

The Poverty Impacts of Revenue Systems in Developing Countries.
A Report to the Department for International Development

by

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with

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Executive Summary

Tax reform has been promoted by the International Financial Institutions (IFIs) as an important component of economic policy reform in developing countries (LDCs). This typically includes a shift from trade taxes to domestic sales taxes, the rationalisation of taxes (reducing the number and level of rates), and measures to reduce budget deficits and raise tax/GDP ratios.

Poverty and/or inequality considerations have received little if any attention in LDC tax reforms. Partly this is because of the belief that few taxes are actually paid by the poor, and partly because of the belief that the tax system does not provide the best instruments to target the poor. The purpose of this study is to assess these beliefs by reviewing analytical methods for and evidence on the effects of tax reform on the poor.

The two beliefs are largely true, but with important exceptions. There are few taxes for which the poor are directly liable, the main exceptions being commodity taxes (excises, and some sales taxes unless basic necessities are zero-rated) and certain levies (such as local poll taxes). However, the poor may be indirectly liable and a full analysis of the effects of taxes on the poor must address the difficult issue of tax incidence. Even where the poor are potentially liable, most evidence suggests that taxes are not regressive, i.e. the poor face a proportionately lower burden than the non-poor. While public expenditures are generally a better instrument for targeting the poor, the tax system can contribute by zero-rating or even subsidising commodities consumed, or activities engaged in, by the poor rather than the rich. As they involve a cost, it is a moot point whether subsidies are instruments of expenditure or tax policy.

In summarising the report, we first review the core features of tax systems in developing countries (LDCs), concentrating on the poorest countries. We then review the main features of tax reforms implemented in recent decades. Methods of assessing the effects of taxes on distribution and the poor are reviewed before presenting the available evidence. We conclude with policy recommendations.

The study begins by identifying a number of typical characteristics, or stylised facts, of taxation in least developed countries:

- Tariffs and domestic sales taxes are the major sources of tax revenue.
- Taxes on exports are now rarely a significant source of revenue.
- Personal income taxes are relatively minor, while Social Security taxes are rarely present, as sources of revenue.
- Corporate taxes vary considerably in terms of their revenue potential.
- Taxes on property or capital gains are rarely significant.
- Collection efficiency is low, avoidance and evasion tends to be high.
- The tax/GDP ratio rarely exceeds 15% (except in resource-rich economies).
- Non-tax revenues are most significant in resource-rich economies.

Tax Reform: The Evidence and Issues

Chapter 2 reviews assessments of tax reform experience in LDCs prior to the mid-1990s.

- Tax administration reforms are essential to increase collection efficiency and reduce evasion problems. Early reforms that concentrated on changes to statutory features of tax systems, such as tax rates and exemptions, often failed to have the anticipated effect because of administrative deficiencies.
- There have been numerous implementation problems, with reversals quite common. This has been pronounced in tariff reforms where governments have subsequently made concessions to domestic groups lobbying for 'special' protection.
- Changes in the revenue shares of different taxes are a poor guide to evaluating reforms as both the numerator and denominator change. For example, reductions in tariff rates are often associated with increases in tariff revenue. The increase in revenue relative to the value of imports will be greater than any increase in tariff revenue as a share of total tax revenue.

- Traditional tax reform recommendations from the IMF and World Bank have often been guided too rigidly by theory. For example, in very poor economies a simple sales tax is probably more appropriate than a complex VAT system. In many cases, theoretical prescriptions for ‘tax neutrality’ (levying uniform tax rates so that relative prices are unchanged) are inappropriate in a developing country context.
- The general presumption against consumer subsidies is misplaced when the range of viable tax instruments is limited. Subsidies targeted at sections of the population are an effective instrument for alleviating poverty.

Chapter 3 reviews the main findings of tax theory and derives implications for tax reform in LDCs.

- **Income taxes** should be based on a simple rate structure including the reduction of very high marginal rates and increases in the lowest income tax threshold. The income tax ‘net’ should be cast as widely as possible.
- Although theory suggests the use of uniform **import tariffs** and **domestic indirect taxes**, this needs to be adapted for LDC conditions. Differentiated commodity taxes (sales or tariffs) may be required for efficiency when some goods or sectors cannot be taxed and/or some tax instruments are not available. Nevertheless, a small number of tax rates within a relatively narrow range (i.e. low dispersion) would typically be recommended.
- **Taxation of intermediates** is *not* precluded by theory but reform design needs to recognise the full ramifications for final goods prices across the economy (e.g. using evidence from studies of effective protection). In poor countries with underdeveloped tax administrations and a limited range of instruments the case for variegated rates of tax becomes stronger.
- Administrative and political economy conditions in LDCs often provide a strong case for minimising the range of tax rates levied, for restricting the types of taxation and for broadening tax bases.

- Allowing for effects on the poor leads to recognition that some taxes, which may be disfavoured on efficiency grounds, may be appropriate to achieve redistribution (e.g. land taxes). Similarly, an argument can be made for subsidising commodities consumed by the poor but not by the rich.

Taxes, Distribution and the Poor: Analysis and Evidence

Chapter 4 discusses measures of inequality, poverty and social welfare and how these are incorporated in models to assess the distributional effects of taxes. An important issue relates to the incidence of taxes (i.e. who actually bears the cost). Some measures relate to aspects of tax structure (e.g. how much progression there is), whilst others are used to compare ‘pre-tax’ and ‘post-tax’ income distributions. A number of conclusions emerge that are relevant to the poverty impacts of taxes and tax reforms.

- As actual incidence is not usually known with accuracy, and the extent of evasion is typically unknown, different methods of analysis should be compared wherever possible (and subjected to sensitivity testing).
- Data availability determines the type of analysis that can be undertaken. Where data are most limited, measures of progression or progressivity are about all that can be attempted. The increasing availability of household expenditure survey data for LDCs allows the construction of tax concentration curves and dominance testing, and may permit the use of fiscal simulation models.
- The counterfactual against which the tax in question is being compared must be specified clearly. If alternatives do not yield the same revenue, observed poverty or inequality changes cannot be unambiguously attributed solely to the tax change but may represent the effects of revenue growth. Appropriate strategies in such cases are considered.
- Untaxed sectors bear some of the tax incidence, and (typically poor) consumers and producers can both be affected even if not statutorily liable. Thus, results can be sensitive to assumptions made regarding tax incidence.

- The inflation tax is a clear example of a tax that the poor *do* pay and it is thus likely to transfer tax burdens to the poor.

Chapter 5 reviews the evidence from different approaches to analysing the distributional effects of taxes and tax reforms. The literature reviewed includes the average rate of progression (ARP) measure, concentration curves and welfare dominance, marginal social cost (MSC) and CGE and fiscal simulation approaches.

General conclusions with respect to particular taxes are quite hard to find as observed distributional effects tend to be country specific. The balance of evidence permits some general inferences however.

- To the extent that the incidence of indirect taxes rests with consumers, **taxes on exports, intermediates, and kerosene** are bad for the poor.
- **Taxes on imports** appear among the less progressive (or more regressive) taxes, and thus are relatively less pro-poor. Trade tax reforms (as proposed by IFIs) may be a case where efficiency and equity outcomes are complementary.
- It is generally difficult to achieve significant redistribution through indirect taxes. Kerosene (or paraffin) is often important within poor households but is not widely used by the rich. Thus, exempting kerosene from fuel taxes would improve equity without encouraging inefficient substitutions between fuel types. A similar argument may apply to other items such as staple foods.
- Excises on **alcohol, tobacco and cars/petrol** are traditionally thought of as regressive, but recent evidence suggests that they are in fact progressive. Reforms that rationalise these taxes will generally improve efficiency, but should not be justified by potential benefits for the poor.
- **Value added taxes** have been introduced in the majority of LDCs by 1998. While VAT is relatively low on the progressivity rankings, it tends not to be regressive.

- **Income tax** reforms often involve reductions in *progression* (e.g. by removing or reducing higher marginal tax rates), but widespread evasion meant that they were not very *progressive* before reform (at least at the top end of the income scale). Reforms generally benefit those in the lower half of the income distribution and are largely irrelevant to most of the poor. The rationalisation of income tax schedules also contributes to a more efficient income tax system.
- Few reform episodes have resulted in substantial changes in revenue collected or effective tax rates. Nevertheless, trade tax reforms, which are generally pro-poor and increase efficiency, are not typically associated with reductions in revenue.
- The principal **taxes paid by the poor** are sales taxes on goods they consume (kerosene and tobacco in particular, as food is usually exempt), tariffs on imports they consume or that are inputs to production, and the inflation tax. The tax system can be made pro-poor if such items are zero-rated or subsidised.
- The taxation of intermediates can lead to effective taxes differing substantially from nominal rates. This affects the poor, for example by undermining subsidies on food items. Reforms that reduce taxes on intermediates are likely to be both efficiency enhancing and pro-poor.

Analysing Poverty Impacts of Tax Reform

Chapter 6 reviews the advantages and disadvantages of various methods for analysing the effects of tax reforms on poverty. The alternative methods can be ranked, from most difficult to apply to easiest:

1. CGE models
2. marginal social cost analysis
3. tax progressivity measures (concentration curves, dominance tests, etc)
4. fiscal simulation models
5. tax progression measures

The suitability of a method for policy advice depends on the desired poverty assessment, the nature of the reforms, the availability of data and of resources for the analysis. The best approach for DFID is to seek compromises between more

comprehensive methods, with their extensive data requirements and/or complex computational procedures, and simpler methods that are more readily applied to limited data.

Policy Recommendations for Pro-Poor Tax Reform

Chapter 7 collates the evidence reviewed in the report to derive recommendations for enhancing the potential for tax reform to be pro-poor, so that the burden on the poor is reduced or, at least, not increased.

- Commodity taxes, both on sales and trade, should have few rates with a low dispersion (i.e. no very high rates).
- Commodity taxes can be made pro-poor by ensuring zero rates on goods that are consumed predominantly by the poor rather than the rich, and on activities that are engaged in predominantly by the poor.
- A strong case can be made to subsidise the price of commodities that are consumed by the poor but not by the rich (e.g. kerosene, some staple foods). This is the only recommendation that differs from standard IFI fiscal policy recommendations.
- Reducing the dispersion and average level of tariff rates is pro-poor.
- A more simple tax structure (fewer and lower rates) contributes to collection efficiency and economic efficiency. Simplification of tax structures usually increases revenue. This suggests a preference for simple sales taxes rather than more complex VAT often recommended by the IFIs.
- A relatively simple income tax is progressive. However, income taxes are not incident on the poor, and are thus not a core element of a pro-poor tax reform strategy.

Chapter 1 Introduction

1.1 Background

Tax reform has been promoted by the International Financial Institutions (IFIs) in recent years as an important component of more general economic policy reform in many developing countries (LDCs). This commonly includes a shift from trade taxes to domestic sales taxes, the rationalisation of income taxes, and measures to reduce budget deficits and/or raise tax/GDP ratios. Attempts to make the economy more 'open', to improve macroeconomic stability, and to improve the efficiency of tax collection (e.g. by minimising distortionary effects) often underlie these reforms. Despite the prevalence of redistribution as a guiding motive in the design of tax systems in developed countries, poverty and/or inequality considerations have generally been of secondary importance, at best, in LDC fiscal reforms. Indeed, even where *inequality* is addressed, impacts on the poor in particular, and poverty in general, have often been ignored in tax reform debates.

There are two likely reasons for the neglect of poverty in discussion regarding tax reform. First, the belief that any effects of taxes on the poor are likely to be small as, in practice, the poor do not pay taxes (few taxes are *directly incident* on the poor). This is not quite correct, as certain taxes (especially trade and sales taxes) affect the prices of goods that the poor consume. Secondly, the belief that public social expenditures provide a better means to target the poor and reduce poverty (taxes are not viewed as instruments for reducing poverty). As a result, the poverty impacts of taxation, and revenue systems more generally, have remained peripheral topics of research, even though the poverty impacts of social expenditures have received increasing research attention, both within the IFIs and beyond (see van de Walle and Nead, 1995).

Tax systems in LDCs are dominated by indirect taxes which, unlike income taxes, cannot be levied directly on individuals, but rather depend on the goods and services consumed. Since rich and poor often purchase broadly similar consumption bundles, it has often been presumed that it is difficult to make these taxes strongly progressive (i.e. to ensure that those on higher incomes pay relatively more tax). This may indeed be the case, but recent evidence suggests that some indirect taxes can be quite strongly

progressive or regressive, so that the potential for adverse poverty effects within LDCs tax systems needs careful examination.

A further important issue is whether making taxes more progressive is likely to be *harmful* to the poor. This can arise if the distortions to behaviour from a progressive tax are sufficient to reduce efficiency, causing revenues that finance poverty-reducing social expenditures to decline. This highlights the importance of assessing tax and expenditure effects on poverty simultaneously: the desirability of progressive taxation may depend on the government's ability to target anti-poverty expenditures adequately. Furthermore, aid can play an important role in financing pro-poor expenditures when tax revenues are low (which may be partly due to a desire to exempt the poor). While the focus of this report is on taxation, we will address the broader context.

1.2 Some Stylized Facts on Taxes in Developing Countries

As discussed in chapter 2, the structure of tax systems (the relative contribution of different types of taxes) and the overall tax/GDP ratio varies considerably among developing countries. In general, the tax/GDP increases as national income rises, from around 5-15% in the poorest countries to 20-25% in middle-income countries. The composition of tax revenues also tends to change, with taxes on trade diminishing in importance and taxes on incomes increasing in importance. Keeping these factors in mind, and given that DFID's primary concern is with the least developed countries, we can identify some typical features of tax systems in the poorest LDCs.

- Personal income taxes tend to be a relatively minor source of revenue, as formal employment levels are low.
- Social security taxes are rarely present as a source of revenue.
- Corporate taxes are the largest component of income taxes, but vary considerably in terms of their revenue potential.
- Domestic sales taxes are a major source of tax revenue.
- Taxes on imports are a major source of tax revenue, but of diminishing importance in most countries.
- Taxes on exports are now rarely a significant source of revenue.
- Taxes on property or capital gains are rarely significant.
- Collection efficiency is low, avoidance and evasion tends to be high.

- The tax/GDP ratio is generally less than 15% (except in resource-rich economies).
- Non-tax revenues are most significant in resource-rich economies.

Tax reform in LDCs has been guided by efforts to mobilise domestic resources (increase the tax/GDP ratio) and increase efficiency. Efforts to increase the economic efficiency of the tax structure have been reflected in reforms that rationalise (reduce the dispersion of) tax rates, reduce average rates (especially of tariffs), and shift emphasis from trade to sales taxes. The report will concentrate on these types of reforms and how they relate to effects on the poor. There have also been many administrative reforms motivated by the need to increase collection efficiency. We will devote less attention to these, as they are of less relevance in terms of effects on the poor.

1.3 Outline of the Study

The report will review the relevant conceptual issues, practical methodologies and evidence on the distributional consequences of LDC tax systems and tax reforms. This provides the basis for evaluating possible frameworks to assess the poverty impacts of particular tax reform experiences and proposals.

Chapter 2 describes the main characteristics of developing country revenue systems and summarises recent reforms to those systems. IFI reform recommendations are then compared with reform experience in practice. *Chapter 3* reviews the analytical basis for IFI proposals, considering the prescriptions from both trade and public finance theory. This helps to distinguish those reforms that are likely to be ‘efficient’ (with or without desirable changes in poverty), from those that are unlikely to deliver efficiency improvements. The chapter demonstrates that differences in institutional and structural characteristics between DCs and LDCs are important both in choosing the relevant analysis, and for the prescriptions that follow from it.

Chapter 4 reviews methodologies available to measure the impact of taxes on welfare, inequality and poverty. It identifies the merits and shortcomings of alternative methods, many of which have traditionally examined welfare or inequality effects rather than poverty *per se*. However, most are readily adaptable to make poverty the primary focus. *Chapter 5* considers the available evidence on the poverty, and broader distributional, effects of taxes and tax reform using the tools reviewed in chapter 4.

The objectives here are (i) to see whether any robust evidence emerges on fiscal-poverty impacts; and (ii) to consider the merits of different methods in practice. This review allows us to examine the potential for using or adapting existing approaches in *chapter 6*. Conclusions are reported at the end of individual chapters, while *chapter 7* provides an overall assessment and some policy recommendations.

Chapter 2 Characteristics of Tax Systems in Developing Countries

Although developed and developing countries use many of the same taxes, tax systems in the two groups of countries are very different. Coady (1997, p.35) describes pre-reform tax systems in LDCs as ‘inefficient, inequitable, beset with complications and anomalies and unable to cope with rising expenditure requirements or external shocks’. Many of the pre-reform differences remain post-reform, but also much has changed. As we show below, although it is instructive to compare tax systems in terms of the tax/GDP ratio and the shares of different taxes in total revenues, these can also mask some important changes in LDC taxes.

The last two decades have seen considerable and often dramatic tax reform. Among the *developed* economies, the aim has usually been to reduce the tax share of national income, and in particular to reduce individual income tax rates. In *developing* countries by contrast, where tax reforms have been an important component of adjustment programmes, they have been intended to raise the tax share of national income - to mobilise domestic resources and reduce dependence on aid and borrowing. For example, some 50% of all adjustment loans agreed between 1979 and 1989 included conditions relating to ‘fiscal reforms’ and more than 50% included conditions relating to both trade and ‘rationalisation of government finances’ which had tax reform elements (Webb and Shariff, 1992, p.71). Thus, even where tax reform did not feature explicitly as a major component of the economic policy reform agenda, that agenda nevertheless had significant effects on tax structures.

2.1 The Level and Composition of Taxes

Data on the allocation of taxes by type, tax/GDP and public expenditure/GDP (G/GDP) ratios are shown in Table 2.1. These reveal a number of features:¹

- 1) Tax/GDP and G/GDP ratios are higher in DCs than LDCs, but perhaps not by as much as might be expected, with G/GDP around 35% and 20-25% respectively.

¹ Considerable caution must be exercised in interpreting these data. They are unweighted averages of varying samples of countries, for many of which data quality is poor. In some cases, countries with missing data may have small values (e.g. for income tax shares) so that reported averages can be biased upwards.

- 2) DCs raise a somewhat greater share of revenues from income taxes, and a much greater share from social security taxes.
- 3) Domestic indirect tax shares are broadly similar between DCs and LDCs, though within this, excises are more important in LDCs.
- 4) LDCs raise much more revenue from trade taxes - around 25% on average in low income countries.
- 5) LDCs raise proportionately more revenue from non-tax sources (e.g. mineral royalties; direct revenues from public enterprises or marketing boards).²

These averages conceal wide disparities between countries and cannot show how LDC tax structures have changed over time. Data (from Heady, 2001) for individual *low-income* countries in 1997/98 are shown in Table 2.2, while Table 2.3 shows changes in their tax shares over 1980-97 - a period which spans most of the relevant tax reform programmes. (Coverage is limited by data availability; see Heady, 2001).

The data in Table 2.2 serve to dispel the notion that poor countries necessarily have low tax/GDP ratios: they range from just over 5% (Georgia and Congo DR) to 30% or higher in Lesotho, Yemen and Zimbabwe. A third of the countries are in the range 13-25%. Therefore, tax/GDP ratios *can* be high for poor countries. It is also dangerous to generalise with respect to revenue shares – trade taxes as a share of revenue vary from less than 10% (Azerbaijan, Congo DR, Indonesia, Mongolia and Yemen) to over 50% (Cote d’Ivoire, Lesotho, Madagascar). Similarly, the share attributable to non-tax revenue (especially important in resource-rich economies) varies from over 60% (Congo DR, Yemen) to 5% or less (Azerbaijan, Cote d’Ivoire, Madagascar, Sierra Leone). Income taxes are also quite high in some low-income countries (Kenya, Zimbabwe). Tanzi (1987, 2000) discusses some of the factors determining tax/GDP shares in LDCs.

Table 2.3 shows that more revenue/GDP ratios worsened than improved over 1980-97. A majority of the sample recorded increases in income tax revenue shares and declines in the shares of trade and ‘other’ taxes, but there is considerable disparity in

² This result is sensitive to the inclusion of Kuwait, UAR, Korea, and Singapore among the LDCs. Including those countries within ‘high income’ leads to more similar DC/LDC non-tax revenue proportions.

magnitudes. Some countries reveal perverse movements (e.g. large trade tax increases in Zimbabwe).

Changes in the trade tax revenue share reflect more than just the impact of trade or tax reform for two reasons. Firstly, due to independent changes in tax structure (e.g. related to industrialisation). Secondly, reform has often involved equalisation of tax rates between domestic production and import tariffs (rather than the removal of tariffs) and the tariffication of quantitative restrictions (QRs). These can push trade tax revenue shares in different directions.

