway and Denmark that illustrates how micro-data can permit a more targeted assessment of personal tax collected on different income types to feed into economy-wide measures. In particular, by isolating taxes that apply to a single income type, and by using taxpayer-specific (rather than economy-wide) average tax rates to decompose revenues raised by taxes levied on multiple income types, one can measure average tax rates for different categories of income with greater precision. A related advantage arises where one is able to more precisely match numerator (tax) and denominator (income) amounts than is possible when relying on aggregate data drawn from different sources (and based on different samples).

The second half of the study focuses on the use of micro-data to measure effective average tax rates on corporate profits. The analysis in this part emphasises the critical importance of accounting for business losses in a consistent manner when measuring corporate profits and the amount of tax thereon, taking into account loss carryover provisions. A number of examples are provided to illustrate the difficulties in interpreting average tax rates based on aggregate data given the inability to properly align profits and tax. The country work shows how both levels and trends in average corporate tax rates may be misrepresented when using aggregate data. The final sections highlight a diverse range of average tax rate results for corporations grouped according to various criteria. As in the work addressing the taxation of labour income, this diversity in results leads one to reconsider what can be made of results derived at the economy-wide level.

The caveats discussed in the study focusing on the treatment of losses are noteworthy. Much attention has been given in recent years to the possible need to rebalance the tax burden on labour *versus* capital. While not always fully articulated, these calls seem to stem from a general concern that the sharing of the tax burden between "capital" and "labour" is in some sense not fair. They also reflect worries that tax systems may be impeding employment and possibly investment. To support the need for reform, advocates would like to point to annual measures of the tax burden on capital and labour, which could be compared across countries and over time. Yet developing reliable annual indicators based on aggregate data has proven to be elusive. The study reviews obstacles met in measuring effective tax rates on income from capital tied to loss considerations, with reference to the analysis of tax on income from capital at the corporate level.

In particular, the work by Belgium and Canada highlights the critical importance of adjusting for business losses in measuring an economy-wide corporate average tax rate. This finding also has implications when considering implicit tax rates on capital income, given that tax on income from capital applies in most systems at both the corporate and personal levels. The study reviews two methods relying on micro-data to adjust for business losses, considers country results based on one methodology, and flags difficulties of interpretation when such adjustments are not possible. While not specifically addressed in the work reviewed in this study, the findings also have implications for the measurement of average tax rates on income of the self-employed.

The study also reports significant variation on average corporate tax rates across firms grouped by industry and firm size. The analysis by Belgium and Canada reveals that economy-wide results may not provide accurate indicators of levels and trends in corporate average tax rates for certain groups of firms. A disaggregate view is normally required to steer policy analysis and decisions. For example, an increase in an economy-wide average corporate tax rate may be driven by changes in tax provisions that affect one group of corporations, largely to the exclusion of others. Elimination of a tax credit for R&D, for example, would hit primarily R&D-intensive firms. Or restrictions on loss carry forward rules may impact small firms more than large. In addressing the increase in the economy-wide average corporate tax rate, focus may therefore be best directed at the affected firms, rather than all firms. This may lead one to possibly consider targeted (tax or non-tax) relief for the affected firms, rather than across the board relief. Or no change may be called for. But the salient point is that micro-data enables a more informed assessment of where and why tax burdens are changing, necessary to guide tax policy debate and reform.

The relative strengths of working with micro-data raise a central issue of the confidentiality of taxpayer information, and the general inability of those outside government to undertake revenue-based average tax rate analysis at the micro-level. This is unfortunate (yet understandable), as broader access to micro-level data would accelerate progress in this field. One area that countries might wish to explore, on the corporate tax side, would examine possible levels of aggregation of taxpayer-level data that maintain confidentiality, while supporting revenue-based average tax rate analysis on a disaggregate basis. On the personal tax side, it would be useful to explore whether confidentiality could be maintained and access to data supported through the used of anonymous taxpayer records.

Chapter 1

INTRODUCTION

This paper reports work by Delegates of Working Party No. 2 of the OECD Committee on Fiscal Affairs (CFA) examining the use of taxpayer-level "micro-data" to assess average tax rates on various income types. The work may be seen as follow-up to that published in *Tax Burdens – Alternative Measures*, OECD Tax Policy Studies No. 2, which examines various "backward-looking" and "forward-looking" tax burden measures.[1] The purpose of the exercise is to examine in greater detail backward-looking measures, and in particular, to draw out relative strengths of tax revenue-based approaches relying on micro-data collected from personal and corporate income tax returns, as an alternative to measures based on aggregate tax revenue data as reported in OECD *Revenue Statistics*.

Interest in the calculation of average tax rates on various categories of income, for example labour or capital income, measured using tax revenue data, can be traced to at least three considerations. First, other often-cited tax rates, including statutory tax rates, and marginal and average effective tax rates based on models of taxpayer behaviour, may provide limited information on tax burdens on labour and capital income. Depending on the modelling approach, forward-looking measures tend to give less than full consideration of certain factors that influence the amount of tax collected, and therefore may provide imprecise indicators of tax burdens on employment, savings and investment activities.

Statutory tax rates, while relevant to tax-planning incentives, work effort and investment decisions, ignore special tax allowances, tax credits and other provisions important to effective tax rate calculations. *Marginal effective tax rates* (METRs), while taking into account a number of factors thought relevant to work and investment behaviour, ignore factors pertaining to infra-marginal activities and tax-planning, which may be important in assessing tax burdens and incentive effects of tax systems. Similarly, forward-looking *average effective tax rates* derived for capital income, while capturing the taxation of infra-marginal rents and provisions relevant to the after-tax cost of acquiring capital, take less than full account of tax-minimising strategies, the influence of business loss carryover provisions, and other factors determining actual tax burdens on income from capital.

Backward-looking *average tax rates*, on the other hand, measured using actual revenue figures, take into account the effects of statutory income tax rates, tax deductions and tax credits in determining the tax take. They also take into account the effects of tax planning, tax relief provided by lax or discretionary administrative practice, as well as non-compliance. Thus revenue-based average tax rates in principle offer certain advantages in measuring actual tax burdens. However, as backward-looking measures, they may give misleading information on effective taxation of returns on prospective investment. On the other hand, given that they account for tax planning, they may be useful in assessing the likely tax burden on past investment. They could be used, for example, as a check against model-based average effective tax rate (AETR) measures that are properly forward-looking, but ignore factors that may be of critical importance in particular cases.

In addition to these possible advantages encouraging the use of actual tax return data, there is a view, perhaps mistaken, that average tax rate analysis based on revenue data is intrinsically a simpler

1. See Chapter 6 of *Tax Burdens – Alternative Measures* for a discussion of the relevance of backward-looking (tax revenue-based) measures to address primarily fairness considerations, and in particular the sharing of tax burdens, and forward-looking (model-based) measures for taxes on capital income relevant to assessing investment incentives.

exercise than model-based approaches, for example AETR analysis. In particular, there is no need to delve into the detailed rules that go into the determination of capital cost allowances, investment tax credits, the cost of financial capital, and so on, that must be encoded into a METR or AETR formula. The net effect of these and other rules on tax burdens is captured in the (numerator) measure of tax revenues collected.

Third, it is recognised that, whatever the relative strengths of average tax rates based on aggregate revenue data, such numbers will be generated, quoted, interpreted and used to influence tax policy debate. Given this, an interest emerges in developing a better understanding of what goes into the making of average tax rates based on aggregate data, and what can and cannot be made of them.

With this background, Delegates of Working Party No. 2 agreed to a project that would consider and implement frameworks relying on *micro-level data* to assess average tax rates on various categories of income. This work would build on earlier work undertaken by the group in this area.[2] The results from the project would be of interest in their own right, while at the same time could shed light on the extent to which average tax rates derived from aggregate (*e.g.* R*evenue* S*tatistics* and N*ational* A*ccounts*) data could be used to inform policy debate. A number of Delegates volunteered (or were asked to volunteer!) to assist in this project, relying on confidential data drawn from tax returns. This paper provides a summary of work undertaken by Delegates from Austria, Belgium, Canada, Denmark and Norway, reporting on the use of taxpayer-level data to assess average tax rates on labour, capital, and transfer income.

Chapter 2 of the paper reviews work by Norway and Denmark focusing on advantages that micro-data offer in isolating tax revenues raised from various types of income. This precision enables a check on results derived from aggregate data, and possibly more accurate estimates of economy-wide average tax rates on labour, capital and transfer income. This section also reviews work by Austria that serves to illustrate the strengths of micro-data in permitting the computation of average tax rates on labour income at various wage levels, and across different household types.

Chapter 3 reports work by Belgium and Canada analysing how micro-data can be used to calculate average tax rates at the corporate level on income from capital. This work is important, given widespread policy interest in assessing average corporate tax rates, and given the general inability of aggregate data to generate a meaningful annual corporate average tax rate series. The considerations also have implications for implicit capital tax rates derived from aggregate data. A number of examples are provided to illustrate the impact of cyclical effects on corporate tax burden measures, the importance of correcting for business losses in average tax rate calculations, and possible adjustments using micro-data. This section also reports variations in tax rates at the industry level and by firm size. Chapter 4 briefly concludes.

2. As reported in T*ax* B*urdens* – A*lternative* M*easures*, OECD Tax Policy Studies, No. 2 (2000), and in T*ax* R*atios* – A C*ritical* S*urvey*, prepared by Jakob de Haan and Bjorn Volkerink, released as OECD Tax Policy Studies, No. 5 (2001).

Chapter 2

ASSESSING AVERAGE TAX RATES ON PERSONAL INCOME

A key attribute of micro-data is the flexibility it provides, enabling the modeller to derive average tax rates at various levels of aggregation ranging from the individual taxpayer to the overall economy level. While a disaggregate view is required to address many policy-related questions, figures reporting levels and trends in the *economy-wide* average tax rate on different categories of income may also be of interest – for example, to address the sharing of tax burdens between labour and capital, and so the overall "fairness" of the tax system. Macro-modellers may also be interested in single, economy-wide tax rate series for labour and capital income. This section considers advantages of relying on micro-data to assess economy-wide average tax rates on labour income, with reference to the Norwegian tax system. It also reports on economy-wide average tax rates on transfer income based on micro-data, with illustrations by Denmark. These strengths are assessed relative to the implicit tax rate approach (reviewed in Annex I) that relies on aggregate *Revenue Statistics* and *National Accounts* data.

A main concern with implicit tax rate analysis is the relatively crude manner in which revenues from a given comprehensive or schedular personal income tax are allocated across (attributed to) different categories of income included in the tax base. The implicit tax rate method in effect assumes that a single economy-wide average tax rate on personal income may be taken as the effective tax rate on all income included in the personal tax base for all taxpayers.[1] This assumption is generally unrealistic, and calls for more detailed work as considered in this paper. As reviewed below, micro-data permit a more targeted assessment of the amount of personal income tax revenue raised from labour income and other types of income. This in turn may enable improved estimates of average tax rates by income type, or more generally, provide results that confirm or lead one to reconsider certain results based on aggregate data.

Obtaining good estimates of the (notional) allocation of personal tax revenues across income types, to calculate economy-wide average tax rates on labour, capital and other income, is important, given the importance of this tax. In OECD Europe, taxes on personal income accounted for roughly one-quarter of total tax revenues in 2000. In OECD America, almost 40 per cent of revenues were raised from personal income tax, while in OECD Pacific the figure was about 30 per cent.

In addition to offering possible refinements to economy-wide average tax rate measures, micro-data enable *disaggregate analysis* to guide policy-making. For example, in assessing distribution effects of the tax system, and the impact of taxation on labour markets, attention may be given to effective tax rates on wage income measured separately for various taxpayer groups that differ by income level and household structure. The ability to measure average tax rates for different taxpayer groups is important to the extent that effective tax rates vary across taxpayer groups (*i.e.* the tax wedge depends on the income level and the household structure). It is also important to the extent that the behavioural response to a given tax wedge differs depending on the taxpayer situation.[2]

1. As reviewed in Annexes I and II, under the implicit tax rate approach, total personal income tax on labour (capital) income is estimated as the proportion of aggregate personal income tax that aggregate labour (capital) income is to aggregate personal income.
2. Average tax rates on wage income, which may affect labour market participation decisions, can differ significantly depending on the wage level and household structure (married *vs.* single, principal *vs.* secondary-earner, with or without children) (see OECD Taxing Wages). There is evidence that elasticities of labour demand and supply may differ depending on the taxpayer group (*e.g.*, primary earners vs. secondary earners) (see R. Blundell [1996]).

To illustrate this point, work by Austria is reviewed which finds significant variability in average tax rates on wage income across wage levels. This raises questions over the use of implicit labour tax rates to assess the tax burden on labour income taxed on a progressive basis, as reliance on aggregate data means that only a single summary labour tax burden measure may be assessed for a given country in a given year. Attempts to use average tax rates to assess fairness in the tax system are therefore severely limited without information on the distribution of the tax burden. The paper argues that assessments of the possible impact of the tax system on labour market participation are strengthened where one is able to measure average tax rates on labour income at various income levels and for different taxpayer groups.

Analysis by Austria shows that an average tax rate measure, even if derived for a tax that applies to one type of income alone, for example a wage tax on labour income, may not be particularly informative for policy purposes where the rate is derived from aggregated data. Problems of interpretation are shown to arise where the average tax rate measure is sensitive to the distribution of labour income, as for example under a progressive tax rate structure. These problems may become pressing where employment concerns are concentrated on blue-collar workers, for example, earning an average production wage.

