

The Practicality of the Top-Down Approach To Estimating the Direct Tax Gap

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I. Scope and Key Concepts

Scope of Paper

The paper evaluates the top-down approach to direct tax gaps. It tackles two distinct issues:

- The practicality of estimating entire direct tax gaps top down; and
- The contribution of top-down methods to elements of the direct tax gap.

The focus of the paper is on UK corporate and personal taxes, corporation tax, income tax and capital gains tax, and national insurance contributions. The paper covers relevant experience in other countries, and draws some conclusions that apply beyond the UK.

Key Concepts

The tax gap is the difference between the tax collected and the tax that would be collected if all individuals and companies complied with both the letter and the spirit of the law. The letter of the law is the literal interpretation of tax legislation. The spirit of the law is the intention of Parliament in legislating on tax. In contrast to the letter of the law, which implies a literal legal interpretation of tax liability, the spirit of the law implies a purposive interpretation.

The *top-down approach* is based on a single estimate of the tax base from which a theoretical tax liability is calculated. *Theoretical liability* is the tax that would be collected if all individuals and companies complied with both the letter and the spirit of the law. The tax gap estimated top down is the difference between theoretical liability and total tax collected.

The alternative to the top-down approach is the bottom-up approach. The bottom-up approach builds a total tax gap from estimates of components of the tax gap. The components for the UK are estimated using tax information, random enquiries, risk registers and data matching.

For the direct taxes covered by this paper the tax base is taxable income. Top-down methods, however, do not estimate taxable income. They estimate a total for income that also includes underground production or the shadow economy.

Underground production would be legal, but the income from underground production is not declared to public authorities and, as a result, it is not included in the primary sources used to compile the national accounts.¹

The shadow economy includes, in addition to underground production, illegal production, such as smuggling.

Under-declared income is the income that should be declared to the tax administration, but is not. It includes both income under-declared on a tax return and income not declared because a tax return that should be submitted is not submitted.² In the UK, and other countries where the primary sources used for the income

in the national accounts largely reflect tax administration data, the income from underground production is under-declared income.

II. Requirements, Advantages and Disadvantages of the Top-Down Approach

Introduction

The top-down approach has two basic requirements:

- (i) suitable information on the tax base; and
- (ii) a calculation of theoretical liability.

This section discusses these basic requirements and the suitability of UK data for top-down direct tax estimates. It also discusses the pros and cons of the top-down approach relative to the alternative bottom-up approach.

Suitable Information

Information on the tax base is only suitable if it is both independent of the tax administration and sufficiently reliable. Information that is not independent of the tax administration, such as national income based on aggregating administration data, does not give the administration new knowledge. A top-down estimate based on aggregated administration data would do more than approximate a bottom-up estimate that the administration could make from the disaggregated data.

The income information in the UK national accounts generally meets the requirement of sufficient reliability. The required reliability does depend on the size of the tax gap and could be an issue where the tax gap is small. The main issue, however, with the UK national accounts is their dependence on HMRC data, a much more fundamental problem than reliability.

The personal, mixed and corporate income statistics in the UK national accounts are largely based on an aggregation of HMRC data.³ In contrast, the information in the national accounts on consumption, the tax base for indirect taxes, which is derived from consumer surveys, is independent of HMRC and suitable for tax gap estimates and as such is used by HMRC to estimate the VAT gap.

Any estimate of national income that includes the shadow economy, or rather underground production, can be used to calculate theoretical liability and the tax gap. In principle all methods that estimate the shadow economy can be used for tax gap estimates. The issue with methods of estimating the shadow economy is reliability. In addition national income does not provide a complete measure of the direct tax base. Also, macro model methods provide only aggregate information on total income without any indication of how much income is subject to corporate and how much to income tax.

Calculation of Theoretical Liability

Theoretical liability is more difficult to calculate for direct taxes than for indirect taxes. Individual circumstances are crucial for direct tax liability, which depends on various reliefs and allowances. In addition tax rates vary with income. For indirect taxes, in contrast, liability generally depends on the value or volume of sales. The tax liability on sales does not generally depend on the circumstances of the individual businesses making the sales.

The key difference between direct and indirect tax theoretical liability is that direct tax liability requires much more information than indirect tax liability, which can generally be calculated from total sales. A calculation of direct tax liability requires, in addition to total income, sufficient information on individual circumstances to calculate the total allowances and reliefs available and the overall distribution of income.

In addition direct tax theoretical liability depends on the reliefs and allowances that would be claimed without avoidance. The available information on reliefs and allowances, which comes from tax records, is on

claims against declared income and does not indicate the reliefs and allowances that could be claimed without avoidance against total income, including under-declared income.

The difficulty of calculating theoretical liability is particularly acute for corporate tax. Reliefs and allowances are more important than for personal tax. Also, HMRC estimates suggest that avoidance is a larger share of the UK corporate tax gap than it is of the personal tax gap.⁴ For these reasons information on total income produced by the top-down approach gives even less indication of theoretical tax liability for corporate tax than for personal tax.

Pros and Cons of the Top-Down and Bottom-Up Approaches

An assessment of the top-down approach must consider the relative merits of the alternative bottom-up approach. The main advantages of the top-down approach are:

- it gives a single estimate;
- it is based on sources independent of the tax administration;
- it produces timely estimates; and
- it requires few resources.

The main disadvantage is the uncertainty of top-down estimates. Uncertainty is also a problem of bottom-up estimates. However, uncertainty reduces the advantage of the single estimate given by the top-down approach. Indeed, uncertainty is such a serious problem that it can render top-down estimates meaningless.

Uncertainty is inherent to the top-down methodology, which estimates a relatively small number by subtracting one large number, the tax actually paid, from another large number, the tax theoretically due. The smaller the tax gap the greater, relative to the size of the tax gap, is the uncertainty inherent to top-down estimates.

For the bottom-up approach uncertainty is less of a problem. The bottom-up approach does not depend on the value of a single estimate. It gives estimates, which are often broken down into considerable detail, of each component of the tax gap. Uncertainty is much less of an issue for some components than for others.

With the exception of most payroll taxes, such as UK national insurance contributions, the tax base for direct taxes is broader than the income estimated by the top-down approach.⁵ The tax base includes interest, capital gains and, for corporate tax, significant other non-trading taxable income. The single top-down estimate only covers the tax gap related to employees' earned income and corporate trading income. The top-down approach does not cover the entire direct tax gap. To give an entire tax gap income estimated top down has to be adjusted to taxable income. The adjustment, which requires considerable extra information, is problematic.⁶ Indeed, the difficulty of making the adjustment with any degree of reliability may be such that the top-down approach is only capable of giving the part of the direct tax gap that relates to employee compensation and trading profit.

