

The distributional profile of taxes on income, wealth and consumption in advanced economies

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Abstract

Most studies of the redistributive profile of taxes across countries focus on income taxes, as data on these are readily available in standard sources. The examination of the incidence of different kinds of taxes, rather than only income taxes, across the distribution of income, also within different demographic groups is of public policy interest, as there are substantial differences across countries and time in the weight given to different kinds of taxes and the extent to which particular demographic groups, such as the elderly or families with children, receive favourable treatment. The Luxembourg Wealth Study (LWS) is a newly available collection of microdatasets that provide comparable data on net worth and disposable income for a number of developed countries, including the US, Canada, Germany and the UK. In some countries, the LWS data also include consumption expenditures broken down by category. All LWS datasets provide information on taxes on income, including taxes on capital income and wealth. By combining the LWS data with national national accounting input-output tables, it is possible to get reasonably good estimates of the consumption taxes paid by each household. The paper will thus examine the distributional profile of the three types of taxes – income [including taxes on labour], wealth and consumption – across the distribution of resources using LWS data.

1 Introduction

Most studies of the redistributive profile of taxes across countries focus on income taxes, as data on these are readily available in standard sources. For instance, the Luxembourg Income Study (LIS) can be used to examine distributional aspects of income taxes for up to 30 countries covering the early 1970s to the present. However, taxes on income cover only part of the public sector's revenue. Taxes on consumption and wealth as well as employer and employee social security contributions are other important revenue sources.

Figure 1 shows the (gross) share of tax revenue in GDP in selected OECD countries between 1997 and 2005. Among this group of countries, the US has by far the lowest level of taxation, varying between 25 and 30 percent of GDP. Sweden tops this "league table", with tax rates of around 50 percent. Finland and Norway are close to the top with a gross tax rate at close to 45 percent in 2005. Germany, Canada and the UK are around 35 percent. The composition of overall tax revenue varies widely across these countries, as demonstrated in Figure 2. While personal income taxes are important in all countries, they are not at the top in all cases. Personal income taxes do account for the majority of tax revenue in the US and Canada, but taxes on goods and services as well as social security and payroll taxes are a substantial part of tax revenue in all cases. It is equally instructive to note that taxes on property and, with the exception of Norway, corporate income taxes tend to be relatively less important sources of revenue.

The full set of tax policies the public sector in a country employs to collect revenue is subject to a variety of considerations. For instance, it is unlikely to be a coincidence that most countries collect relatively little from tax on corporations and wealth, as both firms and capital is widely believed to be internationally mobile. This paper is concerned with neither the determinants of tax policies nor with their general consequences, but with their incidence across the distribution of income among persons within each country.

The examination of the incidence of different kinds of taxes, rather than only income taxes, across the distribution of income, also within different demographic groups is of public policy interest, as there are substantial differences across countries and time in the weight given to different kinds of taxes and the extent to which particular demographic groups, such as the elderly or families with children, receive