2.1. Isolating revenues from different income categories

Examples by Norway and Denmark illustrate how micro-data may permit more direct measurement of the amount of tax revenue raised from different categories or types of income. There may be policy interest, for example, in measuring average tax rates on capital income, or on labour income, or more narrowly on wage and salary income, or transfer income.[3] In such cases, two advantages may be identified when relying on micro-data – one in relation to the treatment of taxes that include a single category or type of income in the tax base, and another in relation to taxes with two or more types of income in the tax base and where a notional revenue split is required.

2.1.1. *Identification of taxes levied on a single income category*

Where there is policy interest in measuring the effective tax rate on a specific category of income, and a given tax is levied on that income category alone (as can occur under a schedular tax system), in general the revenues from that tax should be accounted for in their entirety when measuring an average tax rate for that income. However, when relying on aggregate personal income tax revenue data, the revenues from such a tax are typically factored in only partially. Under the implicit tax rate approach, aggregate personal tax revenues are scaled to approximate a notional labour tax component. In contrast, the use of micro-data can permit the identification and separate measurement of the relevant tax revenue amount. This precision holds out certain advantages, as the implications of partial inclusion are generally unknown, leading to uncertainty over the accuracy of implicit tax rate results.

The Norwegian dual income tax example illustrates this advantage. Under this schedular system, tax is imposed at a flat (proportional) rate on ordinary income, which includes labour and capital income.[4] Separately, an income surtax is imposed under a two-step progressive rate schedule on gross

3. Income may be separated into labour income or capital income. Implicit tax rate analysis generally restricts itself to these two broad income categories (while measuring average tax rates on other "taxable events", *e.g.*, consumption). Access to micro-data enables measurement of average tax rates on various types (sub-categories) of income – for example, on alternative items or groupings of labour income amounts. A broad definition of labour income would include wages and salaries, the labour component of returns to the self-employed, and pension income including social security benefits. Policy analysis may call for effective tax rate measures for more narrow definitions of labour income (*e.g.*, excluding pension income).

4. Ordinary income includes wage and salary income (including fringe benefits), pension/benefits income, imputed labour income of the self-employed, and also capital income (dividends, capital gains, interest, rents, imputed capital income of self-employed business owners, and other forms of capital income), less deductions. A flat 28 per cent rate applies to ordinary income in excess of a threshold which varies depending on the household structure (Class 1 or Class 2). The separate income surtax on gross labour income is imposed at progressive rates with taxable income thresholds and allowances that also depend on the household structure (Class 1 or Class 2), with no deductions.

labour income alone (alternatively called the tax on personal income). Micro-data can isolate the amount of tax collected on labour income by this income surtax, which is not possible when working with aggregate individual income tax data – for example, when relying on *Revenue Statistics* data that combines tax on ordinary income, tax on personal (labour) income, and tax on capital income, and reports a single aggregate personal income tax revenue amount in a given year.[5]

To illustrate, consider the following equation set relying on micro-data to measure the total amount of tax imposed in Norway in a given year on labour income:

$$IT(\text{labour}) = \Sigma_j(w^L_j \cdot OT_j) + S + SSC \quad (1a)$$

$$S = \Sigma_j S_j \quad (1b)$$

$$SSC = \Sigma_j SSC^{ee}_j + \Sigma_j SSC^{se}_j + \Sigma_j SSC^{er}_j. \quad (1c)$$

where the summation term Σ_j is over all individual taxpayers (or alternatively a representative weighted sample of n taxpayers, with j = 1 ,…, n).

The first term in equation (1a) estimates the total amount of tax on ordinary income (OT) derived from the labour income component of the ordinary income tax base, using taxpayer-specific weights w^L_j measuring the fraction of net ordinary income that is labour income.[6] The third term measures aggregate social security contributions collected on labour income, with the components shown in equation (1c). The first two, social security contributions of employees ($\Sigma_j SSC^{ee}_j$) and the self-employed ($\Sigma_j SSC^{se}_j$), are levied on labour income.[7] The third, employer social security contributions ($\Sigma_j SSC^{er}_j$), is levied on wage and salaries alone. All three contributions relate to labour income, and may be included in full in estimating the total amount of tax imposed on labour income.

This sub-section focuses on the second term S in (1a), measuring income surtax revenues.[8] As with social security contributions, the surtax is imposed on labour income alone, and should be included in full when estimating total tax revenues raised on labour income. Working with micro-data, this precision is possible, as reflected in equation (1a).

In contrast, the implicit tax rate approach factors in some fraction f^L of total personal income tax revenues – comprised of ordinary income tax plus income surtax revenues – in measuring the total amount of tax imposed on labour income, as follows:[9]

$$IT^{(agg)}(\text{labour}) = f^L(OT + S) + SSC \quad (2)$$

where OT denotes total tax revenues on ordinary income, S denotes total income surtax revenues, and SSC denotes total social security contributions.

When comparing equations (1a) and (2), two differences are evident. First, the micro-data approach allows one to rely on taxpayer-specific weights (w^L_j), rather than an overall average weight (f^L), when estimating the labour component of the tax on ordinary income. The advantages of relying on taxpayer-specific weights are taken up in section 2.1.2.

Second, whereas the income surtax (tax on personal (labour) income) is accounted for in full in equation (1a), only some fraction (f^L) of S is included in the implicit tax rate model, with the weight (f^L) assessed as the percentage of total individual income that is labour income (see Annex I). As noted, given that the base of S is labour income alone, the surtax amount should be included in full in

5. The revenues from these taxes are aggregated and reported under category 1110 in OECD *Revenue Statistics* ("taxes on income and profits of individuals").
6. As elaborated in section 2.1.2, micro-data enable precision in estimating tax imposed on a given category/type of income by a broad-based tax.
7. Employee social security contributions are imposed on wage and salary income and pension income, while social security contributions of the self-employed are imposed on pension income and imputed labour income of the self-employed.
8. the income surtax is imposed on wage and salary income, imputed labour income of the self-employed, and pension income.
9. Note that total personal income tax (OT + S) in (2) corresponds to category 1100 in the *Revenue Statistics*.

measuring total tax imposed on labour income, to feed into the corresponding calculation of the average tax rate on labour.

When working with aggregate data, the implications are generally unclear of partially rather than fully including the income surtax. The potential for under-estimating labour tax revenues (and thus the average tax rate on labour income) increases the larger is the contribution of the surtax to total tax revenues collected on labour income. However, the percentage contribution of the income surtax is uncertain where one only has access to aggregate personal income tax revenue statistics, as reported in *Revenue Statistics*.

Analysis by Norway of average tax rates on labour income

Work by Norway investigates the importance of this particular advantage of micro-data in assessing the average tax rate on labour income, using a variant of equation set (1), as follows:[10]

$$\tau^{L(Norway)} = (w^L \cdot OT + S + SSC)/(W + SSC^{er}) \quad (3a)$$

$$w^L = W/OY \quad (3b)$$

where the first term ($w^L \cdot OT$) gives an estimate of the labour portion of total tax revenues raised on ordinary income, S is total income surtax, SSC is total social security contributions, SSC^{er} is total employer social security contributions, and W denotes labour income. The scaling factor used to weight total tax on ordinary income is given by (3b), where W includes total wages and salaries of employees plus the total labour portion of remuneration of the self-employed, and OY measures total ordinary income.[11] The average tax rate on labour income (including pension income) is estimated to be 33.1 per cent on average over the period 1997-1999 when relying on tax return data.

Under the implicit tax rate approach, the income surtax S is factored into the numerator only in part, as follows:

$$\tau^{L(implicit)} = (w^L \cdot (OT + S) + SSC)/(W + SSC^{er}) \quad (4)$$

When relying on aggregate data, the average effective tax rate on labour is estimated to be 33.0 per cent in the same period. Thus, the micro-data are useful in this instance in lending support to the results derived from aggregate data. In particular, including the income surtax in part rather than in full is shown to not materially affect estimates of the average tax rate on labour income in Norway over the years considered. This finding reflects the relatively low percentage contribution of the surtax to the total tax on labour income. Conversely, in systems where a tax levied on a single income category accounts for a more significant portion of total tax on that income (with that amount "buried" in aggregate tax data), the use of micro-data could provide for more precise average tax rate measures.

2.1.2. *Treatment of taxes levied on multiple income types*

Micro-data may also enable more precise measurement of the amount of tax imposed on a given category or type of income by a tax that includes more than one type of income in its tax base. Depending on what average tax rate is being measured, interest arises in accurately measuring tax collected, for example, on labour income, or wage income, or transfer income. In such cases, micro data allows one to link features of a tax system that treat different types of income differently to the distribution of these income flows across taxpayers subject to varying average tax rates.

10. In estimating the labour portion of tax on ordinary income, the approach taken in (3a) – unlike that shown in equation (1a) – does *not* use taxpayer-level data. As with the implicit tax rate approach, it instead relies on an overall weight (w^L) rather than taxpayer-specific weight. Thus the exercise concentrates on the benefits of isolating the surtax for the purpose of the average tax rate calculation.
11. In measuring (3a), the labour component of income from self-employment is measured at the taxpayer level (and then aggregated) by relying on the split of operating surplus of the self-employed into labour and capital components as required for tax purposes (as discussed on Annex I). Total labour income in the numerator of equation 3b) is measured net of deductions allocated to labour. Ordinary income OY appearing in the denominator of 3b) is measured from tax returns (gross of the class allowance).

To take an example, when tasked with measuring an average tax rate on labour income, and given the need to incorporate an estimate of the (notional) amount of tax revenue raised from a broad-based tax that can be attributed to labour income, the use of taxpayer-level data can more closely assess the influence of special features targeted at labour income.[12] This section draws on sub-section 2.1.1 focusing on the Norwegian tax system, and examines how micro-data can be used to measure the amount of total tax on ordinary income that can be tied to labour income, or more narrowly, wage income.[13]

Consider first a simple framework that illustrates how micro-data may be used to estimate the (notional) amount of tax revenues raised by a given tax on a specific type of income (*e.g.* personal income tax on wage income) where that income is included with other types of income in the tax base. The general results obtained can be compared with those under the implicit tax rate methodology. While the analysis focuses on measuring an average tax rate on labour income, the issues raised generally carry over when assessing the tax burden on other types of income included in a broadly defined (pooled) tax base. We then turn to an application of the general approach by Denmark, which considers a broad-based personal income tax and focuses on assessing personal tax revenues derived from pension and benefit income.

The illustrative framework assumes an economy with two taxpayers (1 and 2) and a single tax (*e.g.* personal income tax) levied on taxable income that includes labour income W_j and "other" income Y_j, where j is an index over taxpayers (j = 1, 2).

Taxpayer 1

We can model taxpayer 1's personal income tax liability in a general fashion as follows:

$$PIT_1 = t(W_1 + Y_1 - \lambda E_1 - A) - C_1 \qquad (5a)$$

where t denotes the personal income tax rate,[14] W_1 measures labour income, Y_1 measures "other" taxable income, λE_1 measures deductible expenses incurred in earning "other" income with the deductible portion λ given by the tax code, A measures a basic tax allowance, and C_1 denotes a general or targeted tax credit.[15]

The portion of taxpayer 1's personal income tax liability linked to labour income can be estimated as the portion that labour income is to the taxpayer's total economic (or accounting) income:

$$PIT(lab)_1 = PIT_1 \cdot (W_1/(W_1 + Y_1 - E_1)) = f^L_1 \cdot PIT_1. \qquad (5b)$$

Similarly, the amount raised from "other" income is given by:

$$PIT(oth)_1 = PIT_1 \cdot ((Y_1 - E_1)/(W_1 + Y_1 - E_1)) = f^O_1 \cdot PIT_1. \qquad (5c)$$

Consider the income weights for labour (wage) and "other" income for taxpayer 1:

$$f^L_1 = W_1/(W_1 + Y_1 - E_1) \qquad (5d)$$

$$f^O_1 = (Y_1 - E_1)/(W_1 + Y_1 - E_1) \qquad (5e)$$

12. Such features could include special tax deductions or credits tied to employment income (*e.g.*, deductions for travel expenses, earned income tax credits). Similarly, differences in tax burdens on labour income compared with capital income tied to a progressive tax rate structure would be taken into account, unlike in the implicit tax rate approach. If capital income tends to be earned primarily by taxpayers with relatively high average tax rates, tending to increase the average tax rate on capital income relative to labour income, results derived using micro-data would account for this, whereas a reliance on aggregated data would not. To take another example, taxpayer-level data can more directly assess features of the tax system that affect the tax burden on income from capital, for example provisions allowing a partial deduction for interest expense on amounts borrowed to generate taxable interest income.
13. An estimate of the average tax rate on wage income may be a better indicator of the tax burden on employment, compared with an average tax rate on labour income broadly defined.
14. The tax rate t can be interpreted as either a flat tax rate, or representing a progressive rate structure applied to the tax base shown in round brackets.
15. The illustrative framework ignores, for ease of exposition, expenses incurred in earning wage income – such expenses however can be readily factored in, in a manner analogous to that shown for expenses in earning "other" income.

These weights f^L_1 and f^O_1, applied to personal income tax, are taxpayer-specific and are determined *without* reference to the deduction scaling factor λ, the standard allowance or the tax credit. The measurement of the weights requires an assignment of the expense E_1 to the relevant income type (in the example, Y_1). Where an expense (negative income) item relates to more than one type of income, it is necessary to allocate the expense across the relevant income amounts.