The top-down approach is better suited to providing a broad measure of the main elements of a large tax gap than to estimating an entire small tax gap. A small tax gap requires more precision and, also, the adjustment to taxable income is likely to cover a larger part of the total tax gap.

While the bottom-up approach, like the top-down approach, provides only an uncertain estimate of the total tax gap, it has the important advantage of providing operationally useful information. The detailed tax gap breakdown required for a bottom-up approach enables better prioritisation of compliance resources to maximise tax collection.

The useful information provided by a bottom-up approach does require significant resources, for example, random enquiries. Yet, the limited resources required by the top-down approach do not constitute a real advantage over the bottom-up approach. The useful information provided by the bottom-up approach can justify much of the required resources even without a tax gap estimate.

For HMRC, which is already obtaining the information necessary for a bottom-up estimate of the direct tax gap, the issue is the value that the top-down approach can add to the established bottom-up approach.

Any added value depends on the reliability and comprehensiveness of estimates produced by the top-down approach. The reliability of the top-down approach, particularly macro model methods, is highly questionable.

III. The UK Direct Tax Gap and Under-Declared Income

HMRC Tax Gap Estimates

HMRC estimates a tax gap for different components of the tax gap and adds these together to give a total tax gap for direct taxes, indirect taxes and all taxes (Measuring **Tax Gaps** 2010). The estimated total tax gap in 2008/9 is £42bn, almost 9 percent of the tax due, and the direct tax gap (which includes taxes such as stamp duties not covered in this paper) is £22.5bn. Table 1 below gives the estimates for the direct taxes covered by this paper.

TABLE 1. HMRC Estimates of the Direct Tax Gap, 2008/9

Taxes	Tax Gap	Gap as % of Tax Due
Income tax, National insurance contributions, Capital gains tax	£14.5bn	5.4%
Corporation tax	£6.9bn	13.9%

The bottom-up methodology used for the direct tax gap does not allow more than a rough approximation of under-declared income. Under-declared income cuts across most components of the tax gap, including evasion, the failure, in order fraudulently to pay less tax, to declare income that should be declared or to provide accurately other required information. Fraudulent non-declaration of income, of course, forms part of under-declared income, but fraudulent provision of inaccurate information, for example, to claim greater reliefs or allowances, does not. The tax gap arises from overstated expenses and improper claiming of allowances as well as from understated income.

For income tax, national insurance contributions and capital gains tax (hereafter IT, NIC and CGT) £6.6bn, close to half the total direct tax gap is due to inaccurate income tax self-assessment returns. The next largest component is estimated to be the 'hidden economy', the tax loss due to ghosts, moonlighters and individuals with unearned income who are not in self assessment, where the gap is £3.4bn. Inaccurate returns from employers, who are responsible for collection of personal tax from employees as well as payment of employer national insurance contributions, add a further £3.2bn to the gap. Together, the three components total £13.1bn.⁷

Much of the tax gap for IT, NIC and CGT, which is £14.5bn, is due to under-declared income. For the corporation tax gap, which is £6.9m, under-declared income is much more important for small and medium businesses than for large businesses.⁸ For the largest businesses the main tax gap issue is avoidance, for which under-declared income is relatively unimportant. Avoidance accounts for £3.6bn of the estimated £4.3bn corporation tax gap for large businesses.

ONS Adjustments and Under-Declared Income

The Office for National Statistics (ONS) makes adjustments to include under-declared income in the national accounts. These adjustments aim to make estimates of national income, and other estimates, such as data in the sector accounts, comprehensive.

In terms of the components of the tax gap, the ONS adjustments correspond to most evasion, the hidden economy and the net tax gap due to errors and failure to take reasonable care. The adjustments affect each of the three types of factor income in the national accounts, employee compensation, mixed income and operating surplus. Mixed income roughly corresponds to self-employed trading profit and operating surplus to company trading profit.⁹

The adjustments provide only an indication of the under-declared income. The uncertainty around the adjustments is small relative to national income, but it is very large relative to under-declared income. The ONS does not estimate under-declared income as such, but its adjustments provide an implicit estimate.

Table 2 shows the three types of factor income, and total factor income, in the 2009 national accounts, the adjustments and the implicit under-declared income.

TABLE 2. 2009 National Accounts Income Adjustments and Under-Declared Income

Factor Income	Total	Adjustment (%)	Implicit Under-declared Income
Employee compensation	£770bn	0.25 percent	£1.9bn
Mixed income	£84bn	23.3 percent	£19.6bn
Gross operating surplus	£386bn	0.18* percent	£0.7bn
Total income	£1,240bn	1.9 percent	£22.2bn

* The ONS adjustment is to just one component of gross operating surplus, the surplus of private non-financial corporations. This adjustment is 0.3 percent of net trading profit.

The under-declared income implicit in the national accounts at first appears low relative to HMRC's tax gap estimates. The tax due on the £21.5 billion implicit undeclared employee compensation and mixed income is significantly less than the £13.1 billion IT, NIC and CGT tax gap excluding avoidance. However, the tax gap after exclusion of avoidance is not all due to under-declared income.

The value of the implicit under-declared income figures is not the absolute levels, but the relative levels. Under-declared income is a much greater direct tax gap issue for the self-employed than for employees, whose tax is mainly deducted at source, or companies. Also, it is more of an issue for small rather than large businesses.

IV. Top-Down Methods

Introduction

Top-down methods of estimating direct tax gaps fall into three groups, according to their source of information on the tax base. The groups are:

- The national accounts, which give information on the operating surplus of corporations, employee compensation and the 'mixed income' of the self-employed;
- Macro models, which give a single estimate of national income; and
- Micro methods, which use surveys to estimate household income or the labour force.

Table 3 lists the three groups of methods and the eight top-down methods of estimating the direct tax gap, or major elements of the gap.

TABLE 3. Top-Down Methods

A) Methods based on the national accounts
1) Calculation of theoretical liability from income
2) Discrepancy using the income measure of GDP
B) Macro model methods
3) Monetary methods
4) Other single indicator methods
5) Latent variable method
C) Micro methods
6) Discrepancy in labour force measures
7) Direct surveys of households
8) Discrepancy between reported income and income inferred from spending

The rest of this section outlines and assesses the various methods, and also looks at the use of the methods other than by tax administrations. Section V looks at how tax administrations use the methods and Section VI discusses the practicality of using the methods in the UK.