Figure 1 Taxes as a share of GDP in selected OECD countries

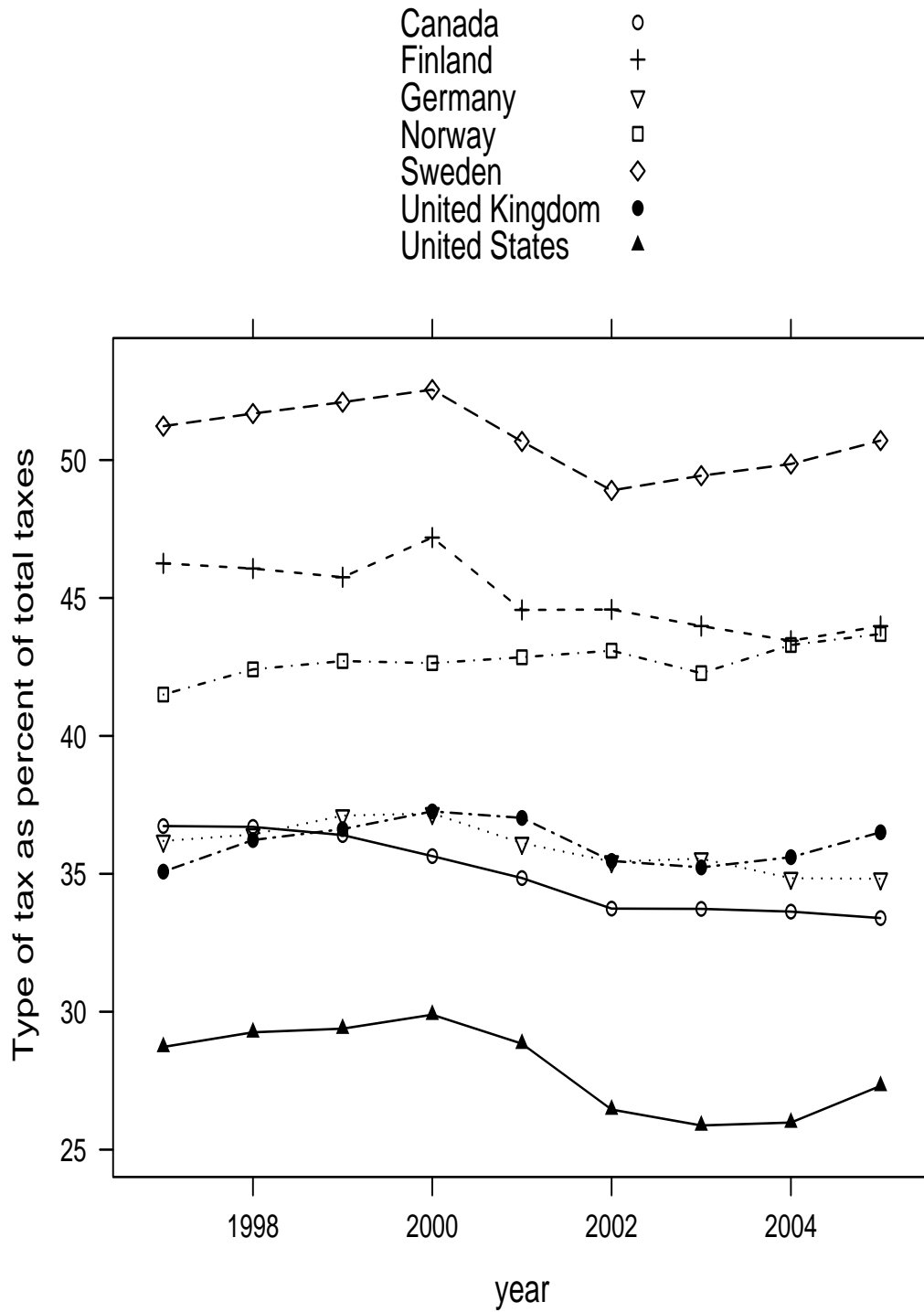
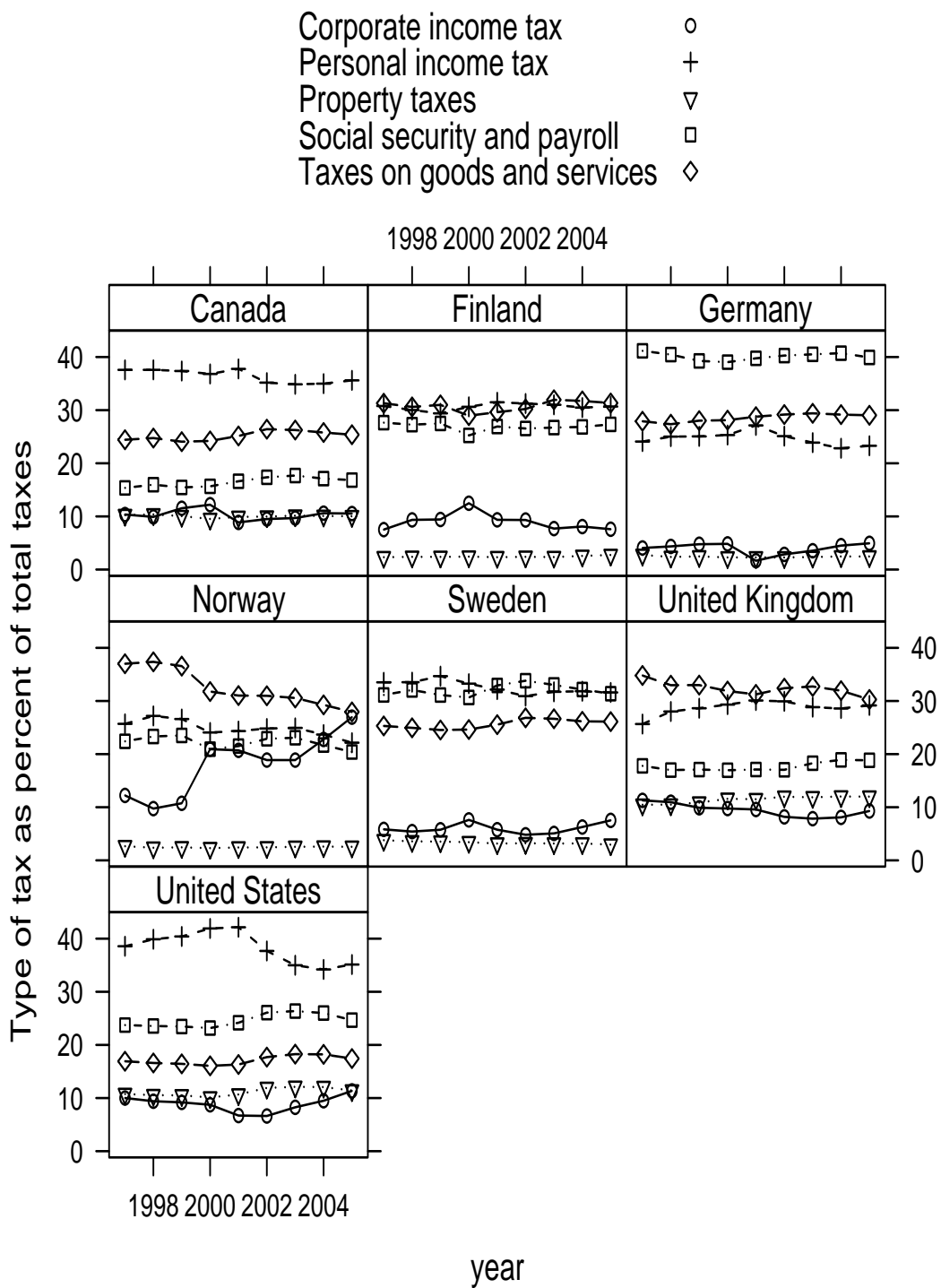


Figure 2 The structure of taxes in selected OECD countries



favourable treatment. An awareness of the potential for income taxes to distort work incentives has led to an increasing policy focus on the use of taxes on consumption. On the other hand, policy makers in different countries worry that the taxation of capital and capital income may lead to capital flight and/or lower savings, which, along with already high levels of labour income taxation, has strengthened the pressure for raising revenue from consumption. Consumption taxes, in turn, are likely to fall heavily on those with low income, as their propensity to consume out of income is likely greater than that of the average consumer.

The Luxembourg Wealth Study (LWS) is a collection of microdatasets that provide comparable data on net worth and disposable income for a number of developed countries, including the US, Canada, Germany and the UK. In some countries, the LWS data also include consumption expenditures broken down by category. All LWS datasets provide information on taxes on income, including taxes on capital income and wealth. By combining the LWS data with data from national accounts, it is possible to construct estimates of the consumption taxes paid by each household. The paper will thus examine the distributional profile of different forms of taxes – payroll, income, wealth and consumption – across the distribution of resources.

This paper uses microdata from LWS and institutional information on taxes across developed countries to study changes across time in the structure of taxation and its incidence across the income distribution. In particular, I draw on LWS data on wealth, income and consumption expenditure along with actual and imputed taxes to examine how the progressivity and regressivity of these different taxes compare across countries. The paper currently take a closer look at four types of taxes, namely (1) payroll taxes, (2) personal income taxes, (3) wealth taxes and (4) taxes on goods and services.