Table 2.4 provides some evidence on tariff rate changes and the import tax share since 1985 in 25 of the countries covered by Dean *et al* (1994). In all of these countries the *range* of applicable tariffs was reduced, in most cases to four or five rates in the range 0-50%, and often QRs were converted into tariffs. The tariff ratio (the ratio of the post-reform average nominal tariff to its pre-reform level) shows that tariff reductions were greatest in Latin America: the eight countries in this region reduced tariffs by 50% or more.³ Korea was the only other country in the sample to reduce tariffs by more than 50%. Thus, about a third of the sample reduced nominal tariffs by more than 50%. Some 40% of the countries reduced tariffs by between 10 and 50%; three reduced tariffs by less than 10%; and four (16%) actually increased average nominal tariffs. Tariff reductions were least in SSA, where only Ghana achieved a significant reduction.

There is no consistent pattern regarding which taxes have been increased to compensate for trade tax revenue losses. Though the general policy advice from IFIs is to increase domestic sales taxes, especially by introducing VAT (see below), only 7 of the 16 countries in Table 2.3 increased the share of sales taxes in tax revenue between 1980 and 1997. The share of income taxes increased in ten of the countries, but usually only modestly. Also for this sample, at least half experienced a fall in the tax/GDP ratio, suggesting that they found it difficult to compensate for losses in revenue from

³ This summary measure is deficient (see Morrissey, 1995). The unweighted average nominal tariff tends to have an upward bias (while tariff dispersion is typically reduced considerably, the measure still attaches a high weight to the highest tariff rates). As it fails to distinguish between input and output tariffs it is not necessarily indicative of changes in effective protection. Also, as an indicator of *trade* reform outcomes, it cannot account for changes in non-tariff measures, which are typically reduced under trade liberalisation.

trade taxes. (Those that suffered the largest trade tax share declines – Burundi, Congo DP, and Pakistan – also suffered the largest tax/GDP falls).

2.2 Characteristics of Tax Reform

From the mid-1980s tax reform became a part of the Structural, and Extended Structural, Adjustment Facilities (SAF & ESAF) sponsored by the IMF and World Bank. These typically involve both a *short-run* aspect, with reform designed to reduce immediate fiscal and balance of payments imbalances, and *longer-term* changes designed to deliver more persistent efficiency improvements both in tax collection and in the wider economy. Because many early packages addressed the immediate needs of stabilisation and trade reform, tax aspects concentrated on trade taxes and consequences for overall revenues were often given only minor consideration. Poverty impacts were usually ignored. More radical and comprehensive tax reforms, accompanying attempts to restructure the economy generally, did address revenue consequences explicitly (though still with little attention to poverty/inequality impacts).

Tax reform recommendations from the IFIs differ in their detail across countries, but most include many of the following elements.

- | | |
|---------------------------------|---|
| <i>Income taxes:</i> | <ul style="list-style-type: none"> - rationalise multiple tax schedules into one or as few as possible - reduce the number of marginal rates applicable - raise the lowest marginal rate threshold but remove assorted exemptions and deductions |
| <i>Trade taxes:</i> | <ul style="list-style-type: none"> - convert QRs to tariffs - reduce the range of tariffs - reduce the average nominal tariff - restructure tariffs to rationalise effective protection anomalies - eliminate or reduce export taxes |
| <i>Domestic indirect taxes:</i> | <ul style="list-style-type: none"> - introduce broad-based sales taxes (usually VAT) at a single rate (plus zero and possibly 'luxury' rates) - remove 'tax cascading' in existing sales taxes - remove taxes on intermediates - set sales tax and tariffs at same or similar rates - narrow the excise base; reduce excessively high rates (e.g. restrict excises to 'sin taxes' - alcohol, tobacco, etc) |
| <i>Property taxes:</i> | <ul style="list-style-type: none"> - rationalise (e.g. up-date property tax base) or remove |
| <i>General:</i> | <ul style="list-style-type: none"> - increase revenue/GDP ratio - reduce budget deficits - improve tax administration |

In revenue terms, a common expectation was that income tax revenues, being relatively unimportant in any case, might not change much, or would increase slightly due to better compliance (despite reduced rates and increased thresholds). Trade tax revenues would depend on the combination of tariffication of QRs, rate rationalisation etc. and trade volume changes. In many cases IFI proposals expected revenue improvements over the longer-term through trade-enhancing and other efficiency improving effects, and did not envisage substantial short-term revenue losses. Recognition in later reforms that tax revenues did sometimes fall significantly led to more consistent emphasis being placed on the introduction of a VAT or similar domestic sales tax to replace lost revenues (and avoid anti-trade biases in the tax system).

2.3 Tax Reform in Practice

Inevitably tax reform in practice has been less radical than the above set of recommendations might lead one to expect. Indeed it might be argued that, after two decades of reform, many LDC tax systems remain unnecessarily complex and a long way from the economically and administratively efficient systems that were sought. In some countries, for example in Africa, reform could be characterised as the replacement of a badly administered 'old' system by a slightly less badly administered 'new' system. In this regard, it is interesting to note that a recent World Bank assessment of Bank sponsored tax reforms (Barbone et al, 1999) focussed almost exclusively on the administration and institutions of tax systems, rather than economic efficiency aspects (and poverty aspects do not surface at all).

This paper will not attempt a review of the large literature on the successes and failures of reform in practice (see Dean et al, 1994; Patel, 1997; Thirsk, 1997; Barbone, et al, 1999; Adam and Bevan, 2001; Tanzi and Zee, 2000; Chu et al, 2000, for general evaluations and case studies). However a number of points are worth mentioning at this stage. Discussion of inequality/poverty aspects is delayed till Chapter 7, following reviews of the relevant theory and evidence. The following points emerge however from most assessments of reform experience.

- 1) Tax administration and evasion problems pre-reform were much worse than originally appreciated; early reforms paid insufficient attention to these aspects;

and even now administration and evasion difficulties remain severe in many LDCs despite (in many cases several) reform episodes. As a result appraisals of reformed systems based on statutory changes can be misleading. For example, the statutory income tax changes may appear to improve progressivity, but if corruption in its administration remains or worsens, actual incidence changes could be quite different from those presumed from the changes in the schedules themselves.

- 2) Implementation of proposed (or even agreed) reforms is partial, with reversals quite common, such as introduction of new excises or increased rates, after reforms have removed or rationalised these. For example, personal income tax schedules for many countries continue to have multiple marginal rates (e.g. 7 in Argentina, 8 in Mexico, 11 in Tanzania – see Tanzi and Zee, 2000). Similarly, tariffs are often re-introduced (often under another name) in response to demands for protection from domestic lobby groups.
- 3) Using information on the revenue shares of different taxes to evaluate reforms can be misleading for a number of reasons. Firstly, real revenues from the tax in question may have increased, perhaps even relative to GDP, but simply grown less rapidly than other taxes. Secondly, it is often easiest to administer tax reform involving moves from tariffs to domestic consumption taxes, by retaining separate collections at the import and domestic production stages. The reforms may well have achieved their objectives (improved revenues, efficiency or equity) but revenue shares need not have changed. The import tax share could even rise.
- 4) Traditional IFI tax reform recommendations have been guided too rigidly by theory. They failed to recognise that a given economic objective might be achieved by different types of tax or tax administration in different contexts. For example, in very poor economies, it may be preferable to stick with simple sales taxes, broaden their use and aim for more uniform rates, rather than introduce a complex VAT system (as often advocated by the IMF). In some cases, such as the emphasis on ‘tax neutrality’ (levying uniform tax rates so that relative prices are unchanged), inappropriate theoretical results from developed country contexts were being applied. This is elaborated in chapter 3.

- 5) It is increasingly recognised that the general presumption against consumer subsidies, especially for food, in reforming countries may be misplaced. As the theory discussed in chapter 3 shows, when viable tax instruments are limited, direct subsidies targeted at sections of the population may be one way of achieving poverty reduction objectives at relatively low efficiency costs.

Table 2.1 Tax Revenues by Income Group

<i>Country Group</i>	<i>Percentage of total current revenue 1991-95:</i>						<i>Total tax revenue</i>	<i>Public expenditure</i>
	<i>Income taxes</i>	<i>Social security</i>	<i>Sales taxes</i>	<i>Trade taxes</i>	<i>Other taxes</i>	<i>Non-tax revenues</i>	<i>(% of GDP, 1995)</i>	
low income	20.72	9.54	32.96	24.73	1.64	16.89	14.3	18.8
middle income	23.36	17.95	28.48	14.20	3.09	18.63	21.0	23.7
lower middle	23.9	18.5	28.5	16.2	2.9	16.6	20.2	22.2
upper middle	22.2	17.2	28.5	9.4	3.5	23.2	23.4	29.2
All LDCs	22.54	16.81	29.84	17.45	2.70	18.10	19.1	22.4
High income (OECD)	32.57	27.12	28.52	1.81	1.84	9.89	29.1 (33.2)	35.2 (38.2)

Source: World Development Report, 1997 and Heady (2001).

Table 2.2 Revenue Shares in Low Income Countries

<i>Country</i>	<i>(% of total revenues)</i>						<i>Revenue (% GDP)</i>	<i>Tax Rev. (% GDP)</i>
	<i>Income taxes</i>	<i>Social security</i>	<i>Sales taxes</i>	<i>Trade taxes</i>	<i>Other taxes</i>	<i>Non-tax revenue</i>		
Azerbaijan	20	23	41	8	2	5	19.3	18.3
Burundi	22	8	45	16	2	7	13.7	12.7
Cameroon	17	0	25	28	3	27	n.a.	n.a.
Congo D.R.	25	0	18	28	9	20	5.3	4.2
Congo, Rep.	9	0	5	9	0	77	29.4	6.8
Cote d'Ivoire	20	6	17	50	3	4	21.6	20.7
Georgia	9	0	55	13	0	22	5.6	4.4
India	27	0	27	22	0	25	11.6	8.7
Indonesia	57	3	28	3	1	9	16.8	15.3
Kenya	34	0	37	15	1	14	26.2	22.5
Lesotho	15	0	12	52	0	21	44.7	35.3
Madagascar	18	0	24	53	2	2	8.7	8.5
Mongolia	26	19	28	5	1	20	19.5	15.6
Myanmar	18	0	30	10	0	42	7.8	4.5
Nepal	13	0	37	28	4	16	10.6	8.9
Nicaragua	11	13	43	21	6	6	n.a.	n.a.
Pakistan	21	0	29	22	8	19	15.9	12.9
Sierra Leone	17	0	33	46	0	3	10.2	9.9
Vietnam	22	0	33	22	10	14	18.2	15.7
Yemen, Rep.	16	0	7	9	2	66	36.8	12.5
Zimbabwe	43	0	24	20	2	10	29.4	26.5
<i>OECD ave.</i>	<i>31</i>	<i>22</i>	<i>28</i>	<i>n.a.</i>	<i>6</i>	<i>13</i>	<i>43.5</i>	<i>37.8</i>

Source: Heady (2001).

Table 2.3 Changes in Revenue Ratios and Shares in Low Income Countries
(in Percentage Points)

<i>Country</i>	<i>(% of total revenues)</i>						<i>Revenue (% GDP)</i>
	<i>Income taxes</i>	<i>Social security</i>	<i>Sales taxes</i>	<i>Trade taxes</i>	<i>Other taxes</i>	<i>Non-tax revenue</i>	
Burundi	3	7	20	-24	-6	1	-4.5
Cameroon	-5	-8	7	-10	-2	19	n.a.
Congo D.R.	-5	-2	6	-10	4	8	-4.8
Congo, Rep.	-40	-4	-3	-4	-3	53	6.9
Cote d'Ivoire	7	0	-8	7	-3	-4	-0.4
India	9	0	-15	0	-1	8	-0.7
Indonesia	-21	3	19	-4	0	4	-2.0
Kenya	5	0	-2	-4	0	1	3.8
Lesotho	2	0	2	-9	-2	7	5.7
Madagascar	1	-11	-15	25	-1	0	-2.8
Myanmar	15	0	-12	-5	0	2	-2.7
Nepal	7	0	0	-5	-4	0	2.2
Nicaragua	3	4	6	-4	-2	-4	n.a.
Pakistan	7	0	-5	-12	8	1	-3.2
Sierra Leone	-5	0	17	-4	-2	-7	6.1
Zimbabwe	-3	0	-4	16	1	-10	5.3
<i>No. of</i>	<i>10</i>	<i>3</i>	<i>7</i>	<i>3</i>	<i>3</i>	<i>10</i>	<i>5</i>
<i>Increases</i>							
<i>No. of</i>	<i>6</i>	<i>4</i>	<i>8</i>	<i>12</i>	<i>10</i>	<i>4</i>	<i>8</i>
<i>Decreases</i>							

Source: Heady (2001).

Table 2.4 Tariff Reductions in the 1980s and 1990s

Country	Average Nominal Tariff ¹			Tax ²
	Pre-Reform	Current	Ratio	Dependence
<i>South Asia</i>				
Bangladesh (1989, 1992)	94	50	0.53	0.42
India (1990, 1993)	128	71	0.55	0.30
Pakistan (1987, 1990)	69	65	0.94	0.38
Sri Lanka (1985, 1992)	31	25	0.81	0.22
Average	80	53	0.71	
<i>East Asia</i>				
China (1986, 1992)	38	43	1.13	
Philippines (1985, 1992)	28	24	0.88	0.29
Indonesia (1985, 1990)	27	22	0.81	0.03
Korea (1984, 1992)	24	10	0.42	0.17
Thailand (1986, 1990) [†]	13	11	0.88	0.22
Average	29	25	0.82	
<i>Africa</i>				
Cote d'Ivoire (1985, 1989)	26	33	1.27	0.31
Ghana (1983, 1991)	30	17	0.57	0.18
Kenya (1987, 1992)	40	34	0.85	0.23
Madagascar (1988, 1990)	46	36	0.78	0.32
Nigeria (1984, 1990)	35	33	0.93	0.23
Senegal (1986, 1991)	98	90	0.92	0.43
Tanzania (1986, 1992)	30	33	1.10	0.07
Zaire (1984, 1990)	24	25	1.04	0.17
Average	41	38	0.94	
<i>Latin America</i>				
Colombia (1984, 1992)	61	12	0.20	0.13
Peru (1988, 1992)	57	17	0.30	0.22
Costa Rica (1985, 1992)	53	15	0.28	0.13
Brazil (1987, 1992)	51	21	0.41	0.02
Venezuela (1989, 1991)	37	19	0.51	0.05
Chile (1984, 1991)	35	11	0.31	0.11
Argentina (1988, 1992)	29	12	0.41	0.05
Mexico (1985, 1987)	29	10	0.34	0.03
Average	44	15	0.35	

Notes: Years given in parenthesis are pre-reform and current.

1 Unweighted average nominal tariff (tends to be biased upwards); rounded.

Ratio is Current/Pre-Reform - lower ratio implies greater tariff reductions.

Figures in Average rows are unweighted averages for each region.

2 Tax dependence is tariff revenue as proportion of tax revenue in 1984.

† import-weighted average nominal tariff.

Source: Derived from various tables in Dean et al (1994).

Chapter 3 The Theoretical Basis for Tax Reform

This chapter examines how far tax theory provides a basis for tax reform, considering the prescriptions of ‘standard’ tax theory devised for developed countries (section 3.1), and how these can be adapted to address specific features of developing countries (section 3.2). Three recent reviews (Coady, 1997; Devarajan and Panagariya, 2000; Heady, 2001) provide the basis for the discussion. Section 3.3 draws some conclusions for reform.

Trade theory has often been used to identify ‘optimal’ *trade tax* structures, treating taxes on exports and imports as in some way different from other taxes. As Devarajan and Panagariya (2000) point out, all taxes should be judged on public finance principles. That is, on their ability to (i) raise revenues (to finance expenditure); (ii) alter the distribution of resources; and (iii) minimise administrative costs. An efficient tax can be regarded as one which achieves its objective(s) whilst minimising distortions to behaviour (typically as depicted by relative prices), thereby maximising social welfare.

3.1 ‘Standard’ Tax Theory

The central objective of much tax theory is to identify which taxes, and *rates* of tax, will lead to maximum social welfare (or, more usually, minimise welfare losses). This usually means identifying which taxes minimise distortions to economic behaviour. Key preoccupations are whether this will be achieved with direct or indirect taxation, and whether or not tax rates should vary across households and/or goods. The usual approach is to assume that, in the absence of taxes, the economy is Pareto efficient (competitive markets, no externalities etc), that the government can tax both directly and indirectly, and is capable of making lump-sum payments to households. This allows redistribution to be dealt with via a combination of transfers and income taxes, so that commodity taxes can be focussed on efficient revenue raising only.

If raising a given amount of revenue is the only objective in setting indirect taxes, then how these tax rates should be set – uniformly or non-uniformly – depends on whether or not factors (labour, capital etc) are in fixed supply (or equivalently, the consumption of commodities is independent of factor supply). Where factors are fixed (e.g. there is no work-leisure trade-off), the incidence of commodity taxes will be shifted back to

those factors rather than shifted forward to consumers via price increases. In this context, uniform taxes ('tax neutrality') will keep *relative* prices fixed and so ensure no change in tax incidence. In this fixed factor world, it does not matter whether taxes are levied on production and imports or consumption. If there are intermediates, then uniform taxes should simply be based on value added rather than output.

Where factor supplies are not fixed, theory suggests non-uniformity. For example, with work-leisure choices, leisure is analogous to a commodity that cannot be taxed, and tax theory shows that higher tax rates should apply to those goods complementary with leisure, and lower rates on leisure substitutes. Heady (1987) shows that this prescription is analytically equivalent to the familiar 'Ramsey rule' which proposes that goods in inelastic demand should be taxed more heavily than goods in elastic demand.⁴ It may also be appropriate to tax inputs used intensively in the production of untaxed goods.

Heady argues that, if the only non-taxable good is leisure (as is typically supposed in developed countries), there is only a weak case for non-uniformity, provided governments are able to make uniform income transfers to all households. This can be achieved, for example, through a uniform income tax exemption. Thus, in developed countries, even with variable labour supply, the 'tax neutrality' argument appears strong. Externalities associated with some goods (such as alcohol, tobacco, fuel consumption, education) remains the only basis in this framework for advocating non-uniform taxes (or subsidies) on such goods.

The above results hinge on revenue generation being the sole objective of tax policy. If transfers to the poor, or other forms of public expenditure, cannot be relied upon to achieve desired redistribution, optimal commodity tax prescriptions change. Diamond (1975) showed that if inequality considerations are taken into account the Ramsey rule of 'higher tax rates on necessities' for efficiency reasons has to be balanced against the need for 'lower taxes on goods consumed by the poor' (also often necessities) for distributional reasons. The resulting compromise depends, not surprisingly, on the weighting of distributional factors versus distortionary effects in consumption.

⁴ When there are no cross-price effects, this rule becomes the familiar: 'goods should be taxed in inverse proportion to their elasticities of demand'.

Since income taxation is, and is likely to remain, relatively unimportant in LDCs, optimal income tax theory need not be examined in detail here. In addition, this literature has generally failed to produce clear guidance for policy makers. Optimal income tax rates often depend strongly on assumptions regarding the strength of labour supply responses and inequality aversion. Heady (1993) notes that, under a variety of assumptions, the optimal income tax schedule turns out to be approximately linear (a single marginal rate above a tax-free threshold). In other words, even when redistributive considerations are important, a series of increasing marginal tax rates is not required – largely because the tax-free threshold can achieve a significant amount of redistribution, and higher marginal rates have strong disincentive effects.

3.2 Tax Theory for Developing Countries

Conditions in many developing countries differ sufficiently from those in developed countries, such that the assumptions underlying the above ‘standard’ analysis need to be altered. Key differences are:

- various goods/sectors (e.g. agriculture; informal) should be treated as non-taxable;
- the range of tax instruments available to LDC governments is often much more restricted (e.g. personal income taxes or direct transfers to the poor are limited or unavailable);
- economic and political conditions are very different (e.g. corruption; limited administrative expertise; extensive smuggling and evasion).

A further issue is whether the assumption of fixed or of variable factor supplies is the more appropriate for developing countries? To the extent that supplies of labour and capital in taxed sectors respond, for example through international flows, rural-urban migration or urban under-employment, then the incidence of taxation will lead, to some extent, to changes in prices. In this case the results for ‘fixed factors’ – such as ‘tax neutrality’ - are not the relevant ones for LDCs.

If the range of tax instruments is limited, so income transfers are not viable and income taxes are unable to achieve redistribution (e.g. due to evasion or administrative constraints), then redistribution may have to be achieved via commodity taxes. This suggests that goods that are important in the budgets of poor households *and not in rich households’ budgets*, should be subsidised, financed by taxes on goods consumed mainly

by rich consumers. To the extent that goods are consumed by both groups, the case for redistributive indirect taxes is weakened – inefficiencies from different rates may outweigh the smaller amount of redistribution achievable. This result highlights the importance of targeting subsidies or lower tax rates at commodities predominantly consumed by the poor. Typically, staple foods dominate the consumption bundle of the poor, and often the foods consumed by the poor are (qualitatively at least) different to what is consumed by those on higher incomes. The prices of goods produced by state-owned enterprises (SOEs) are just as relevant as those privately produced. In some cases (e.g. potable water) it may be appropriate to set SOE prices above or below marginal cost to achieve the implicit taxes or subsidies required on certain types of goods.