National Accounts Methods

National accounts methods are based on factor incomes, the compensation of employees, mixed income and gross operating surplus, which are the main components of GDP. There are two methods. Method 1 calculates total tax theoretical liability from factor income. Method 2 uses the discrepancy between factor income and some other measure of income.

The value of the methods depends on the comprehensiveness of the national accounts. The information national statistical institutions (NSIs) need to ensure comprehensiveness is similar to that needed by tax administrations to estimate a tax gap. Some NSIs undertake considerable work to estimate under-declared income in sectors where non-declaration of income that should be declared is a particular problem.¹⁰

In Italy the NSI uses a labour input method, considered here as a micro method, Method 6. Since the national accounts are based on surveys, the distinction between national accounts and micro methods may seem artificial. The difference between the methods is that the national accounts methods use aggregate factor incomes whereas the micro methods use results from surveys, which do not generally contribute to the national accounts.

Conversion of National Accounts Data to Taxable Income

A critical problem for both Methods One and Two is converting national accounts income measures to taxable income. The USA illustrates the difficulty of converting national accounts employee compensation to taxable income.¹¹ Until recently the Bureau of Economic Affairs (BEA), the US NSI, adjusted its personal income statistics to make them comparable to the IRS's adjusted gross income (AGI), a measure of taxable income, by, for example, excluding non-taxable income and including benefits, capital gains and pensions.

In 2005, the last year for which the adjustment was done, an unexplained gap of \$778bn, or 8.9 percent of the adjusted BEA measure remained after "all known and measurable statistical and definitional differences", including a "misreporting adjustment" of \$508bn for income not declared to the IRS (under-declared income plus income that did not need to be declared). The unexplained gap is attributed to "known definitional differences that cannot be estimated, statistical discrepancies, data sampling and nonsampling errors, use of different source data for AGI and for personal income, incomplete source data, timing anomalies, and other unknown factors." These reasons, along with "immeasurable sources of tax-exempt income" mean the unexplained gap "is not a proper measure of non-compliance" (Ledbetter, 2007, in a BEA journal).

The "misreporting adjustment" for under-declared income is based on IRS tax gap estimates. The unexplained gap could include some under-declared income missing from IRS estimates. However, the BEA's explanation of the unexplained gap means that national accounts methods are not applicable to income tax in the USA. An attempt to apply Method 1 would simply add the tax theoretically due on the unexplained gap, which is not a measure of non-compliance, to IRS tax gap estimates. Method 2 would include the unexplained gap in the discrepancy used to calculate theoretical liability.

The conversion of employee compensation in the national accounts to income that should be declared to the tax administration may not be as difficult in other countries as in the USA. However, in all countries there must be an issue of whether the "unexplained gap" after all possible adjustments is a measure of non-compliance.

For corporate tax the adjustments required to convert operating surplus in the national accounts to taxable income are more difficult than the adjustments for personal income.¹² Gross operating surplus and taxable income are quite distinct concepts.

For a payroll tax gap, such as the national insurance gap, national accounts methods may be more applicable. The base for payroll taxes is usually closer to the employee compensation in the national accounts than the income

tax base. The OECD in its 2004 Employment Outlook used Method 1 to calculate “shortfalls in receipts” of compulsory social security contributions for 27 member countries, including the UK. The NIC tax gap of 20 percent, or more, calculated for the UK was discounted, because of a “relatively simplistic” calculation that did not account of the lower contribution rates for “contracted out” employees and some married women.

Employment Outlook did not discuss the dependence of national accounts data on tax administration data.¹³ However, the OECD Secretariat has agreed in private correspondence that where, as in the UK, the national accounts are based on tax administration data and include an estimate of under-declared income, the estimate is the best measure that can be derived from the national accounts.

Use of Method 2 by National Statistical Institutions

Method 2 uses the discrepancy between income in the national accounts and the income given by some other source. In the UK the ONS did, over thirty years ago, use the initial residual discrepancy (IRD) between the initial expenditure and income measures of GDP as a measure of the shadow economy. MacAfee (1980) found a “glimpse” of the UK shadow economy in the IRD, which was 3.3 cent of GDP in 1978.

The idea here is that the surveys of consumer expenditure used for the expenditure measure include under-declared income when it is spent. The initial income measure does not include under-declared income.

Unfortunately, the IRD only permits a glimpse of the shadow economy through a very dark glass. The UK IRD fell sharply from 1978, becoming negative in the mid-1980s. A study by the Rockwool Foundation of Denmark concluded, “IRD can probably only be interpreted as a reflection of random fluctuations in the underlying statistics used to estimate GDP.” While subsequent revisions to the national statistics mean that the UK IRD was not actually negative, the apparent absence since the 1980s of any use of the IRD as a measure of the UK shadow economy indicates widespread acceptance of this conclusion.

The IRD does not provide a reliable measure of the UK shadow economy. It is of no value for work on the tax gap.

Where the national accounts are independent of the tax administration, Method 2 can use the discrepancy between the final measure of income in the national accounts and the income declared to the tax administration. Statistics Netherlands has used this version of Method 2 to estimate under-declared income.¹⁴ The NSI’s work highlights the limitations of the Method.

The net adjustments to convert operating surplus in the national accounts of the Netherlands to taxable income were three times as large as the estimate of under-declared income. Presumably, there is a balance of relatively large positive and negative adjustments. The uncertainty in adjustments will result in much greater uncertainty in an estimate of under-declared income that is a small percentage of total income.

The NSI’s analysis at sector level showed a further limitation of Method 2. In some sectors the taxable income declared to the tax administration was more than the theoretical taxable income estimated from the operating surplus. Sectoral analysis of Method 2 results, particularly for sectors with little or no under-declared income, can give an indication of bias and uncertainty in the results. Information on sectors with high under-declaration could be useful in prioritising resources and as a check on bottom-up estimates. However, the value of an estimate of an entire tax gap that includes negative values for some sectors can be questioned.

Macro Model Methods

Macro models, which are used to estimate the shadow economy, provide a potential means of calculating tax gaps. These models use a macroeconomic model to estimate national income independently of the national accounts. The difference between the independent estimates of national income and the GDP in the national accounts provides a measure of the shadow economy.¹⁵

The macro models estimate the shadow economy, which combines under-declared income from underground production, which is a cause of the tax gap, with income from crime, which is not. Where income in the national accounts includes income from crime, the income from crime is separately estimated and can

be easily excluded from a tax gap calculation. The macro models, unlike the national accounts, provide just a single estimate of national income from which income from crime cannot readily be excluded.