The denominator of the weights $(W_1 + Y_1 - E_1)$ is comprised of flows that establish taxpayer 1's economic income, as opposed to the individual's net income for tax purposes. For practical purposes, the modeller may resort to an accounting measure of net income. The counterpart to this accounting basis at the economy wide level is household income on a N*ational Accounts* basis. Tax provisions relevant to measuring the tax base are *not* taken into account in the measurement of the denominator of the weights. The effect of tax provisions is captured through their impact on reported tax revenues (PIT).

Personal tax raised on a taxpayer's labour income can be expressed as a fraction (f^L_1) of personal income tax (see equation (5b)), or alternatively as a percentage τ_1 of that taxpayer's labour income W_1 where τ_1 is *taxpayer 1's average tax rate* on personal income:

$$\tau_1 = PIT_1/(W_1 + Y_1 - E_1) \quad (5f)$$

T*axpayer* 2

Modelling taxpayer 2's income tax liability in an analogous fashion we have:

$$PIT_2 = t(W_2 + Y_2 - \lambda E_2 - A) - C_2 \quad (6a)$$

$$PIT(lab)_2 = f^L_2 \cdot PIT_2 = \tau_2 \cdot W_2 \quad (6b)$$

$$PIT(oth)_2 = f^O_2 \cdot PIT_2 = \tau_2 \cdot (Y_2 - E_2) \quad (6c)$$

$$f^L_2 = W_2/(W_2 + Y_2 - E_2) \quad (6d)$$

$$f^O_2 = (Y_2 - E_2)/(W_2 + Y_2 - E_2) \quad (6e)$$

$$\tau_2 = PIT_2/(W_2 + Y_2 - E_2) \quad (6f)$$

For each taxpayer, the tax rate τ_j is an average rate over the taxpayer's labour and "other" income – in other words, income-specific tax rates for each taxpayer are *not* derived in this framework.[16] However, the rates are taxpayer specific, with τ_j reflecting taxpayer j's taxable position. In particular, this rate depends on the *level* of taxpayer j's total taxable income where the tax rate schedule denoted by t is progressive and/or where standard (fixed) allowances are provided. Individual tax rates may also differ across taxpayers depending on the *composition* of income to the extent that personal income tax deductions and/or credits are targeted at (or earned in respect of) different income types, and income composition varies across taxpayers.

In the context of the model, when comparing results for taxpayer 1 and taxpayer 2 (*i.e.* comparing equations (5a) and (6a), and (5f) and (6f)), the average income tax rate for taxpayer 1 (τ_1) can differ from that for taxpayer 2 (τ_2) to the extent that:

- taxpayer 1 and taxpayer 2 have *different levels of* (*pre-tax*) *income*, and the personal tax rate structure (t) is progressive and/or standard allowances (A) are provided ; and/or
- taxpayer 1 and taxpayer 2 have the same (pre-tax) income level, but *different income composition*, and different tax payable due to income- or expenditure-specific tax deductions and/or tax credit claims (as denoted by λE_i and C_i).

While the approach measures a single average income tax rate for a given taxpayer in a given year, the micro-data allow one to assess different average tax rates for different taxpayers, and thereby enable notional tax revenue and overall average tax rate estimates for different categories of income that take into account different taxpayer situations.

16. As pointed out at the CESifo conference, an assessment of income-specific rates would be important where one is assessing a marginal (as opposed to an average) tax rate.

Measuring average tax rates on labour income

Using these ***micro data*** results, an average tax rate on labour income, and an average tax rate on "other" income can be derived taking into account potentially important taxpayer-level information. For illustrative purposes, consider the measurement of the average tax rate on labour income, which we can denote by $\tau^{L(micro)}$. This rate is determined by adding the taxpayer-level (notional) amounts of personal tax on labour income and dividing by aggregate labour income, as follows:

$$\tau^{L(micro)} = (\tau_1 \cdot W_1 + \tau_2 \cdot W_2)/(W_1 + W_2) \quad (7a)$$

where the taxpayer-level personal tax rates are given by:

$$\tau_i = PIT_i/(W_i + Y_i - E_i) \ (i = 1, 2) \quad (7b)$$

The point to emphasise is that the estimate of total tax revenues derived from labour income, appearing in the numerator of the average tax rate calculation (7a), is determined using taxpayer-specific (rather than overall) average personal income tax rates. In particular, labour income at the taxpayer-level is weighted using taxpayer-specific tax rates (τ_i).

In contrast, when working with ***aggregate data***, as under the implicit tax rate approach (reviewed in Annex I), the estimate of total tax revenues derived from labour income is derived by applying a single (overall) taxpayer average personal income tax rate τ^{agg}, as follows:

$$\tau^{L(impl)} = \tau^{agg} \cdot (W_1 + W_2)/(W_1 + W_2) \quad (8a)$$

where

$$\tau^{agg} = \Sigma \ PIT_i/\Sigma \ (W_i + Y_i - E_i) \quad (8b)$$

Compare the two approaches. The micro-data approach links features of the tax system determining average income tax rates of individual wage earners with the distribution of wage income across taxpayers (similarly for "other" income). In estimating the notional amount of revenue raised from labour income, the micro-data framework weights labour income at the taxpayer level with taxpayer-specific tax rates. Depending on the distribution of wage income in the economy, and the variation in average tax rates at the taxpayer level, the resulting estimate of the notional amount of tax revenue raised on labour income could differ markedly from that obtained when relying on an overall economy-wide average tax rate, as under the implicit tax rate approach.

To elaborate this point, consider the situation where labour income is concentrated in the hands of taxpayer 1 (with "other" income in the hands of taxpayer 2), and taxpayer 1's average tax rate τ_1 is lower than that of taxpayer 2 (and thus lower than the overall rate τ^{agg}). Then weighting labour income by τ_1 would provide a closer approximation of tax revenues raised from labour income than relying on τ^{agg}. In practice, wage income is dispersed among taxpayers and the importance of using taxpayer-specific rather than overall economy-wide average tax rates is an empirical question. Yet the use of taxpayer-level data holds out the advantage where such differences are important.

Analysis by Denmark of average effective tax rates on transfer income

Work by Denmark analyses how taxpayer-level data can be used to disaggregate personal income tax revenues into notional component parts, and derive corresponding average effective tax rates, using an approach along the lines set out in the simple framework discussed above. The results reported in Table 1 show significant variation in average tax rates across different types of transfer income, indicating that the distribution of transfer income across taxpayers differs depending on the specific type of transfer income. The results also show the relative importance of tax allowances for different taxpayers earning different types of transfer income. For example, tax allowances are shown to have little effect on average effective tax rates on social pensions and low income transfers, while lowering rates on unemployment benefits and sickness benefits by 4 to 5 percentage points.

Table 1. **Average effective tax rates on various types of social transfers, Denmark**

Type of transfer income	Average effective tax rate	
	Without tax allowances	*With tax allowances*
Social pensions	29.25	29.20
Supplementary pension	31.46	31.38
Civil servants pension	38.72	38.47
Early retirement pension	31.60	30.81
Sickness benefits	32.29	28.25
Parental leave	28.50	22.26
Educational allowance	20.96	20.07
Support, start enterprise	28.91	25.15
Unemployment benefit	31.98	26.49
Early retirement unemployment	31.46	28.31
Low income	29.12	28.57

Source: Ministry of Finance, Denmark.

2.2. Addressing progressivity and income distribution effects

Average tax rate measures for labour income may be of policy interest where there are concerns that the tax system is not sufficiently progressive, or more generally does not adequately address income distribution concerns. Such measures may also be of interest where concerns exist that the tax system is creating a large wedge between gross (pre-tax) labour costs and the after-tax take-home pay of workers, discouraging labour market participation. However, measuring a representative average tax rate is difficult when relying on aggregate data, as the net impact of progressive tax rate structures, tax allowances and tax credits can differ, sometimes significantly, depending on the gross wage level and household structure.

For example, the effect of a fixed allowance in offsetting tax is relatively more pronounced at low earnings. Tax allowances and credits may be subject to thresholds and have tapering (phasing-in and phasing-out) provisions, where again the relative importance of such measures depends on gross earnings. Where the average tax rate on labour income varies with gross income, the relevance of an average tax rate derived using aggregate data is less than clear. An analysis of Austrian data shows that average tax rates on labour income derived on the basis of aggregated tax revenue data are representative for only a narrow band of wage earners. In contrast, reliance on micro-data can provide a range of effective tax rate calculations of policy interest.

Austrian micro-data gather separate series for taxes assessed on labour income, including wage taxes, (final) income taxes, and social security contributions. While final income tax assessments determine the final income tax burden on labour income, the wage tax statistics (reflecting a prepayment of income tax) offer timely insights into average tax rates on labour income at various wage levels. The figures closely approximate the "true" tax burden figures where final assessments result in minimal adjustments, and offer the advantage of being available a year before the final income tax data. Furthermore, wage tax statistics are compiled separately for employees (Table 2) and pensioners (Table 3). This feature is attractive where one is interested in examining the impact of the tax system on employment incentives for a particular taxpayer group (employees), with reference to effective tax rates on current wages (as opposed to pension income taxed as ordinary income). The data show that removing pensioners from the sample sharpens the focus of the exercise, with total wage tax paid by pensioners amounting to over 48 billion ATS in 1999, or roughly 23 per cent of total wage tax collected in that year. Moreover, effective tax rates are shown to differ between pensioner and employee groups at various income levels.

Table 2. **ATR results for employees based on micro-data (Austria, Wage Tax Statistics, 1999)**

Gross income 000's ATS	Gross wages and salaries			Wage tax					Social security contributions			
	Persons	Mill.ATS	Per head	Persons	Mill.ATS	Per head	ATR	DTR	Persons	Mill.ATS	Per head	ATR
0-50	459 915	9 727	21.1	224 916	241	1.1	5.1%		341 154	1 174	3.4	16.3%
50-100	287 951	21 579	74.9	151 315	601	4.0	5.3%	5.4%	269 805	3 228	12.0	16.0%
100-150	275 379	34 394	124.9	172 310	1 050	6.1	4.9%	4.2%	273 443	5 714	20.9	16.7%
150-200	281 671	49 416	175.4	262 406	2 276	8.7	4.9%	5.1%	280 842	8 524	30.4	17.3%
200-250	317 780	71 736	225.7	315 526	5 217	16.5	7.3%	15.6%	317 212	12 482	39.3	17.4%
250-300	372 715	102 622	275.3	371 921	9 558	25.7	9.3%	18.5%	372 249	17 834	47.9	17.4%
300-350	357 645	116 069	324.5	357 447	12 772	35.7	11.0%	20.4%	357 260	20 076	56.2	17.3%
350-400	292 265	109 239	373.8	292 161	13 556	46.4	12.4%	21.7%	291 954	18 728	64.1	17.2%
400-450	215 355	91 257	423.8	215 226	12 555	58.3	13.8%	23.9%	215 057	15 437	71.8	16.9%
450-500	157 145	74 440	473.7	157 046	11 335	72.2	15.2%	27.7%	156 924	12 354	78.7	16.6%
500-600	205 798	112 314	545.7	205 558	19 535	95.0	**17.4%**	31.7%	205 346	18 133	88.3	**16.2%**
600-700	119 999	77 413	645.1	119 721	15 367	128.4	19.9%	33.5%	119 533	11 718	98.0	15.2%
700-800	71 179	53 115	746.2	70 866	11 537	162.8	21.8%	34.1%	70 906	7 300	103.0	13.8%
800-900	45 304	38 358	846.7	45 101	8 852	196.3	23.2%	33.3%	45 078	4 797	106.4	12.6%
900-1 000	29 720	28 146	947.0	29 580	6 788	229.5	24.2%	33.1%	29 526	3 214	108.9	11.5%
1 000-1 400	52 229	60 320	1 154.9	51 865	15 705	302.8	26.2%	35.3%	51 768	5 815	112.3	9.7%
1 400-2 100	19 944	32 982	1 653.7	19 825	9 354	471.8	28.5%	33.9%	19 686	2 244	114.0	6.9%
2 100-2 800	4 725	11 263	2 383.7	4 699	3 292	700.6	29.4%	31.3%	4 604	533	115.8	4.9%
2 800-3 500	1 778	5 506	3 096.7	1 774	1 683	948.7	30.6%	34.8%	1 718	200	116.4	3.8%
3 500 and over	2 207	12 764	5 783.4	2 204	4 018	1 823.0	31.5%	32.5%	2 132	263	123.4	2.1%
	3 570 704	**1 112 660**	**311.6**	**3 071 467**	**165 292**	**53.8**	**17.3%**		**3 426 197**	**169 768**	**49.5**	**15.9%**

Average (APW) income Median income ATR (agg)

Note: ATR = average tax rate ; DTR = "discrete change" tax rate.
Source: Ministry of Finance, Austria.