In the extreme case where only trade taxes are available, results analogous to those above for domestic commodity taxes hold. That is, if there are no fixed factors, tariffs should not be uniform but be guided by the Ramsey rule – highest on goods with a low import elasticity of demand, lowest on complements of exports. Uniform tariffs on imports (and subsidies to exports) would only be justified in this case if factors are in fixed supply.

If all sectors cannot be taxed, this also has implications for tax neutrality. For example, if agriculture cannot be taxed it becomes optimal (even ignoring equity issues) to tax other sectors at different rates. The output of agriculture may be taxed indirectly via input or export taxes. Heady and Mitra (1987) investigated the quantitative importance of this for Turkey and found that ‘modest but significant trade taxes were optimal for a range of plausible parameter values’ (Heady, 2001, p.10). On the other hand, high levels of protection to manufacturing combined with high taxes on agricultural exports have often resulted in high effective taxation of agriculture. Frequently, this was compounded by low controlled producer prices for foods operated through State Marketing Boards. While direct taxation of agriculture has been low, effective taxation has tended to be high, resulting in significant disincentive effects.

Similar arguments could apply to the informal sector. Unlike agriculture, where there are both rich and poor producers/consumers, the informal sector is likely to be unambiguously favoured on equity grounds. Theory suggests that subsidies to this sector could be achieved by subsidising formal sector goods (such as housing for the poor) which are complements of informal sector outputs. Alternatively, taxes on

informal sector substitutes could achieve the same objective. Such a result might justify higher taxes on formal sector fuels in order to encourage a switch towards informal alternatives. (Of course, a direct subsidy to the informal sector would be preferred if this is possible).

Assessing appropriate tax policies towards the informal sector, however, needs care. It is sometimes argued that the urban informal sector is a result of excess migration out of agriculture, perhaps because the modern urban wage is 'too high' (above market-clearing levels). To the extent that this is regarded as socially undesirable, it becomes more appropriate to tax, rather than subsidise, the sector. Where this cannot be achieved directly, indirect alternatives should be sought, for example, by taxing goods consumed by informal sector workers. This sort of tax is likely to be inequitable; if an alternative rural/agricultural subsidy could be targeted accurately (to discourage potential migrants from leaving) it would be preferable. This discussion serves to illustrate the difficulties of arriving at appropriate tax or subsidy rates when instruments are limited and some sectors cannot be taxed. However, it reinforces the case for non-uniform taxation either on equity or efficiency grounds.

The informal sector tax issue represents a case of (labour) market failure. Market failure arguments (externalities) also justify specific excises, as discussed above (alcohol, tobacco etc.). Administrative requirements, and the greater prevalence of inflation in many LDCs, suggest the use of *ad valorem* rates rather than fixed excises which require regular up-dating.

The case against production taxes, discussed in section 3.1, was based on variable factor supplies and this is likely to carry over to LDCs so that consumption taxes are generally preferred (if they are feasible). This also implies a uniform rate across domestically produced goods and imports. The latter may be dealt with administratively by an import tariff if domestic production is similarly taxed (and exports can be exempted).

Finally, political economy and administrative considerations are much more important in LDCs. The usual presumption in developed countries that administrative cost differences are of minor importance is not, in general, valid for LDCs. If the costs of administering multiple tax rates is high, or opportunities for corruption and evasion are increased, these

may swamp conventional efficiency and/or equity arguments for differentiated rates. Unfortunately, administrative aspects have not been built into formal models of tax structure so that administrative arguments for or against various taxes remain largely as caveats to theoretical results from conventional models.⁵

In addition, many political economy arguments against non-uniform tax rates have been applied to tariffs; these are likely to apply with greater force in LDCs, where tariffs assume a more important role. For example, a constitutional or fiscal ‘rule’ against differentiated tariffs can serve to minimise lobbying by special interest groups (e.g. of domestic producers) for special protection. Furthermore, a single (low) rate reduces the opportunities and incentives for evasion and avoidance. Similar arguments apply to income tax exemptions, different domestic indirect tax rates for different classifications of goods, or targeted subsidies. If these lead to significant rent-seeking activities, they may waste resources relative to the costs of inefficiencies associated with uniform indirect tax rates.

Gupta et al (1998) provide some evidence that corruption increases inequality, while Tanzi and Davoodi (2000) show that increased corruption is associated with lower total tax revenues (as a share of GDP) and with lower income and domestic indirect tax revenues (especially the former). This evidence must be treated with considerable caution, not least because the corruption indices used may be proxying for a variety of effects, but it tentatively suggests that tax choices might be affected by corruption considerations. Tanzi and Davoodi further suggest that corruption is likely to reduce the progressivity of a tax (if lower income earners suffer most from corruption effects) though it is unclear that this is the typical scenario.

3.3 Conclusions for Tax Reforms

In the light of the above discussion, what can be said about the appropriateness of IFI-inspired tax reforms in LDCs? As chapter 2 pointed out, general recommendations in IFI proposals often include broadening of tax bases and ‘rationalisation’ of the tax structure (more use of general taxes levies at uniform, or few, rates). It is often argued (or implied) that theory supports such changes. These recommendations apply to income taxes,

⁵ Though on modelling of corruption and evasion, see Hindricks et al. (1999)

import taxes and domestic indirect taxes (VAT, excises etc), though for income taxes narrowing rather than broadening their scope is typically advocated.

Though the guidance from theory for **income taxes** is limited, it is generally supportive of the direction of IFI income tax reforms. The elimination of multiple income tax schedules, the simplification of rate structures including the reduction of very high marginal rates and increases in the lowest income tax threshold can generally be expected to enhance the efficiency aspects of the tax. Ideally the income tax ‘net’ should be cast as widely as possible. However, problems of evasion suggest that narrowing the scope of the tax, to more closely target those from whom revenues can actually be raised, will enhance compliance with the tax, allowing its scope to be broadened gradually as administration and enforcement practices improve.

As we have seen, support from theory for the elimination of **export taxes**, the use of uniform **import tariffs** and **domestic indirect taxes**, and non-taxation of input goods is not clear-cut. Though *trade* theory suggests uniform tariffs (to avoid distorting relative prices from ‘world’ levels), this applies in a fixed factor context. Differentiated tariffs may be required for efficiency when some goods cannot be taxed and/or some tax instruments are not available. When, in addition, it is recognised that indirect taxes may have to take account of equity objectives, tariffs, alongside domestic taxes such as VAT, may need to be levied at different rates. Nevertheless, tax theory *does not support* the kinds of pre-reform assortment of tax rates observed in practice. Rather it suggests that we should not presume that ‘tax neutrality’ is the appropriate objective for reformed tax systems in LDCs. Assessing the direction for reform should take account of the features discussed above and consider carefully, in country-specific contexts, what departures from neutrality would be appropriate.

Taxation of intermediates is *not* precluded by theory (even ignoring equity aspects). If such taxes exist, reform design needs to recognise the full ramifications for final goods prices across the economy (e.g. using evidence from studies of effective protection), and identify desired changes in tax rates on intermediates in the light of this. These arguments are likely to apply particularly in the most revenue-constrained economies that have access to a limited range of tax instruments. For example, tax reform in many Latin American countries, with higher income levels and better tax administration, has

involved greater use of income taxes and VAT. Distorting input taxes and excise can be avoided there more easily. However, in African countries with underdeveloped tax administrations, and a limited range of instruments, the case for variegated rates becomes stronger.

The above discussion should not be interpreted as critical of IFI tax reform proposals *per se*. Rather it points to the weaknesses in using tax theory as a justification for various aspects of those proposals. Administrative and political economy conditions in LDCs often provide a strong case for minimising the range of tax rates levied, for restricting the types of taxation and for broadening tax bases. It is however important to recognise which arguments provide support and which do not. As Devarajan and Panagariya (2000, p.213) put it: ‘being right for the wrong reasons is a very dangerous thing’.

Finally, though this chapter has largely judged reform proposals on the basis of their efficiency aspects, tax reform should also be judged by its ability to deliver poverty improvements. In general, this leads to a recognition that some taxes which may be disfavoured on efficiency grounds may be the best or only available taxes to achieve redistribution. In some cases efficiency and equity concerns favour the same taxes or reform directions – for example land taxes often involve few distortions (due to its fixed supply nature) and can penalise the rich disproportionately.⁶

⁶ This does not make land taxes an unambiguously preferable tax however. See Heady (2001) for discussion of the issues.

Chapter 4 Assessing the Distributional Impact of Taxes: Analysis

This chapter discusses several measures of inequality, poverty and social welfare that can be used to assess the distributional effects of taxes in practice. Some of these measures relate simply to the tax structure or schedule (section 4.2), whilst others are used to compare ‘pre-tax’ and ‘post-tax’ income distributions (section 4.3). First, we consider the issue of tax incidence which is fundamental to all attempts to measure tax burdens.

4.1 Tax Incidence

In seeking to identify how much tax each person pays it is important to distinguish between the ‘statutory incidence’ (the legal liability to pay the tax) and the economic incidence. For example, producers at each stage of production are usually legally liable to pay VAT. Clearly however, producers are often able to raise prices to recoup their tax liability, so that consumers of the taxed products pay all or part of the tax. In addition, if consumers switch away to untaxed (or lower taxed) products so that these prices rise, consumers of the untaxed products also bear some of the tax burden. Tax incidence studies using any of the methods described below must decide on the appropriate tax incidence ‘shifting’ assumptions to make. The traditional assumptions adopted are shown in Table 4.1.

These assumptions are known to be inaccurate, even in developed countries, but are likely to be especially inappropriate under conditions in many LDCs. For example, for indirect taxes, partial equilibrium analysis can demonstrate that it is only under extreme assumptions about price elasticities of demand and/or supply that full forward shifting is appropriate. It is generally a mixture of convenience and a lack of reliable information on these elasticities that leads to the widespread adoption of the full forward shifting assumption. We discuss aspects especially relevant to LDCs in section 4.5. The empirical studies discussed in chapter 5 generally adopt the assumptions in the right-hand column of Table 4.1.

4.2 Measures of Tax Progression

The term ‘tax *progression*’ refers to the extent to which a tax structure departs from proportionality, whereas measures of ‘tax *progressivity*’ combine information on both

the tax structure and the distribution of incomes (or some other tax base measure) to describe the amount of redistribution achieved by the tax. Under certain assumptions, such as an unchanged pre-tax income distribution and no re-ranking of individuals between pre- and post-tax distributions, *progressivity* conclusions can be drawn from *progression* measures.

The most commonly used measure is *average rate progression (ARP)*; but liability progression (*LP*); and residual progression (*RP*) are sometimes also calculated.⁷ Letting $m_j(y)$ and $a_j(y)$ be respectively the marginal and average rates of tax j then

Average rate progression is:⁸
$$ARP_j = m_j(y) - a_j(y)$$

The marginal rate of tax exceeds the average rate, (i.e. the average tax rate increases with income, y). Progression implies $ARP_j > 0$.

Such tax progression measures can be compared at selected income levels or for specific income groups, such as income deciles. They cannot quantify the extent of redistribution through the tax system, but they provide information on an important component: the degree of departure of the tax from proportionality. The *ARP* in particular has often been used in studies of LDC tax systems to summarise tax progression or regression (often erroneously labelled as ‘progressivity’ or ‘regressivity’). It has the merit that, if calculated from information on actual tax payments by individuals at different income levels, it can give a more accurate picture of progression than the use of statutory marginal (or average) tax rates, since the latter ignore compliance aspects. A given tax schedule can, of course, demonstrate progression, proportionality, and regression over different ranges of income.

4.3 Analyses Using Measures of Inequality, Poverty and Social Welfare

The distributional impact of a tax can be assessed in a number of ways. For example, frequent questions asked by investigators are: does the tax increase or reduce a measure of the inequality of incomes of the population or some population sub-group? Is some measure of post-tax poverty greater or less than its pre-tax equivalent? Has the tax raised or lowered overall social welfare? All of these approaches can be used to

⁷ Liability progression is the elasticity of tax liability with respect to pre-tax income: $LP_j = m_j(y)/a_j(y) > 1$. Residual progression is the elasticity of post-tax income to pre-tax income: $RP_j = \{1 - m_j(y)\}/\{1 - a_j(y)\} > 1$. A fourth measure, *marginal rate progression*, captures the change in the marginal tax rate as income increases.

⁸ This is the ‘scale independent’ version of the *ARP* measure, proposed by Lambert (1993).

examine *poverty*: inequality aspects can focus on poor income groups, and social welfare functions can be defined in such a way that the welfare of those in poverty is the exclusive or primary consideration.

Different measures of inequality, poverty and social welfare have been used in empirical tax studies and will be discussed in this section. It is important at the outset, however, to distinguish between *statistical* and *normative* analyses. Statistical measures simply record, for example, how an income distribution differs from an alternative using an index such as the Gini coefficient. Whether one distribution is regarded as superior to the other requires value judgements. In some cases (e.g. Gini coefficients) investigators draw welfare conclusions without considering the implicit value judgements used to construct the indices.⁹ The most frequently used measures in tax analyses are as follows:

Inequality	Poverty	Social welfare
<i>Lorenz and Generalised Lorenz curves</i>	<i>Poverty Head Count</i>	<i>Equivalent & Compensating Variations</i>
<i>Concentration Curves</i>	<i>Poverty Gap</i>	<i>Tax Excess Burdens</i>
<i>Gini and Generalised Gini</i>	<i>Poverty 'inequality'</i>	<i>Abbreviated Social Welfare Indices</i>
<i>Atkinson Index</i>	<i>'TIP' Curves</i>	<i>Marginal Social Cost & Marginal Cost of Finance</i>
<i>'Welfare Dominance'</i>		

Inequality Measures

The **Lorenz curve** is a familiar measure of inequality in the income distribution, plotting the cumulative proportion of income recipients (ranked from lowest to highest) against the proportion of total income received. The further the curve lies below the 45° line, the greater is the inequality of the variable under consideration. In tax analysis Lorenz curves can be used to compare the pre- and post-tax income distribution. Where one Lorenz curve dominates the other – that is, one curve lies wholly inside the other – equality can be said to be greater for the distribution with the dominant (inner)

⁹ See Lambert (1993) for discussion of research seeking to identify value judgements which allow normative welfare conclusions to be drawn from the statistical evidence.

Lorenz curve. **Concentration curves** are similar to Lorenz curves but whereas the Lorenz curve uses the same income definition to rank both the axes, concentration curves use different income definitions for each axis.¹⁰ These typically plot post-tax income, expenditure or tax payments against the proportion of the population ranked by pre-tax income.

For an indirect tax, these curves can be compared to the concentration curve for total expenditures, the relevant tax base (the equivalent, in the indirect tax case, to the pre-tax Lorenz curve discussed above). If an indirect tax is unambiguously progressive, its concentration curve will lie wholly *outside* the concentration curve for expenditures. That is, the poor pay proportionately less tax than their share of expenditures.

In analysing whether taxes are redistributive, it is usual to compare the post-tax situation with a counterfactual of *proportional* taxation. Conveniently, the pre-tax Lorenz curve exactly overlays the hypothetical post-tax Lorenz curve for a proportional tax (under the assumption that the pre-tax income distribution is unchanged by the presence of the tax), so that the ‘pre- and post-’ comparison mirrors the ‘proportional versus non-proportional’ comparison.

Comparisons of Lorenz or concentration curves give rise to the notion of **Lorenz dominance** – where one curve dominates the other (is unambiguously more equal). This can be determined from visual inspection or, more rigorously, statistical tests can be employed to verify whether the inner curve is confirmed as statistically significantly different from the outer curve (see Younger et al (1999) for discussion of alternative tests). Some investigators go further, however, by testing for **welfare dominance**. Yitzhaki and Slemrod (1991) have shown that for *any* social welfare function which supports income transfers from richer to poorer members of the society (a value judgement likely to find widespread support within aid agencies), Lorenz dominance implies an unambiguous improvement in social welfare, or ‘welfare dominance’.

Conclusions about welfare dominance typically relate to the whole income distribution. But agencies more interested in the welfare of the poorest, can focus on the impact on

¹⁰ See Lambert (1993, p.38), who shows that where individuals, ranked by their pre-tax incomes, differ from the post-tax ranking, the post-tax Lorenz and concentration curves will not coincide and the concentration curve overstates the extent of redistribution.

the poorest $x\%$ of the population, simply by examining the behaviour of Lorenz or concentration curves in the region of the left-hand axis. For example, where concentration curves for different taxes cross but that crossing point occurs relatively high up in the population ranking, one tax may still be judged to be unambiguously preferred if it is clearly superior for the poorest 20%, say, of the population.¹¹

An numerical measure of the extent of inequality associated with Lorenz or concentration curves is the **Gini coefficient**, measuring the area between the relevant curve and the 45° line, as a proportion of the total area beneath the 45° line. However, this measure does not distinguish between cases where Lorenz curves cross from those where they do not. In such ‘crossing’ cases, a reduction in the Gini would imply that improved inequality in part of the income distribution was weighted more than the worsened inequality elsewhere in the distribution. The Gini coefficient, however, gives equal weight to all incomes regardless of whether they are received by the rich or the poor. An extension to the Gini measure – the **Extended** or **Generalised Gini coefficient** allows lower incomes to be given a greater weight than higher incomes in the aggregation.

The Gini coefficient can be represented as a covariance term (see Jenkins, 1988) such that:

$$G(v) = v \text{Cov}(y, \{F(y)\}^{v-1}) / \bar{y} \quad (4.1)$$

where y is the relevant income, expenditure or tax payment measure and \bar{y} is the mean of that measure; $F(y)$ is the proportion of individuals with income less than or equal to y . Here v plays the role of a distributional or ‘inequality aversion’ parameter. Setting $v=2$, (4.1) reduces to the conventional Gini. As $v \rightarrow 1$, $G \rightarrow 0$ so that inequality is given zero weight in the construction of the Gini, while as $v \rightarrow \infty$, inequality is given greater weight, with only the income of the poorest counting at $v = \infty$. Therefore, an advantage of the generalised Gini coefficient is that the evaluator can make his/her

¹¹ The problem of indeterminate conclusions when Lorenz or concentration curves cross led to the notion of the **Generalised Lorenz (GL) curve**, obtained by multiplying the Lorenz curve values by mean income. This yields a relationship between the proportion of income recipients and the cumulated value of income per capita. The intuition behind the *GL* curve is that, since a higher income level is always preferred (in welfare terms) to a lower income level, the *GL* relationship allows comparisons of distributions with different means. An advantage of the *GL* curve is that where Lorenz curves cross, often *GL* curves do not, allowing dominance to be identified.

value judgements explicit in the form of the parameter ν when calculating the redistributive impact of taxes. For a given value of ν , differences in $G(\nu)$ s for different taxes imply differing redistributive impacts, reflecting value judgements regarding those whom it is desired most to benefit from the redistribution.

Finally Atkinson (1970) proposed an index of inequality which also reflects value judgements regarding aversion to inequality, and which has become widely used in tax analyses. Atkinson's approach was to ask the question: how much total income would one be willing to give up in order to achieve a transfer of income such that everyone had the same income level? This income level which everyone receives, Atkinson called the *equally distributed equivalent* income, y_e . It will obviously depend upon a person's inequality aversion, captured by the parameter ε in the following expression for y_e .

$$y_e = \left\{ (1/n) \sum_{i=1}^N y_i^{1-\varepsilon} \right\}^{\frac{1}{1-\varepsilon}} \quad \varepsilon \neq 1^{12} \quad (4.2)$$

The Atkinson measure is then defined as:

$$A = 1 - \frac{y_e}{\bar{y}} \quad (4.3)$$

This has a convenient interpretation as the 'cost of inequality'. For example, if $y_e / \bar{y} = 0.8$ then the person making the welfare judgement is willing to sacrifice 20% of the total current income ($A = 1 - 0.8 = 0.2$) in order to achieve equality. Larger values of ε yield larger values on A : a greater proportion of income would be sacrificed to achieve equality. Thus, like the extended Gini coefficient, the Atkinson index can be applied to income, expenditure or tax distributions to compare their inequality or poverty impacts depending on judgements about inequality aversion. $\varepsilon = 0$ implies no concern with inequality, while as $\varepsilon = \infty$, implies concern only for the poorest individual. It is common to examine sensitivity of outcomes to values of inequality aversion from 0 to around 5.

¹² For $\varepsilon = 1$ the term on the right hand side of (4.2) is replaced by $\exp\left\{ \sum_{i=1}^N \ln(y_i / \bar{y}) \right\}$.