In general macro models are used simply to estimate the shadow economy. However, estimates of the shadow economy are sometimes also interpreted as a measure of the tax gap. Such an interpretation is simplistic. Rather than assuming that the shadow economy and the tax gap are the same, a proper tax gap estimate would combine macro models with both a conversion of national accounts information to taxable income and a theoretical liability calculation. Yet, the research for this paper has not found any example of such a proper estimate. The apparent absence of any proper estimate of the tax gap from the shadow economy may reflect a widespread view of the unreliability of macro model estimates of the shadow economy. The difficulty of excluding crime may also be a factor.

Indicator Methods

The three types of macro model, monetary methods, other indicator methods and the latent variable method, are all indicator methods. They rely on an indicator or indicators of the shadow economy. The basic idea behind indicator methods is that the shadow economy leaves some trace in particular statistics. For example, the monetary methods assume that monetary statistics provide an indicator of the shadow economy. The change in a monetary statistic that cannot be explained by factors unrelated to the shadow economy indicates the change in the shadow economy.

Various indicators have been used. The indicators used for Method 3, monetary methods, include the share of large denomination notes in cash in circulation, the cash-deposit ratio and the share of cash in a broad measure of money that includes savings deposits as well as cash deposits. Other single indicator methods, Method 4, have used various measures of electricity consumption, labour force measures, such as multiple job holding and the number of self-employed, and the number of very small enterprises. The latent variable method, Method 5, uses a number of indicators.

Indicator methods have two fundamental failings. The first failing is that the methods only estimate change in the shadow economy. They cannot estimate the size of the shadow economy. In general the methods assume the size of the shadow economy in one year, or in several years, to provide a starting point for the changes that they estimate and, so, give new estimates of the size of the shadow economy.¹⁶ Unfortunately, the size of the shadow economy is not known in any year. If it were, the method used to establish the share in that year would be used to establish the share in other years and indicator methods would be largely redundant.

The second fundamental failing of indicator methods is ignorance of the relationship between the change in the indicator and the change in the shadow economy. Again, an assumption is needed. It is generally assumed that the indicator shows the same effect from a given change whether the change is in the shadow economy or in the economy observed in the national accounts. For example, the electricity consumption method assumes that a change in the total economy indicated by a variation in electricity consumption is the same whether the change is in the shadow economy or the observed economy. This assumption, however, is unjustified and seems to be adopted simply as a matter of convenience.

The monetary methods, and also the latent variable method, assume the same increase in the demand for cash when the shadow economy grows as when the observed economy grows. This assumption, in more technical terms that the velocity of circulation of cash is the same in the shadow economy as in the observed economy, is questionable.

There are good reasons to expect a lower velocity of circulation of cash in the shadow economy. Cash from the shadow economy is less likely to be placed in a savings account because of the risk of questions about its source. Controls to prevent money laundering must contribute to the hoarding of cash by criminals, which can be extensive. Cash hoarding by tax evaders is also common. If shadow economy cash is hoarded, its velocity of circulation will be lower.

A significantly lower velocity of circulation in the shadow economy would mean that the assumption of equal velocity causes serious overestimation of changes in the shadow economy. For example, if an extra

pound of income from the shadow economy increases the demand for cash by half as much as an extra pound of income in the observed economy, the assumption of equal velocity means that the estimated change in the shadow economy is twice the actual change (assuming no other reason for the estimate to differ from the actual change).

Method 5, Latent Variable Method

Recent estimates of the shadow economy tend to use Method 6, the latent variable method, sometimes in combination with a cash demand equation, Method 4. The latent variable method uses a 'multiple indicator multiple causes' or MIMIC model or a dynamic variation, a DYMIMIC model. The MIMIC model was developed for factor analysis in psychometrics to estimate intelligence, which is an unobservable latent variable.

The shadow economy is not a latent or hypothetical quantity like intelligence. It exists, and has the same units of measurement as the observed economy. A fundamental criticism of the latent variable method is that, as the shadow economy is not a latent variable, it cannot be estimated by a MIMIC model.¹⁷

An obvious advantage of Method 6 over the single indicator methods is the use of more than one indicator. However, this advantage is very much reduced by controversy over whether the indicator variables used are valid indicators.

The main issues with Method 6 are the fundamental failings identified for all indicator methods, the need to assume an anchor for estimated changes in the shadow economy and ignorance of the relationship between the change in the indicator and the change in the shadow economy. These failings are acknowledged in a recent latent variable study, Schneider, Buehn and Montenegro (2010).

"This [MIMIC] analysis provides only relative estimates, not absolute, of the size of the shadow economy. Therefore an additional procedure, benchmarking or calibration procedure, is required in order to calculate absolute values of the size of the shadow economy" (ibid, page 13). "The base values necessary for ... the calibration procedure are from the year 2000 and taken from Schneider (2007), who presents estimates of the shadow economies in 145 countries around the world using the MIMIC and the currency demand approach" (ibid, page 19).

The estimates of the base values, or anchors, rely on "the assumption of no shadow economy in the base year."¹⁸ The assumption is justified as "Relaxing this assumption would ... imply an upward adjustment of the shadow economy" (ibid, page 39).

The justification of the assumption implies that the shadow economy estimates after an upward adjustment would be implausible. The real issue may be whether macro model estimates are implausibly high even before any upward adjustment due to relaxing the assumption of no shadow economy in the base year.

It is, of course, true that the shadow economy cannot be negative. It does not, however, follow that an anchor based on no shadow economy in a particular year produces under-estimates. If the uncertainty in the estimates of change is larger than the shadow economy, there can be negative estimates in some years. The assumption, which is actually that the shadow economy is never estimated as negative, rather than that the actual shadow economy is never negative, can cause an upward bias.

The second fundamental failing, ignorance of the relationship between the change in the indicator and the change in the shadow economy, is also acknowledged in the recent study. "Without knowledge about the velocity of circulation in the shadow economy, one has to accept the assumption of an 'equal' money velocity" (ibid, page 38).

Ignorance does not justify a single assumption. Where results of a study depend on assumptions, the study normally examines the sensitivity of results to alternative assumptions. Sensitivity analysis, however, is not necessary to indicate the wide uncertainty around latent variable estimates. The authors of latent variable studies generally acknowledge their limitations.¹⁹ Latent variable, and other macro model estimates, of the shadow economy are unsuitable for tax gap estimates.