2 Methods and data

2.1 Methods

In this section I briefly present the methods used for studying the incidence of taxes. I use the following notation:

w gross wealth

x gross income

c consumption expenditure

t_e social security contributions and payroll taxes

t_x (direct) income taxes

t_w (direct) wealth taxes

t_c consumption taxes

τ_z tax *rate* of type z

t'_z marginal tax of type z

F the cumulative distribution function (of the tax base, if nothing else is indicated).

A tax system is said to be progressive if the *average* tax rate $\tau = \frac{t}{x}$ is increasing, and regressive if τ is decreasing.

Following Lambert (1993) and others, I distinguish between tax progression (regression) and tax progressivity (regressivity). The former two refer to properties of the tax schedules, $t()$, whereas the latter refer to the properties of the tax schedules and the tax base $\langle t(), F() \rangle$.

Let capital letters X and T denote the stochastic variables “tax base” and “tax”, respectively and x and t be their realisations. $L_X(p)$ and $L_T(p)$ are the Lorenz curve and concentration curve of the tax base and taxes for $p = F_X(x)$. $G_X(\eta)$ and $C_T(\eta)$ [$\eta > 1$] are the generalised Gini coefficient and concentration coefficients.

The Lorenz curve of gross income X with cdf $F_X(x) = F(x)$ is

$$L_X(p) = \frac{1}{\mu} \int_0^p F^{-1}(u) du \quad (1)$$

and the concentration curve of taxes T wrt. income is

$$L_T(p) = \frac{1}{\mu_T} \int_0^p t[F^{-1}(p)] du, \quad (2)$$

where $F^{-1}()$ is the inverse distribution function of the tax base. The Gini and concentration coefficients are

$$G_X = 1 - 2 \int_0^1 L_X(p) dp \quad (3)$$

and

$$C_T = 1 - 2 \int_0^1 L_T(p) dp. \quad (4)$$

The measures of progression, progressivity and their associations (if any) that are discussed by (ch 6 and 7 Lambert, 1993) are summarised in Table 1. There are two things that should be noted before the measures are discussed. Firstly, measures and the inequalities they should satisfy are shown here (and by Lambert) in terms of progression. For regression, the opposite conditions hold. Secondly, the progressivity indices that correspond to each measure of progression are members of large classes of alternative measures rather than the single index that satisfies the relevant measure. To measure progressivity (regressivity) I will focus on *departures from proportionality*, comparing the inequality of the tax base with that of taxes, and the *redistributive effect*, comparing the inequality of the tax base with that of the tax base less taxes.

Table 1 Measures of progression and progressivity

	Progression	Progressivity
Liability progression	$LP(x) = e^{t'(x),x} = \frac{xt'(x)}{t(x)} = \frac{t'(x)}{\tau(x)} > 1$	Departure from proportionality $L_X(p) > L_T(p), p \in [0, 1]$
Residual progression	$RP(x) = 1/e^{x-t(x),x} = \frac{x-t(x)}{x[1-t'(x)]} = \frac{1-\tau(x)}{1-t'(x)} > 1$	Redistributive effect $\Pi^k(\eta) = C_T(\eta) - G_X(\eta)$ $L_X < L_{X-T}$ $\Pi^{RS} = G_X(\eta) - C_{X-T}(\eta)$
Average rate progression	$ARP(x) = \frac{xt'(x)-t(x)}{x} = t'(x) - \tau(x) > 0$	
Marginal rate progression	$MRP(x) = t''(x) \geq 0$	
Convexity of the tax schedule	$CP(x) = \frac{xt''(x)}{t'(x)} = e^{f'(x),x} \geq 0$	Gains from splitting
Concavity of post-tax income schedule	$CVP(x) = \frac{-xt'(x)}{1-t'(x)} = -e^{1-t'(x),x} \geq 0$	Gains from splitting

Source: Lambert (1993).

2.2 Data

In this section, I first describe the Luxembourg Wealth Study database (LWS) and then explain the selections we have made for the analyses in this paper. The surveys in LWS differ by purpose and sampling frame (for details see Sierminska et al., 2006). Certain surveys have been designed for the specific purpose of collecting wealth data (i.e. Canada, , Italy, and the SCF in the United States), whereas others cover different areas and have been supplemented with special wealth modules (i.e. Germany and the PSID in the United States). Some surveys over-sample the wealthy and provide a better coverage of the upper tail of the distribution (Canada, Germany and the SCF in the United States), but at the cost of higher non-response rates. And not all oversample evenly, as only the US SCF uses a list sample of tax authority records and a large sample of high wealth persons. Others ask only a small number of broad wealth questions, but achieve good response rates (e.g., US-PSID). Germany applies a special case of bottom-coding as financial assets, durables and collectibles, and non-housing debt are only recorded when their respective values exceed 2,500 euros) – and better comparability can be achieved by imposing the same bottom-coding to the records of other countries.

Definitions are also not uniform across surveys: In general, the unit of analysis is the household, but it is the individual in Germany, and the nuclear family (i.e. a single adult or a couple plus dependent children) in Canada. A household is defined as including all persons living together in the same dwelling, but sharing expenses is an additional requirement in Italy, Sweden and the United States. This implies that demographic differences reflect both the definition of the unit of analysis and true differences in the population structure. The household's head is defined as the main income earner in most surveys, but as the person most knowledgeable and responsible for household finances in Germany, and Italy. The United States is the only country where the head is taken to be the male in mixed-sex couples. The surveys included in the LWS archive differ in many other respects, and some aspects more closely related to wealth variables are discussed in the next Section. Full documentation of each survey's features is an important constituent of the LWS archive. The LWS documentation also reports which of these differences in the original surveys were corrected for in the harmonization process, and which were not. See <http://www.lisproject.org/lwstechdoc.htm> for more on these idiosyncrasies.