Poverty Measures

Presuming readers are familiar with the main poverty measures this section will discuss these only briefly. Measuring the impact of different taxes on poverty has been much less prevalent than assessing inequality impacts. Studies that have been undertaken demonstrate the importance of the particular poverty measure chosen for conclusions reached. The most commonly used measures in tax analyses are:

head count (the numbers, or proportion, below a specified poverty line);

poverty gap (the average income of those in poverty relative to the poverty line); and

‘inequality of poverty’ (the dispersion of incomes within the poor group).

Foster et al (1984) show that these measures fall within the general class of poverty measures captured by:

$$P_{\theta} = \frac{1}{N} \sum_{y_i \leq y_p} \left(1 - \frac{y_i}{y_p} \right)^{\theta} \quad (4.4)$$

where θ is an integer parameter, and y_p is the poverty level. P_0 is the head count measure – the proportion of the population in poverty, N_p/N ; P_1 depends on P_0 and the poverty gap; and P_2 includes inequality within the poor. Jenkins and Lambert (1997) have referred to these as the ‘*Three “I”s of Poverty*’: incidence, intensity and inequality, and proposed a ‘*TIP curve*’ to capture these three aspects. *TIP* curves, like Lorenz curves, can be constructed for any income/expenditure measure and plot the total poverty gap per capita against the cumulative proportion of the population below that gap (from lowest to highest). See Creedy (1998a) for further details.

An example is shown in Figure 4.1. The horizontal axis measures P_0 , the vertical axis measures the poverty gap; while the concavity of the *TIP* curve below the poverty line measures inequality within the poor. Beyond the poverty line, (set at 10 units, giving $P_0 = 0.4$, in Figure 4.1) the *TIP* curve becomes horizontal. If the *TIP* curve for one distribution lies closer to the horizontal axis than another, then the former involves less poverty as measured by the poverty gap. If only the head count measure of poverty is considered as relevant, proximity of a *TIP* curve to the vertical axis is preferred.¹³

Though *TIP* curve comparisons could provide valuable information on the poverty

¹³ *Normalised TIP* curves can also be obtained (by dividing the poverty gap by the poverty line) - so that the values on both axes lie between 0 and 1. This allows poverty dominance tests to be conducted of the sort described above for inequality using Lorenz curves.

impacts of different taxes, we are not aware of any examples applied to developing countries. Creedy (1998a) uses them to examine hypothetical tax and transfer schemes.

Measures of Social Welfare

Is one tax preferred to another? Perhaps the most common approach by economists to answer that question is to construct a measure of social welfare (from some combination of the well-being of individuals or households) and examine the impact of the taxes in question on that measure. For the case of indirect taxes, the most relevant case for most LDCs, the standard approach is to construct money-metric measures of utility – usually income – and consider how a given indirect tax, which changes goods prices, affects this utility measure. Individual utilities, or utility changes, are then aggregated according to the social welfare function, which specifies how different individuals are weighted.

The most common measure of welfare change of this sort is the **Equivalent Variation (EV)**. Consider an increase in the prices of goods resulting from the imposition of a set of taxes. Compared to a no-tax situation this will make an individual feel less well off (reduce welfare). The *EV* is the amount of money which this individual would be willing to pay to avert the change in prices.¹⁴ *EVs* therefore provide a money measure of the welfare losses suffered as a result of the tax change. They can be calculated for specified groups or types of individuals (or households), or aggregated to measure overall welfare losses. Aggregation however requires specific judgements about household weightings, so most studies using *EVs* report them for specified, relatively homogeneous, groups.¹⁵

A simple way of measuring effects on social welfare is the **Abbreviated Social Welfare Function**. Lambert (1993) shows how welfare rationales can be used to justify the abbreviated forms:

$$W = \mu[1 - G(v)] \text{ and } W = \mu[1 - A(\varepsilon)] \quad (4.5)$$

¹⁴ A similar alternative measure is the *Compensating Variation* – see Creedy (1998b) for details.

¹⁵ An alternative welfare measure, the **Excess Burden (EB)** of taxation, subtracts the value of the tax revenue raised from the *EV* in order to identify the *net* welfare gain or loss for each individual. Most studies of LDCs ignore this revenue component because of the difficulties identifying the amount of tax revenue paid by each individual. Where additional tax revenues are squandered (in the sense that they produce no, or few, social benefits) it would be more appropriate to use the *EV* in any case.

where $G(v)$ and $A(\varepsilon)$ are the extended Gini and Atkinson inequality indices discussed above. (4.5) shows that welfare can be measured simply as the mean income multiplied by an index of equality (one minus the inequality index). Since IFI reforms might be expected to affect mean income, the abbreviated *SWF* provides a useful tool to assess the equity-efficiency trade-offs using the Gini or Atkinson measures. By adopting different values for the inequality aversion parameters, (v, ε) , (4.5) can focus on poverty effects rather than more general inequality effects. The major difficulties of this approach in practice are likely to be separating the effects of tax changes from other influences on mean incomes and equity.

The concept of the **Marginal Social Cost (MSC)** of taxes was developed and extended to the context of LDC tax reform in the 1980s and '90s (see Ahmed and Stern, 1984, 1991; Stern, 1987).¹⁶ This approach is applied to *marginal* tax changes, where the question being asked is: would a marginal increase in tax i , funded by a marginal decrease in tax j improve welfare? If desired welfare can be specified to focus exclusively on those in poverty.

The *MSC* of a tax can be defined as:

$$\lambda_i = \frac{\partial W / \partial t_i}{\partial R / \partial t_i} = (\partial W / \partial t_i)(\partial t_i / \partial R) \quad (4.6)$$

where ∂W and ∂R are respectively the change in welfare and tax revenue. Thus, (4.6) can be interpreted as the change in welfare, W , brought about by the change in tax rate, t_i which is required to raise one additional unit of revenue, R . If λ_i is greater than the equivalent for an alternative tax, λ_j , then the social costs associated with tax i are greater than those for tax j . Reform could beneficially reduce the tax rate on i and increase it on j . Clearly reforms that raise welfare and do not lower total tax revenues are preferred in this framework. However, welfare-raising reforms which reduce revenue cannot be unambiguously evaluated without knowledge or assumptions about the use of the foregone revenues. The *MSCs* can readily be calculated from information on consumers' expenditures, tax rates, aggregate cross-price elasticities, and welfare weights chosen by the investigator (see Creedy, 1998a; Madden, 1995, 1996).

¹⁶ The wider literature on this concept is reviewed by Creedy (1998b). The *MSC* concept is closely related to the concept of the *Marginal Costs of Funds (MCF)*. The latter concept is the relevant measure when considering the welfare costs of raising tax revenues to fund additional expenditures, while the

Evaluating marginal reforms is therefore much less data intensive than evaluations of non-marginal reforms. What constitutes ‘marginal’ in this context is open to some interpretation. If general equilibrium effects are not thought to be large, the *MSC* approach may provide a reasonable approximation even for relatively large shifts in tax structure. Where there are substantial changes in the tax system, and behavioural responses are thought likely to be important, **Computable General Equilibrium** (CGE) models are usually the preferred method of analysis. These model social welfare and economic behaviour across the economy explicitly, typically assuming price flexibility and using the equivalent variation to measure the social welfare effects of tax changes (see chapters 5 and 6).

4.4 The Inflation Tax

Tax reforms that reduce revenues, without any commensurate reduction in expenditures, must be funded from some other source. For governments in LDCs struggling to find sufficient funding, money creation can be a convenient alternative with familiar consequences for inflation. The resulting ‘inflation tax’ is just as much a tax as any other and can therefore have analogous distributional consequences.¹⁷

Revenue from the inflation tax may be defined as:

$$R_{\pi} = \pi m \quad (4.7)$$

where π is the inflation rate and m is real money balances (the tax base). Dividing both sides by real income, y , gives the ‘average inflation tax rate’:

$$ATR_{\pi} = R_{\pi} / y = \pi(m / y) \quad (4.8)$$

One way of assessing the distributional impact of the inflation tax would be to examine its average rate progression. From (4.8), this will depend on (i) how the inflation rate faced by individuals differs by income levels; and (ii) how the money balances-to-income ratio differs with income levels. In the case of (i), to the extent that consumption bundles differ between the poor and the rich, and inflation rates are not uniform across all goods, there is the potential for differing incidence of the inflation tax. A pertinent issue here concerns the case where goods consumed predominantly by the poor are subsidised. It can be shown that if the producer prices of all goods inflate at the same rate, the consumer prices of subsidised goods will inflate at a higher rate

MSC is the relevant measure when comparing alternative, revenue-neutral taxes. In fact the two measures are related by: $MSC = MCF - 1$.

¹⁷ This argument is just as relevant for revenue-enhancing tax reforms since the additional tax revenues may facilitate reduced reliance on the inflation tax.

(unless the subsidy is increased at the inflation rate). In this case consumers of subsidised goods face a higher effective inflation tax rate.

With respect to (ii) above, the variation in the m/y ratio across income levels is unclear *a priori*. The poor who operate largely outside the monetary economy will be essentially unaffected. However, for those who do participate in the monetary economy, the poor may have more of their assets in the form of cash and may have a more limited capacity to raise nominal incomes in order to maintain real incomes in an inflationary environment. On the other hand the poor hold few financial assets subject to erosion by inflation so that they may gain relative to richer households in this respect. We know of no direct evidence on the cross-sectional variation in money-income ratios which would shed light on this issue. However, a recent assessment by Adam and Bevan (2001) concludes that *'there is a strong consensus that higher inflation is at least as costly to the poor as it is to other sections of the population, reflecting mainly the lesser ability of the poor to protect their factor incomes and asset portfolios from the effects of inflation. At the least, there is nothing to suggest that targeting a low rate of inflation ... would be contra-indicated when the interests of the poor are taken into account'*.

Creedy (1998b) examined the distributional effects of inflation in Australia and New Zealand in the 1990s and found (i) distributional effects were small (inequality indices increased by less than 1%); (ii) effects were mildly regressive in most years but were progressive in some; and (iii) inequality effects were greatest in years of highest inflation. This last effect suggests the possibility of larger effects in those LDCs which suffer from higher rates of inflation over prolonged periods. However, even if the inflation tax is generally proportional, reform assessments must recognise that, with lower inflation, revenue-neutrality may require increased reliance on an alternative regressive or progressive tax.

4.5 Issues Arising for Applications in LDCs

The discussion in sections 4.2 and 4.3 suggests a number of issues to be addressed when tax incidence is examined in an LDC context.

The inappropriateness of traditional **tax incidence assumptions** for many LDC applications has been highlighted by Shah and Whalley (1991). They argued that quantitative restrictions on many imports, general price controls and regulations, the existence of informal (and other non-taxable) markets, rural-urban migration and tax evasion affect the ability of those legally liable for various taxes to shift these as traditionally assumed. Table 4.2 below summarises their main arguments. CGE modelling (see chapter 5) suggests that altering incidence assumption can lead to quite different conclusions regarding who bears the burden of taxes in LDCs. Empirical applications of other methods have made limited changes to incidence assumptions, but some recognition of the issues represented in Table 4.2 could be attempted.

Assessing the incidence of import taxes is further complicated by the fact that consumption expenditure data does not normally distinguish imports from domestic goods. Recently Rajemison and Younger (2001) have proposed using input-output tables to help resolve this issue. For most indirect taxes, however, it is always likely to be the case that incidence will remain uncertain, supporting the case for sensitivity analyses.

Tax evasion is an especially serious issue that affects incidence and is difficult to include. Existing incidence studies, which ignore evasion, can be thought of as providing a benchmark of what ‘full implementation’ of the tax would produce. In some cases, access to actual tax revenues can reveal the extent to which receipts fall short of expectations based on statutory rates and this could be used to gauge ‘compliance rates’. Jenkins and Kuo (2000) discuss possible uses of compliance ratios in a VAT simulation model, though they focus on revenue, rather than redistributive, aspects.

Taxation of intermediate inputs is significant in some LDCs. In such cases it is important that incidence analyses are based on *effective*, not nominal, tax rates. Younger (1996) and Younger et al (1999) argue, for Ghana and Madagascar, that taxation of petroleum is an important example. Since fuel is sold as an intermediate as well as a final good, fuel taxation can affect other final goods such as transport, consumed by the poor. In the absence of input-output data, they make an informed

guess regarding the pass-through of fuel taxes to transport.¹⁸ Ahmed and Stern (1987, 1991) however calculated effective commodity tax rates for India and Pakistan and showed that goods consumed disproportionately by the poor can face positive effective rates even though nominal rates were zero or negative (subsidy). Nominal-effective differences were widespread. Education, for example, was essentially untaxed (nominally) but faced an effective tax rate of around 9%. Some examples are given in Table 4.3 below.

4.6 Conclusions

A number of conclusions emerge, even at this stage, for studies of the poverty impacts of taxes and tax reforms.

1. Given uncertainties over incidence, evasion etc., different methods should be compared wherever possible.
2. Within a given method, sensitivity testing of assumptions should be pursued as far as possible.
3. Data constraints in individual country settings are likely to influence strongly the type of analysis that can be undertaken. Where data are more severely limited, the *ARP* approach can provide useful information (especially if alternative incidence assumptions can be applied) but must be interpreted with care. However, many countries now have some form of household expenditure survey data which can be used to improve the *ARP* approach and allow the construction of tax concentration curves, dominance testing and the use of fiscal simulation models.
4. The counterfactual against which the tax in question is being compared must be considered carefully. The usual counterfactual is *a proportional tax yielding the same revenue*. However, tax comparisons in practice in LDCs (e.g. pre- and post-reform), may involve increased or reduced revenues so that observed poverty or inequality changes cannot be unambiguously attributed solely to the tax change but may represent the effects of growth. There are two options here. Firstly, comparisons can be made whereby both taxes generate equal revenues. Secondly if revenues change after reform, consideration can be given to how this revenue (including deficit finance) would likely have been raised in the absence of reform. The new tax should then be compared with this alternative.

¹⁸ Rajemison and Younger (2001) use I-O tables to allow for this effect more carefully.

Table 4.2 Tax Incidence Adjusted for LDC Conditions

Tax	LDC-specific conditions	Direct effect	Implications for tax incidence
	Forex. controls Quotas Import licensing	Restrictions to supply \Rightarrow marginal unit <i>domestically</i> supplied	- limited forward shifting to consumers
<i>Sales tax</i>	Price controls	Limited price increases	- limited forward shifting.
	'Black' markets	Demand shift: 'white' to 'black' markets	- black market bears some incidence
<i>Income tax</i>	Tax evasion; bribes	Transfers to government officials	- uncertain incidence of tax plus bribes. - evasion by rich?
	<i>Public/urban sector-</i> <i>specific income tax</i>	Rural-urban migration/ inter-sectoral mobility	- private/rural sector bears some incidence

Table 4.3 Nominal & Effective Tax Rates (%) for Selected Commodities in India

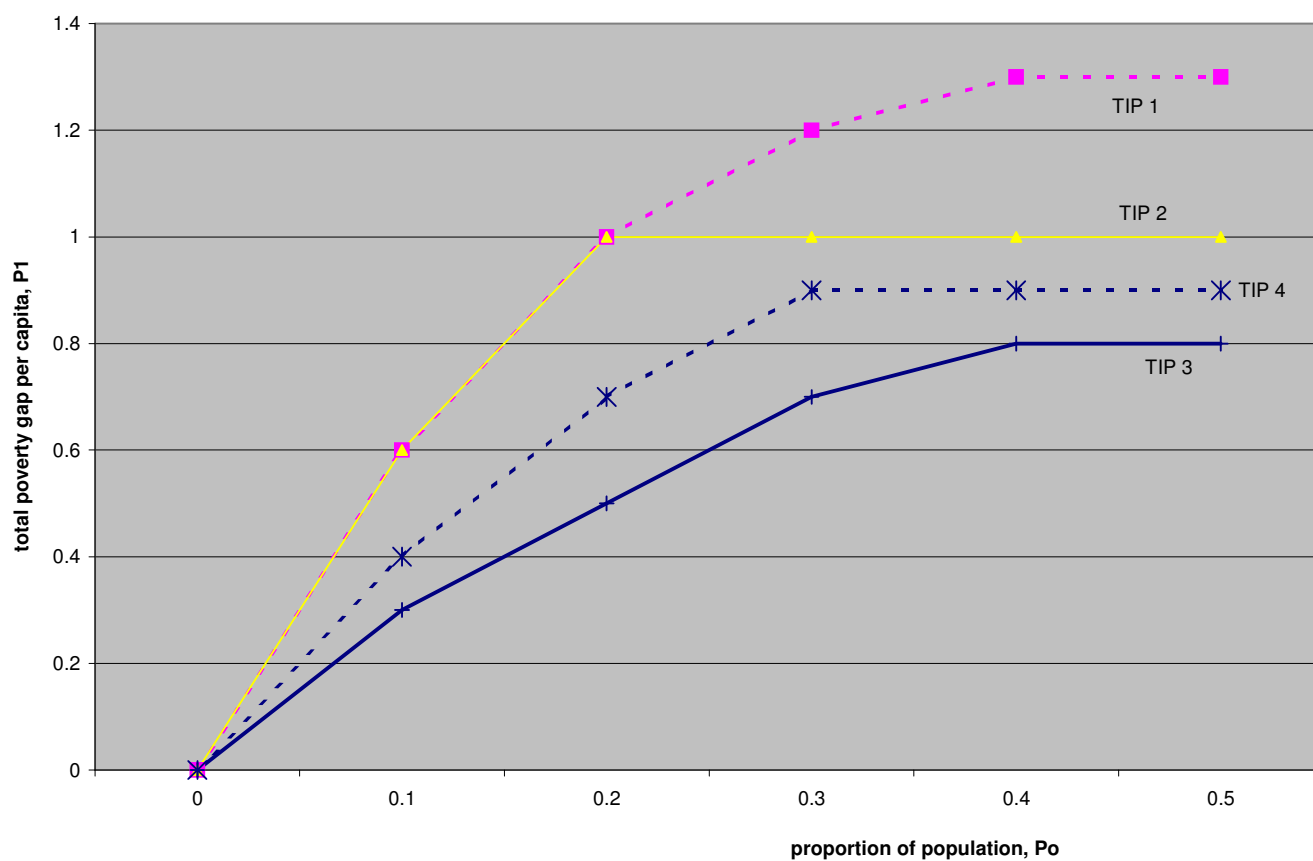
<i>Commodity</i>	t^e	t	t^{diff}
1 Rice	-3.5	-2.6	-0.9
2 Wheat	6.9	8.7	-1.8
3 Cotton textiles (handloom)	7.0	-1.2	8.2
4 Cotton textiles (other)	10.8	5.7	5.1
5 Wood products	9.3	1.5	7.8
6 Iron & steel	13.4	2.1	11.3
7 Tractors	22.0	13.1	8.9
8 Construction	6.5	0.0	6.5
9 Non-rail transport	15.0	3.5	11.5
10 education	9.2	-0.1	9.3

Notes: (1) t^e = effective tax rate; t = nominal tax rate; $t^{diff} = t^e - t$. (2) 10 commodity groups are shown out of a total reported of 89: $t^{diff} > 20\%$ for 4 commodities; $t^{diff} = 10-20\%$ for 30 commodities; $t^{diff} < 5\%$ for 55 commodities.

Source: Ahmed and Stern (1987).

Figure 4.1 TIP Curves

Data for TIP curves in Figure 4.1										
	<i>Incomes of individuals</i>									
	1	2	3	4	5	6	7	8	9	10
<i>Distⁿ 1</i>	4	6	8	9	12	15	20	25	30	35
<i>Distⁿ 2</i>	4	6	11	11	12	15	20	25	30	35
<i>Distⁿ 3</i>	7	8	8	9	12	15	20	25	30	35
<i>Distⁿ 4</i>	6	7	8	11	12	15	20	25	30	35



Chapter 5 Evidence on the Distributional Impact of Taxes and Tax Reform

This chapter reviews the evidence from different approaches on the distributional effects of taxes and tax reforms. The most popular, traditional, approach was the *Average Rate of Progression (ARP)* measure (section 5.1). Evidence is now also available for several countries using concentration curve and welfare dominance concepts (section 5.2). These measures have generally been used to assess the progressivity of existing taxes rather than compare pre- and post-reform regimes (an exception is Chen et al (2001) for Uganda) but they can nevertheless shed light on this issue. Marginal social cost evidence (section 5.3) addresses reform explicitly, both actual and counterfactual. Finally, evidence from CGE and fiscal simulation approaches are examined in sections 5.4 and 5.5 respectively.