Micro Methods

Method 6, Discrepancies in Labour Force Measures

Discrepancies in labour force measures are widely used by NSIs to estimate the number of undeclared workers and to ensure that the national accounts are comprehensive. The idea is that household surveys give all workers while business surveys only give declared workers. The difference in survey results represents the number of undeclared workers who do not pay tax.

In Italy the NSI uses discrepancies in labour force measures to calculate the labour input of undeclared workers in each sector and build up a detailed picture of income concealed by employers through not declaring workers. Undeclared workers are more of an issue for the tax gap in Italy, where the NSI has a particular need to estimate the shadow economy, than in Denmark, the UK and probably most other OECD countries.²⁰

Method 7, Direct Surveys

Surveys of households and individuals are an obvious way to obtain information on the shadow economy. The problem, however, is the willingness of tax evaders to take part and to reveal earnings deliberately concealed from the tax administration. The design of survey questionnaires, and of any advance letters used, is crucial in addressing this problem.

In 2006 HMRC commissioned a feasibility study from Bristol University. After a pilot survey, HMRC decided not to go ahead with a full survey. The reason was doubt over the ability of the survey to obtain useful information from ghosts and moonlighters with a high level of under-declared income.

Unfortunately, the study did not give detailed consideration to the design of the questionnaire in the light of earlier work. The Netherlands national statistical institution, the European Commission and a Danish research institute, the Rockwool Foundation, have done considerable work on how best to design and use surveys to obtain information on the shadow economy and the tax gap.

Research on undeclared work for the European Commission, Directorate General for Employment and Social Affairs, has included surveys. In 2004 an expert seminar sponsored by the Commission agreed that direct methods (observation, interviews and surveys on the supply side) provided the best means of studying undeclared work. The method of questioning is important for results. The Rockwool Foundation of Denmark had achieved very promising recent results in internationally comparable direct surveys (Rooney et al, 2004).

The Rockwool surveys approach the subject of earnings from undeclared work gradually, first asking about aspects related to the subject, but not particularly sensitive, such as general opportunities to earn extra money in the interviewee's line of work. Such 'warming up' questions help establish interest in the topic and create confidence between interviewer and interviewee. More sensitive 'core' questions about the interviewee's undeclared work are then supposed to be answered more frankly. Indeed, the Rockwool Foundation has shown that the gradual approach finds a much higher level of undeclared work than the direct approach used in the Bristol University pilot

The Netherlands NSI has also adopted a gradual approach. The NSI carried out surveys in 1983 to compare the results of different research designs, as the Rockwool Foundation did later. With the gradual approach 12 percent of interviewees admitted undeclared work, twice the proportion found by the direct approach (OECD, 2002).

Method 8, Discrepancy Between Inferred and Reported Income

Pissarides and Weber (1989) pioneered a method of estimating income concealed by the self-employed through not declaring some of their earnings.

The P-W methodology first estimates the marginal propensity to consume food using cross-section data for a sample of the employed and self-employed. It then estimates under-declared income by comparing the marginal propensities.

The original P-W study in 1989 estimated that under-declared income was 55 percent of the income declared by the self-employed in the UK, but the proportion was lower in later studies. The methodology makes a number of assumptions:

- All respondents report food expenditure accurately.
- Employed respondents report income accurately.
- Employment status does not affect the marginal propensity to consume food.
- Households with tax evaders are not significantly under-represented in a survey that primarily covers spending.

HMRC has shown considerable interest in the P-W methodology, sponsoring work in 1993 and carrying out its own analyses in 2001 and 2005. The 2005 analysis was a useful cross check on the results of the random enquiry programme. It also provided potentially useful information on employment with the greatest risks of under-declaration.

More recently, the PW methodology has been used to estimate income under-declared by the self-employed in Canada, Finland and Sweden. It has also been used to estimate total under-declared income in Turkey, relying on an assumption that the income of employees of large companies is reported accurately.

V. Tax Administration Experience

Introduction

A partial survey of the use of top-down methods by tax administrations to estimate under-declared income or an entire direct tax gap has been conducted.²¹ The survey concentrates on developed countries, few of which have used top-down methods.²² Table 4 summarises the findings of the survey, which includes how the results are or were used.

TABLE 4. Use of Top-Down Methods by Tax Administrations

Country/ Region	Method Used and What is or Was Estimated	Application of Results
Denmark	Method 2 Under-declared personal income	Used to calculate a performance objective, but administration is seeking to measure objective bottom up
Latin America	Method 1 Corporate tax gap Method 7 Personal tax gap	Broad assessment of relative levels of tax gaps for different taxes
New Zealand	Method 5 Total tax gap	None - the administration has considerable reservations about the methodology
Sweden	Method 2 Personal tax gap	Reconciliation with bottom up under-declared income estimates No plan for further top-down work

Denmark

The Danish tax administration has, since 1947, calculated a personal tax gap using the difference between personal income in the national accounts and declared income. The tax gap is “before tax”, that is under-declared income, rather than the tax due on under-declared income.

The method used in Denmark avoids the difficulty, and uncertainty, of calculating theoretical liability. Yet, uncertainty is still a serious problem. This problem is reduced by publishing the tax gap as a five year moving average rather than as a potentially misleading annual figure. While the moving average does not reduce systematic errors, it does lessen the fluctuations due to random variation in the data and so provides a better indication of trends.

The Danish “before tax” personal tax gap, measured as a share of GDP, varied between 15 and 20 percent from 1947 to 1955, and then declined, falling below 5 percent in the early 1970s. The latest figure, which is for

2005 to 2009, is 2.3 percent. The decline since 1955 is attributed to structural changes in the economy reducing the share of hard to tax employment, such as self-employment, day labourers paid in cash and domestic service (OECD, 2004).

In Denmark the “before tax” tax gap is a performance objective for the administration. However, the administration is seeking to measure its objective bottom up using random audits. Even with a long history of top-down measurement and without a theoretical liability calculation, the administration views a bottom-up method as better fitted for a performance measure.

While there have no doubt been some methodological improvements since the personal tax gap was first measured in Denmark, the estimated tax gap is now less than one fifth of its 1947 level. The uncertainty in the top-down estimate may mean that a method valuable in 1947 for a relatively large tax gap has ceased to be useful. In contrast the value of bottom-up methods is much greater than in 1947 because of tax administration developments, such as random audits.