LWS variables and income and wealth classifications The number and definition of recorded wealth variables vary considerably across surveys. The number of wealth categories ranges from 7 in the UK-BHPS (which is not used here) to 30 or more in the IT-SHIW and the US-SCF. These differences compound with the detail of the questions: in some surveys, there are few simple summary questions; in other surveys, the very high level of detail leads to a considerable multiplication of the number of separate recorded items. The US-SCF is by far the most detailed survey of those included in the LWS database: checking accounts, for instance, are first separated into primary and secondary accounts, and then distinguished according to the type of bank where they are held.

The great variation in the amount of recorded information makes the construction of comparable wealth aggregates a daunting task. This problem has been approached by defining an ideal set of variables to be included in the LWS database. This starts with a general classification of wealth components, from which totals and subtotals are obtained by aggregation. This set is then integrated with demographic characteristics (including health status) and income and consumption aggregates, plus a group of variables particularly relevant in the study of household wealth: realized lump-sum incomes (e.g., capital gains, inheritances and inter-vivo transfers) and “behavioural” variables such as motives for savings, perceptions about future events (e.g., bequest motivation), attitude towards risk, and so forth.

This ideal list has been pared down after a comparison with the information actually available in the LWS surveys. With regards to wealth, this process has led to identify the following categories:

- Financial assets: Transaction and savings accounts; Certificate of Deposits; Total bonds; Stocks; Mutual and investment funds; Life insurance; Pension assets; and other financial assets.
- Non-financial assets: Principal residence; Investment in real estate; Business equity; Vehicles; Durables and collectibles; and other non-financial assets.
- Liabilities: Home secured debt – i.e. the sum of principal residence mortgage, other property mortgage, and other home secured debt (including lines of credit); Vehicle loans; Installment debt (including credit card balance); Educational loans; other loans from financial institutions; and informal debt.

- Net worth: Financial plus non-financial assets less Liabilities.

The LWS aggregates are broadly comparable, but this fall far short of perfect comparability, since underlying definitions and methods vary across surveys. Moreover, these aggregates fail to capture important wealth components, such as business equity and pension assets. As their importance differs across countries, cross-national comparisons are bound to reflect these omissions. Some indication on the size of these omissions is provided by comparing LWS definitions and the national accounts definitions of households' net worth. The LWS database includes the variables which are part of the national accounts concept but are excluded from the LWS definition. This allows users to reconcile the different definitions. As Sierminska et al. (2006) demonstrate, once the missing items are included back in net worth, the LWS figures closely approximate those released in the national accounts. On the other hand, and more worryingly, the weight of these omissions is significant and varies considerably across countries: it goes from about a half in the two North-American nations to less than a fourth in the three European nations of Table A.3 in Sierminska et al. (2006). This evidence is a salutary warning of the currently high cost of cross-country comparability: until a greater standardization of wealth surveys is achieved ex ante, we have to trade off higher comparability against a somewhat incomplete picture of national wealth. For now, I stick to the definition that is less inclusive in that it includes business equity but that is available for more countries.

Further comparability issues Other methodological differences, in addition to the definitional issues described above, affect comparability. Some relate to the way assets and liabilities are recorded (i.e. as point values, by brackets, or both) and to their accounting period. Wealth values generally refer to the time of the interview, but in four countries end-of-year values are registered. Moreover, in half of the surveys included in the LWS database the reference period for income differs from that for wealth.

The criteria to value assets and liabilities may differ too (see Atkinson & Harrison, 1978, pp. 5-6). In most cases, wealth components are valued on a "realization" basis, or "the value obtained in a sale on the open market at the date in question" (Atkinson & Harrison, 1978, p. 5), as estimated by the respondent. But there are exceptions, the most relevant being the valuation of real property in Sweden and Norway, which are valued on a "taxable" basis. In the case of Sweden, Statistics Sweden calculates

the ratios of purchase price to tax value for several types of real estate and geographical locations, and then use them to inflate the tax values registered in the survey. No adjustment of tax values is applied in Norway, although Statistics Norway estimated that the taxable value of houses in the 1990s was less than a third of their market value (see Harding et al., 2004, pp. 15-6, fn. 10). These diverse choices are likely to affect comparisons between the two Scandinavian countries as well as between them and the other countries relying on valuation at market prices as estimated by respondents.

Lastly, there are different patterns of non-response and different imputation procedures. For instance, the overall response rate of the IT-SHIW is rather low, about 36% of units in the 2002 wave were not found at the available address, but item non-responses are few. Similarly, LWS net worth cannot be derived for 14% of the households in the UK-BHPS. Banks et al. (2002) have applied a “conditional hot-deck” imputation method at the benefit unit level to alleviate the missing information problem, but it is still to be determined whether LWS will follow the same methodology. In the US-PSID, financial assets as well as housing equity are imputed. Discussions are under way whether this imputation method can be followed to obtain values for the principal residence and mortgages that would reduce the overall proportion of missing values. In the US-SCF, item non-response is tackled by using a sophisticated multiple imputation procedure (Kennickel, 2000), while in the GE-SOEP it is currently treated by simply replacing missing values with the overall mean (a complex imputation procedure is under study).

Sierminska et al. (2006) provide a synthetic assessment of the information contained in the LWS database by comparing the LWS-based estimates with their aggregate counterparts in the national balance sheets of the household sector (which include non-profit institutions serving households and small unincorporated enterprises). In all countries where the aggregate information is available, the LWS wealth data account for between 40 and 60% of the aggregate wealth. Not all of the discrepancies should be attributed to the deficiency of the LWS data. They reflect not only the under-reporting in the original micro sources, but also the dropping of some items in the LWS definitions to enhance cross-country comparability as well as the different definitions of micro and macro sources.

To sum up, despite the considerable effort put into standardizing wealth variables, there remain important differences in definitions, valuation criteria and survey quality that cannot be adjusted for.

Moreover, the degree to which LWS-based estimates match aggregate figures varies across surveys. These observations have to be borne in mind in reading the results discussed in the next section. The most reassuring thing about the LWS surveys is that the LWS income data are almost identically to the LIS income measures available on the LIS income surveys (Niskanen, 2007). . This should come as no surprise because for Germany, Italy and Sweden, the data are from the same surveys.