5.1 Tax Progression Evidence

Numerous studies, calculating average tax rates by income level or across income groups were undertaken during the 1960s and '70s. They used statutory tax rates and traditional shifting assumptions and are of questionable reliability, especially early studies where data were particularly limited. Jimenez (1986) and Gemmell (1987) review this evidence. Although the terms 'progressivity' and 'regressivity' are regularly used in these studies, the evidence relates simply to *departures from proportionality* of the taxes concerned. Broadly, the evidence is as follows:

Personal income taxes	<i>progressive (but evasion generally ignored)</i>
Corporate taxes	<i>U-shaped (regressive then progressive)</i>
Property Taxes	<i>progressive? (but generally low revenue share)</i>
Indirect taxes	<i>regressive</i>
Overall tax system	<i>varied, often regressive at low incomes</i>

Jimenez (1986) reports overall tax incidence from various country studies (Table 5.1). In cases where progressivity is found, this is often because income tax evidence dominates (but where the use of statutory tax rates and thresholds is especially unreliable). Despite this, the combined effect of taxes in many countries appear to be regressive at lower income levels, even if they appear to be progressive further up the income scale. One problem with this evidence for indirect taxes (import taxes, sales taxes etc) is that progression has often been measured with respect to income levels

rather than expenditures. As discussed in chapter 4, this can lead to apparent evidence of regressive indirect taxes when, in fact, it reflects the income-expenditure relationship.

5.2 Progressivity Evidence: Concentration Curves and Inequality Measures

Recent work by Stephen Younger and colleagues has begun to report concentration curves (with associated welfare dominance tests) and Gini coefficients for several taxes in African countries (see Younger, 1996; Sahn and Younger, 1998; Younger et al, 1999; Rajemison and Younger, 2001; Chen et al, 2001). These are generally based on statutory tax rates and traditional incidence assumptions, but do allow for some shifting of intermediate goods taxes. Rajemison and Younger use input-output tables to track incidence across goods/sectors, and calculate tax rates from actual collections, for indirect taxes in Madagascar.

Evidence on tax progressivity/regressivity from dominance testing is shown in Table 5.2 for six African countries: Cote d'Ivoire, Ghana, Guinea, Madagascar, Tanzania and Uganda. Taxes are designated as progressive (regressive) if the concentration curve for the relevant tax lies wholly outside (inside) that for household expenditures *and* the difference is statistically significant. Where this cannot be established, the tax is shown as 'neutral/inconclusive'.

When considering beneficial reforms the 'welfare dominate' criterion is useful, as dominance implies a preference for the dominating tax regardless of the weight given to the poorest. Tables 5.3 – 5.6 report results for Cote d'Ivoire, Guinea, Madagascar and Tanzania (similar results are not available for Ghana). In each table the taxes in the left-hand column are arranged in descending order of progressivity; for example, in Guinea (Table 5.4), gasoline and diesel taxes are estimated as most progressive, followed by taxes on beverages, alcohol, automobiles, etc. The right-hand column shows those taxes that are welfare dominated by the associated tax in the left-hand column. What emerges from this evidence is:

- Taxes on private transport (gasoline, autos) tend to be strongly preferred on distributional grounds.
- VAT and sales taxes are more progressive than import taxes or excises, though usually not by enough for statistical tests to confirm welfare dominance.

- Export taxes and taxes on kerosene are often regressive and are strongly dis-preferred to any other taxes.
- Progressivity of the so-called ‘sin taxes’ on alcohol and tobacco is variable. In 3 of the 4 countries alcohol taxes are more progressive than tobacco taxes, but only in Cote d’Ivoire is tobacco taxation regressive.¹⁹
- Uniform taxation of fuel would be problematic because of the very different consumption patterns for gasoline and kerosene (or paraffin), which are respectively highly pro-rich and pro-poor in their consumption.

Rajemison and Younger (2001) investigate incidence using (i) actual tax payments to calculate tax rates; and (ii) input-output (I-O) tables to calculate effective tax rates, in Madagascar where intermediates form over 60% of imports and 80% of petroleum consumption. They find that (i) substantially reduces tax rates while (ii) significantly increases them. Two examples are given below:

<i>Industry</i>	<i>VAT</i>			<i>Import Duty</i>		
	<i>statutory</i>	<i>actual</i>	<i>I-O based</i>	<i>statutory</i>	<i>actual</i>	<i>I-O based</i>
Tobacco	7.7	0.6	3.6	7.8	0.2	1.6
Textiles	11.4	1.2	3.5	17.6	0.7	2.1

However, all three methods (including using statutory rates) produce similar progressivity rankings except for the two taxes where intermediate use is important: import duties and petroleum tax. However, it is the use of actual tax rates, rather than allowing for I-O effects, which has a substantial effect on progressivity results.

For import duties, conventional incidence assumptions produced a regressive outcome whereas they were progressive (and could not be dominated by any other taxes) using I-O methods. Traditional incidence assumptions for tariffs may, therefore, be seriously misleading; an important observation for evaluation of IFI-type reforms. One methodological difficulty with the I-O approach however is that it can require considerable aggregation across goods in order to estimate effective tax rates, reducing the accuracy of progressivity comparisons. In the case of Madagascar, applying I-O methods reduced the number of goods examined from 222 to 30!

¹⁹ Tobacco taxes also appear to be regressive in Ghana except at high income levels.

Chen et al (2001) report, for Uganda, that allowing for the pass-through of petrol tax into other sectors reduces the estimated progressivity of the tax. With strong aversion to inequality, it can become regressive. This is also one of few studies to compare pre- and post-reform progressivity, using concentration curves and dominance testing. Chen et al find that, overall, the two systems are similarly progressive but there are some important changes for individual taxes. General excises became more progressive while import duties became more regressive. Also the coffee stabilisation tax (1994-96) was regressive (but evasion was believed to be very high).

5.3 Marginal Social Cost of Taxation Evidence

Ahmed and Stern (1987, 1991) use the *MSC* method to examine possible welfare-improving reforms in India and Pakistan respectively. Using effective tax rates for around 90 commodity sub-groups, they calculate the *MSCs* (λ_i) for 9 (India) and 13 (Pakistan) commodity aggregations of mainly food and clothing products. The rankings for India, by λ_i , for each indirect tax and alternative inequality aversion assumptions, are shown in Table 5.7.²⁰ The tax with the highest social cost is ranked '1' implying that a reduction in this tax, offset by a revenue-neutral increase in any other tax, would be welfare improving. In brief, Ahmed and Stern found:

1. Welfare improving reforms can be sensitive to assumed inequality aversion. For example, attaching a high (low) priority to equality suggested reducing (raising) the tax on cereals. The rankings of some goods however were insensitive to inequality aversion assumptions (e.g. sugar in India; milk products in Pakistan).
2. For each inequality aversion, there was always at least one reform which could improve on current welfare.
3. When efficiency considerations dominate (ϵ close to zero), taxes on goods with low price elasticities of demand, such as some cereals and domestic fuel, can be increased to improve social welfare. However, since these are consumed disproportionately by the poor, any reasonable concern with poverty leads to those taxes reducing welfare.

²⁰ Results for Pakistan display similar characteristics; see Ahmed and Stern (1991, p.209).

5.4 CGE Evidence

Because of their multi-sector nature, CGE models are best suited to examining the implications of changing incidence assumptions and evaluating major tax restructuring. A number of CGEs have now been constructed for individual LDCs to explore the distributional impact of taxes. For example, Clarete (1991) and Shah and Whalley (1991) examine the progressivity of various taxes in the Philippines and Pakistan respectively, the latter distinguishing between urban and rural income earners. Dahl and Mitra (1991) apply CGE tax models to Bangladesh, China and India and explore distributional effects by industrial sector, between formal and informal, and between rural and urban areas.

For Pakistan, Shah and Whalley found that the effect of changing incidence assumptions (presumed to reflect the institutional and economic conditions in LDCs better) led to very different conclusions regarding progressivity. Table 4.2 in chapter 4 summarised the main difference in incidence assumptions proposed by Shah and Whalley. In essence the arguments are two-fold.

1. Quantitative restrictions can mean that *indirect* taxes are not fully passed on to consumers in prices. Instead, some or all of the incidence is borne by the importer or domestic producer. (Quantitative restrictions include import quotas or licenses, direct price controls or restrictions which limit price flexibility, or foreign exchange).
2. *Income* taxes are generally restricted to modern, urban or public sectors. This renders these sectors less attractive to potential employees, or limits the supply of jobs. The consequence is increased supply of labour to other (e.g. rural) sectors which depresses wages there. Some incidence of the tax is therefore borne by untaxed sector producers or workers or both.

The second effect is probably not quantitatively important in most countries (because income taxes are little used), but may be relevant in specific cases. The first effect, however, could be substantive enough to raise doubts about the distributional conclusions reached by existing studies using conventional incidence assumptions. Shah and Whalley (1991) provide some evidence on this but only for trade taxes. They show that, in Pakistan, traditional assumptions would lead to a regressive conclusion. They argue however, that quantitative restrictions would cause some of the incidence to fall on import and export license holders; and *assume* that the incidence rests with capital income earners. The link here is a tenuous one and Shah and Whalley

experiment with alternative assumptions regarding which capital income earners are affected. These alternatives lead to trade taxes appearing to be progressive, sometimes strongly so.

It remains unclear how far these arguments apply to *domestic* indirect taxes. The key issue is whether supply curves for taxed goods can reasonably be thought of as perfectly elastic at the margin. If not, there is good reason to think that not all of the incidence of indirect taxes will fall on consumers of those products. In addition it should be remembered that Shaw and Whalley provide no data in support of their alternative incidence assumptions.

Clarete (1991) undertakes a similar exercise for major Philippine taxes (allowing for imports and foreign exchange restrictions and rural-urban migration). He shows that, allowing for these three institutional effects (one at a time), leads to different conclusions for excise taxes, VAT and tariffs. Corporate and personal income tax results are essentially unchanged.²¹ The importance of incidence assumptions for model results is confirmed by Chia et al's (2000) CGE model of Ivorian tax incidence. Two other key results emerge from this study. (i) Incidence may vary considerably across socio-economic groups which does not translate into a simple income ranking – the poor in one sector may suffer while the poor elsewhere gain. (ii) Allowing for inter-household transfers (e.g. remittances from urban to rural households) substantively affects incidence results.²²

Coady and Harris (2001) used CGE methods to measure the social cost of raising revenues from alternative VAT systems (single- and multi-rate, exemptions etc) to finance transfers to the poor in Mexico. They show that with even modest concern for the poor (inequality aversion) there are social gains from all VAT options but all are dominated by financing the transfers by reducing food subsidies. They also show that if concern is with the very poorest, raising tax revenues to finance transfers can be

²¹ Further examples of CGE simulations of the distributional impact of taxes under different assumptions can be found in Choon (2000), Chia et al (2000), and Lora and Herrera (2000), for Singapore, Cote d'Ivoire, and Colombia respectively.

²² This is a case where it is important to analyse tax and expenditure incidence together. If, hypothetically, inter-household transfers were instead paid to the government in tax and the government made equal transfers to those households, tax incidence would change considerably but no difference may have occurred in households income positions. The incidence of the transfers should be examined alongside that for taxes.

socially costly in the sense that, although tax incidence is low for the poor in general it can be higher on the very poorest (with any incidence on the poorest being treated as especially costly).

In summary, much CGE evidence must be regarded as ‘suggestive’ rather than conclusive, but three tentative conclusions are:

- there is greater uncertainty concerning the distributional effects of taxes in LDCs than had generally been appreciated;
- overall the tax system *may* be more progressive than is often presumed;
- sector-specific taxes, and segmented LDC markets, can lead to incidence effects differing as much across sectoral or socio-economic groups as across income levels.

Shah and Whalley’s own summary of the impact of adopting their alternative tax shifting assumptions (in Table 4.2) is:

Tax:	<i>Traditional incidence assumptions</i>	<i>‘New’ assumptions reflecting LDC conditions</i>
<i>Income tax</i>	<i>Progressive</i>	<i>Ambiguous</i>
<i>Corporate tax</i>	Progressive/Proportional	Progressive
<i>Sales/VAT taxes</i>	Regressive	Progressive
<i>Trade taxes</i>	Regressive	Progressive
<i>Payroll taxes</i>	Ambiguous	Ambiguous/Progressive
<i>Urban property tax</i>	Regressive/Progressive	Progressive

Finally, Ahmed and Stern (1987, 1991) have explored the distributional impact of (hypothetical) major reforms in India and Pakistan, involving the replacement of some or all of the existing excise taxes with a proportional VAT. Estimating Equivalent Variations separately for 14 urban and 14 rural income groups, they show that a revenue-neutral reform could reduce poor rural households expenditures by as much almost 7% (and 5% for poor urban households). The richest households gain by up to 4%. Even exempting cereals from the VAT (to assist the poor), still produces welfare losses for the poorest 6 rural (10 urban) groups. This suggests a trade-off between improvements in efficiency and poverty. However, reform involving domestic sales

taxes can be tailored to help the poor but probably only at the cost of increasing the complexity of the system (e.g. with exempt goods and more than one tax rate). As Ahmed and Stern (1987, p.320) note, for India: *'it would be interesting ... to study a system with, for example, a selective VAT, plus food subsidies, plus special taxation of selected items such as gasoline and some luxury items. We could very probably produce a package that would lose no revenue and would look attractive in terms of the above [welfare] analysis'*.

5.5 Evidence from Fiscal Simulation Models

Fiscal simulation models use simple simulation techniques to capture the essential features of income and expenditure distributions, and combine these with tax structure information to examine revenue, redistributive and welfare effects of tax systems and reform. Where information is available, or plausible assumptions can be made, they can be extended to incorporate consumers' and labour supply responses. In this case they resemble more narrowly focused CGE models. The most sophisticated fiscal simulation models have been produced for developed countries (e.g. by the *IFS* for the UK; Creedy (1999) for Australia and New Zealand). Where there is limited modelling of behaviour, these models are best suited to examining the 'impact' (i.e. short-run) effects of tax reforms.

So far, applications to LDCs have been limited to simulating revenue aspects using fairly simple models (see Jenkins and Kuo, 2000). More sophisticated models have been applied to Australia, New Zealand and the UK by Creedy (1998, 1999) and Creedy and Gemmell (2001a, b). This evidence is not relevant here but there is potential to adapt these models for LDCs (see chapter 6). Jenkins and Kuo (2000) use data on incomes and expenditures across income groups in Nepal to consider the revenue effects of replacing an existing sales tax and set of excises with a VAT. This type of analysis can focus on details of the tax system, can simulate different degrees of tax compliance (using actual tax collection evidence as a guide), and can consider the effects of base broadening, alternative tax rates etc. For Nepal, Jenkins and Kuo use the model to estimate the VAT rate which would be required to yield equal or greater revenues to those produced by the current system, examining this for alternative compliance rates.

5.6 The Revenue Effects of Tax Reform

A major concern with reforms to trade regimes in LDCs has been whether tax revenues would be depleted or enhanced by the changes to tariffs etc. Evaluating long term effects is made difficult by the fact that numerous other changes take place in an economy in the years following reform. As a result most revenue assessments look at relatively short-term or 'impact' effects. Over the longer term, Adam and Bevan (2001, pp.12-13) argue that most LDCs need a tax structure yielding revenues around 15-20% of GDP to fund public expenditures around 20% of GDP. They also note that similar post-reform tax structures across countries are associated with very different tax/GDP ratios suggesting that differences in compliance and administrative efficiency may be important. Indeed, some of the best examples of successful stabilisation programmes (e.g. Uganda, Tanzania) have been associated with tax/GDP ratios around 11-12%. This is likely to lead to severe funding problems over the longer term unless reformed tax systems can generate additional revenues or donor agencies are willing to make up the shortfall. The latter seems unlikely in most cases.

Two reviews of the short-run (up to 5 years) revenue effects of trade reform (Greenaway and Milner, 1991; Devarajan and Panagariya, 2000) find examples of both revenue-enhancement and depletion, but with the former appearing to dominate. Their particular focus is on trade tax reforms which restructure the import and export tax/quota systems (elimination or reduction in export taxes; reductions in tariff rates; 'tariffication' of import quotas). There is no clear *a priori* prediction but Greenaway and Milner find 3 out of 5 countries undertaking SAL programmes experienced trade revenue increases (as a % of GDP); the other two experience revenue reductions. Devarajan and Panagariya (2000) examined 40 trade reform episodes in 22 developing countries, and found that in 25 of those trade or import tax revenues rose, 2 showed no change and 15 experienced trade/import revenue declines. These results are encouraging both because of the majority of enhancement cases and because arguments for broader fiscal reform have often presumed that new revenue sources would be needed to counteract trade tax revenue losses. If post-reform trade tax revenues can be maintained or increased, it is more likely that reforms to domestic taxes can complement this and assist in further revenue raising.

5.7 Conclusions

What conclusions can be drawn from the above evidence? Firstly, general conclusions with respect to particular taxes are quite hard to find – progressivity/regressivity conclusions are often country specific. To the extent that the incidence of indirect taxes rests with consumers (i.e. prices adjust by the full amount of the tax), evidence from *ARP* studies, concentration curves and welfare dominance tests point to **taxes on exports** (cocoa in Ghana; coffee in Uganda; vanilla in Madagascar), **intermediates, and kerosene excises** as bad for the poor. In general, one would also expect that taxes on foods, especially basic foods, would have an adverse effect on the poor (see the discussion of taxes on food imports in Kenya in Annex 1).

Taxes on imports also often appear among the more regressive (less progressive). Since IFI inspired reforms frequently involve reductions in and/or rationalisation of, trade taxes, and the elimination of taxes on intermediates, this aspect of reform might reasonably be expected to assist the poor (see the example of Kenya in Annex 1). However, if Shah and Whalley's argument that import tax incidence is in any case borne by higher income recipients, this effect might be small. It would however be hard to argue that removing these taxes harms the poor – though, of course, the net effect will depend on what taxes replace tariffs etc. Trade tax reforms may therefore represent cases where efficiency and equity outcomes are complementary.

Because different income groups tend to consume similar goods (albeit in differing proportions) it is generally difficult to achieve significant redistribution through indirect taxes. However **kerosene** (or paraffin) is often important within poor household's budgets for heating/lighting/cooking fuels but is not widely used by the rich. Thus, not only will kerosene taxes be harmful to the poor, but it should be possible to exempt kerosene from more general fuel taxes to improve equity without encouraging inefficient substitutions between fuel types. This argument may apply to other items such as some foodstuffs.

Negative externalities associated with **alcohol, tobacco and cars/petrol** are often used to justify taxes on those goods on efficiency grounds. They have also traditionally been thought of as regressive, partly as a result of early evidence. More recent evidence however, even using traditional incidence assumptions casts some doubt on this.

Younger's African evidence, for example, found that car/petrol taxes were strongly progressive; alcohol taxes appear quite progressive in most cases; and even tobacco taxes were reasonably progressive in Madagascar. Reforms that rationalise these taxes (e.g. imposing uniform rates on different types of tobacco or alcohol) will generally improve efficiency, and removing or significantly reducing them would not have a disproportionate effect on the poor. Low demand elasticities for those goods tend to make them good candidates on efficiency grounds.

Value added taxes have been the main domestic 'replacement' tax for tariffs and a wide array of excises in many reforms, and by 1998 were used in the majority of LDCs (according to Tanzi and Zee, 2000). Concentration curve and dominance test evidence generally puts VAT relatively low on the progressivity rankings though it is not normally found to be regressive. Indeed much early evidence suggesting regressivity of indirect taxes in general, and sales taxes/VAT in particular, appears to result partly from estimating tax rates as proportions of *income* rather than *expenditures*.²³ When expenditure is used as the base, progressivity conclusions are more likely. Since the poorest consumers are unlikely to spend much of their income on VAT-liable goods (especially where necessities are exempted) VAT has little effect on the poor. Where it replaces an *ad hoc* array of excises at penal rates, VAT may even assist the poor by removing taxes with serious price distortions. Nevertheless, the same pro-poor objectives could be achieved with a sales tax that is administratively easier.

Income tax reforms often involve reductions in *progression* (e.g. by removing or reducing higher marginal tax rates), but widespread evasion meant that they were not very *progressive* before reform (at least at the top end of the income scale). Reforms therefore probably generally benefit those in the lower half of the income distribution and are largely irrelevant to most of the poor (see discussion of Mauritius in Annex 1). The rationalisation of income tax schedules also contributes to a more efficient income tax system, even if only by removing previous 'evaders' from the tax net. Whilst it is possible that limiting income taxes to formal sector employees has knock-on effects to the wages of informal and rural sectors (as Shah and Whalley argue) this is likely to have a minor effect at most on the poorest.

On the issue of **revenue enhancement or depletion**, the trade tax evidence is generally encouraging but individual cases must be examined carefully, especially where there is heavy trade tax dependence prior to reform (Morrissey, 1995). Evaluations of reforms (see Burgess and Stern, 1993; Patel, 1997; Perry et al., 2000) suggest that many ‘major’ reforms have not resulted in substantial changes in revenue collections or effective tax rates. Nevertheless, with increasing revenue needed to fund growing expenditures over the longer term, it is important to assess whether these additional revenues are likely to be raised from taxes which hurt or help the poor.

