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# Measuring the Size of the Informal Economy: A Critical Review

George M. Georgiou

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## Abstract

There has been a burgeoning number of studies attempting to measure the size of the 'black' economy. These are based on a variety of methodologies and provide a range of estimates, not just across countries but also within the same countries and often by the same author(s). This raises a number of issues: What is meant by the term 'black' economy? Is it an appropriate description? What, if any, is the theory underlying the estimates of informal economic activity? This paper examines these and other issues, and concludes that whilst the existence of what we prefer to call the 'informal' or 'grey' economy in most countries is incontrovertible, there is a lack of consensus on the appropriate methodology for estimating its size. More importantly, the large number of studies so far are simply exercises in measurement without theory, though we are sceptical that even with strong theoretical underpinnings it is possible to provide accurate estimates of a complicated web of informal activities.

Keywords: Informal, grey and black economy, tax evasion, criminal activities.

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Address: George M. Georgiou, Economic Research Department, Central Bank of Cyprus, 80 Kennedy Avenue, P.O.Box 25529, 1395 Nicosia, Cyprus. E-mail: [GeorgeGeorgiou@centralbank.gov.cy](mailto:GeorgeGeorgiou@centralbank.gov.cy)

## 1. Introduction

In the 1950s two studies, Kaldor (1956) and Cagan (1958), marked the early beginnings of research into informal economic activity<sup>1</sup>. These were followed in the 1970s by, among others, Guttman (1977) and Feige (1979). These early works led to a proliferation of research in the 1980s and 1990s<sup>2</sup>.

Having read the literature from the 1980s and 1990s as well as more recent research, we share the doubts of Tanzi (1999) and Thomas (1999) about the meaning of the concept of a 'black' economy, and about the methods used to estimate its size. This has led me to wonder what, if anything, we have learnt about informal economic activity after five decades of research.

This discussion paper attempts to summarise the burgeoning body of mostly empirical literature with a view to drawing firm conclusions about the usefulness of what has been done so far and whether researchers should continue to try to provide an aggregate estimate of such a disparate group of economic activities.

The ever increasing literature has been driven by legitimate concerns about the economic consequences of activities which are unreported and unrecorded. For example, such 'hidden' activities "reduce the tax base, thereby undermining the financing of public goods and social protection" (Lyssiotou *et al*, 2004, p.622). If the reduction in the tax base is compensated by an increase in tax rates, this can "create a vicious cycle, as this reinforces the incentive not to declare economic activities to the public" (*ibid*). There is also the issue of the reliability of GDP measures. If economic activities are not reported and recorded, then a country's measured GDP will be less than its actual GDP, with obvious consequences for macroeconomic policies<sup>3</sup>. In Section 2 we look at the issue of terminology, which remains a cause of confusion. Section 3 discusses some of the theoretical issues, while Section 4 presents a summary and critique of the expanding list of methodologies. Section 5 contains some general criticisms of the literature, and Section 6 concludes.

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1. The Kaldor study is cited by Bhattacharyya (1999) as "the first attempt to estimate the unrecorded national income" (p.349).
  2. For example, Tanzi (1980, 1983, 1984), Feige (1980, 1989), Contini (1981), Matthews (1982), Frey (1989), Frey & Weck-Hanneman (1984), O'Higgins (1989), Pissarides & Weber (1989), Lubell (1991), Loayza (1996), Bhattacharyya (1990, 1999), Johnson *et al* (1997), Lippert & Walker (1997), Ernste & Schneider (1998), Giles (1999a, 1999b), to name just a few.
  3. For a discussion of the undesirable economic consequences of informal economic activities, see, for example, Smith (1981), Ernste & Schneider (1998), Bhattacharyya (1999) and McGee & Feige (1989). Kesselman (1997) discusses the positive as well as the negative policy implications of tax evasion.