Table 3. **ATR results for pensionners based on micro-data (Austria, Wage Tax Statistics, 1999)**

Gross income 000's ATS	Gross wages and salaries			Wage tax				
	Persons	Mill.ATS	Per head	Persons	Mill.ATS	Per head	ATR	DTR
0-50	290 359	6 005	20.7	13 001	30	2.3	11.2%	
50-100	257 654	19 656	76.3	18 411	85	4.6	6.1%	4.2%
100-150	422 728	51 443	121.7	83 697	259	3.1	2.5%	–3.4%
150-200	264 056	45 890	173.8	240 294	2 575	10.7	6.2%	14.6%
200-250	213 786	47 955	224.3	211 489	4 868	23.0	10.3%	24.3%
250-300	170 819	46 733	273.6	170 228	6 102	35.8	13.1%	26.0%
300-350	123 017	39 846	323.9	122 829	6 080	49.5	15.3%	27.1%
350-400	84 085	31 271	371.9	83 980	5 257	62.6	16.8%	27.3%
400-450	43 562	18 403	422.5	43 508	3 334	76.6	18.1%	27.8%
450-500	29 032	13 761	474.0	29 001	2 673	92.2	19.4%	30.2%
500-600	32 572	17 755	545.1	32 545	3 733	114.7	**21.0%**	31.7%
600-700	19 453	12 551	645.2	19 438	2 861	147.2	**22.8%**	32.5%
700-800	12 235	9 116	745.1	12 216	2 196	179.8	24.1%	32.6%
800-900	7 192	6 088	846.5	7 183	1 526	212.4	25.1%	32.2%
900-1 000	5 134	4 865	947.6	5 123	1 288	251.4	26.5%	38.5%
1 000-1 400	8 270	9 492	1 147.8	8 247	2 643	320.5	27.9%	34.5%
1 400-2 100	2 567	4 254	1 657.2	2 563	1 207	470.9	28.4%	29.5%
2 100-2 800	817	1 858	2 274.2	816	548	671.6	29.5%	32.5%
2 800-3 500	382	1 184	3 099.5	380	315	828.9	26.7%	19.1%
3 500 and over	530	2 970	5 603.8	529	780	1 474.5	26.3%	25.8%
	1 988 250	**391 096**	**196.7**	**1 105 478**	**48 360**	**43.7**	**22.2%**	

Average income Median income ATR (agg)

1. ATR = average tax rate ; DTR = "discrete change" tax rate.

Source: Ministry of Finance, Austria.

The average tax rate (ATR) analysis for employees in Table 2 derives two average tax rate series, one for wage taxes (τ^{L}_{I}) and a second for employee social security contributions (τ^{L}_{II}):

$$\tau^{L}_{I} = WT/W \quad (9)$$

$$\tau^{L}_{II} = SSC^{ee}/W \quad (10)$$

where WT measures wages taxes withheld on wage income, SSC^{ee} measures employee social security contributions, and W measures gross wages and salaries of employees (wages and salaries recorded net of SSC^{ee}, plus SSC^{ee}). Employer social security contributions and payroll taxes are not included (although these could be factored in). Instead, the analysis focuses on wage tax and employee social security contribution components of average effective tax rates on labour, and draws out a number of useful observations.[17]

First, the results reveal that a single average tax rate derived using aggregate taxpayer data provides limited tax burden information in the Austrian example, even where the relevant tax revenues on labour income can be isolated (as they can, in this example in the case of the wage tax). In particular, Table 2 shows that the average tax rate on wage income, derived at an aggregate level for all employees as a group, at 17.3 per cent, corresponds to the average tax rate on wages of taxpayers with gross income of roughly 550 thousand ATS. This rate is nearly double that applicable to those with average wage earnings of 300 thousand ATS, and triple the rate applicable to those with gross earnings in the range of 50-200 thousand ATS. Given this variability, it is unclear how one should interpret in a policy context the overall figure of 17.3 per cent. Taking this as an estimate of the tax burden on "labour" to be compared with that on "capital" would be difficult to explain, given the variability in observed results across income levels.

Rather than generating a single "representative" value, the micro-data approach solves for average tax rates at various income levels. This range of values allows one to assess how the various Austrian personal tax provisions combine to shape the degree of progressivity in the system. Furthermore, average tax rate figures derived from actual tax return data may be helpful in assessing how the tax system has impacted on employment activity – for example, on labour market participation decisions.[18]

However, interpreting a stationary or variable single rate over time, derived from aggregate data is difficult, given the variability in average tax rates across income levels, and the sensitivity of the overall rate to the pre-tax income distribution. By enabling tax rate calculations at various income levels, micro-data allows one to more readily associate average tax rates with a corresponding income level. This may be helpful where employment problems tend to be acute for employees at certain earnings levels (*e.g.*, low-paid labour). Also, the micro-data results allow one to more readily identify differences in effective tax rates over time (and across countries) at various income levels resulting from differences in tax policy (affecting tax base and statutory rates), as opposed to differences in pre-tax earnings distribution.

The micro-data also permit the calculation of "discrete change" tax rates (DTR) which examine how the tax burden changes with discrete increases in gross wage income. These rates are not true marginal rates, as they are measured for discrete rather than unit increases in gross wage income, and do not reflect tax changes arising solely from changes in gross wage income (based on actual tax revenues, the DTR measure does not hold other factors constant).[19] The DTR results for wage income may be potentially useful when addressing the impact of the tax system on work incentives for those already in work, who consider the net benefits of additional work effort. In particular, the results may be usefully compared with marginal tax rate results derived from a micro-simulation model focusing on tax effects

17. The ATR series (τ^{L}_{I} and τ^{L}_{II}) can be combined to give $\tau^{L}_{I+II} = [WT + SSC^{ee}]/W$ which more closely aligns with the implicit tax rate equation (I.1) in Annex I (the Austrian results ignore employer social security contributions and payroll taxes). While measuring this combined tax rate τ^{L}_{I+II} using micro-data can usefully assess the combined tax burden at various wage levels, information provided by each series individually is lost in this aggregation.
18. This may be particularly true where benefit levels for those out of work are not high. Where they are, consideration of the labour market participation decision should factor in benefit and tax impacts of taking up work.
19. The discrete change tax rate on wage income (DTR) series is derived by measuring the change in wage tax per head resulting from a (discrete) increase in gross wages/salaries per head (from one gross income band to the next).

resulting from a unit increase in gross wages, holding other factors constant (as in OECD *Taxing Wages*). With access to only aggregate income tax or wage tax revenues, assessing effective tax rates "at the margin" in this way using actual tax revenue figures is not possible.

In addition, the micro-data set reveals differences in the tax burden imposed by alternative taxes on wage income at various earnings levels, which may be useful if policy makers wish to target tax relief to a particular group of workers. To take an example, for employees earning roughly 300 thousand ATS in gross wages, employee social security contributions impose a tax burden roughly twice that imposed by the wage tax. In contrast, for those earning in excess of 600 thousand ATS, the wage tax burden is higher, and increases as wages climb above this mark. Thus reductions in social security contribution rates would tend to favour low- to median-wage earners. While such impacts can be inferred from the statutory provisions relevant to each tax, the availability of micro-based effective tax rates provides the analyst with a useful source of information to assess distributional effects, estimate the fiscal cost, and steer policy decisions.

Chapter 3

ASSESSING AVERAGE TAX RATES ON CORPORATE INCOME

This section focuses on the use of micro-data to assess corporate average tax rates, and identifies problems and limitations encountered when relying on aggregate data, based on contributions by Belgium and Canada. The discussion does not address difficulties in relying on aggregate data to measure average tax rates on income from capital more generally (covering corporate and shareholder-level taxes), although the findings presented on the corporate side have implications that carry over.

The attention given to average tax rates at the corporate level is motivated in part by the high degree of policy interest in corporate-level tax burdens. For example, in an open economy context, there is interest in examining separately the effective tax rate on corporate profits to address the possible negative impact that taxation may have on (direct) investment incentives. Also, there are often concerns captured in the press that corporations are not paying their "fair" share of tax. The review focuses first on the need to make adjustments in respect of business losses to obtain meaningful average tax rate measures, which requires access to micro-data. Such adjustments are shown in the country work to be very important. Indeed, the inability to properly account and adjust for losses when relying solely on aggregate *Revenue Statistics* and *National Accounts* data largely explains why implicit tax rate modellers avoid reporting implicit corporate tax rates.[1] The work by Belgium and Canada also highlights the broad set of calculations made possible by micro-data, including estimates of average corporate tax rates by sector, asset size, and income strata.

3.1. Accounting for business losses

Properly accounting for business losses and their tax treatment in the measurement of average tax rates on corporate income is complicated, both in theory and in practice. One might argue that losses and their tax treatment should be ignored, restricting attention to the treatment of firms that are profitable in all years. However, important information relevant to determining the corporate tax burden is lost when the tax treatment of losses is ignored.[2] Important issues include the treatment of unclaimed losses under loss carry-forward rules, and whether or not related firms are taxed on a separate basis, or instead on a group basis allowing for the losses of one firm to offset taxable income of related companies in the group. Such provisions can impact significantly on corporate tax burdens.

When relying on aggregate data, a central problem is the fact that aggregate corporate income tax revenues appearing in the numerator of an average tax rate are reduced by losses incurred in prior years, while the denominator is reduced by losses incurred in the current year (see Annex III). The

1. The distorting effects (linked to losses) in implicit tax rate analysis (relying on aggregate data) are generally more pronounced when attempting to measure an average *corporate* tax rate. These effects, however, also factor in when measuring an average tax rate on income from *capital* (incorporating both personal and corporate taxation), given the inclusion of corporate income tax in the numerator (reduced by loss carry forwards) and operating surplus in the denominator (reduced by current period losses).
2. Working with micro-data, one could consider measuring an average corporate tax rate for profitable companies alone by including in the numerator an estimate of corporate tax revenues in the absence of loss carryover claims and, in the denominator, current period profits of profitable firms alone (note that such an adjustment would not be possible when relying on aggregate *National Accounts* data, as operating surplus in a given year includes the losses of current loss-making firms). However, as noted in the main text, ignoring the treatment of losses would omit important information relevant to assessing the tax burden imposed on the corporate sector.

numerator effect results from loss carry-forward provisions. The denominator effect results from the inclusion of current year losses of current year loss-making firms, offsetting profits of profitable firms in the same year upon aggregation. Thus losses are factored into the numerator and denominator, but the losses are mismatched in the sense that they are in respect of different periods (*i.e.* prior year *versus* current year).

This timing problem could be addressed by aggregating numerator amounts (*e.g.*, corporate income tax) over a number of years, and dividing this by an aggregate of denominator amounts (operating surplus of incorporated companies) summed over the same period. The longer the aggregation period, generally the smaller is the problem (in relative terms) of any remaining inconsistency in loss treatment. However, policy interest in a multi-year average tax rate declines the longer the aggregation period.[3] This is particularly the case when tax policy changes have occurred over this period, and one is interested in examining the impact of these changes by examining the time profile of the effective tax rate on corporations from one year to the next.

Before turning to the work by Belgium and Canada illustrating the flexibility of micro-data in accounting for business losses, it is useful to reflect on some of the relevant considerations. Tables 4

Table 4. **Corporate ATR implications of relying on macro- *versus* micro-data**
Example 1

	Year 1	Year 2	Year 3	Year 4
Firm 1				
Profit/loss	20	20	20	20
Taxable profit	20	20	20	20
Tax (@**20**)	4	4	4	4
Firm 2				
Profit/loss	0	–5	5	10
Cumulative unclaimed losses	0	–5	–5	0
Loss carryforward claim	0	0	–5	0
Taxable profit	0	0	0	10
Tax (@**20**)	0	0	0	2
Macro-data results				
Total tax	4	4	4	6
Total profit	20	15	25	30
ATR(agg)	20%	26.67%	16%	20%
Micro-data results				
Total tax	4	4	4	6
Total adjusted profit	20	20	20	30
ATR 1	20%	20%	20%	20%
Total adjusted tax (*no discounting*)	4	3	5	6
Total profit	20	15	25	30
ATR 2A	20%	20%	20%	20%
Total adjusted tax (r = 10%)	4	3.09	5	6
Total profit	20	15	25	30
ATR 2B	20%	20.61%	20%	20%
Discount rate r	10%			

3. There are also a number of difficult modelling choices, including the use of a fixed or moving-average aggregation period, and the length and timing of the aggregation period. Arguably, the length should reflect the business cycle. However, business cycles can vary over time and across countries, making a uniform aggregation procedure difficult. Also, one could argue that the aggregation period should take into account the number of years in which losses can be carried over for tax purposes if loss claims are discretionary. This recognises that where taxpayers delay a loss claim in a given year, in favour of another claim (*e.g.* tax credit) under liberal carryforward rules, too short an aggregation period could overstate the effective tax burden.

Table 5. **Corporate ATR implications of relying on macro- *versus* micro-data**
Example 2

	Year 1	Year 2	Year 3	Year 4
Firm 1				
profit/loss	20	20	20	20
taxable profit	20	20	20	20
tax (@20)	4	4	4	4
Firm 2				
profit/loss	0	–5	5	10
Cumulative unclaimed losses	0	–5	–5	0
loss carryforward claim	0	0	–5	0
taxable profit	0	0	0	10
tax (@20)	0	0	0	2
Firm 3				
profit/loss	0	–5	–5	–5
Cumulative unclaimed losses	0	–5	–10	–15
loss carryforward claim	0	0	0	0
taxable profit	0	0	0	0
tax (@20)	0	0	0	0
Macro-data results				
Total tax	4	4	4	6
Total profit	20	10	20	25
ATR(agg)	20%	40%	20%	24%
Micro-data results				
Total tax	4	4	4	6
Total adjusted profit	20	20	20	30
ATR 1A	20%	20%	20%	20%
Total adjusted profit *	20	20	15	25
ATR 1B	20%	20%	27%	24%
Total adjusted tax (r = 10%)	4	3.09	5	6
Total profit	20	10	20	25
ATR 2	20%	30.91%	25.00%	24.0%
Discount rate r	10%			

and 5 illustrate problems of interpretation when relying on aggregate data alone, and how micro-data can be used adjust (denominator) profit figures or alternatively (numerator) tax figures in an average tax rate (ATR) measure in order to adjust for the effects of losses. The illustrative examples assume that firms are able to carry losses forward (loss refunds are not provided). Table 4 examines two firms over a four-year period, with each firm subject to an effective corporate income tax rate of 20 per cent.[4] Firm 1 is profitable over this period, earning 20 units of profit in each year. Firm 2 begins operations in year 2 and incurs losses in that year, but becomes profitable in year three and is able to carry forward its initial losses to claim against tax in year 3.