Finally **what are the main taxes paid by the poor?** Income taxes can largely be ignored in terms of direct incidence. Shah and Whalley’s arguments (that low income earners suffer if urban income taxes reduce urban employment and thereby depress rural and informal sector wages), depend on the validity of the Harris-Todaro model of migration in which expected urban wages influence migration decisions. Despite its intellectual appeal, this model remains largely ‘unproven’ empirically, and it seems likely that any incidence shifting of income taxes to the poorest is small at most. The poor directly pay excises levied on goods they consume – kerosene and tobacco are obvious examples – and commodity taxes on staple foods, and in some of these cases the poor consume them disproportionately. The poor pay the inflation tax. As a result any attempt by governments to avoid raising taxes to pay for expenditure increases, and which instead leads to monetary expansion, will affect the poor. This is worst for the poor if the foregone tax source is progressive.

Finally, taxation of intermediates (including the failure to exempt exports etc from VAT), can lead to effective taxes differing substantially from nominal rates. This affects the poor, in India and Pakistan at least, by undermining public subsidies aimed at the poor on food items such as cereals. Reforms that remove intermediates from taxation are therefore likely to be both efficiency enhancing and poverty improving (provided revenue-neutrality is not achieved by raising taxes on final goods important to the poor).

²³ Note that Shah and Whalley (1991) use income as the ‘base’ for estimated effective average indirect tax rates.

Table 5.1 Incidence of Taxation from ARP Studies

<i>Country</i>	<i>% of income paid in taxes</i>			<i>Conclusion</i>
	<i>Lowest income</i>	<i>Middle income</i>	<i>Highest income</i>	
Argentina	17.2	19.8	21.4	progressive
Brazil	5.2	14.3	14.8	progressive
Chile	18.2	16.2	26.7	progressive
Colombia	17.1	13.1	29.9	U-shaped
Kenya	11.5	8.8	12.7	U-shaped
Korea, South	16.4	15.7	21.6	U-shaped
Lebanon	8.4	20.2	20.3	progressive?
Malaysia	17.7	16.5	42.1	U-shaped
Mexico	40.2	22.7	14.9	regressive
Pakistan	15.0	9.6	25.3	U-shaped
Peru	4.8	17.4	26.6	progressive
Philippines	23.0	16.9	33.5	U-shaped

Note: Figures include direct and indirect taxes.

Source: Jimenez (1986, p.116).

Table 5.2 Progressivity Results from Dominance Testing

<i>Tax:</i>	<i>Dominance Test Results</i>		
	<i>Progressive</i>	<i>Neutral/inconclusive</i>	<i>Regressive</i>
<i>Exports:</i>		C.d'I, Guinea, Mad.	Ghana, Uganda
<i>Imports:</i>	Guinea, Mad., Tanz., Uganda	C.d'I,	
<i>VAT/Sales:</i>	Guinea, Mad., Tanz., Uganda	C.d'I, Ghana	
<i>Excises:</i>	Mad., Tanz.	C.d'I, Guinea, Uganda	
<i>Tobacco:</i>	Mad., Uganda	C.d'I, Guinea, Tanz.	Ghana
<i>Alcohol:</i>	C.d'I Guinea Ghana, Tanz., Uganda	C.d'I,	
<i>Non-alcoholic Beverages:</i>	C.d'I, Guinea, Ghana, Uganda		
<i>Gasoline:</i>	C.d'I, Guinea, Tanz. Ghana, Mad. Uganda		
<i>Kerosene: /Paraffin:</i>		C.d'I, Tanz.	Ghana, Guinea, Mad. Uganda
<i>Transport:</i>	Mad., Tanz.	C.d'I, Guinea	
<i>Autos:</i>	C.d'I, Guinea, Mad.		

Note: C.d'I = Cote d'Ivoire; Mad. = Madagascar; Tanz. = Tanzania. Results for Ghana are based on concentration curves without statistical testing of dominance.

Source: Based on results in Younger and associates (1996, 1999, 2001).

Table 5.3 Tax Dominance: Cote d'Ivoire

	Tax	<i>Dominates the following:</i>
<i>Most progressive</i>	Autos:	<i>All others below</i>
	Gasoline:	<i>VAT, imports, excises, kerosene</i>
	Beverages:	<i>VAT, imports, excises, kerosene, transport, exports</i>
	Alcohol:	<i>Excises, tobacco, exports</i>
	VAT:	<i>Imports, kerosene, tobacco</i>
<i>Least progressive</i>	Excises:	<i>Tobacco</i>

Note: Taxes which appear in the right-hand column but not in the left-hand column (e.g. import taxes) do not dominate any other taxes but are dominated by at least one other tax.

Table 5.4 Tax Dominance: Guinea

Tax	<i>Dominates the following:</i>
Gasoline & Diesel, Beverages:	<i>VAT, imports, excises, tobacco, kerosene, exports</i>
Alcohol:	<i>Kerosene, exports</i>
Autos:	<i>Kerosene, exports, VAT, imports, tobacco</i>
Transport, VAT, Imports, Excises, Tobacco:	<i>Kerosene, exports</i>

Table 5.5 Tax Dominance: Madagascar

Tax	<i>Dominates the following:</i>
Gasoline, Transport:	<i>All others below except autos</i>
Autos:	<i>All others below except tobacco</i>
Transport, Excises, Gas in transport, alcohol:	<i>Imports, kerosene</i>
VAT, Petroleum, Imports:	<i>Kerosene</i>

Table 5.6 Tax Dominance: Tanzania

Tax	<i>Dominates the following:</i>
Gasoline & Transport:	<i>All others below</i>
Alcohol:	<i>Sales, imports, kerosene</i>
Excises, Sales, Imports, Tobacco:	<i>Kerosene</i>

Table 5.7 Welfare Ranking of Indirect Taxes in India

<i>Commodity</i>	<i>Effective tax rate</i>	<i>Levels of inequality aversion, ϵ</i>				
		<i>0</i>	<i>0.1</i>	<i>1</i>	<i>2</i>	<i>3</i>
Cereals	-0.052	8	7	2	2	2
Milk, dairy prods.	0.009	9	9	9	9	9
Edible oils	0.083	6	6	4	4	5
Meat, fish, eggs	0.014	7	8	6	5=	4
Sugar, gur	0.069	5	5	5	5=	6
Other foods	0.114	4	3	3	3	3
Clothing	0.242	1	1	7	7	8
Fuel and light	0.274	2	2	1	1	1
Other non-food	0.133	3	4	8	8	7

Chapter 6 Analytical Frameworks for Analysing Poverty Impacts of Tax Reform

The evidence on tax incidence in developing countries discussed in chapter 5 was grouped into five approaches. There are merits and problems associated with each method, but a probable ranking, from most difficult to apply to easiest, would be:

- 1) CGE models
- 2) marginal social cost analysis
- 3) tax progressivity measures (concentration curves, dominance tests, etc)
- 4) fiscal simulation models
- 5) tax progression measures

All of these methods could be usefully applied to poverty analyses of taxes or tax reforms. The suitability of each for policy advice often hinges on the scope of the desired poverty assessment, the nature of the reform being considered (e.g. how narrowly focused or widespread it is), the availability of relevant data, and the resources available to be committed to the exercise. The best approach for DFID is probably to seek compromises between more comprehensive methods, with their extensive data requirements, and/or complex computational procedures, and simpler methods that are more readily applied to limited data. Below, are the main pros and cons of each method.

6.1 Alternative Methods

Methods 1 and 2: CGE and MSC analyses

These are probably beyond the scope of investigators without tested computable models designed for the country or countries in question. However, increasingly CGE models are being created for individual LDCs which (even if not constructed to examine fiscal issues) may be adaptable for this purpose. Relevant authors could be commissioned to undertake tax-poverty assessments. Both methods, however, work best with data at a fairly high degree of disaggregation and, as a result, price response information may not be reliable. For this and other reasons it can be difficult to assess the reliability of any of the scenarios produced. The data requirements of *MSC* analyses are significantly less than those of *CGE*.

Methods 3 to 5 are probably the most feasible for DFID economists (or consultants) to pursue to assess the poverty impacts of tax reforms in specific country contexts. Below we outline, in reverse order, how these methods can be applied.

<i>Method</i>	<i>Pros</i>	<i>Cons</i>
1. <i>CGE</i>	<ul style="list-style-type: none"> - can examine variety of incidence assumptions - can examine sector/ socio-economic divisions - includes behavioural responses - various welfare measures 	<ul style="list-style-type: none"> - data intensive - imposes parameters - smooth price adjustment assumptions not always appropriate - requires behavioural data
2. <i>Marginal social cost</i>	<ul style="list-style-type: none"> - less data intensive than CGE - behaviour responses via aggregate price responses - limited welfare measure 	<ul style="list-style-type: none"> - requires behavioural data (price elasticities) - marginal changes only - mainly for expenditure taxes - results tend to be sensitive to inequality aversion
3. <i>Concentration curves Welfare do min ance Inequality measurement</i>	<ul style="list-style-type: none"> - can compare pre- & post-reform distributions - can focus on poverty groups - needs limited data (expend., income distribution by group) - apply to direct & indirect taxes - can examine tax compliance - software available 'off the shelf' - no (or limited) behavioural responses 	<ul style="list-style-type: none"> - interpreting crossing curves - statistical tests can have low power - need good data at low incomes to calculate Ginis etc for poor groups - limited ability to alter incidence assumptions - no behavioural responses
4. <i>Fiscal simulation</i>	<ul style="list-style-type: none"> - <i>as above; plus</i> - can generate income distribution data - can include or exclude behavioural responses - can report poverty indices - can simulate alternative incidences 	<ul style="list-style-type: none"> - not previously applied to LDCs, therefore limited knowledge of method's weaknesses in this context - only 'impact effects' without behavioural assumptions - software available but needs some adapting to LDC conditions
5. <i>Tax progression</i>	<ul style="list-style-type: none"> - requires only data on tax structures - simple to interpret 	<ul style="list-style-type: none"> - measures tax rates by income level/group but not distributional or poverty impacts - welfare interpretations not always possible - cannot readily adapt incidence assumptions - can be misleading re progressivity if few taxpayers at some tax rates

Method 5: Tax Progression

This essentially requires knowledge of the various tax rates, exemptions and thresholds and data on actual tax collections. Where the latter are not available by income group, it is not possible to estimate tax progression for indirect taxes unless household expenditure data are available by income groups (see below). Also for indirect taxes, it is the amount of tax as a share of expenditure, *not income*, which should be used to

calculate tax rates. Tax progression indices are the easiest to calculate and it is easy to focus on the poorest income groups if desired. This was the approach followed by most 'first generation' incidence studies; it can provide a quick guide to *potential* progressivity. However, care is needed in interpretation, since it can give a false picture of distributional effects without knowledge of how many taxpayers pay each tax rate. For indirect taxes such as sales taxes with exempt items, marginal tax rates can be difficult to calculate accurately. Tax progression evidence using statutory tax rates for *income* taxes is regarded as especially unreliable.

Method 4: Fiscal simulations

Three fiscal simulation approaches are possible, two to examine indirect taxes (trade taxes, excises, sales taxes etc) and one which examines both personal income and indirect taxes. All require data from a household expenditure survey (HES) or equivalent.

In the simplest approach HES data are organised (by income and/or household group) into items subject to different rates of indirect tax, for example, in the form of an Excel matrix of total expenditure and expenditure shares for taxed and untaxed items. An illustration for the UK is shown in Table 6.1. This uses income deciles and items are arranged in 10 groups of expenditure items facing different tax rates in the UK system: items subject to VAT at a 'standard rate', at 0% and at 5% (insurance, domestic fuel), alcohol etc. Since these HES data are arranged by income decile, when the tax rates in column 2 are applied to the expenditure data, the resulting average tax rates provide a measure of progressivity, not just progression. Statutory tax rates are used in Table 6.1, but where information on actual collections is available or can be simulated, corrections can be made to reflect tax compliance. Table 6.1 shows that, for the UK, while overall indirect taxes are roughly proportional this is made up of a mixture of progressive (wine excise) and regressive (domestic fuel) taxes. Impacts on poor groups can be gauged from the lowest deciles.

Alternative incidence assumptions can be examined by this method if data are available, or plausible scenarios can be identified. For example, if it is believed that the majority of purchases by consumers in the lowest two deciles are made in the informal sector (and therefore are untaxed), this can be factored into the spreadsheet. Examining the incidence of import taxes (for goods that are also produced domestically) is more

difficult because expenditure data does not normally distinguish the source of supply. However, a combination of input-output (I-O) tables and import data can often provide a reasonable assessment of import consumption by income levels. Sensitivity testing of alternatives is usually worthwhile, since theory suggests the prices of perfect substitutes should be equal whether all are taxed or not.

Two fiscal simulation models (with assorted variants) have been created by John Creedy of the University of Melbourne, Australia. The first ('DAWES' – **D**emand **A**nd **W**elfare **E**ffects **S**imulator) can analyse the welfare, inequality or poverty dimensions of indirect taxes and reform, and incorporates demand responses to the price changes induced by tax changes. (The method is described in Creedy, 1999; the main elements of the programme are in Annex 2). The second, and simpler, programme ('FLEXI') analyses the 'built-in flexibility' of taxes; that is, average and marginal rates of tax and tax elasticities (the proportionate change in tax revenue) across income levels (see Creedy and Gemmell, 1998; 2001b for Australian and UK applications). This programme evaluates both income and expenditure taxes, simulates an income distribution, and can identify tax progressivity measures for the whole income distribution, for selected groups (e.g. below some poverty threshold) or at specified income levels.

The input data required are shown in Table 6.2. This shows that 'effective', rather than nominal, income tax allowance/deductions can be incorporated which could be used to capture evasion aspects. Also the income-expenditure relationship (shown as $C = c(Y - a)$ in the table) allows for effects of savings differences across income levels and any other factors which change the reported proportion of disposable income available for expenditure (such as evasion). Statutory indirect tax rates can be modified to reflect compliance if desired. To simulate progressivity, additional input files for total expenditure and budget shares are used. An illustration of average and marginal tax rate outputs for the UK is shown in Figure 6.1. This indicates, not surprisingly in the UK case, that the income tax is progressive at all income levels (ATR_y). All indirect taxes combined (ATR_v^*) are approximately proportional. The (apparently regressive) ATR_v curve however, shows the ATR measured as a proportion of gross income, indicating the possibilities for misinterpretation if indirect tax liabilities are not measured with respect to expenditure. These results also confirm that using actual

distribution data in Table 6.1 and the simulated distribution in Figure 6.1 yield similar estimates.

Neither approach allows for demand responses. When examining tax *changes*, this method is best interpreted (like *method 3*) as measuring ‘impact effects’. To the extent that behavioural responses are thought likely to be small, however, these simulations provide a ‘benchmark scenario’ for longer-term effects of reform. Alternative ‘effective’ tax rates and compliance rates can of course be imposed for each tax reform simulation examined.

Method 3: Concentration curves, inequality indices etc.

Calculation of Lorenz and concentration curves, Atkinson and Gini coefficients, dominance testing and a wide range of other measures, can readily be performed using the “*DAD4.0*” software provided by Jean-Yves Duclos and colleagues at the University of Laval in Canada. This method requires income or expenditure distribution, or tax payment, data arranged in a *DAD* spreadsheet such as that shown in Figure 6.2. Thus, for example, using the budget share data in Table 6.1, together with the relevant tax rates, allows shares of tax revenues for each income decile to be obtained. These can be inserted into the *DAD* spreadsheet, from which concentration curves can be obtained from the “curves” pull-down menu shown. As with the above methods, indices, specific to poor groups can be calculated. Alternative incidence assumptions can be examined by first building these into the data spreadsheets as in Method 4. If desired, these Atkinson, Gini etc measures can be used in an abbreviated social welfare function, where mean income and equality measures (suitably weighted for the poor) are multiplied together, as discussed in chapter 4. Pre- and post-reform regimes can be assessed by comparing these abbreviated SWFs.

6.2 Conclusions

Choosing between the methods discussed above will obviously depend on the availability of data, the country and particular tax scenario being investigated, and so on. There is no unambiguously preferred technique. Testing incidence assumptions is possible with most methods, but in all cases the challenge is to know which of these most accurately depict reality.

Tax progression methods provide a useful ‘first pass’ at *potential* progressivity of taxes, but should be complemented wherever possible by either the concentration curve/dominance testing/Gini measures for which the DAD software is available, or by the use of fiscal simulations. The merit of this last approach is that it can be applied with limited data but can also use more sophisticated methods where data allow. However, it has not so far been applied to LDC conditions.

Table 6.1 Illustrative Excel Example: the UK

	<i>Income decile:</i>											<i>All</i>
<i>Budget shares</i>	<i>tax rate</i>	<i>first</i>	<i>second</i>	<i>third</i>	<i>fourth</i>	<i>fifth</i>	<i>sixth</i>	<i>seventh</i>	<i>eight</i>	<i>ninth</i>	<i>tenth</i>	
VAT exempt	0.00	0.39	0.41	0.39	0.36	0.36	0.34	0.33	0.32	0.31	0.31	0.33
standard VAT	0.15	0.44	0.42	0.45	0.48	0.48	0.50	0.52	0.54	0.55	0.57	0.52
insurance	0.05	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02
beer	0.32	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.02	0.02
wines	0.53	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
spirits	0.64	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01
other alcohol	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
tobacco	0.82	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02
petrol	0.86	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
domestic fuel	0.05	0.07	0.07	0.06	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.03
Total expenditure (£ per wk)		119.7	146.8	178.1	244.8	300.0	361.8	412.9	481.8	565.2	782.5	359.4
Decile expenditure shares		0.03	0.04	0.05	0.07	0.08	0.10	0.11	0.13	0.16	0.22	
Total tax payment (£)		15.73	19.33	24.56	35.14	43.97	54.40	62.19	72.40	84.98	110.6	52.37
ATR (all taxes)		0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.14	0.15
ATR (VAT)		0.06	0.18	0.19	0.21	0.23	0.24	0.26	0.28	0.29	0.31	0.30
ATR (wines)		0.003	0.003	0.003	0.004	0.004	0.004	0.005	0.005	0.006	0.007	0.005
ATR (dom. fuel)		0.003	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001

Table 6.2 Input Data for 'FLEXI' Simulation Programme

<i>Income distribution</i>	
9.5825 0.4560	initial mean and variance of log income
<i>Income tax</i>	
3; 1999	number of thresholds ;year
0.1, 0.23, 0.4	marginal tax rates
4335, 5835, 32335	tax thresholds
0.25	elasticity of allowance/deductions w.r.t. income
<i>Expenditure-income relationship</i>	
0.95, 4000	parameters, c and a, of expenditure-income relationship: $C = c(Y+a)$
<i>Expenditure taxes</i>	
indirect tax rates for 10 commodity groups	
.0000 .1750 .0500 .4706 1.1277 1.7778 .8244 4.5556 6.1429 .0500	
<i>Income growth parameters (for time-series simulation)</i>	
1.0; 0.03; 0.0	beta (for income changes; see note below); growth rate of income; indexation rate
1999	budget share year
10	number of periods (of increasing incomes)

Note: Income changes can allow for non-equiproportionate changes in incomes. Hence beta=1 gives equal proportionate changes in incomes; beta<1 implies equalising changes; beta>1 implies disequalising change.