## 2. Terminology (or what's in a name?)

There is a plethora of terms for what Dixon (1999) describes as "a mixture of non-market economic activities (such as home production), illegal market activities (such as prohibited production and distribution of proscribed substances) and legal market activities that are kept hidden for reasons such as tax-evasion" (p.335). Including the terms mentioned thus far, the following have been used: black, cash, clandestine, corrupt, covert, dual, grey, hidden, household, illegal, illegitimate, informal, invisible, irregular, marginal, moonlight, parallel, second, secret, shadow, submerged, subterranean, twilight, underground, unobserved, unofficial, unrecorded, unreported, unregulated and unsanctioned<sup>4</sup>.

Some economists and policymakers use these terms interchangeably while others prefer to stick to one particular word, with or without an explanation, for their choice. And yet a case could be made for the need to be precise in the choice of terminology, since these words can have very specific meanings and are not always policy-neutral. On this latter point, words such as black, shadow, clandestine, and subterranean conjure up images of sinister and even seedy activities reminiscent of Europe in the aftermath of the second world war, so vividly depicted in Carol Reed's film version of Graham Greene's novella *The Third Man*<sup>5</sup>.

This has obvious implications for policy prescription. For example, due to the negative connotations associated with, say, *black* economic activity, it follows that policymakers, and certainly editors of tabloid newspapers, may wish to outlaw all such activity or increase existing penalties<sup>6</sup>. Contrast this with *cash* and *household* which imply nothing about the legality or morality of the associated economic activities. In fact, these sound harmless and even desirable – what could, in the pre-electronic payments era, be more convenient than transactions executed in cash? Or consider the practical and civil nature of household production. Hence some words generate, intentionally or otherwise, vivid images which often reflect either the policy bias of the researcher or the prevailing *zeitgeist*, whereas other words are policy and morally neutral.

Most of the aforementioned terms imply that there is a sharp dichotomy between the formal and informal economy. However, as we shall argue below, there are

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4. Many of these terms are listed in Smith (1981) and Smith (1997).

5. Cowell (1990) makes a similar point when he states that these terms "suggest social undesirability if not innate evil... 'black economy' (= 'black deeds?')... 'underground activity' (= 'under the counter' or 'under the bed?')" (p.126).

6. Again, Cowell (1990) makes a similar point when he states that "insofar as policymakers are responsive to opinion... the language influences the strategy and the tactics of enforcement" (p. 126).

strong linkages between formal and informal activities hence the word *grey*, to be used interchangeably with *informal*, would appear to be a more appropriate term.

Table 1 shows the various activities which we describe as grey or informal. Although the list is by no means exhaustive, it does cover the majority of informal activities. Two things stand out: first, the list covers a very disparate group of activities, and second the majority of listed activities are clearly criminal.

As we shall see in Section 4, researchers do not always specify whether their measurement of informal activity captures all or part of the list in Table 1. Indeed, many studies either avoid defining what they are supposed to be measuring or are (perhaps intentionally) vague. This is understandable since it is often difficult, if not impossible, to delineate between activities. For example, those engaged in the distribution of narcotics are also likely to be engaged in money laundering in order to legitimise their income. But money laundering is also linked to human trafficking and unauthorised arms trading. Smuggling is obviously linked to the payment of bribes, and some unauthorised prostitution to the trafficking of humans. These interlinkages lead some researchers to explicitly exclude criminal activities.

Not only are there interlinkages between various criminal activities, but the distinction between criminal and legal activities is blurred. The clearest example is money laundering, which involves the legitimisation of income derived from illegal activities. The legitimisation process can take many forms, some of the most classic being the purchase of physical and liquid assets such as property, enterprises<sup>7</sup>, shares in publicly listed companies, etc. Parts or all of these assets are then resold and the proceeds, which are deposited in legitimate bank accounts<sup>8</sup> either in offshore jurisdictions or mainstream financial centres, are then used to finance further illegal activities.

It should also be stressed that for many forms of money laundering to be successful, they require the collaboration of lawyers and accountants. However, the laundering 'fees' of these professionals cannot be disentangled from legitimate income.

Apart from the interlinkages, there is the more obvious problem of data. Due to the very nature of the legitimisation process, it is impossible for economists to distinguish between legitimate and illegitimate income for statistical purposes. The

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7. Apart from the purchase of existing enterprises, money launderers sometimes set up new companies, often in tax havens.