Latin America

In Latin America work on the tax gap has tended to focus on VAT rather than direct taxes. Still, most countries have estimated direct tax gaps. The Colombian tax administration, whose first estimate is for 1987 (Shome, 1995), is perhaps the second after Denmark to estimate top-down direct tax gaps.

Columbia has used Method 1, adjusting the operating surplus from the national accounts to give an estimate of taxable income and then to split the taxable income according to whether it was corporate income, subject to corporation tax, or self-employed income, subject to income tax. Seven other Latin American countries covered in a recent study, including Chile and Mexico, have also made Method 1 estimates of the corporation tax gap (Jiminez et al, 2010). The seven countries have also estimated personal income tax gaps through Method 7 surveys.

In the seven countries corporate tax gaps ranged from around 50 to as high as 65 percent of tax liability while personal tax gaps ranged from 30 to 50 percent. The study, in commenting on why the personal tax gap is lower than the corporate tax gap refers to possible over-estimation of the corporate tax gap because of issues with the national accounts data and accounting for revenue loss through deductions. The possible overestimation of the corporate tax gap indicates the major difficulty in estimating corporate tax top down.

The relatively high tax gap levels in Latin America mean that the uncertainty of top-down estimates is a less serious problem than in the UK. Estimates used to assess relative levels of gaps for different taxes require less precision than performance measures. Accordingly, national accounts methods are of more value for Latin American countries than for the UK and Denmark, where tax gaps are smaller. Also, a top-down estimate is much more useful if information required for bottom-up measures is lacking.

New Zealand

In 1999 the New Zealand Inland Revenue Department commissioned a Method 5 latent variable macro study to estimate the tax gap, but shortly later decided not to estimate a tax gap at all. The reason for not using top-down methods is that they lack reliability and do not indicate where the tax gap exists. A method that fails to indicate where the tax gap exists is of no use for decisions on targeting compliance activity.

The study for the Department estimated the total tax gap. It assumes that the discrepancy represents income from undeclared work, under-declared income, and that the income evades indirect taxes when spent as well as evading direct taxes when earned.

Sweden

In 2006 the Swedish tax administration made experimental use of Method 2, estimating under-declared personal income from the national accounts discrepancy between expenditure and income measures.²³ The discrepancy was estimated as about 5 percent of GDP.

As with the New Zealand study, the Swedish administration estimated a total tax gap and assumed that where income from an activity is under-declared, the sales of the goods or services produced by that activity are also under-declared so that both direct and indirect tax are not paid.

The tax gap estimate has a wide range, plus or minus 10 percent, reflecting the uncertainty introduced by the calculation of theoretical liability. This range is in addition to the uncertainty over the level of under-declared income used to calculate the tax gap. For reconciliation with bottom-up estimates the administration used under-declared income, which does not suffer the additional uncertainty caused by the calculation of theoretical liability. The reconciliation used top-down information from direct surveys of households, Method 7, and estimates based on income inferred from food consumption, Method 8.

Other Countries

Comprehensive information on countries that do not appear in Table 2 is lacking. Yet, tax administrations more closely comparable to HMRC, such as the IRS in the USA, have never used top-down methods to estimate entire direct tax gaps. Perhaps, the main reason top-down methods are not used is a widespread view that under-declared income cannot be reliably estimated.²⁴ Most administrations focus on identifying and assessing risk factors and prioritising compliance resources to areas of highest risk. Top-down estimates are of no value for decisions on compliance priorities.

A number of tax administrations have decided against the top-down approach to the direct tax gap, as has HMRC. Indeed, the tax administrations in Australia, Canada and New Zealand have decided against tax gap measures altogether. The Australian Tax Office “has concluded that accurate and defensible measures of the absolute size of the tax gap are impossible to achieve in a practical sense” (OECD Forum on Tax Administration, 2008). In the United States the IRS has concentrated on bottom-up measures and does not see that the top-down approach would add anything of value.

Conclusions on Tax Administration Experience

Experience in Denmark and Sweden shows how serious the problem of the uncertainty of theoretical liability is for direct tax gaps. Denmark avoids the uncertainty by estimating only under-declared income. When Sweden calculated theoretical liability, the margin of error, 10 percent, was so large as to cast doubt on the value of the calculation.

Tax administrations similar to HMRC do not generally estimate entire tax gaps by top-down methods. Even in Denmark, which is an exception, the administration would prefer a performance measure calculated bottom up.

NSIs and tax administrations have a common interest in under-declared income. Estimates of under-declared income, which may be required to ensure the comprehensiveness of the national accounts, are valuable for tax gap purposes. This creates the possibility of joint work. In the UK, where the ONS has not reviewed the methodology of their under-declared income estimates for some considerable time, HMRC and the ONS are exploring the possibility of working together.

VI. Evaluation of the Methods and Conclusions

This Chapter evaluates the eight methods, including their applicability to the UK, before giving overall conclusions.

National Accounts Methods, Methods 1 and 2

The dependence of the UK national accounts on HMRC means that Method 1, Calculation of theoretical liability from national accounts income, is not applicable in the UK. Method 1 can only be used if the income information in the national accounts is independent of the tax administration.

Method 2, which is based on a discrepancy using the income measure of GDP, can be applied where Method 1 is inapplicable. Indeed, the version of Method 2 that uses the Initial Residual Difference between

income and expenditure measures of GDP exploits the dependence of the income measure on the tax administration. However, for the UK the IRD reflects fluctuations in the underlying statistics used to estimate GDP rather than the shadow economy.

Method 2 has been applied in Denmark and, experimentally, in Sweden to calculate under-declared income or a personal tax gap. The discrepancy used in Denmark, the difference between income declared to the tax administration and income in the national accounts, is not available in the UK. Method 2 in Sweden used the IRD where, in contrast to the UK, the IRD has been remarkably stable over 40 years.

The personal tax gap in Sweden, according to a Method 7 survey, is twice that in the UK.²⁵ Sweden, unlike the UK, does not limit tax liability to activities with a business purpose. The IRD in Sweden in 2006 was 5 percent, which is considerably more than the last available figures for the UK. Given the relatively low level of the personal tax gap and the large fluctuations in IRD in the UK, the experimental use of IRD in Sweden provides no reason to revise the conclusion based on UK experience that the IRD cannot provide useful tax gap information for the UK.

Macro Model Methods, Methods 3 to 5

Unlike the national accounts methods, macro models are readily applicable to the UK. The basic requirement for a macro model is simply an equation relating national income to an economic variables or variables. Studies can cover as many as 162 countries and their scope is only limited by data availability, which is not an issue for the UK.