Figure 6.1 Tax Progressivity by Income Level (UK, 1999)

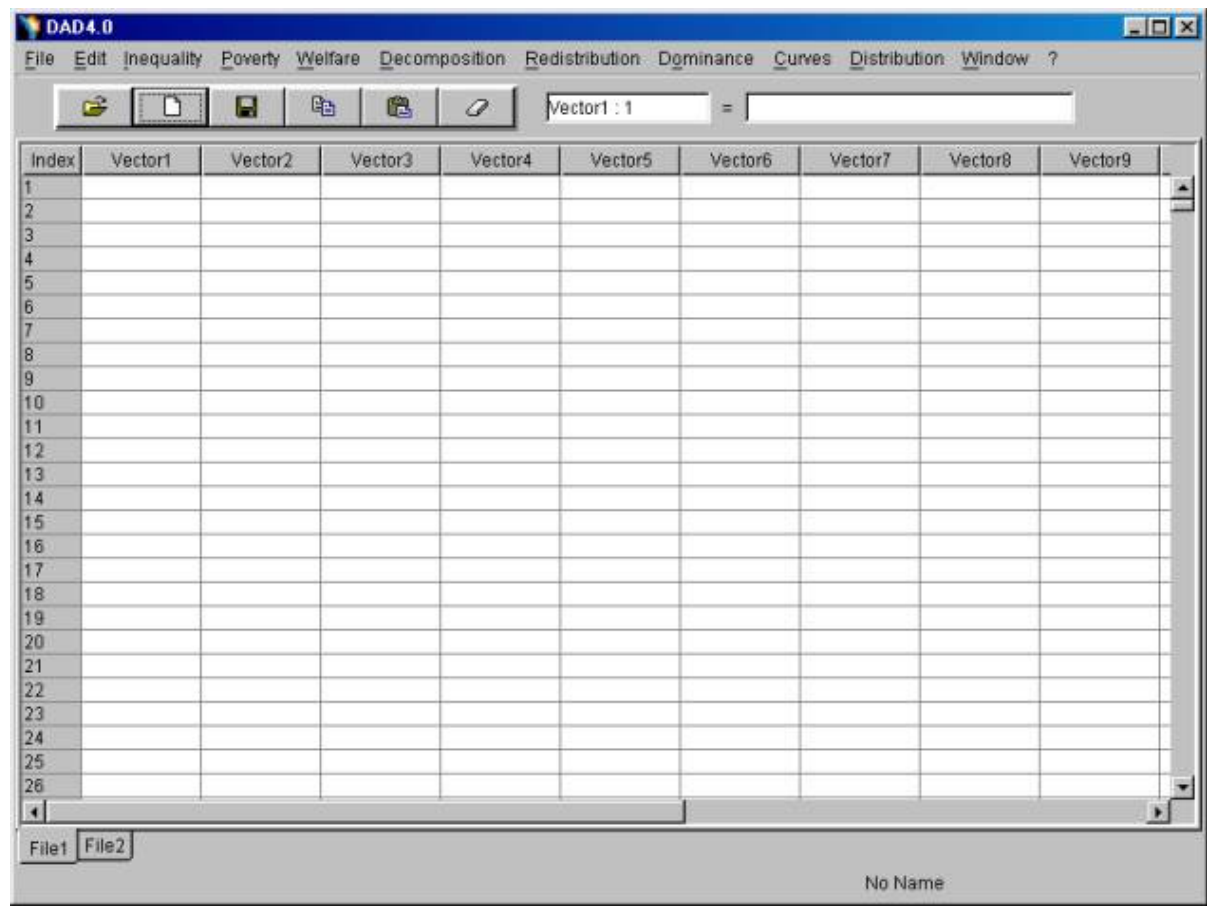
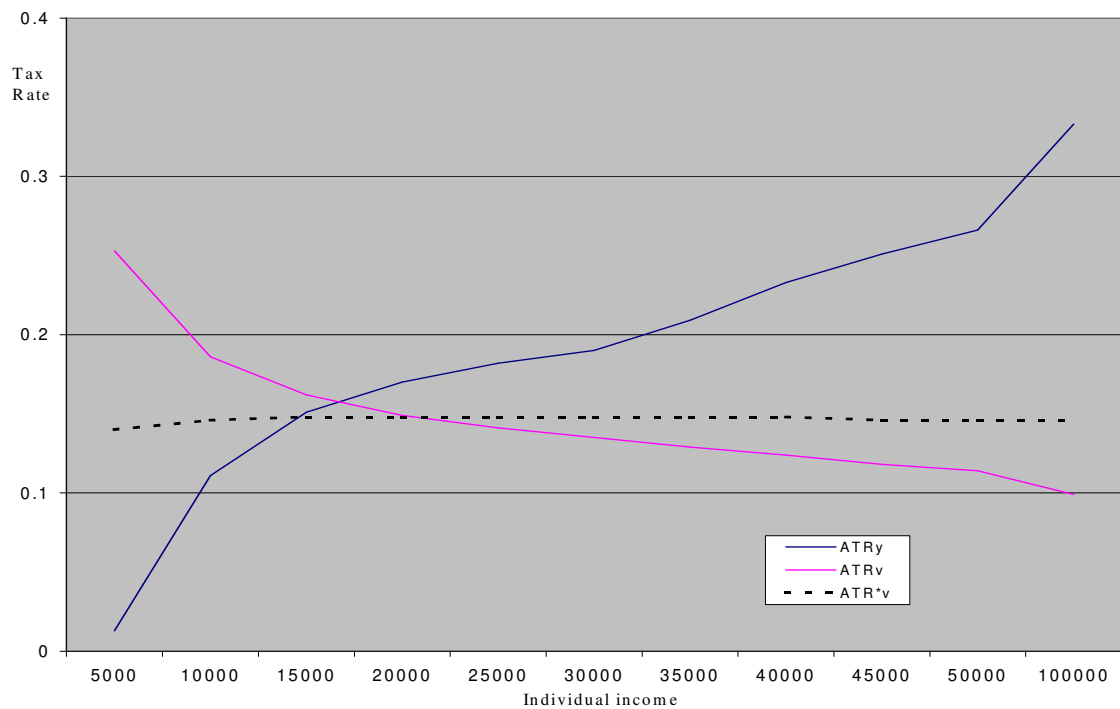


Figure 6.2 The DAD Spreadsheet

Chapter 7 Conclusions and Policy Recommendations

The objective of this report is to consider how tax systems and tax reforms in developing countries impact on poverty. To provide some background, chapter 2 reviewed tax systems in developing countries and the characteristics of tax reform programmes. A summary assessment of this is in section 2.3. Conclusions drawn at the end of earlier chapters will not be repeated here. Section 3.3 summed up the prescriptions from tax theory which are relevant to developing countries; section 4.6 drew some conclusions concerning which tools might best be used in tax-poverty assessments; and section 5.7 summarised the available evidence to date. Chapter 6 has also suggested possible frameworks and tools that might be used to measure the poverty impacts of taxation. Some of these are viable using available software and with limited data. They allow traditional incidence assumptions – which have been criticised – to be altered for LDC contexts, but to a limited degree. It is also important to remember that there is very little evidence available to allow the accuracy of alternative incidence assumptions to be checked. We sum up by addressing a number of questions and making a set of policy recommendations.

As the focus has been on taxes that affect the poor, directly or, more often, indirectly, some types of taxes have received little or no attention. The poor are not liable for personal income tax - even in the rare cases that they earn formal incomes, these will not exceed the threshold. Thus, the case for income tax reforms is based on efficiency and equity considerations, and is not in itself an instrument of a poverty reduction strategy. Similarly, corporate income (profits) taxes or capital taxes (on inheritances or capital gains) are unlikely to have even an indirect effect on the poor, and hence have been excluded from consideration. The same applies to property taxes: while desirable for equity reasons, they are not incident on the poor (although they could be passed on to tenants) and rarely used in LDCs.

We have not considered local taxes, largely because there is very little evidence available, these are rarely the subject of tax reform discussions, and practices vary considerably. However, it is worth mentioning that some countries have poll taxes as a means of raising revenue. While these are usually at very low, and not always uniform, rates, the presumption would be that they are regressive. In fact, this may not be the

case. Fjelstad and Semboja (2001) discuss the development levy, a local poll tax in Tanzania, and reach two conclusions of relevance here. First, compliance rates are higher for those on higher incomes because they are involved in more visible activities (such as trade), so the tax is progressive. Second, taxpayers are more willing to comply if they can see that public services are being provided. This emphasises the important role that aid finance for the provision of public services (especially visible pro-poor services such as education, health and sanitation) can play during the tax reform process.

Taxpayers are more willing to comply if public services are being provided. In the pre-reform stage, total revenues are low (hence constraining the level of services provided) and collection is inefficient (due to corruption by tax administrators and evasion by taxpayers). Tax reform is associated with two types of uncertainty, both of which can be reduced by aid inflows. First, governments are uncertain of the effects on revenue; this is one major reason for implementation failure of trade tax reforms (see Morrissey, 1995). Second, administrative changes imply statutory uncertainties that increase the scope for evasion (this provides an argument for relatively simple reforms). If aid is used to maintain revenues, supporting government commitment, and to finance public services, increasing the incentives for taxpayers to comply, it can support the reform process. We return to this point in the policy implications.

1. *Do any reliable analytical results emerge for the design/reform of 'efficient' revenue systems in LDCs?*

Section 3.3 provided some answers to this question. In essence, the answer is that analytical results do emerge, but they depend on the range of tax instruments available to the government and whether all goods/sectors/households can be taxed. In poorer countries where income taxes are limited and agricultural/informal sectors cannot readily be taxed directly, the common 'tax neutrality' advice for tariffs and domestic indirect taxes derived from theory is not appropriate. This is reinforced when equity considerations are part of the objectives of the tax system. However, arguments for varying sales/excise tax rates must be treated cautiously. Indirect taxes are blunt instruments for redistribution to the extent that both rich and poor consume similar goods. Where they consume different goods, it is possible to target indirect taxes better than poorly administered and evaded direct taxes. A case for neutrality as representing

a simple tax structure that reduces incentives for evasion can be made, based more on the realities of poor administration services and corruption. The general recommendation is for few relatively low tax rates.

2. *Does the analysis/evidence generate robust findings on the distributional and poverty impacts of taxes and/or reform?*

Robust findings are quite hard to find, in part because for many countries or taxes only one or two methods have been used to examine redistribution, often adopting similar incidence assumptions. There is a dearth of comparable country studies. Two results do appear with some regularity:

- a) trade and sales taxes (e.g. VAT) may not be ‘regressive’ as typically found in early studies. This partly results from the deficiencies of early methods, and from the fact that numerous anomalies in these tax rates have been removed by reforms. Recent studies tend to find trade and sales taxes to be progressive, if only mildly. Since many reforms involve replacing trade taxes with VAT or similar sales taxes, an interesting issue is whether the ‘new’ taxes are more pro-poor. Results here seem to be country specific. In some studies VAT is more progressive than tariffs and/or excises, but the reverse is true in others. It seems that progressivity measures for these taxes are often very close so that ‘not much changes’ with this aspect of reform. Effects on the poorest of most such tax reforms are likely to be small.
- b) the most robust results appear to be the regressivity of fuel taxes such as kerosene and export taxes such as those on cocoa and coffee. While taxes on intermediates such as fuel are often thought to be regressive because they affect transport costs for the poor, evidence so far does not confirm this. Rajemison and Younger (2001) find that allowing for this effect does not make implicit transport taxes regressive in Madagascar, while Chen et al (2001) find, for Uganda, that progressivity is reduced but not reversed. This does *not* mean that the poor are not affected by these taxes – there can be sizeable effects – but they do not fall *disproportionately* on the poor.

In general, most evidence does not examine poverty effects of taxes directly, but focuses on broader inequality effects; at best, one can infer effects on the poor, on the assumption that more progressive taxes are more pro-poor. The general verdict for

Africa seems to be that expenditures are very unequally distributed, but taxes (with the exceptions noted above) have relatively little impact on this.

3. *Can, and should, tax systems be reformed to make them more progressive?*

The evidence suggests that some aspects of current tax systems in LDCs could be reformed to make them more progressive. The removal of highly regressive excises is one example, reducing the level and dispersion of trade taxes is another. However, some progressivity enhancing reforms would undoubtedly have distortionary effects and/or be administratively difficult. Great care needs to be taken in assessing (a) the potential extent of these; and (b) the necessary value judgements required before the required compromises can be recommended. As Chu et al (2000, p.37) put it: 'if the progressivity of the tax system were achieved at the cost of revenue, relative to the case of a neutral tax regime, the gains in redistribution on the tax side could be more than offset by the lost opportunities to use progressive expenditure policy instruments'. Where public expenditures can be targeted at the poor they are likely to provide a more potent, and less distorting, anti-poverty instrument than a highly non-proportional tax.

4. *How reliable are existing methods for assessing poverty impacts of taxation?*

There are now a variety of methods available. Tax progression studies are possibly the least reliable (at least, early versions) because they rely only on an examination of statutory tax rates. Shah and Whalley (1991) argue that 'traditional' incidence assumptions lead to misleading results for LDCs, especially for indirect taxes. But even using (close to) traditional assumptions, recent evidence is more supportive of 'mildly progressive' indirect taxes (more radical changes of incidence assumptions also produce this revision). It is therefore hard to make a judgement on the reliability of methods, but improving data availability is encouraging for empirical analysis. So long as data on such aspects as informal sector expenditures is limited it will be difficult to know how well these aspects are captured by current practice.

Chapter 6 suggested that existing methods can be used by economists engaged in policy advice provided care is taken to check sensitivity to assumptions wherever possible. Country-specific conditions must also be evaluated carefully. Younger (1996) provides a pertinent example in Ghana. He found that about 70% of the additional tax revenues achieved during the 1980s tax reform were accounted for by the highly

regressive cocoa export duty and petroleum excises. This might suggest reform was bad for the poor. However, cocoa farmers incomes rose during the reform and, before reform, an overvalued exchange rate meant that there was an implicit tax on exports (benefiting foreign importers rather than the government). When pre-reform taxes are adjusted to reflect this it turns out that reform actually *reduced* reliance on the regressive cocoa duty. This highlights the importance of considering implicit tax incidence carefully.

5. *Can tax reform contribute to a poverty-reducing growth strategy?*

The answer to this question is 'yes'. Existing evidence points to examples (even in tax systems that have undergone reforms) of taxes which either distort behaviour or adversely affect the poor or both. Reforming these taxes can help to facilitate growth and reduce poverty. Most export taxes seem to fall into this category. However in countries that rely heavily on export revenues to finance expenditures it will be important to ensure that revenue losses are avoided. If not, the adverse effects of the inflation tax on the poor will ensue. Equally important is the *type* of tax which replaces export revenues. If this is simply achieved by raising taxes which are regressive (such as some excises) on goods in inelastic demand, it may simply substitute adverse effects on one poor group to benefit another. Alternatively, if revenues are increased from progressive taxes, care must be taken not to distort incentives such that growth objectives are undermined.

In general, the role of tax reforms in Poverty Reduction Strategy Papers (PRSPs) should depend on how effectively poverty can be targeted by social expenditures. Where this is effective, it may be best to restrict tax policy to making the tax system no more than mildly progressive, but maximise its administrative and economic efficiency. In these cases, *approximate* tax neutrality is probably a reasonable policy. Over the longer term LDCs will have to raise their tax/GDP ratios if increases in poverty-reducing expenditures are to be financed from domestic rather than aid resources. This will require careful thought concerning which taxes should provide the additional resources, and this will vary from country to country. However, it seems that broad-based sales taxes such as VAT are not generally regressive in most LDCs, in part because of the use of exemptions and two or three tax rates. It is generally not desirable to make these taxes strongly progressive, but they can be designed to avoid

hurting the poorest. With reforms to regressive excises and tariffs, improvements in tax administration over time, and a readiness to expand income taxation as practicalities allow, tax reforms should be capable of delivering increasing revenues without adversely affecting the poorest. Finding ways of taxing richer producers in agriculture other than through export taxes (which seems to hurt poor farmers more) is one challenge for future tax reform. Greater use of rural property taxation may be an option that avoids excessive distortions, but this has proved politically difficult to implement in the past.

Policy Recommendations for Pro-Poor Tax Reform

In the light of the answers to the preceding five questions, and given the evidence reviewed in earlier chapters, there are a number of concluding recommendations to enhance the pro-poor potential of tax reform, so that the burden on the poor is reduced or, at least, not increased. While the general principle from standard theory for commodity taxes (sales and trade) is to levy a uniform rate (tax neutrality), we have argued that there good reason to deviate from this principle in LDCs. The first three recommendations refer to such deviations, the remainder are more general.

- Commodity taxes, both on sales and trade, should have few rates with a low dispersion. A simple sales tax is more appropriate than a complex VAT, and excises should be levied on an *ad valorem* rather than fixed charge basis. Tax rates should be higher on goods with inelastic demand as factors are not fixed, some sectors cannot be taxed directly and the range of tax instruments is limited.
- Commodity taxes can be made pro-poor by ensuring zero rates on goods that are consumed predominantly by the poor rather than the rich, and on activities that are engaged in predominantly by the poor. As the poor predominate in the informal sector, one would not tax informal sector activities, or complementary activities. Similar arguments apply to subsistence agriculture.
- A strong case can be made to subsidise the price of commodities that are consumed by the poor but not by the rich (e.g. kerosene, some staple foods). While there are well known problems of targeting subsidies accurately, the benefits to the poor are

likely to outweigh the possibility that some of the non-poor will benefit. This is the only recommendation that differs from standard IFI fiscal policy recommendations.

- Reducing the dispersion and average level of tariff rates is pro-poor, largely because tariff reductions lower taxes on intermediate inputs and reduce the effective taxation of agriculture.
- A more simple tax structure (fewer and lower rates) contributes to collection efficiency and economic efficiency. Economic efficiency is greater because relative price distortions are reduced. Collection is more efficient because simple taxes are easier to administer and the incentives to evade are less. Consequently, simplification of tax structures usually increases revenue.
- A relatively simple income tax is progressive. The threshold exemption is in effect a lump-sum transfer that provides for progression, while having few tax rates reduces the disincentive effects. However, income taxes are not incident on the poor, and are thus not a core element of a pro-poor tax reform strategy.

Sometimes the obvious can bear re-stating. In LDCs, especially the poorest, tax administration capacity is severely limited – staffing levels are low, wages are low, and resources are limited – while the culture of tax evasion is well-established. Simple tax reforms, and reforms that introduce more simple tax structures, are not only the most feasible, they are also likely to increase revenue. Political capacity to implement reforms is also weak, while domestic political opposition is likely to be strong (both from those facing increased taxes and from those losing protection as tariffs are reduced). The reform process itself introduces uncertainties that constrain implementation capacity and provides incentives for opponents of reform and would-be evaders to exploit. Aid support from donors, to ensure provision of public services and provide technical support for administering reforms, is a vital component of a successful reform programme.

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Annex 1 Two Tax Reform Examples: Kenya and Mauritius

Oliver Morrissey

This annex considers two different cases of tax reform: Kenya and Mauritius. Kenya is a 'lower middle income' African country (and one that appears to be moving towards 'low' rather than 'middle') that has a reputation for inconsistent compliance with successive adjustment programmes since the 1980s. Mauritius is one of the African successes, having implemented significant policy reforms and grown rapidly since the 1970s. Considering two such diverse examples permits us to draw out contrasting issues.

Kenya in 2000

A number of important trends in the composition of tax revenue and the implicit tax rates (revenue collected expressed as a percentage of the relevant tax base) for Kenya in the late 1990s are summarised in Table A1. Note a general tendency for the contribution of income taxes to decline (largely due to declining profits, hence less revenue from corporate profits tax), while the share of revenue from VAT increases (although food and agriculture are largely exempt). However, although the contribution of import duties would be expected to decline (as trade policy reforms include reducing import protection), this trend was reversed in the late 1990s (but is projected to be back on track in the early 2000's, heading back towards 16% of revenues).

The estimates of implicit taxes are instructive. Tariffs on inputs (basic materials, machinery and capital equipment) have been reduced, as have those on transport equipment, but tariffs on foods, beverages and fuels appear to have increased. This is noticeable in budgets, since 1998/99 measures have been introduced to raise duty rates on foods, agricultural produce and substitutes, to 25% in many cases, with suspended duties imposed on various fruits and vegetables. Although residual fuel duties were reduced, the tax revenue from fuel remains very high.

Kenya has been implementing a Tax Modernisation Programme since the mid-1980s, involving restructuring and rationalisation of rates, and measures to improve tax administration and increase collection efficiency. Many reforms have related to local

taxes, including property taxes, although these do not yet yield significant revenues. The efficiency of the system has been increased significantly, and distributional considerations are taken into account. The general approach has been to take a long-term perspective, with the view that higher growth rates are the best way to deliver poverty reduction and higher incomes. Thus, tax rates should not be so high as to discourage private sector activity. Furthermore, business profits are not a reliable source of revenue both because of declining profitability in recent years and because of the disincentive effects.

Given the importance of the agricultural sector to the economy, and the concentration of poverty in rural areas largely dependent on agriculture, the tax treatment of the agricultural sector has been an issue of major concern. The strategy has reflected twin objectives of assisting agricultural producers while minimising the taxation of food and other agricultural products. Basic foods (such as flour, bread and milk) are exempt from VAT. In general, farmers are exempted from tax registration and subject to indirect means of taxation. All unprocessed farm products (except coffee and tea) are VAT exempt. The principal agricultural inputs, such as fertilizers and seeds, are zero rated for VAT and exempt from import duties.

On the other hand, Kenya has chosen to use trade policy to protect farmers, notably through tariffs on imports of agricultural products, especially the major grains (maize, wheat, rice), milk, sugar, fruits and vegetables. The nominal protection on these items ranges from 25% up to maximum of 100% on sugar although, since October 2000, imports are duty free (in principle) from COMESA countries. While the motives for this protection policy are understandable, high tariffs are known not to be the best way to help achieve this. The predicament, for Kenyan policy and for the PRSP, is that most measures to increase agricultural output and incentives demand public spending (on improving transport and marketing, providing improved quality inputs and technology, and extension services).