Corporate tax burden analysis based on *aggregated* data (shown under the Macro-data heading) finds an average corporate tax rate ATR(agg) of 26.67% and 16% in years 2 and 3. In year 2, with current period losses included in year 2 aggregate (net) profits, but the tax treatment of those losses not factored into the numerator, the effective tax rate is overstated in year 2. In year 3, the effective tax rate at 16% is understated due to the year claim for year 2 losses impacting on the numerator, but without those losses factoring into the denominator.

4. The effective corporate tax rate of 20 per cent can be interpreted as resulting from a statutory corporate tax rate in excess of 20 per cent, with tax expenditures (*e.g.*, accelerated depreciation or special tax credits) that lower the effective rate to 20 per cent. Alternatively, one can interpret the rate as the statutory corporate income tax rate where such tax expenditures are not provided.

Two types of adjustments relying on micro-data to address the mismatch in loss treatment are considered in Table 4. The first approach, with results shown as ATR 1, excludes current year unclaimed losses from the denominator profit measure, and instead reduces the denominator in respect of prior year losses, and in particular, loss carry-forward claims impacting the numerator.[5] In other words, where a firm incurs losses, the losses are accounted for in measuring aggregate corporate profits in the year in which claims are made in respect of those losses. Rather than recognising the loss of (5) by firm 2 in measuring year 2 aggregate profits, this loss is set off against corporate profits in year 3 when the claim is made for that loss. This yields an ATR value of 20% in each year in the illustration in Table 4.

An alternative approach is to include current-year profits and current-year losses in the denominator (net) profit measure, and to adjust corporate tax revenues in the numerator in respect of future claims on current-year losses. In particular, where losses are realised in a given year, corporate tax revenues for that year are reduced in respect of the present value of future claims on those losses. In the example, the second set of results in Table 4 (ATR 2A and ATR 2B) adjusts aggregate tax revenues in year 2 to take into account the loss carry-forward claim in year 3 by firm 2 in respect of its losses realised in year 2. In particular, the loss claim in year 3 of 5 units of losses reduces tax in that year by 1 unit (assuming a 20 per cent corporate tax rate). Thus, under the adjustment without discounting, aggregate corporate tax receipts (4 units) in year 2 are reduced from 4 to 3 units, yielding an average tax rate of 20%.

The second set of results (ATR 2B) takes into account the time value of money, assuming a 10% discount rate, and deducts from aggregate corporate tax receipts the present value in year 2 of the loss claim of 5 in year 3. The ATR of 20.61% in year 2 reflects the assumption that the tax system does not allow losses to be carried forward with interest (as implicitly assumed in the first set of micro-data results, ATR 2A.)

Table 5 broadens the analysis by adding a third firm assumed to be in a loss position in each year over the 4-year period. As in Table 4, the first set of results ATR(agg) illustrate the problems of interpretation created when (unadjusted) aggregated data are used. The next two sets of results are derived using adjusted profits. The ATR 1A results ignore the losses of firm 3, which in the example are never offset in full or in part by the tax system, in measuring corporate profits. The approach can be interpreted as reflecting a benchmark system that denies a loss offset to perpetually loss-making firms. In contrast, the ATR 1B results assume an alternative benchmark, reducing profits in respect of prior year unrelieved losses, regardless of whether loss-making firms eventually become profitable or not.

The ATR 2 results are derived under the alternative loss-adjustment approach of adjusting aggregate corporate tax revenues (rather than aggregate profits) in respect of future claims on current year losses, and assuming a benchmark profit measure that recognises the losses of all firms. The inability of the loss firm (Firm 3) to claim relief in respect of its losses means that aggregate corporate tax receipts would not be adjusted downward in respect of these losses (*i.e.* the present value of zero relief is zero). The losses do however lower aggregate profit, putting upward pressure on the corporate ATR.

The cases examined in Tables 4 and 5 serve to illustrate possible approaches relying on micro-data to adjust for business losses. In principle, one may wish to reduce aggregate corporate tax revenues in respect of the present value of future claims (if any) on same period losses, rather than following the alternative of adjusting aggregate corporate profits in respect of same period claims on prior year losses. A concern that arises under the latter approach is that the results tend to blur the timing of the corporate average tax rate series – that is, the impact of losses on aggregate corporate profits and tax is not recognised until the year(s) in which tax claims are taken. Also, realised losses that never get claimed for tax purposes are ignored. However, in practice the profit-adjustment approach may be preferred, as the alternative is difficult to implement, even where statutory corporate tax rates remain fixed. Few corporate tax micro-models are dynamically structured to provide an account, by firm, of when unutilised losses are eventually claimed (or lost). A manual checking of tax returns and *ad hoc* adjustments would normally be required, tending to limit the focus on only large firms in the corporate sample.

5. This is the approach followed by Belgium and Canada in their work.

3.1.1. *Illustrations based on micro-data*

This section examines approaches by Belgium and Canada in using micro-data compiled from tax returns to measure corporate average tax rates, in particular, domestic corporate income tax rates on domestic source income.[6] Results are compared and contrasted with findings based on aggregate data. Before analysing the results, it is useful to address a number of measurement issues.

First, measuring a corporate average tax rate involves, in general, dividing (adjusted) corporate tax revenues by an adjusted measure of corporate profits, with a focus in each year on (taxable and non-taxable) firms that are profitable in the year (see the discussion above concerning alternative methods to factor in losses). In principle, the denominator profit measure should reflect economic income at the corporate level. Arguably such a measure is appropriate when assessing fairness and distribution concerns, and also where the measure is used to assess effective tax rates on past investment (as a possible check against forward-looking tax burden measures which ignore tax planning). This benchmark would provide true economic depreciation, corrections for inflation in measuring depreciation and the cost of goods sold (inventory valuation adjustment), and factor in income from the decline in the real value of debt of the non-financial sector during periods of inflation. As elaborated below, the profit measures used by Belgium and Canada do not make all of these adjustments. The results nevertheless draw out a number of important considerations, most importantly loss effects and variability of corporate ATRs by sectors and firm size.

As shown in Annex III, the implicit tax rate approach to measuring a corporate average tax rate, relying on aggregate data, measures domestic tax on domestic and foreign-source income as a percentage of the domestic operating surplus of the (domestic) incorporated sector. Corporate operating surplus is a measure of the return to capital employed in the economy, net of depreciation, including returns to debt and equity.[7] As noted above, operating surplus includes current year losses.

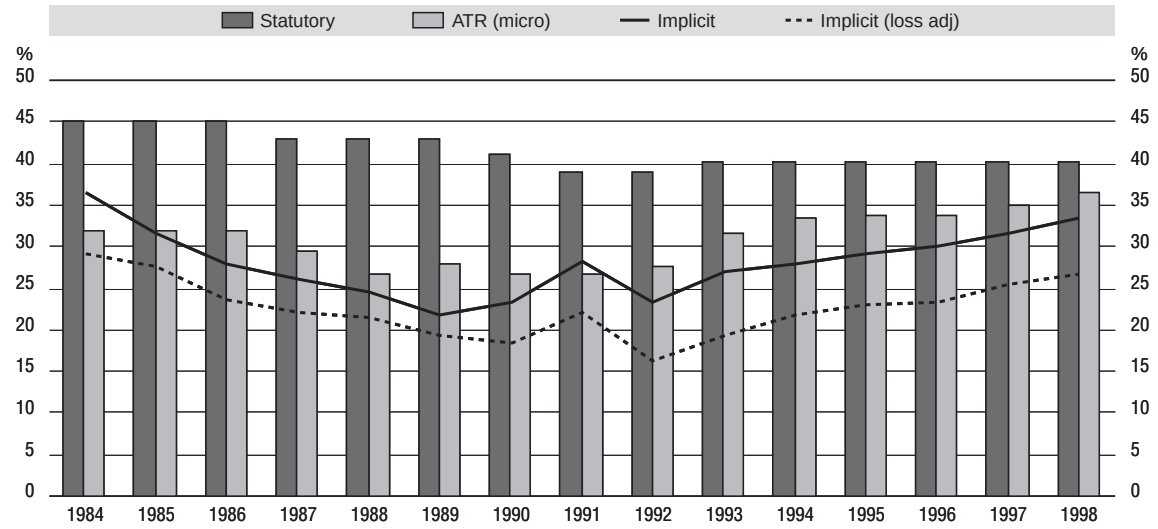
The Canadian AETR figures use an adjusted book income figure in the denominator, derived at the micro-level for a weighted-sample of corporations.[8] Measuring adjusted book income begins with net income as reported in financial statements. This amount is adjusted to arrive at a measure of domestic corporate profit that removes double counting of domestic income, excludes foreign income, factors out corporate tax payments, and adjusts for losses by netting out loss carry forward claims for tax purposes in the current year.[9] Foreign income is excluded in the interest of focusing on domestic tax on domestic source income.[10] No adjustments are made in respect of depreciation. Therefore depreciation claims used for accounting purposes are incorporated in the benchmark profit measure.

6. An alternative measure would assess net domestic corporate tax on domestic plus foreign-source income of resident firms as a percentage of worldwide income. However, interpreting such a measure would be difficult, tending to limit its use. Where the home country operates an exemption system, the measure would exclude entirely foreign tax on foreign source income, relevant to fairness, as well as investment and efficiency considerations. Similar problems of interpretation arise where the home country operates a residence-based system, given difficulties in establishing the amount of foreign tax levied on foreign income.
7. Operating surplus can be measured either gross or net of depreciation of real capital. While deriving corporate tax as a percentage of net operating surplus conforms with measures of tax on income, comparing results across countries is difficult on account of non-uniform measurement of depreciation in the N*ational Accounts* across countries.
8. In each year, a weighted-sample of profitable corporations is chosen (individual firms included in the sample may vary from one year to the next). Losses are factored into the analysis through the treatment of prior-year losses of currently profitable firms (with current year loss claims used to reduce current year aggregate profits).
9. The adjusted book income figure nets out (taxable and non-taxable) dividend receipts both domestic and foreign, foreign branch and other (non-business) foreign income, and net equity of affiliates included in financial income. As net financial income is measured net of current income and capital taxes, these amounts are added back to arrive at a pre-tax amount. Other adjustments include netting current-period loss claims from book income (including non-capital [business] losses, net capital losses, and farm losses), and adding back charitable donations.
10. Canadian corporate tax is not imposed on foreign dividends received from treaty countries. However, the numerator of the Canadian corporate ATR includes some Canadian income tax to the extent that it exceeds foreign tax credits earned on other foreign source income. While in principle this tax should be excluded for consistency with the denominator profit measure, the inclusion of this tax does not have a significant impact on the results.

Rather than beginning with financial income, the Belgian example begins with net taxable income, and "works backwards" to arrive at an adjusted benchmark measure of corporate profit. Beginning with net taxable income, corporate profits are measured net of loss carry forward claims without further adjustment.[11] Also, with net taxable income measured net of domestic dividend income, no adjustment is required in respect of these amounts to avoid double counting of domestic profit (with the underlying profit accounted for in the net taxable income of the distributing company). However, in order to ensure that profits exempted under special tax regimes are accounted for, the exempt profits of qualifying firms are added back.[12] Disallowed expenses (that is, expenses that reduce economic income but do not qualify for a tax deduction) are subtracted, while tax expenditures are added back.[13] As net taxable income excludes (most) foreign profits, no adjustment is made in respect of these amounts.[14]

Turning now to the results, Figure 1 shows the Belgian corporate average tax rate based on micro-data, along with other corporate tax rate measures, over the period 1984-1998. The results clearly reveal the need to factor in corporate tax base considerations, and not just the statutory corporate rate, in assessing the corporate income tax burden. The progressive narrowing of the discrepancy between the

Figure 1. **Corporate tax rate comparison, Belgium (1984-1998)**



Source: Ministry of Finance, Belgium.

11. As the calculation of pre-tax profit begins with net taxable income (already measured net of loss carry-forward claims), no adjustment is necessary in respect of loss amounts. Also, by focusing on taxable firms, the sample includes firms that are profitable in the given year. As in the Canadian example, losses are factored in by netting loss carry-forward claims from current year profits.
12. The special regimes include co-ordination centre, distribution centre and service centre regimes.
13. The tax expenditures include special deductions for investment, exempted gifts, tax relief for additional staff. As noted in the text, profits exempted under special regimes are also added back. These tax expenditures reduce tax liability (and thus factor into the numerator), but do not relate to pre-tax economic income.
14. Profits earned in countries with which Belgium has a double tax treaty are tax-exempt. Thus these profits are excluded from the denominator (net taxable income) and numerator. Profits earned in countries with which Belgium does not have a double taxation treaty are taxed at one-quarter of the nominal rate. These amounts are included in the denominator and tax thereon is included in the numerator. While in principle these amounts should be excluded in a pure domestic corporate ATR measure, their inclusion does not have a significant impact on the results.

statutory and the average tax rates illustrates a convergence of the actual tax base to the benchmark profit measure in the denominator of the ATR, with the micro-data indicating that this results mainly from a series of tax reform measures that reduced tax expenditures.[15]

Figure 1 also shows an implicit corporate tax rate time series derived using aggregate data, as well as an adjusted implicit tax rate series with a loss adjustment that nets out from the denominator (corporate operating surplus) the deduction for losses factored into corporate income tax liabilities in the numerator.[16] In years where significant corporate losses were incurred, the implicit tax rate exceeds the ATR based on micro-data (1984 and 1991).