Comparability of income and wealth across populations What particular deflator, purchasing power parity (PPP) exchange rate and equivalence scale to use for income on the one hand and wealth on the other used involves judgement. For one thing, it is far from certain that the best choice of, say, deflator for income is the same as that for wealth. There are reasonably standard choices on how to treat incomes for comparative analyses: e.g., to use a consumer price index to deflate incomes to a common base year and to “standard” PPPs to render incomes comparable in purchasing power terms (Gottschalk & Smeeding, 1997). While there are many equivalence scales to choose from, there is little debate as to the appropriateness of using one that takes some kind of household economies of scale into account. Typically, either the “old” OECD or the so-called “square root scale” are used.

Whether or not the same set of choices is appropriate for the distribution of wealth is an open question and depends on what we think the wealth has been accumulated for. Suppose, for instance, that the bulk of wealth is held to smooth consumption during periods of low income. In that case, the purpose is to be able to draw down on wealth to finance consumption for (more or less) the current household and the same kind of choices that apply to income are appropriate. That is, the value of wealth is in its capacity to finance the consumption of the current household something that consumer price deflators, PPPs and an equivalence scale that is supposed to translate the capacity to generate wellbeing of a given sum of money across households of different structures.

On the other hand, suppose wealth is accumulated to finance consumption after retirement. While that wealth too is held to finance consumption, it is the consumption not of the current household but one that will exist at some future point in time. Presumably, for instance, offspring who at this point in time are minors will by then be self-supporting adults in their own households, so using an equivalence scale based on current household structure may undervalue the capacity of the wealth held to finance

consumption.

For the superrich, the purpose of holding wealth is unlikely to be (solely) to finance consumption, but presumably some elements of the capacity of wealth to yield status and power to its holds are involved. In that case, cross-country comparison might reasonably rely on exchange rates, not PPPs. Presumably, for instance, the Forbes list of billionaires in the world relies on comparison of portfolios based on exchange rates.

However, since this paper is concerned with the distribution of well-being in a sense closely related to the tradition of income distribution research, I opt to use quite standard methods. In particular, I use the OECD's price deflator for Actual Final We have converted all currencies to international dollars using the PPPs for personal consumption in 2002 as published by the OECD, having first used national price deflators for personal consumption to express national currencies in year 2002 prices. Both income and wealth (as well as the tax variables) are further adjusted for household economies of scale using the square-root scale.

While I do take a closer look at most forms of taxes, the analysis is incomplete in several important ways. First, I naively assume for every type of tax that the incidence is fully the nominal paper of the tax. Thus, payroll, income, wealth and consumption taxes fall entirely on households, while corporate taxes fall entirely on corporations and do not enter this analysis at all. These assumptions are obviously extremely strong and will be looked into (in a later version).

Second, while I examine the incidence of taxes on household by their income or wealth, I do not similarly examine the incidence of the benefits of taxes – income transfers and public expenditures such as schooling or health services. Taxes are collected to fund activities that contribute to the well-being of individual members of society. An examination of the incidence of transfers is reasonably straightforward – although not without its complications, since many of the benefits may be realised at later dates than taxes are collected – but a serious effort to allocate services to households is beyond the scope of this paper.

Finally, while taxes on goods and services may be most interesting for our paper, that is the area where the information available is the weakest. For this study, I have chosen to study Canada, Finland, Norway, Sweden and the United States. This selection of countries is dictated by data availability. The

US, Norway and Sweden all give wealth taxes, while the US (again), Canada and Finland have the most expenditure categories available.

Descriptives Tables 2 and 3 show the means and 10th, 50th and 90th percentils of gross income and grss wealth, along with sample size in each of our datasets.

Table 2 Countries included – LWS and original datasets and years

Country	Name	Agency	Wealth year	Income year	Type of source	Wealthy OS	Sample size	# wealth items
Canada	Survey of Financial Security (SFS)	Statistics Canada	1999	1998	Sample survey	Yes	15,933	17
Finland	Household Wealth Survey (HWS)	Finland Statistics	End of 1998	1998	Sample survey	No	3,893	23
Norway	Income Distribution Survey (IDS)	Norway Statistics way	End of 2002	2002	Sample survey plus administrative records	No	22,870	35
Sweden	Wealth Survey (HINK)	Sweden Statistics	End of 2002	2002	Sample survey plus administrative records	No	17,954	26
United States	Panel Study of Income Dynamics (PSID)	Survey research Center of the University of Michigan	2001	2000	Sample panel survey	No	7,406	14

Table 3 income N=66643

	N	mean	quantile.10%	quantile.50%	quantile.90%	gini
country						
Canada	15933	32427.70	8540.42	23453.31	58067.21	0.44
Finland	3893	28925.43	10990.69	24569.63	49988.80	0.33
Norway	22870	37459.51	14859.92	32890.70	59525.83	0.32
Sweden	17954	33725.64	12117.35	27479.16	59519.81	0.36
US (PSID)	5993	41309.80	9297.77	30797.33	76727.01	0.45

Table 4 wealth N=66643

	N	mean	quantile.10%	quantile.50%	quantile.90%	gini
country						
Canada	15933	109655.11	61.94	52883.89	245263.37	0.68
Finland	3893	78306.91	474.63	57409.84	159818.89	0.52
Norway	22870	52587.92	2185.01	28091.19	96480.49	0.61
Sweden	17954	95890.47	0.00	48630.53	209814.88	0.66
US (PSID)	5993	115953.07	0.00	49964.40	254956.66	0.71

3 Results

The Lorenz curves for gross income and gross wealth are shown in Figure 3. The Lorenz curves are drawn in “difference” form, i.e., as $p - L(p)$, so the horizontal line at zero corresponds to the normal 45-degree line (this way of drawing them allows for more room for the differences between curves to be displayed). For income, there are no surprises, in that the Nordic countries have more equal relative distributions, followed by Canada and the United States. For wealth, two things are to be noted. First, in all of our countries, gross wealth is more concentrated than is income. Furthermore, many of the Lorenz curves cross (as might be expected by the fact that the Gini coefficients are quite close). Thus, not definite inequality orderings by wealth arise from these data.