Given the prevalence of poverty in poor areas, a pro-poor growth strategy would clearly include policies to support the development and increased productivity of the agricultural sector. Tariff protection can be helpful as a sector develops, but can also support, if not encourage, inefficiency in local production. 'The inward-oriented policies in the agriculture sector have led to the development of agri-processing

industries, the major branch of Kenya's manufacturing sector. Nevertheless, liberalization reforms have revealed the weaknesses of the intersectoral linkages and the lack of competitiveness of the manufacturing sector' (WTO, *Trade Policy Review Kenya*, 2000, p.51). It is important to determine why Kenyan agricultural producers feel that they face unfair competition from (some) imports. If the underlying problem is low levels of efficiency in Kenyan agriculture, farming and agri-processing, the appropriate intervention would be support at the production level. This would have implications for government spending.

A number of measures try to protect the poor from taxes. Unprocessed or basic foods, medical and health care items are generally exempted, but processed foods are taxed (these are mostly consumed by middle and higher income households). The poor generally derive their fuel needs from wood, charcoal and kerosene; the former are not taxed (but may be over-used) while the latter is lightly taxed. Taxes on petrol and diesel have not increased in line with the world price so that the effective tax rates on petrol and diesel have fallen significantly in recent years. Household's can consume basic electricity needs without paying VAT. The personal income tax allowance effectively exempts all low-income individuals (although it fails to capture all the taxable income of those actually liable).

In addition to the various agricultural products that are subject to high import duties, a number of other products that form a significant share of the expenditure budget of the poor are also subject to tariffs. Nominal duty rates are in the range of 30% to 40% for clothing and textiles, footwear, dry cell batteries (for radios, torches, etc), paper and paper products, soap, toothpaste, and most metal, plastic and wooden products. These goods are also subsequently subject to VAT. The high duty rate on clothing has encouraged a thriving market in used clothing imports (much of which is smuggled) that tends to benefit the poor; clothing prices have risen much slower than the general consumer price index in the 1990s. Thus, while some taxes increase the prices of goods that are important in the consumption bundles of the poor, there is limited scope to alter the tax structure in a pro-poor manner. Thus, the poor are largely sheltered from having to pay taxes on their incomes or on the goods they consume.

Mauritius in the 1990s

Mauritius avails of a wide range of taxes. To sketch the composition we take fiscal year 1990/91, when total tax revenue was some nine billion Rupees, as an example (see Morrissey, 2001). Income taxes contributed about 15 per cent of total tax revenue, in the rough proportion 60:40 between corporate and individuals, while social security contributions and payroll taxes added about another five per cent. Domestic taxes on goods and services contributed about a quarter of revenue, in rough proportions 40:40:10:10 between excise duties, sales taxes, taxes on gambling and on hotel bills. Trade taxes contributed 52 per cent of tax revenue; 90 per cent of which is from tariffs (and export taxes were abolished from 1994/95). The only other major tax is that on property, which contributes just less than seven per cent of total tax revenue. Non-tax revenues were equivalent to five per cent of tax revenue and came mostly from property income, fees, charges and non-industrial services.

A number of general trends are apparent in Mauritius. First, and perhaps foremost, the country is becoming progressively less reliant on trade taxes, which have declined as a share of tax revenue from about 60 per cent throughout most of the 1980s, to 50 per cent in the early 1990s and tending towards 40 per cent in the late 1990s. About half of this decline is attributable to the reduction and then abolition of export taxes, but tariffs' contribution to revenue also seems to be declining. This dependence on trade taxes implies relatively high levels of effective protection and has adversely affected resource allocation. Such trade taxes increase the degree of economic inefficiency in the tax system.

Although nominal tax revenue almost quadrupled between 1985 and 1995, real tax revenue, as indicated by the tax/GDP ratio, rose only slightly from 20 to about 22 per cent (there is an one-off fall in tax revenue in 1994/95, apparently associated with the abolition of export taxes). This is consistent with rising national income, and arguably the aggregate tax take is about right. Domestic taxes on goods and services are becoming an increasingly important source of revenue, from just over a fifth of tax revenue in the early 1980s to almost one third by the late 1990s. This trend is likely to continue under the VAT. Part of this increase may reflect replacing tariffs with sales taxes, which would generally imply a reduction in economic inefficiencies associated with the tax system.

Contributing about 15% of revenues the income tax in Mauritius can potentially contribute more to redistribution than in most African countries. Table A2 provides some data on the progression of the individual income tax system in Mauritius for 1992/93 compared with 1994/95 (for illustrative purposes). Three points are worth making. First, the overall *ATR* (on the tax base of gross income) falls slightly to just above seven per cent (allowances and bands probably increased by more than income). Subsequently, changes to the income tax structure suggest that the *ATR* will have increased, perhaps to eight per cent by 1997/98. Second, for both years there are anomalies in the data: the apparent *ATR* is relatively high for those earning Rs20-40,000 in 1994/95, and there is almost certainly some misallocation to the Rs100-250,000 range from adjacent ranges. (The pattern for 1992/93 is what would be expected and is similar to the patterns for 1991/92 and 1993/94 (not shown)). Third, there is a discernible degree of progression: the *ATR* rises from around 2% to 18%; and, given an *MTR* of around 30%, Liability Progression in 1992/93 was roughly 3.9 and in 1994/95 was almost 4.2. This also implies potential buoyancy in the income tax: as incomes rise, tax revenue should rise more than proportionally, suggesting scope for income tax to be an increasingly important source of revenue.

The tax system in Mauritius therefore has a number of merits. Income tax appears relatively equitable, demonstrating progression, and is relatively simple. The principal anomaly lies in the special treatment of agricultural incomes, especially those in the sugar sector. The introduction of VAT to replace Sales tax will have transitional costs but should ultimately lead to more efficient (economically, and in terms of collection) and buoyant taxation of domestic goods and services. Further moves to reduce and rationalise tariffs should promote simplicity, economic and collection efficiency; while the elimination of taxes on exports removes one major distortion. Overall, the changes to the tax system can be regarded as moving it towards a more desirable structure, but much remains to be done.

Table A1 Kenya: Tax Revenue and Implicit Tax Rates, 1995-2000

	1995/96	1997/98	1999/00
<i>Components (% of total taxes)</i>			
Income tax	39.2	38.2	36.1
VAT (domestic)	12.0	12.2	13.7
VAT (imports)	11.1	11.5	11.1
Import duties	17.3	16.9	18.5
Excise Duties	18.4	19.5	18.9
<i>Implicit Tax Rates (% of base)</i>			
<i>Import Duties</i>			
Food and beverages	20.2	17.7	29.0
Basic materials	2.8	1.5	2.3
Fuels	18.6	14.3	20.8
Transport Equipment	19.3	13.2	12.0
Machinery & equipment	14.0	9.2	9.6

Notes: Data from *Economic Survey 2000*: 1995/96 actual, 1997/98 provisional and 1999/00 estimates. *Implicit tax rates:* for import duties, calculated under each heading as value of import duty relative to value of imports; income tax revenue expressed as a proportion of total public and private wage earnings.

Source: Republic of Kenya *Economic Survey, 2000*; Nairobi: CBS and MFP; and own estimates.

Table A2 Mauritius: Progression of the Income Tax, 1992/93 and 1994/95

1992/93			
<i>Gross Income Range (Rs '000s)</i>	<i>Gross Income</i>	<i>Tax Paid</i>	<i>Average Tax Rate</i>
< 20	5.2	0.1	1.92
20 - 30	9.8	0.3	3.06
30 - 40	69.0	1.7	2.46
40 - 50	184.9	4.0	2.16
50 - 100	2060.0	69.4	3.37
100 - 250	3063.1	215.5	7.04
250 - 500	854.7	116.8	13.67
> 500	790.6	136.3	17.24
TOTAL	7037.3	544.1	7.73
1994/95			
<i>Gross Income Range (Rs '000s)</i>	<i>Gross Income</i>	<i>Tax Paid</i>	<i>Average Tax Rate</i>
< 20	0.6	0	0.00
20 - 30	0.6	0.1	16.67
30 - 40	0.8	0.1	12.50
40 - 50	108.6	0.3	0.28
50 - 100	2320.1	38.3	1.65
100 - 250	388.5	235.1	60.51
250 - 500	1225.1	155.0	12.65
> 500	1051.5	187.6	17.84
TOTAL	8595.8	616.5	7.17

Source: Derived from Table 6.1 in *Digest of Public Finance Statistics 1992-1996*, Port-Louis, Mauritius: Central Statistics Office

Annex 2 Demand And Welfare Effects Simulator

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1 Introduction

This annex describes a set of computer programs that are designed to examine the welfare effects of price changes, allowing for consumers' demand responses. The programs are described in terms of the general title: Demand And Welfare Effects Simulator - DAWES.

It is possible to examine the effects of a specified set of proportional price changes on the compensating and equivalent variations of each household in the Household Expenditure Survey (HES), along with the distribution of 'equivalent incomes' (money metric welfare measures). Alternatively the welfare changes at alternative specified levels of total expenditure can be obtained. The price changes apply to the commodity groupings used by the HES. The price changes may arise for a variety of reasons - DAWES only requires the proportionate changes to be specified. If the price changes arise from indirect taxes, or changes in indirect taxes, it is also possible to compute tax rates that are revenue-neutral in aggregate.

Section 2 describes the analytical framework of analysis used. The various programs and their associated data files are described in section 3.

2 The Modelling Framework

This section describes the way in which household demands are modelled and the calculation of equivalent and compensating variations.¹ The framework is one in which the total expenditure of each household is assumed to remain fixed when prices of goods and services change; hence direct taxes and transfers are not modelled and only the demands for goods vary in a partial equilibrium, rather than a general equilibrium, context. Thus, possible changes in production (associated with the changing structure of demands) and consequently factor prices and the distribution of income are ignored.

2.1 Prices, Demands and Indirect Tax Changes

Consider a single individual (or household) and let x_i and p_i denote the consumption and price respectively of good i , for $i = 1, \dots, n$: If y is total expenditure, then in general the demand functions can be expressed as $x_i =$

¹For further details, see Creedy, J. (1998) Measuring the welfare effects of price changes: a convenient parametric approach. Australian Economic Papers, 37, pp. 137-151.

$x_i(p_1, \dots, p_n, y)$: Holding y constant and differentiating the demand for good i with respect to the prices gives:

$$\frac{\dot{x}_i}{x_i} = \sum_{j=1}^n e_{ij} \frac{\dot{p}_j}{p_j} \quad (1)$$

where the dots indicate proportionate changes and e_{ij} is the elasticity of demand for i with respect to a change in the price of good j . If $w_i = p_i x_i / y$ is the budget share of the i th good, the new level of expenditure on that good, m_i , is therefore expressed as:

$$m_i = y w_i \left(1 + \sum_{j=1}^n e_{ij} \frac{\dot{p}_j}{p_j} \right) \quad (2)$$

If price changes are considered to arise from changes in indirect taxes, Suppose that the tax-exclusive ad valorem tax rate imposed on good i is denoted t_i . This gives rise to a tax-inclusive rate of $t_i = (1 + t_i)$. The revenue, R_i , from the indirect tax is therefore:

$$R_i = m_i \frac{t_i}{1 + t_i} \quad (3)$$

If, for example, t_i is increased by ϕt_i ; the resulting proportionate increase in the price of the i th good is given by:

$$\frac{\dot{p}_i}{p_i} = \frac{\phi t_i}{1 + t_i} \quad (4)$$

Given the budget shares, w_i ; total expenditure, y ; and a set of price elasticities, e_{ij} ; it is therefore possible to use (2) to calculate the new expenditure levels resulting from a set of price changes, \dot{p}_j . The above results are completely general, but in practice it is necessary to make a number of assumptions in order to compute the required price elasticities of demand for each household. The approach is described in the following section.

2.2 Demand Elasticities

Households are divided into a number of groups, according to their total expenditure. Each household within a specified total expenditure group is assumed to have identical preferences, described by the Linear Expenditure System (LES). However, tastes differ between groups by allowing the parameters of the utility functions to vary with total expenditure. For the linear expenditure system in total expenditure group, k , the direct utility function is:

$$U = \prod_{i=1}^n (x_{k;i} \cdot \alpha_{k;i})^{-\beta_{k;i}} \quad (5)$$

with $0 < \beta_{k;i} < 1$; $\alpha_{k;i}$ is the committed consumption of good i ; and $\prod_{i=1}^n \beta_{k;i} = 1$: Each of the parameters, $\beta_{k;i}$ and $\alpha_{k;i}$ have an additional subscript, k ; to allow them to vary with y_k .

For the LES, the own-price elasticity of demand for the i th good, e_{kii} ; in total expenditure group k ; is:

$$e_{kii} = \frac{\beta_{k;i} (1 - \beta_{k;i})}{x_{k;i}} \quad (6)$$

The cross-price elasticity, e_{kij} , that is the elasticity of demand for good i in response to a change in the price of good j ; in total expenditure group k ; is:

$$e_{kij} = \beta_{k;i} \frac{\alpha_{k;j}}{x_{k;j}} \frac{w_{k;j}}{w_{k;i}} \quad (7)$$

where $w_{k;i} = p_i x_{k;i} / y_k$ is the expenditure or budget share of the i th good. The total expenditure elasticity of good i ; $e_{k,i}$; is:

$$e_{k,i} = \frac{\beta_{k;i} y_k}{p_i x_{k;i}} = \beta_{k;i} w_{k,i} \quad (8)$$

Households in the HES are thus divided into separate total expenditure groups, and within each group, k ; average budget shares for each commodity, $w_{k,i}$; are computed. For $k = 1, \dots, K$ total expenditure groups, this gives rise to a rectangular matrix, $w_{k,i}$; of budget shares, with K rows and n columns. Comparisons between adjacent expenditure groups gives a matrix of total expenditure elasticities, using $e_{k,i} = 1 + \frac{w_{k,i} - w_{k-1,i}}{w_{k,i}}$ (where the dots actually indicate discrete changes from group $k-1$ to k).

The $e_{k,i}$ are then used to calculate the $\beta_{k,i}$ from (8) using $\beta_{k,i} = w_{k,i} e_{k,i}$: Given own-price elasticities of demand for each good at each income level, equation (6) can be used to give $p_i \alpha_{k,i}$. The own- and cross-price elasticities are first obtained using a property of directly additive utility functions. It can be shown that:

$$e_{kij} = \beta_{k;i} \frac{\alpha_{k;j}}{x_{k;j}} \frac{w_{k;j}}{w_{k;i}} \quad (9)$$

$$e_{kii} = \beta_{k;i} \frac{1}{w_{k,i}} \left(1 + \frac{\alpha_{k,i}}{x_{k,i}} \frac{w_{k,i}}{w_{k,i}} \right) \quad (10)$$

In these expressions, η_k denotes the elasticity of the marginal utility of total expenditure with respect to total expenditure in group k, the 'Frisch parameter'. The specification used to describe the variation in η_k with y_k is:

$$\log(\eta_k) = \alpha + \beta \log(y_k + \mu) \quad (11)$$

This method produces kn^2 own-price and cross-price elasticities of demand, since there is an $n \times n$ matrix for each k. In view of the fact that the parameters, α , β and μ are imposed by the user, rather than being estimated, it is useful to carry out sensitivity analyses.

2.3 Prices and Welfare Changes

Defining the terms A and B respectively as $\sum_i p_i^0 q_i$ and $\sum_i (p_i^1 / p_i^0)^{-1} q_i$; where the k subscript has been dropped for convenience, the indirect utility function, $V(p; y)$, is:

$$V = (y - A) / B \quad (12)$$

The expenditure function, $E(p; U)$; is found by inverting (12) and substituting E for y to get:

$$E(p; U) = A + BU \quad (13)$$

Suppose that the vector of prices changes from p_0 to p_1 . The equivalent variation, EV, is $EV = E(p_1; U_1) - E(p_0; U_1)$: Substituting for E using (13) and assuming that total expenditure remains constant at y; gives:

$$EV = y - (A_0 + B_0 U_1) \quad (14)$$

Substituting for U_1 ; using equation (12); into (14) and rearranging gives:

$$EV = y - A_0 \left[1 + \frac{B_0}{B_1} \frac{y - A_1}{y - A_0} \right] \quad (15)$$

The term A_1/A_0 is a Laspeyres type of price index, using q_i s as weights. The term B_1/B_0 simplifies to $\sum_i (p_{1i}/p_{0i})^{-1} q_i$; which is a weighted geometric mean of price relatives. These two terms can be expressed in terms of the p_i s.² Suppose that all prices change by the same proportion. Rearrange (15) to get $EV/y = (1 - B_0/B_1) + (A_0/y) f(B_0/B_1) (A_1/A_0) - 1/g$ and note that if $p_i = p_i^0 (1 + \underline{p}_i)$; $B_1/B_0 = A_1/A_0 = 1 + \underline{p}$:

²Since $p_{1i} = p_{0i} (1 + \underline{p}_i)$; and defining $s_i = p_{0i} q_i / \sum_i p_{0i} q_i$; it can be shown that $A_1/A_0 = 1 + \sum_i s_i \underline{p}_i$ and $B_1/B_0 = \sum_i (1 + \underline{p}_i)^{-1} s_i$:

2.4 Equivalent Incomes

Equivalent income is defined as the value of income, y_e , which, at some reference set of prices, p_r , gives the same utility as the actual income level. In this context, income and total expenditure are treated as synonymous. In terms of the indirect utility function, y_e is therefore defined by $V(p_r; y_e) = V(p; y)$: Using the expenditure function gives:

$$y_e = E(p_r; V(p; y)) \tag{16}$$

For the linear expenditure system, this is found to be:

$$y_e = \sum_i p_{ri} \alpha_i + \sum_i \frac{\bar{A}_i}{p_i} \left(\sum_j y_j \frac{p_j \alpha_j}{p_i} \right) \tag{17}$$

The effect on welfare of a change in prices and income can be measured in terms of a change in equivalent incomes, from y_{0e} to y_{1e} , where, as before, the indices 0 and 1 refer to pre- and post-change values respectively. An important feature of equivalent income is that it ensures that alternative situations are evaluated using a common set of reference prices. If pre-change prices are used as reference prices, so that $p_{ri} = p_{0i}$ for all i ; the post-change equivalent income is the value of actual income after the change less the value of the equivalent variation; that is, $y_{1e} = y_1 - EV$.

3 The DAWES Suite of Programs

3.0.1 Program: DAWES_M.EXE

This takes budget shares for a range of income (total expenditure) groups and calculates compensating and equivalent variations in each group for a set of price changes.

INPUT: The following input files are required

- 2 SHARES: The first line gives the number of income groups used. The remainder contains, for each income group, the budget shares for each commodity group. This is presented in two 'blocks', whereby the first block gives the shares for the first 7 commodity groups, the second block gives the shares for the last 7 groups;
- 2 EXPEND: this contains the midpoints of the expenditure groups;
- 2 FRISCH: this contains one line giving the parameters of the function $\log(y_k + \mu) = \sum_j \beta_j \log(y_k + \mu)$: Give β_j ; μ ; followed by the minimum absolute Frisch value;

² PRICES: this contains the proportionate price changes

3.0.2 Program: DAWES_Y.EXE

This is the same as DAWES_M.EXE but instead of providing the welfare changes for the midpoints given in EXPEND, it uses a set of values (with \$100 intervals). The same input files are used with the addition of UPPER, which contains the upper limits of the income classes used.

3.0.3 Program: DAWES_R.EXE

In the context of a change in the indirect tax structure, this program calculates the set of tax rates required to produce a specified revenue, where the revenue figure may be taken from the output from running DAWES_M.EXE for a given set of tax rates.

This program uses the same input files as used for DAWES_M.FOR, except that instead of PRICES, the input file INREV is required. This contains:

$t_1; \dots; t_{14}$	initial 'trial' values used for tax rates
R	required revenue (from running LESEV for direct taxes)
$c_1; \dots; c_{14}$	$c_i = 0$ if the i th tax rate is not to be adjusted $c_i = 1$ if the i th tax rate can be adjusted

3.0.4 Program: DAWES_H.EXE

This uses information about the total expenditure of each of a large number of households, taken from the HES, and produces the distribution of equivalent income following a specified set of proportional price changes.

INPUT: the files, SHARES, EXPEND, FRISCH, PRICES and UPPER, as describe above, are required. In addition, the file HEXP.DAT contains the total expenditure data for the households. The first line gives the number of households; then simply list the expenditure values. The equivalent income values are placed in the file INLORZ, which can be used with the following program.

3.0.5 Program: GINI.EXE

This uses INLORZ, generated by DAWES_H.EXE, in order to calculate generalised Gini, $G(v)$; and Atkinson, $A(\alpha)$; inequality measures and associated abbreviated social welfare function values.

INPUT: in addition to INLORZ, the file INGIN contains one line giving " α "; " β " and " ϕ "; the initial, final and incremental value of inequality aversion

for use with the Atkinson measure. The values used for v are $\frac{1}{2}$; and so on.