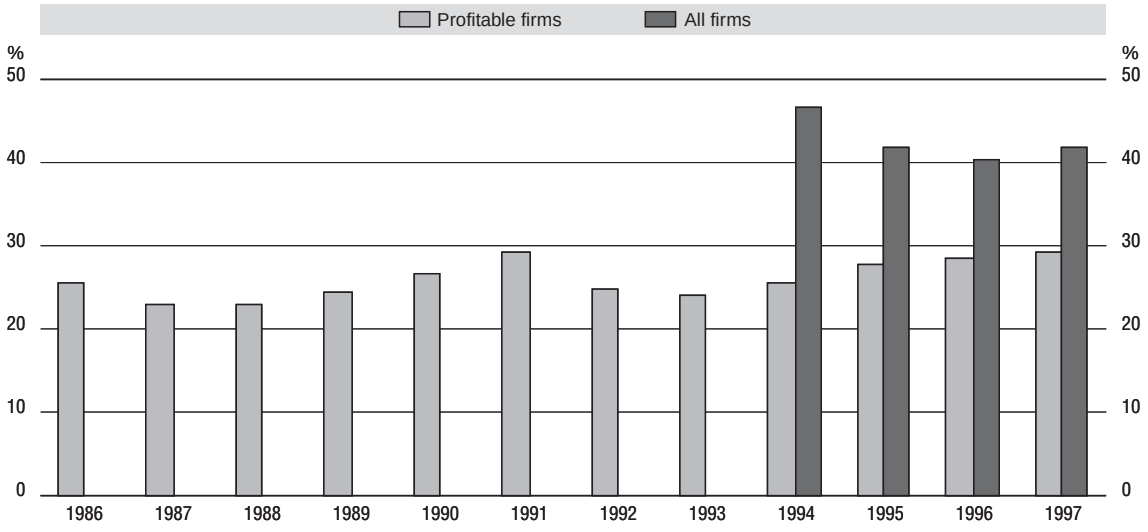
However, in other years the implicit tax rate is below the micro-data ATR. Drawing from the analysis in Table 4, this suggests that the effect of loss carry forward claims in the numerator (in years immediately following 1984, and 1991) were more pronounced than the effect of current year losses factoring into the denominator. Another possible explanation is that the N*ational Accounts* operating surplus measure is significantly broader than corporate operating surplus, due for example to the inclusion in the N*ational Accounts* of non-taxable corporations including government enterprises (as indicated by Norway in its work on average effective tax rates on capital). It may also be that corporate profits are not properly consolidated in the N*ational Accounts*, tending to overstate the true value, as noted by Belgium.

It can also be observed from Figure 1 that trends in the corporate tax burden may be misrepresented by implicit tax rate figures, particularly when considering short time intervals. For example, the micro data show that the average tax rate in the corporate sector was essentially unchanged over the three-year period 1984-1986, while the implicit tax rate results show a reduction exceeding 8 percentage points. Similarly, the aggregate data suggest that the corporate average tax rate increased by 8 percentage between 1989 and 1991, while the micro-data find a reduction in the corporate tax burden over that period.

A similar finding emerges from Figure 2 showing Canadian corporate average tax rates, which factor in not only corporate income tax, but also federal capital taxes (net wealth taxes) on corporations.[17] Results shown for the last four years included in the Figure 1994-1997 compare corporate average tax rates when loss making firms are included in the analysis, as they are under the implicit tax rate approach, with corporate ATRs with loss firms excluded.[18] When loss-making firms are included, the figures show a declining average corporate tax burden over the three-year period 1994 to 1996, while the results relying on adjusted profits of profitable firms show an upward trend in the tax burden over this period.

15. This includes the elimination over the period of deductible notional withholding taxes (précomptes fictifs) on loans and capital contributions to Belgian co-ordination centres and other amounts.
16. In order to avoid double counting of losses, it is necessary to exclude current period losses from current period operating surplus. Without this adjustment, losses of a firm in year t would be taken into account in year t (through the inclusion in operating surplus of losses of firms in year t), and also in subsequent years where previously loss-making firms become taxable and claim a loss carry forward.
17. The inclusion of a tax determined as a percentage of capital stock (or a similar base, as opposed to profit) is appropriate in a measure of corporate tax paid out of corporate profit. One can argue that this inclusion is suitable only where the resulting rate is used for distribution analysis. When considering tax consequences of additional investment, one would like to capture additional capital tax paid as a result of an expanded capital stock. Including capital tax in the numerator of a measure used to assess tax burden on investment may be justified where aggregate corporate profits is proportional to aggregate capital stock. Note that the Canadian figures are used in the paper to address distribution issues.
18. Unlike the profit measure in the denominator of the AETRs computed for the profitable group, the profit measure for the "all firm" series does not net out loss carry forward claims (consistent with the inclusion of loss making firms).

Figure 2. **Canadian corporate ATR (1986-1997) implications of loss treatment**



Source: Ministry of Finance, Canada.

3.2. Measuring corporate ATRs by sector and firm size

In addition to enabling an adjustment for business losses, micro-data also permit disaggregate analyses of corporate tax burdens. A disaggregate approach is useful, for example, where the tax system targets preferential tax treatment to firms engaged in certain business activities, or to firms on the basis of their size. Policy interest naturally arises in such cases in assessing the impact of the special tax provisions on targeted groups – investment companies in Belgium, and manufacturing and processing companies in Canada, as examples. Additionally, the tax systems in both Belgium and Canada provide special tax relief to "small" firms, and so policy interest arises in comparing the tax burden across companies of different size measured by assets or income.[19]

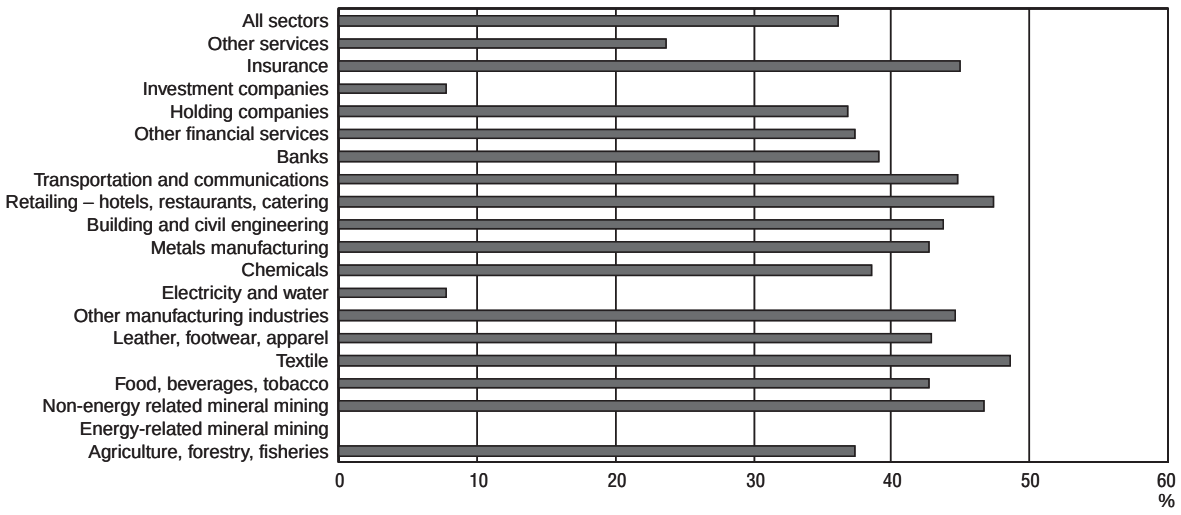
Even in the absence of targeted measures, there may be interest in assessing the impact of general features of the corporate tax system that affect different industries differently. For example, tax depreciation rules tend to be more important to firms in industries that are relatively capital intensive, while loss treatment tends to matter more to firms in industries exhibiting strong cyclical effects. As the net effect of these and other features of the tax system get captured in disaggregated average tax rates, an incentive exists to construct such rates for firms grouped by industry (and possibly by other criteria, for example size or location). The remainder of the paper reviews findings by Belgium and Canada based on micro-data that illustrate a diverse of corporate average tax rates, a diversity that tends to get masked when relying on aggregate data alone. Certain implications for policy analysis are addressed.

3.2.1. ATR *results by sector*

Micro-data results by Belgium and Canada reveal significant variation in corporate average tax rates across industries, as illustrated in Figures 3 and 4. As emphasised in the analysis provided by Belgium, interpretation of the Belgian results by sector requires careful examination of the underlying micro-data and an accounting for the impact of special features of corporate tax system.

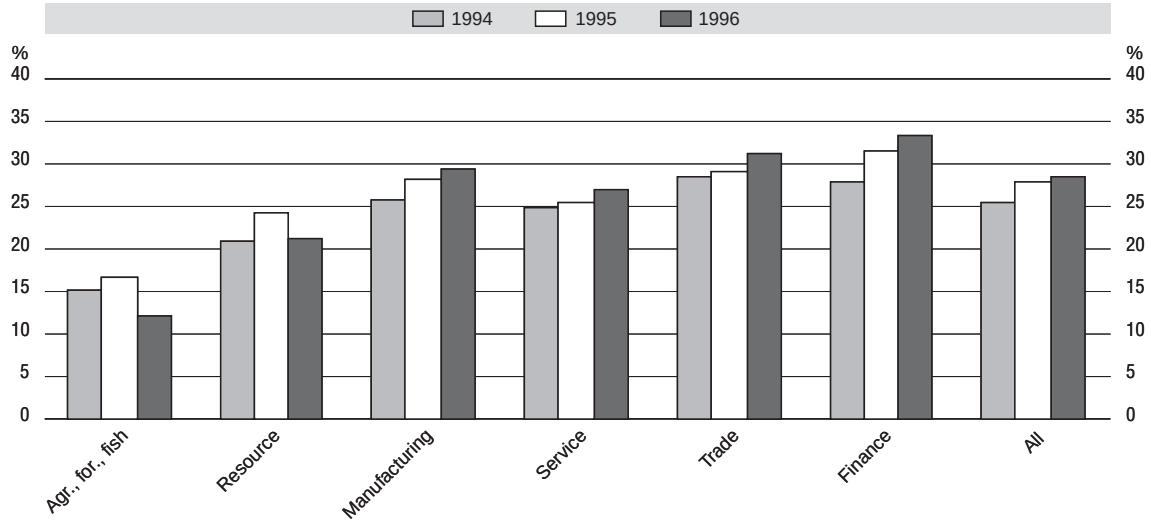
19. Belgium offers tax relief for supplementary personnel employed in small and medium sized enterprises, while Canada targets small firms through its small business deduction.

Figure 3. **Belgian corporate ATR by sector (1998)**



Source: Ministry of Finance, Belgium.

Figure 4. **Canadian corporate ATR by sector**



Source: Ministry of Finance, Canada.

To take an example, one striking finding is that in most of the industrial sectors (with the exclusion of the chemical industry, and electricity and water industry) the corporate ATR is found to *exceed* the statutory tax rate. This finding, particularly pronounced for small firms, is traced to disallowed expenses (netted from taxable profits in measuring benchmark profit) that exceed tax expenditures (removed from benchmark profits).

The Belgian analysis gives an insightful interpretation to average tax rates calculated for the industry and retail trade sectors, and other "other services" sector. In particular, the analysis cautions that the true tax burden on the industry and retail trade sectors is actually lower than that suggested by

the corporate ATRs computed for these sectors. The reason is that part of the "true" profit of these sectors is paid out in the form of interest and other deductible charges to related companies where the amounts are received tax-free under the Belgian co-ordination centre regime rules. These payments are deductible in measuring tax (numerator) and pre-tax profits (denominator) in the calculation of the corporate ATR of the industry and retail trade sectors. Therefore, the impact of the co-ordination centre rules does not tend to be reflected in the corporate ATRs for these sectors. With co-ordination centres included in the "other services" sector, the corporate ATR for this sector is lowered on account of the tax exemption for income from transactions with related companies in the industry and/or retail trade sectors under the co-ordination regime (in other words, the "other services" sector corporate ATR would be higher if co-ordination companies were excluded).