Next, we’ll look at the progressivity of the different forms of taxes relative to gross income. The choice of gross income as the (initial) tax base is not unproblematic. However, since all taxes represent flows, relating them to the flow variable income rather than the stock of wealth appears to be an appropriate point of departure.

In terms of the definitions in Table 1, to measure progressivity/regressivity I (currently) focus on the *departure from proportionality* of each type of tax, i.e., the concentration curve of the tax is compared with the Lorenz curve for income. (The concentration curves for taxes are shown in the appendix.) It needs to be born in mind that the analysis is limited in that payroll taxes have been imputed based on aggregate revenue statistics and that the taxes on goods and services are based on aggregate tax rates and incomplete expenditure data. Thus, the results should be taken as being highly preliminary.

The comparison of the departure from proportionality are first shown across tax types in each country in Figure 6. As one might expect, income taxes are progressive in all countries, with (perhaps somewhat surprisingly) the US exhibiting the most progressivity, followed by Canada. Payroll taxes tend to be mildly progressive, although for US, not globally so (in that there is a crossing at around the 70th percentile of gross income).

Wealth taxes are present only in Norway, Sweden and the US. In Sweden and Norway, these are highly concentrated on high income earners and therefore highly progressive, but are globally regressive in the United States. Taxes on goods and services are regressive in all countries in which we have any expenditure data (all except Norway). The overall impact of taxation is far less than one might expect

Figure 3 Distribution of income and wealth – Lorenz curves

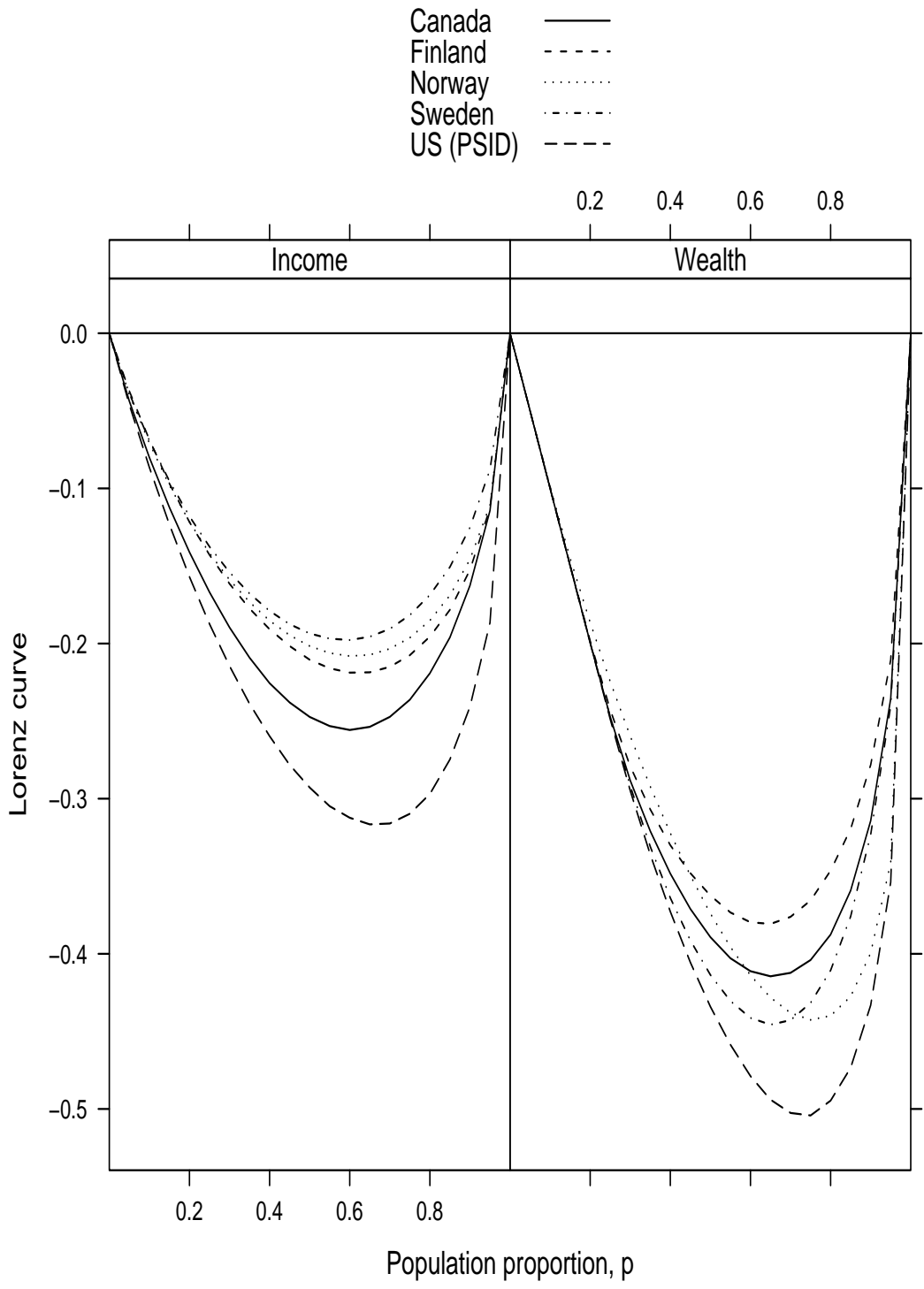
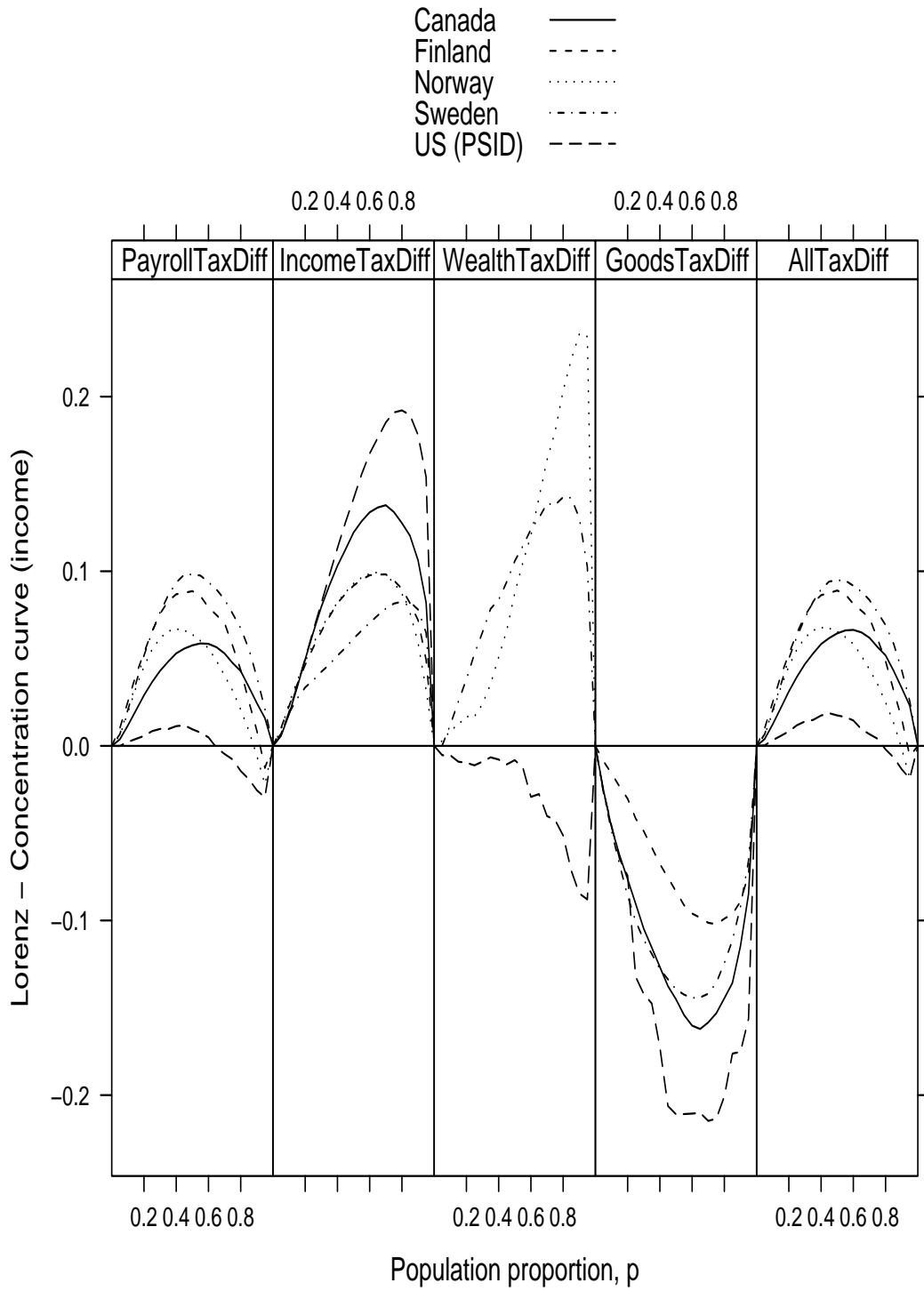