The main issue with the macro model methods is their reliability. The methods require information that does not exist in the UK or in other countries and have to make assumptions.²⁶ For example, monetary methods require information on the velocity of circulation in the shadow economy. The general assumption of equal velocity in the shadow and observed economies is unjustified and probably results in exaggerated estimates of change in the shadow economy.

The macro model methods only identify changes in indicators, such as cash demand, unexplained by factors not related to the shadow economy. They rely on assumptions to estimate the shadow economy. First, there is an assumption, such as on the velocity of circulation, to estimate the change in the shadow economy from changes in the indicator or indicators not explained by other factors in the estimating model. Then, there is a further assumption to estimate the size of the shadow economy from the change in the shadow economy.²⁷

Macro models sometimes estimate the size of the shadow economy from the change in the shadow economy from a year in which there is assumed to be no shadow economy. The basis of this assumption is that the shadow economy cannot be negative. However, macro models will produce negative estimates of the shadow economy if the uncertainty in the estimates of change is sufficiently large relative to the actual shadow economy. As a result there may be a strong upward bias in estimates of the shadow economy, particularly in countries like the UK with relatively small shadow economies.

Macro model methods have not produced reliable estimates of changes in the shadow economy or of the size of the shadow economy. They are of no value for work on the tax gap. This conclusion on macro model methods is very much in line with a declaration by the world's statistical institutions.²⁸

Declaration by the world's statistical institutions

“Unofficial estimates [of the shadow economy] are often based on macro economic models. ... The OECD-ILO-IMF-CIS manual on measuring the non-observed economy rejects such ‘macro-model’ methods because these methods suffer from serious problems that cast doubt on their utility for any purpose in which accuracy is important. In particular, they are completely unsuitable for use in compiling the national accounts.”

Micro Methods, Methods 6 to 8

Method 6 uses discrepancies in employment statistics to estimate undeclared work just as Method 2 uses discrepancies in income statistics to estimate the shadow economy. Method 6 also requires information on average income from undeclared work. It is not particularly suitable for UK tax gap estimates. Illegal workers, such as non-EU nationals working in the UK without work permits, are part of the discrepancy in employment statistics, but may be paying taxes and so making no contribution to the tax gap.

Employment discrepancies identify ghosts, whose work is entirely underground production, but not moonlighters, only part of whose work is underground production. Their value for tax gap estimates depends on the relative importance of ghosts and moonlighters. In the UK the limited available evidence suggests that ghosts are not more important than moonlighters.²⁹ As in Denmark, Method 6 might not even find employment discrepancies in the UK. The Method appears to have no value for the UK.

Method 7, the direct survey method, has considerable potential for use in UK tax gap estimates, provided that a gradual approach is used. Indeed, Method 7 already contributes to HMRC's tax gap estimates for moonlighters through the use of the results of a 2003 study by the Rockwool Foundation of Denmark.

Method 8, reported and inferred income, like Method 7, has been used by HMRC for work on the tax gap. Methods Seven and Eight share the difficulty of all top-down methods in calculating a tax gap from under-declared income. Data matching with HMRC records, which is now open to external researchers through the HMRC Data Lab, subject to safeguards on taxpayer confidentiality, overcomes this difficulty. National insurance numbers of individuals of interest for under-declared income could potentially be used in a booster to the ONS Living Costs and Food survey with the main sample a control group.

Overall Conclusions

Top-down methods do not provide a practical method of estimating entire UK direct tax gaps. Yet, direct surveys (Method 7) and inferred and reported income (Method 8) can potentially contribute to elements of the direct tax gap by providing estimates of under-declared personal income, particularly for the self-employed. Indeed, elements of these methods are already used in the UK for direct tax gaps. Internationally, top-down methods give more meaningful information for developing countries than for developed countries, where tax gaps are generally smaller.

Appendix

GLOSSARY

Bottom-up approach	The bottom-up approach builds a total tax gap from estimates of components of the tax gap, generally based on tax information.
Evasion	Evasion is the failure, in order fraudulently to pay less tax, to declare income that should be declared or to provide accurately other information required by a tax administration.
Ghosts	Ghosts are individuals with taxable income (from employment or self-employment) but who fail to make any tax return.
Hidden economy	The hidden economy consists of productive activities on which tax is due, but which are hidden from the tax administration by not making any tax return (as opposed to concealment through non-declaration when a tax return is made)
Illegal production	Illegal production consists of productive activities, including the distribution and sale of goods and services, forbidden by law.
Letter of the law	The letter of the law is the literal interpretation of tax legislation.
Money laundering	Money laundering is the processing of income from illegal or underground production to disguise the origin of the income.
Moonlighters	Moonlighters are individuals who pay tax on income from one employment (generally through employer deductions) but not on income from other employment or self-employment.
Non-observed economy	The non-observed economy consists of the shadow economy plus informal and other activities, such as household production for own use.
Shadow economy	The shadow economy consists of both underground and illegal production.
Spirit of the law	The spirit of the law is the tax administration's interpretation of the legislature's intention in legislating on tax.
Tax gap	The tax gap is the difference between tax collected and the tax that should be collected (the theoretical liability). The tax gap does not include theoretical liability due to illegal production.
Theoretical liability	Theoretical liability is the tax that would be collected if all individuals and companies complied with both the letter and the spirit of the law.
Top-down approach	The top-down approach estimates the tax gap as the difference between theoretical liability and total tax collected.
Under-declared income	Under-declared income is the income that should be declared to the tax administration, but is not. In the UK and other countries where the primary sources used to compile the national accounts are not independent of the tax administration, it is also the income from underground production.
Underground production	Underground production consists of productive activities that are in themselves permitted by law but are illegal because income is not declared to public authorities and, as a result, not included in the primary sources used to compile the national accounts