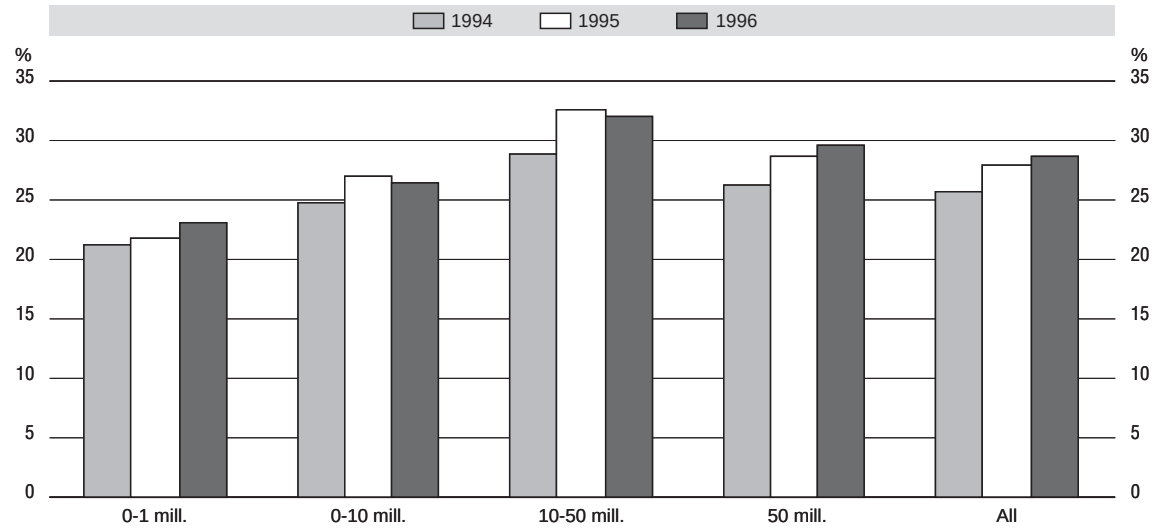
The corporate ATR analysis by Canada reveals the need to distinguish firms by industry when considering trends in the corporate tax burden over time. In particular, when considering all profitable firms, the results show an increase in the corporate ATR in 1995 (+2.3 percentage points from 1994), and again in 1996 (+0.5 percentage point). However, the same percentage increases are not found in the manufacturing, service, trade and finance industries, while the tax burden is shown to decrease in 1996 in the resource sector, and in the agricultural, forestry and fishing sector.

3.2.2. ATR *results by firm size*

In assessing the tax burden on firms according to their size as measured by assets, Canadian results show variability in corporate ATRs across firms, and over time, not reflected in the aggregate results. For example, profitable firms in the CDN$ 10-50 million asset range are found to have the highest ATR, in the order of roughly 29 to 32%, depending on the year, as illustrated in Figure 5. Small firms with assets less than CDN$ 1 million are found to have considerably lower ATRs, in the range of 21 to 23%, owing mostly a special small business deduction.

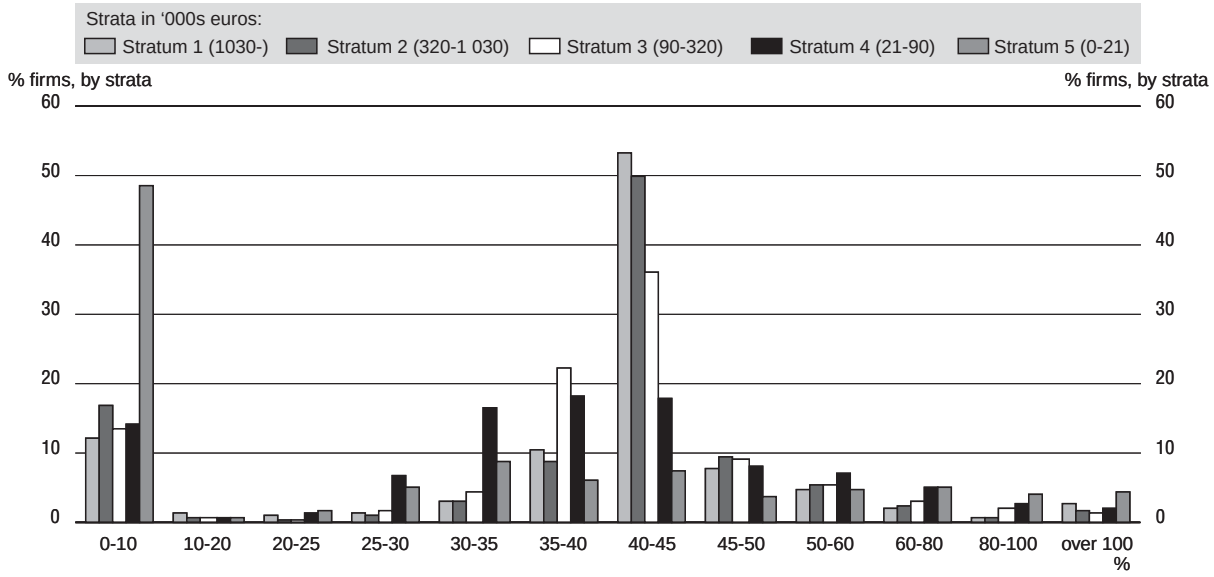
Also, year-to-year fluctuations in ATRs at the disaggregate level are not always reflected in the aggregate results. For example, while the corporate ATR for all profitable firms shows the corporate ATR increasing by 2.5 percentage points from 1994 to 1995, a 3.6 percentage points increase is found for the most heavily taxed group (in the CDN$ 10-50 million range). For the same group, the corporate ATR falls

Figure 5. **Canadian corporate ATR by asset size (Cdn$)**



Source: Ministry of Finance, Canada.

Figure 6. **Belgian corporate ATR dispersion, by cross taxable income strata (1998)**



Source: Ministry of Finance, Belgium.

in 1996, while the results for all profitable firms show an increase in the corporate ATR in 1996 by over half a percentage point. Similarly, the ATR for firms in the CDN$ 1-10 million asset range is shown to decline by 0.5 percentage point in 1996, while the aggregate data show the ATR increasing by 0.7 percentage point.

The Belgian example takes an alternative approach of grouping firms by gross taxable income strata, and measuring for each income strata, the percentage distribution of firms across different ATR ranges. From this analysis, a general profile is evident, as illustrated in Figure 6. For all of the income strata, there is a concentration of firms with ATRs close to zero, and a concentration of firms with ATRs close to the statutory rate. Almost half of the smallest firms (in the fifth stratum with taxable income in the range of 0-21 000 euros) are found to have ATRs close to zero. A closer look at the micro-data reveal that this finding can be explained largely by loss carry over claims. For larger firms, tax expenditures and the exemption system are found to be more important in explaining ATRs below the statutory rate.

Chapter 4

SUMMARY AND CONCLUSIONS

Relying on tax revenue information to measure average tax rates on labour, capital, and other types of income offers the advantage of incorporating the net effect of a complex set of factors that determine tax liabilities and are difficult to model.[1] Micro (taxpayer-level) data drawn from tax returns provide values for various entries determining final tax calculations, which can assist in refining measurement techniques. And micro-data figures can be (partially) aggregated to cover particular taxpayer groups. The ability to generate results for different taxpayer groups offers insights into possibly divergent tax burdens, which in turn helps one interpret tax burden trends at the aggregate level, and more generally provide an empirical basis for tax policy analysis.

While in general a micro-level view (by taxpayer-group, or by sector) is necessary to address many if not most tax policy-related questions, interest also exists in economy-wide average tax rates derived, for example, for labour or capital income. This paper reviews work by Norway and Denmark examining how micro-data can permit a more targeted assessment of personal tax revenues imposed on different income types to feed into such measures. In particular, by isolating taxes that apply to a single income type, and by using taxpayer-specific (rather than economy-wide) average tax rates to decompose revenues raised by taxes levied on multiple income types, one can measure average tax rates for different categories of income with greater precision.

Work by Belgium and Canada highlights the critical importance of adjusting for business losses in measuring an economy-wide corporate average tax rate, with implications for the proper measurement of an economy-wide average tax rate on income from capital (including both corporate and shareholder-level taxation).[2] The insights are important given widespread interest in corporate tax burdens and their effects, and the general inability of aggregate data to generate a reliable annual corporate average tax rate series. The paper reviews a number of possible adjustment techniques relying on micro-data, and certain issues encountered with each. While not addressed in the work reviewed in this paper, the findings also have implications for the measurement of average tax rates on business or total income of the self-employed.

Perhaps most importantly, the paper underscores the difficulties in drawing policy conclusions from results based on aggregate data. An ability to measure average tax rates for different taxpayer groups is important, as effective tax rates tend to vary, sometimes significantly, by taxpayer group. Work by Austria finds significant variation in average tax rates on wage income across wage levels, raising questions over the use of a single (implicit) tax rate for a given year based on aggregate data to assess the tax burden on labour income taxed on a progressive basis. The paper argues that assessments of the possible impact of the tax system on labour market participation are strengthened where one is able to measure average tax rates on labour income at various income levels and for different taxpayer groups.

The paper also reports significant variation on average corporate tax rates across firms grouped by industry and firm size. The analysis by Belgium and Canada reveals that economy-wide results may be

1. It has been pointed out that tax burden measures that factor in tax liabilities, but exclude taxpayer compliance costs, understate true tax burden. Also, measures that rely on financial statements to measure corporate profit may be biased to the extent that profits are manipulated (*e.g.*, overstated).
2. Loss adjustments are also obviously important for analysis at the disaggregate level.

misleading indicators of levels and trends in corporate average tax rates for certain groups of firms, calling for a disaggregate view to steer policy analysis and decisions.

The paper provides very limited discussion of the use of various micro-based average tax rates to address specific policy questions. Such an analysis is beyond the purpose or scope of the current exercise, which in the main has been to question the extent to which average tax rate results derived from aggregate data can be taken to be representative where significant diversity in tax burdens exists at the disaggregate level across taxpayer groups, and where year-to-year percentage changes in tax burdens are not uniform.

This raises a central issue of the confidentiality of taxpayer information, and the general inability of those outside government to undertake revenue-based average tax rate analysis at the micro-level. This is unfortunate (yet understandable), as broader access to micro-level data would accelerate progress in this field. One potentially fruitful area to explore would be to consider what levels of aggregation of taxpayer-level data would be possible that would maintain confidentiality, while supporting revenue-based average tax rate analysis on a disaggregate basis.

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Annex I

MEASURING IMPLICIT TAX RATES ON LABOUR

While approaches can vary, an implicit tax rate on labour in a given year can be derived on the basis of aggregate tax revenue and factor returns as follows:[1]

$$\tau^{L1} = [(f^{L1} \cdot PIT) + SSC^{ee} + SSC^{er} + PAY]/WSSS \quad (I.1)$$

or alternatively,

$$\tau^{L2} = [(f^{L2} \cdot PIT) + SSC^{ee} + SSC^{er} + SSC^{se} + PAY]/[WSSS + WSE + SSC^{se}] \quad (I.2)$$

Both formulations assess taxes on labour, entering the numerator, as a fraction of labour costs entering the denominator. The two differ in terms of their treatment of returns to the self-employed, with (I.1) treating the operating surplus of the self-employed as a return on capital, and (I.2) attempting a split of this surplus into capital and labour components. These alternative methods have implications for the measurement of the fraction of individual income tax ascribed to labour income. These fractions (f^{L1} and f^{L2}), and gross labour costs of dependent (or non-self) employment (WSSS), entering these formulations are as follows:

$$f^{L1} = W/(W + OSPUE^{*} + PEI) \quad (I.3)$$

$$f^{L2} = (W + WSE)/(W + OSPUE^{*} + PEI) \quad (I.4)$$

$$WSSS = W + SSC^{ee} + SSC^{er} \quad (I.5)$$

The (aggregate) data entering these equations are as follows:[2]

PIT – income taxes on individuals (1100);

SSC^{ee} – social security contributions of employees (2100);

SSC^{er} – social security contributions of employers (2200);

SSC^{se} – social security contributions of self-employed (2300);

PAY – payroll taxes (3000);

W – wages and salaries of employees (measured exclusive of SSC^{ee});

WSE – (notional estimate of) wages and salaries of the self-employed;

$OSPUE^{*}$ – (adjusted) operating surplus of private unincorporated enterprises;[3]

PEI – household property and entrepreneurial income.

Under the implicit tax rate methodology, total income tax revenue raised on labour income, appearing in the numerator of the implicit tax rate calculation, is estimated as the proportion of total personal income tax revenues that aggregate wages and salaries is to the estimated aggregate individual income. This approach implicitly assumes that labour income and other forms of personal taxable income (for example capital income, transfers) are subject to a common average effective personal income tax rate.

This implicit assumption can be illustrated using the formulation that ascribes OSPUE fully to capital by re-writing equation (I.1) as follows, where τ^{agg} denotes the average effective personal income tax rate (across income types, and taxpayers), derived at the aggregate level, which is applied to labour income to assess the notional amount of individual income tax raised from labour income:

$$\tau^{L} = [\tau^{agg}(W) + SSC^{ee} + SSC^{er} + PAY]/WSSS \quad (I.6)$$

1. To simplify the presentation, the equations presented here do not factor in unallocable social security contributions (*Revenue Statistics* category 2400), which cannot be allocated to employees, employers, or the self-employed).
2. The OECD *Revenue Statistics* tax revenue category codes are shown in brackets.
3. The operating surplus of private unincorporated enterprises (OSPUE) as reported in *National Account* (capturing the return to capital *and* labour of the self-employed) is measured gross of SSC^{se} – $OSPUE^{*}$ nets out SSC^{se}. (that is, $OSPUE^{*} = OSPUE - SSC^{se}$). Also note that operating surplus of private incorporated enterprises is measured inclusive of imputed rentals on owner-occupied housing (regardless of their tax treatment).

where

$$\tau^{agg} = PIT/(W + OSPUE^{*} + PEI) \quad (I.7)$$

The same average effective personal income tax rate is used, when deriving an implicit tax rate for capital income, to estimate the notional amount of individual income tax raised from capital income.

Isolating the labour component of OSPUE*

A difficulty encountered in measuring an implicit tax rate for labour (and similarly for capital) involves the treatment of the operating surplus of the self-employed (OSPUE). The problem relates to how to treat the return to the labour component – that is, aggregate payments by the self-employed to themselves for their labour input – and separately the capital component. Clearly the treatment is particularly important where unincorporated sector forms a significant part of the economy, as it does in many countries.