Figure 4 The departure from proportionality for different types of taxes relative to income – comparisons of tax concentration curves with income Lorenz curves within tax within countries across tax types



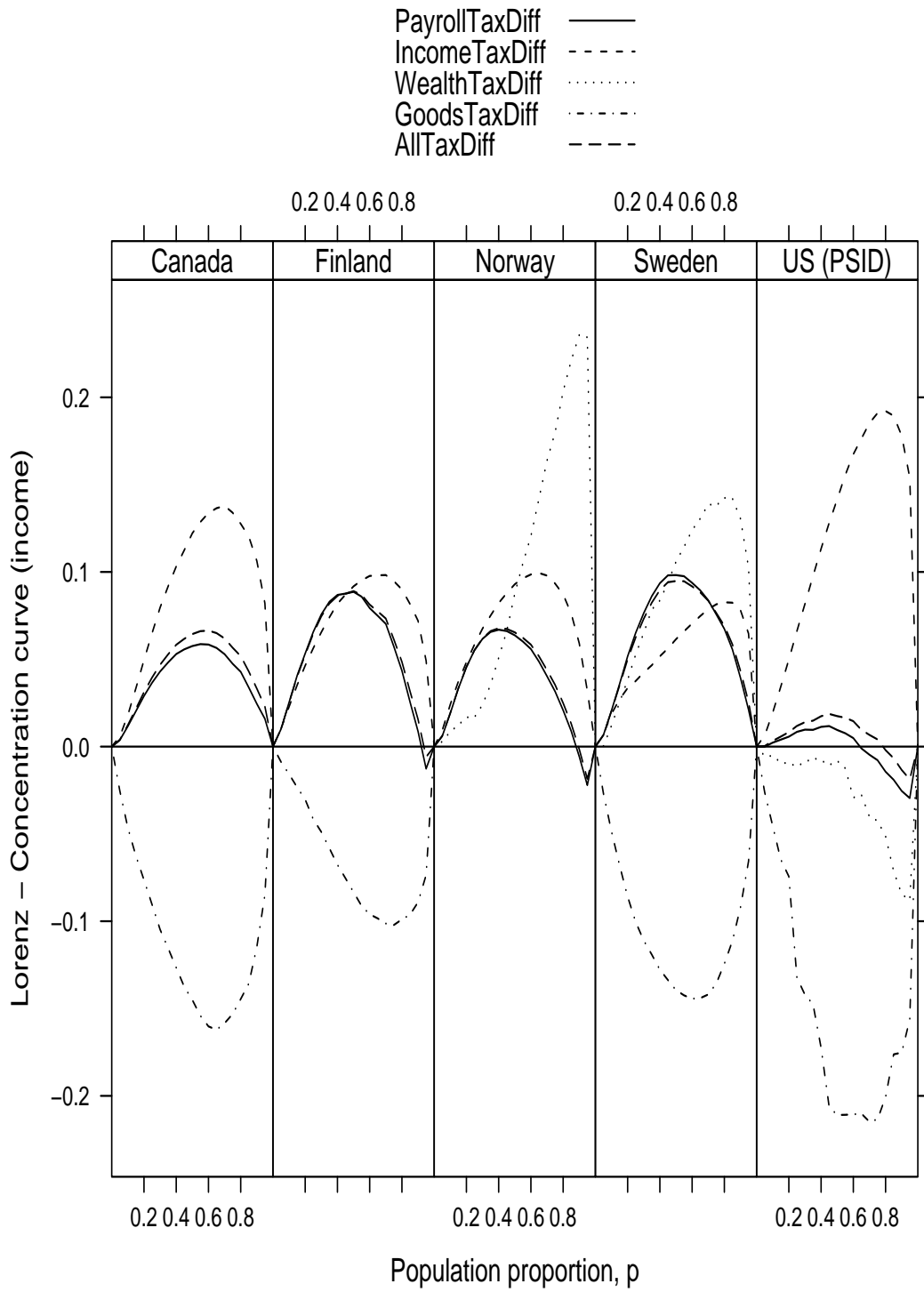
based on income taxes alone, and in the US taxes are not progressive across the whole distribution of income, either.