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Endnotes

- ¹ The informal sector, for example individuals below the tax threshold, is legal but not included in the primary sources and is separately estimated in the national accounts.
- ² HMRC does not estimate under-declared income.
- ³ The text is a simplification for corporate income. The UK national accounts use company accounts for the surplus of large companies. However, companies use the same information for their accounts and tax returns. Accordingly, the accounts of large companies are not independent of tax returns.
- ⁴ For personal tax the 2008/09 avoidance estimate is £1.4m, which is 9 percent of the total personal tax gap estimate of £14.5bn. While an avoidance estimate is not published for all corporate tax, the estimate for avoidance by large businesses is £3.6bn, over half the total corporate tax gap of £6.9bn.
- ⁵ Even for national insurance contributions the top-down approach does not cover the entire tax base. National insurance offshore avoidance, for example, the supply of staff as part of a composite service by an overseas company, does not affect income estimated top down.
- ⁶ Details of the adjustments for corporate income in the UK are given in endnote 12. The value of the personal income gap remaining after adjustments as a measure of the tax gap is discussed for the USA and the Netherlands.
- ⁷ The figure of £13.1bn is illustrative rather than definitive because it includes the hidden economy for which the estimates are illustrative.
- ⁸ A large business has either 250 or more employees or both a turnover over €50 million and a balance sheet total over €43 million.
- ⁹ For details on mixed income see paragraphs 5.29 to 5.31 of the ONS publication “National accounts concepts sources and methods.”
- ¹⁰ UNECE (2008), Non-observed economy in the national accounts, provides a survey of NSI practice.
- ¹¹ The difficulty is even more acute for ‘mixed income’, the surplus of unincorporated enterprises owned by households before interest or rent. The income is mixed because, in addition to the operating surplus of unincorporated enterprises, it includes the employee compensation of household members from an unincorporated enterprise owned by a member of the same household. A calculation of income tax and national insurance liability requires information on the distribution of income between household members. To calculate theoretical liability from under-declared ‘mixed income’ would require a series of heroic guesses that cannot produce reliable estimates.
- ¹² In the UK the main adjustments concern interest and finance lease rentals, which are not part of taxable income, and financial charges such as commissions, stamp duties and other expenses connected with mortgages, capital issues and transfers of financial assets, which are not deducted in calculating taxable income. Chapter 4, The Income Approach, in the UK Gross National Income (ESA95) Inventory gives details of the adjustments, which also concern expenses associated with take-over activity, launch aid subsidies, entertainment expenses, royalties on patents and profits earned abroad.
- ¹³ A Vienna Institute for Economic Studies working paper, which calculates both income tax and NIC tax gaps, similarly does not mention the dependence (Christie and Holzner, 2006). The working paper finds a UK NIC gap of 35 percent and a UK income tax gap of 22 percent in 2002/3. On the basis of a reduction in the UK income tax gap from 35 percent in 1995-96, the paper concludes, “It seems clear that the tax collection process itself has been improved over the period.” The results rely on “simplified calculations of the liabilities based on the most important elements, namely employment income, pensions and average separate tax rates for property income where applicable, though we also took account of the most important deductions, personal allowances and tax credits.” The OECD’s finding of a much lower NIC gap suggests that results are very sensitive to how the tax system is simplified. The trend in the personal income tax gap may also be sensitive to simplification.
- ¹⁴ OECD (2002), “Measurement of the Non-Observed Economy: A Handbook,” page 52.
- ¹⁵ The independent estimate of the shadow economy includes, as well as the difference between independent and official GDP, the estimate of the shadow economy in official GDP.

- ¹⁶ The reliance on assumptions is sometimes disguised by reference to estimates from other studies. However, these studies are generally also indicator studies and can only give the size of the shadow economy by assumption.
- ¹⁷ Breusch (2005) also makes several more technical objections to the use of the latent variable method to estimate the shadow economy. The main objections as summarised by Schneider et al (2010, page 19, footnote 23) are “(i) instability in the estimated coefficients with respect to sample size changes, (ii) instability in the estimated coefficients with respect to alternative specifications, (iii) difficulty of obtaining reliable data on cause variables other than tax variables, and (iv) the reliability of the variables grouping into “causes” and “indicators” in explaining the variability of the shadow economy”. These technical objections appear to be largely accepted. However, this paper does not discuss the technical objections further. The conclusion that the latent variable method has no value for tax gap estimates does not require technical arguments.
- ¹⁸ For the currency demand studies the reliance is direct and for the MIMIC studies indirect through their use of other studies that rely on the assumption.
- ¹⁹ For an acknowledgement of the limitations see Del’Anno and Schneider (2006). “Estimation is particularly challenging, researchers are forced to use some kind of ‘imagination’ because existing estimation procedures are not convincing and complications are still numerous and available” (page 2). “Shadow economy estimates are never very stable and absolute, and there is always space for questions, discussion and critique” (page 16).
- ²⁰ In Denmark an attempt to apply the Italian labour input method showed no discrepancies (Rockwool, 1998: page 72). In a 2008 UNECE survey Italy had the largest non-observed economy (NOE), 15 percent of the total economy, of any OECD country. Excluding Italy and Mexico, the seven OECD countries in the survey with NOE estimates averaged 3 percent. The NOE is broader than the shadow economy, including also informal and other activities, such as household production for own use, omitted from NSIs’ basic data collection programmes. For most OECD countries differences in the NOE are likely to reflect differences in the shadow economy.
- ²¹ The survey is based on the publications in the references and correspondence with colleagues in Denmark, New Zealand, Sweden and the USA.
- ²² A 2008 report by the OECD Forum on Tax Administration, which as well as OECD countries covered 15 non-members, found that only four countries, Denmark, Sweden, Chile and Mexico, had estimated top-down direct tax gaps.
- ²³ The Swedish tax administration, the Tax Gap Map (2008).
- ²⁴ The National Audit Office in its 2008 report, Tackling the Hidden Economy, states “In our work comparing how tax authorities tackle the hidden economy we found that none of them has yet found a reliable way to estimate the shadow economy.”
- ²⁵ Pedersen (2003) estimates the Swedish personal tax gap as 3.3 percent of GDP in Sweden and 1.7 percent in the UK, but attributes much of the difference to the scope of taxation.
- ²⁶ Even the initial assumption that the shadow economy can be traced in cash demand is questionable, at least for the UK (Franklin, 2010).
- ²⁷ Not all studies are explicit about these assumptions. For example, other studies may be used to give an estimate of the shadow economy in a base year. The base year estimate enables the shadow economy in later years to be calculated from estimated changes, but the studies used for the base year make assumptions about another base year.
- ²⁸ Declaration of the ISWGNA (2006). The members of the ISWGNA are the European Commission (Eurostat), the International Monetary Fund, the Organisation for Economic Co-operation and Development, the United Nations and the World Bank.
- ²⁹ The uncertainty of the estimates, particularly for ghosts, makes a more definite statement on relative importance impossible. HMRC estimates the 2008/09 tax gap due to ghosts as £1.3bn with a lower limit of £0.3bn and an upper limit of £3.9bn and due to moonlighters as £1.9bn with a range of £1.2bn to £3.6bn.