One approach to this problem is to simply assign OSPUE in its entirety to capital or labour.[4] Where assigned to capital (labour), this would tend to underestimate (overestimate) the average effective tax rate on capital (labour). The formulation for the implicit tax rate on labour given by equation (I.1) corresponds to the case where OSPUE is assigned entirely to capital.

The other possibility is to attempt a split – that is, to assign OSPUE in part to labour and in part to capital, and to use an implicit tax rate formulation that accommodates the split, as in equation equations (I.2). One approach found in the literature assumes that the self-employed pay themselves, on average, an annual salary equal to the average annual wage/salary of employees.[5] This approach is problematic to the extent that average annual wages and salaries and/or average hours worked differ between the two groups (with the latter factor relevant where one relies on numbers of workers, rather than numbers of hours worked, in measuring self-employment *versus* dependent employment).

Another possibility is to use tax return information, as does Norway in its work. Under Norwegian rules, most self-employed taxpayers are required to split their operating surplus into a labour and capital component, with the labour component included in the base of the top tax and in the base of social security contributions. The split is not required for the purpose of calculating tax on ordinary income, as this tax includes in its base the full operating surplus amount.

As pointed out by Norway, a problem with relying on the split as reported by taxpayers is that the different tax treatment of wage and capital income creates an incentive for the self-employed to underreport the amount of their operating surplus that is a return to labour. This is because labour income is subject to a higher combined tax rate, with labour income taxed as ordinary income, as well as being included in the base of the top tax and social security contributions, while capital income is subject to ordinary income tax alone. Norway has indicated that further work is required to gauge how significant this distortion is.

4. This approach is followed for example by Mendoza, E., A. Razin and L. Tesar (1994), "Effective Tax rates in Macroeconomics: Cross country Estimates of Tax Rates on Factor Incomes and Consumption", NBER Working Paper, No. 4864, September. In their work, the whole amount of OSPUE is allocated to capital (the denominator of their implicit tax rate on capital is the economy-wide operating surplus [OS], which includes OSPUE).
5. This approach is followed by Carey, D. and H. Tchilinguirian (2000), "Average Effective Tax Rates on Capital, labour and Consumption", Economics Department Working Paper No. 258. In their model, the aggregate wage bill for the self-employed is measured by $WSE = (W^n/EE)ES$ where W^n measures aggregate wages/salaries of employees, EE measures dependent employment, and ES is the number of self-employed in the economy. The authors point out that this approach tends to underestimate WSE to the extent that self-employed consist of professionals with relatively high earnings, and to the extent that part-time workers are more prevalent amongst those in dependent employment versus those that are self-employed.

Annex II

MEASURING IMPLICIT TAX RATES ON CAPITAL

Measurements of the implicit tax rate on capital, consistent with the treatment of labour set out in Annex I, can be derived on the basis of aggregate tax revenue and factor returns, as follows:

$$\tau^{K1} = [(f^{K1} PIT) + CIT + PROPT + FCT]/OS \quad (II.1)$$

or alternatively

$$\tau^{K2} = [(f^{K2} PIT) + CIT + PROPT + FCT]/[OS - (WSE + SSC^{se})] \quad (II.2)$$

Both formulations assess taxes on capital, appearing in the numerator, as a fraction of the aggregate return on capital entering the denominator. The two differ in terms of their treatment of the capital component of returns to the self-employed, with implications for the measurement of the fraction of individual income tax ascribed to capital income. These fractions (f^{K1} and f^{K2}) are as follows:

$$f^{K1} = (OSPUE^{*} + PEI)/(W + OSPUE^{*} + PEI) \quad (II.3)$$

$$f^{K2} = (OSPUE^{*} - WSE + PEI)/(W + OSPUE^{*} + PEI) \quad (II.4)$$

with W, WSE, $OSPUE^{*}$ and PEI as defined in Annex I. The first formulation given by (II.1) and (II.3), consistent with the labour tax counterparts ((I.1) and (I.3)), implicitly treats the full operating surplus of the self-employed (including wages, salaries and social security contributions of the self-employed) as a return to capital. The second formulation given by (II.2) and (II.4), consistent with (I.2) and (I.4), allows for a split of this operating surplus into labour and capital components.

In particular, gross labour costs of the self-employed (estimated wages and salaries, and social security contributions) are netted from the aggregate operating surplus of the economy OS in the denominator of the capital tax rate τ^{K2}. Also, estimated wages and salaries of the self-employed WSE must be netted from the (adjusted) operating surplus of the unincorporated sector $OSPUE^{*}$ (already measured net of social security contributions of the self-employed) in the numerator of the weighting factor (f^{K2}) for personal income tax.[1]

The (aggregate) data entering these equations, taken from *Revenue Statistics* and *National Accounts*, are as follows (see also variable definitions in Annex I):

CIT – income taxes on corporations (1200);

PROPT – recurrent taxes on immovable property (4100);

FCT – taxes on financial and capital transactions (4400);

OS – operating surplus of the overall economy. [2]

1. OS covers the operating surplus of the incorporated sector and the unincorporated business sector, where the latter is measured in *National Accounts* gross of labour costs of the self-employed (including social security contributions of the self-employed). Subtracting ($WSE + SSC^{se}$) from OS leaves the capital component of the operating surplus of the private unincorporated business sector (together with returns to capital in the incorporated sector).
2. See the preceding footnote. Also note that OS is measured net of capital depreciation

Annex III

MEASURING CORPORATE IMPLICIT TAX RATES

As noted in the main text, significant problems are met when relying on aggregate *Revenue Statistics* and *National Accounts* data to measure an average effective tax rate at the corporate level (on income from capital). However, for the purpose of illustrating these difficulties, it is helpful to consider the possible construct of an implicit tax rate for the corporate sector, as follows:

$$\tau^{COR} = [CIT + NWT]/(OS - OSPUE) \qquad (III.1)$$

where the (aggregate) data entering this calculation, taken from *Revenue Statistics* and *National Accounts*, are as follows:[1]

CIT – income taxes on corporations (1200);

NWT – recurrent taxes on net wealth paid by corporations (4220);

OS – operating surplus of the overall economy;

OSPUE – operating surplus of private unincorporated enterprises.

The denominator nets out operating surplus of the private unincorporated sector (OSPUE) from the overall operating surplus of the economy, leaving the operating surplus of the incorporated sector. As OSPUE is measured gross of both the returns to labour of the self-employed (WSE + SSC^{se}), and the returns to capital of the self-employed, there is no further adjustment in respect of these amounts.

While the simplest in construct of the three implicit tax rates considered in Annexes I, II and III, as noted in the main text, the corporate implicit tax rate measure is potentially the most problematic given the importance (in relative terms) of the treatment of losses, and in particular the asymmetric treatment of business losses in the numerator and denominator.

1. In some formulations, non-resident withholding tax (NWT) is also factored into the numerator, where information is available on such taxes imposed at the corporate level.

Annex IV

ESTIMATING AVERAGE TAX RATES ON LABOUR AND WAGE INCOME

The Case of the Norwegian Tax on Ordinary Income

This Annex considers a possible framework and certain advantages (relative to implicit tax rate analysis) when using micro-data to measure average tax rates on labour income, and more narrowly wage income, when confronted with a broad-based tax, with reference to the Norwegian tax on ordinary income. The analysis, which is meant to broaden the review of the Norwegian tax system as a case study, is not included in the main text, as empirical results based on the framework are not yet available.

Measuring effective taxation of labour income

Consider first measuring an average tax rate on *labour income*, with reference to the discussion in section (B)1a) of the Norwegian tax on ordinary income. The notional amount of ordinary income tax (OT) levied on labour income can be estimated, at the taxpayer level, using taxpayer-specific weights w^L_j measuring the fraction of net ordinary income that is labour income (see equation (1a) in the main text)):

$$w^L_j \cdot OT_j = (W_j/(W_j + Y_j - E_j)) \cdot OT_j \quad \text{(IV.1)}$$

where W denotes labour income, Y denotes other ordinary income (*e.g.*, capital income) and E denotes expenses incurred in earning ordinary income. By rearranging terms, this approach to estimating ordinary income tax raised from labour income can be viewed alternatively as one that weights labour income, at the taxpayer-level, by taxpayer-specific average tax rates on ordinary income, denoted by τ_j:

$$w^L_j \cdot OT_j = \tau_j \cdot W_j \quad \text{(IV.2)}$$

$$\tau_j = OT_j/(W_j + Y_j - E_j). \quad \text{(IV.3)}$$

In other words, the estimate of the notional amount of ordinary tax paid by taxpayer j on labour income can be thought of as being determined by applying that taxpayer's average effective tax rate on ordinary income to the taxpayer's labour income. These values can be summed across taxpayers and used to measure an economy-wide average effective tax rate on labour income, which also factors in taxes targeted exclusively at labour income:

$$\tau^{L(micro)} = (\Sigma_j(\tau_j W_j) + S + SSC)/(W + SSC^{er}) \quad \text{(IV.4)}$$

where W denotes aggregate labour income (ΣW_j), S and SSC measure total income surtax and total social security contributions, and SSC^{er} measures total employer social security contributions. The numerator in (IV.4), measuring tax imposed on labour income, corresponds to equation (1a) in the main text (using the identity (IV.2)).

The micro-data approach stands in contrast to that under the implicit tax rate methodology where aggregate ordinary income tax and income surtax revenues are scaled by the share of aggregate ordinary income that is aggregate employment (wage) income (see equation (4) in the main text).

Measuring effective taxation of wage income

The flexibility and precision made possible by micro-data can be elaborated by considering attempts to measure a more narrowly defined effective tax rate. Consider for example relying on micro-data to assess an average effective rate on what we can call *wage income*, that is labour income excluding pension income, which includes wage and salary income of employees and compensation for labour input of the self-employed. The focus on wage income may be of interest when analysing, for example, the impact of taxation on current employment activity. Returning to the Norwegian example, the following equation, drawing on micro-data, may be used to measure the total amount of tax imposed on wage income:

$$IT(wage) = \Sigma_j(w^1_j \cdot OT_j) + \Sigma_j(w^2_j \cdot S_j) + \Sigma_j(w^3_j \cdot SSC^{ee}_j) + \Sigma_j(w^4_j \cdot SSC^{se}_j) + \Sigma_j SSC^{er}_j. \quad \text{(IV.5)}$$

The first term $\Sigma_j(w^1_j \cdot OT_j)$ in equation (IV.5) measures total ordinary income tax (OT) raised on wage income using taxpayer-specific weights w^1_j measuring the fraction of net ordinary income of taxpayer j that is wage income. Similarly, the second, third and fourth terms estimate total income surtax, employee social security contributions,

and social security contributions of the self-employed collected on wage income, using taxpayer-specific weights w^2_j, w^3_j and w^4_j measuring the fraction of total gross personal income that is wage income. The last term gives total employer social security contributions, which are imposed solely on wage income. While the first four terms give notional estimates (given that the relevant taxes, in the case of Norway, include income other than wage income in the base), the fifth component is an observed (actual) amount to be included in full.

The precision made possible when relying on micro-data to measure an average tax rate on wage income (as in the example considered above) can be contrasted again with the implicit tax rate approach on two counts (see equation (4) in the main text). First, the micro-data approach reflected in equation (IV.5) allows one to include, for each taxpayer in the sample, estimates of only that portion of employee social security contributions (measured by weight w^3_j) and that portion of social security contributions of the self-employed (measured by weight w^4_j) that are linked to wage income. In contrast, these contributions would be included in their entirety with recourse only to aggregate data as under the implicit tax rate approach, and more specifically, without taxpayer-level information on the split between wage and non-wage (pension) income in the social security contribution tax base.

Second, the micro-data approach can measure at the taxpayer level an estimate of the amount of tax revenue linked to wage income for the tax on ordinary income and the income surtax using taxpayer specific average effective tax rates (see equation (IV.5)). The use of taxpayer-level information can link features of the tax system, relevant to the tax burden on wage income, to the distribution of wage income across taxpayers subject to varying average tax rates. This precision offered by micro-data can be elaborated with reference again to the Norwegian system, considering for illustrative purposes the notional split of tax on ordinary income. Where taxpayer-level data is available, taxpayer-specific weights (denoted by w^1_j in equation (IV.5)) measuring the fraction of net ordinary income that consists of wage and salary income can be assessed as follows:

$$w^1_j = W_j/(W_j + X_j - E_j) \quad \text{(IV.6)}$$

where W_j is wage income (wages and salaries of employees and or the labour component of returns to the self-employed) and X_j is other ordinary income (*e.g.*, pension income, transfer income, income from capital) and E_j measures expenses incurred in earning ordinary income, all indexed to taxpayer j.[1] With reference to equation (IV.5), it is important to recognise that the taxpayer-specific weights shown in (IV.6) are applied to ordinary income tax at the individual taxpayer level (OT_j). This approach relying on micro-data in effect derives estimates of the average effective tax rate on wage income at the individual taxpayer-level, and applies these to the corresponding income amounts at the taxpayer level. In contrast, this level of detail is lost when one instead applies an overall average effective tax rate, with averaging across all taxpayers and across different taxes where more than one tax applies to wage income.

1. Where taxpayer j is self-employed, W_j is an estimate of the labour portion of the total return to the self-employed. For the purpose of the discussion in this section, the treatment of the self-employed can be ignored.

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