A second look at the progressivity of taxes is taken in Figure 6 where the same data are organized by showing each type of tax within each country. For most countries, payroll taxes and income taxes mimic closely the overall progressivity of taxes. The main outlying observation is the US.

4 Concluding remarks

The preliminary results in this paper suggest that while income taxes are progressive in the five countries examined – Canada, Finland, Norway, Sweden and the United States – taxes on wealth, payroll, and goods and services are not necessarily progressive and can be strongly regressive. While such findings are not new and are unsurprising, they do underscore the importance in considering broader measures of taxation than just direct income taxes when examining the distributional profile of taxes.

Figure 5 The departure from proportionality for different types of taxes relative to income – comparisons of tax concentration curves with income Lorenz curves within tax type across countries



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A Concentration curves

Figure 6 The concentration curves for different types of taxes relative to income – comparisons within countries across tax types

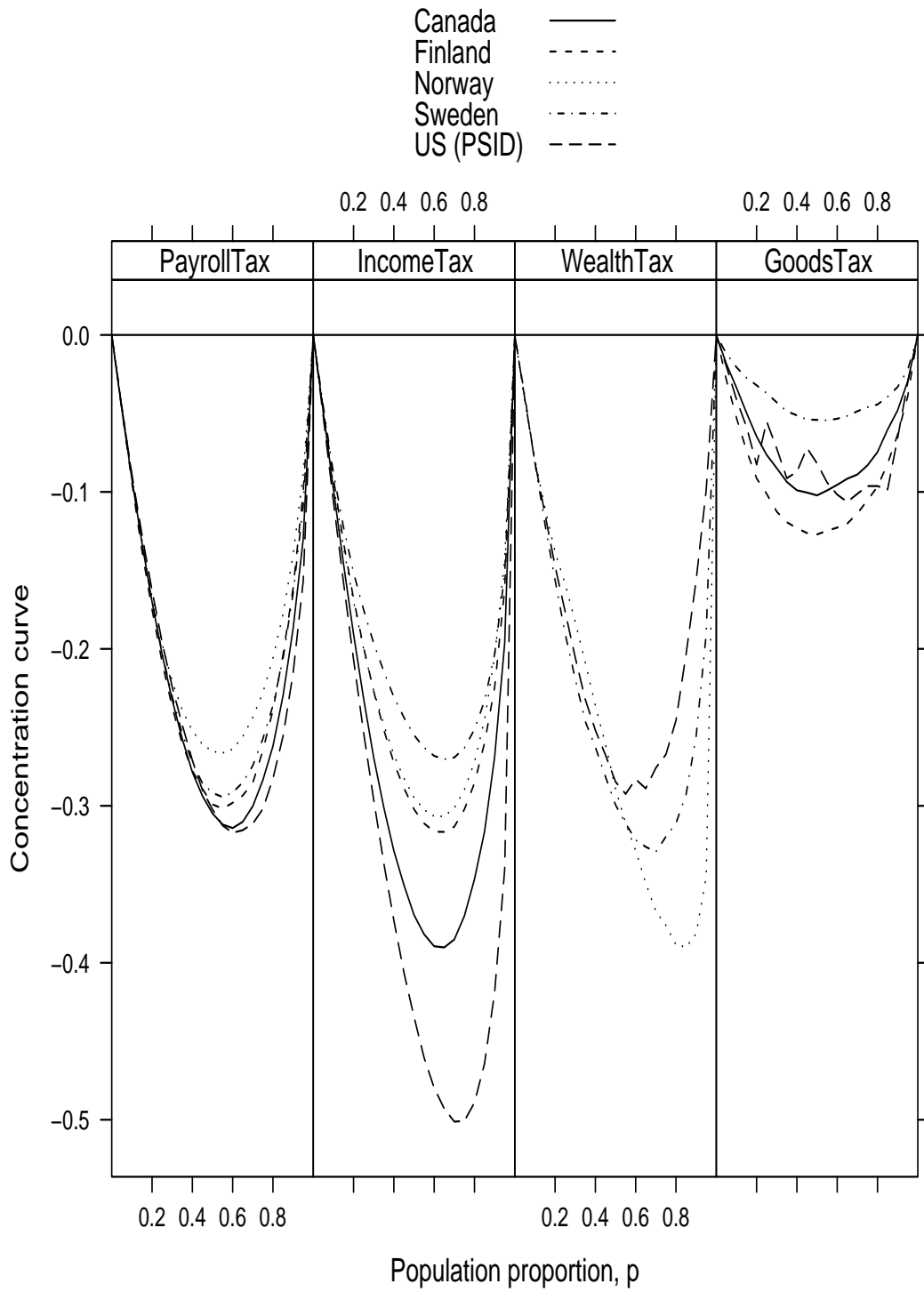


Figure 7 The concentration curves for different types of taxes relative to income – comparisons within countries across tax types