8. Contrary to journalistic folklore, criminals do not turn up at banks with large suitcases full of cash.

data available, be it at the micro level or the macro level, conceal the proceeds of the money launderer. The aggregate figures often mentioned in the media are nothing more than "guesstimates" extrapolated from the relatively infrequent cases when money launderers are discovered by the authorities. This is also true of other illegal activities. For example, in commenting on the drug trade in Canada, which in the early 1990s was estimated to be worth \$10 billion annually, Killam (1997) states the following: "The estimates for Canada could very well be understated. These figures are extrapolated from bits of evidence like the following. On February 22, 1994, 5.4 metric tonnes of cocaine were seized off the coast of Nova Scotia, thus eliminating approximately 11 million gram doses.

**Table 1 - Informal (or Grey) Activities**

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Tax avoidance (legal)	Infringement of copyrights
<ul style="list-style-type: none"> <li>• fringe benefits</li> <li>• legal tax planning, e.g. trusts</li> </ul>	<ul style="list-style-type: none"> <li>• production of counterfeit goods</li> </ul>
Tax evasion (illegal)	Fraud
<ul style="list-style-type: none"> <li>• underreporting or non-reporting of income</li> <li>• non-issuance of receipts</li> <li>• illegal tax schemes</li> </ul>	<ul style="list-style-type: none"> <li>• Internet fraud</li> <li>• social security fraud, etc</li> </ul>
Double jobbing/moonlighting	Work by illegal immigrants
<ul style="list-style-type: none"> <li>• e.g. civil servants</li> </ul>	Production, distribution and sale of narcotics
Home production/services	Corruption
<ul style="list-style-type: none"> <li>• baby sitting</li> <li>• home hairdressing</li> <li>• cleaning, etc</li> </ul>	<ul style="list-style-type: none"> <li>• e.g. bribes</li> </ul>
Petty unregulated/unreported trading and production	Illegal arms trading
Benefits in kind	Money laundering
<ul style="list-style-type: none"> <li>• e.g. use of company facilities for personal gain</li> </ul>	Unauthorised gambling
	Trafficking of humans
	Unauthorised prostitution
	Extortion
	Smuggling
	Theft
	Piracy of the seas

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Assuming that the cocaine was all destined for Canada we could reasonably expect that it would be diluted or "cut" at least once, thus making the total amount available for sale 10.8 metric tonnes. If sold for \$25,000/kg, [...] the value of this shipment [...] would be \$270 million [...]. The value of the same shipment if all sold in one-gram doses at \$150 [...] would be \$1 billion, \$650 million [...] if we estimate

that enforcement officials intercept less than 10 percent of all drugs [...] this would equal \$16 billion, \$500 million. Looking at the 1994 seizure [...] the inescapable conclusion is surely that the annual underground drug economy in Canada is massive and probably underestimated at \$10 billion" (pp. 105-106).

Even though Killam was responsible for the Royal Canadian Mountain Police (RCMP) Proceeds of Crime Program, his back of the envelope calculations need to be treated with some caution because his assumptions need to be verified. The criminal nature of these activities make any assumptions and their concomitant extrapolations unreliable.

Given the complex linkages *between* and *within* legal and illegal activities, the distinction between the formal and informal economy is at best blurred and at worst a complex labyrinth. Hence *grey* may be a better word since it captures the broad variety of activities described by Dixon (1999), while at the same time explicitly referring to the fact that the distinction between formal and informal activities cannot be easily delineated.

As far as *informal* is concerned, according to Lubell (1991) the term first came to prominence in 1972 when the International Labour Organization (ILO) published a study of unregulated entrepreneurial activity in Kenya. Although the ILO's use of the word was confined to the activities of micro-enterprises in the context of developing economies, the term is now used as a synonym for the range of activities defined by Dixon (1999).

Another difficulty illustrated by Table 1 is that there are some informal activities which, though illegal, can hardly be considered to be seriously criminal. The pensioner who offers gardening services for cash payment or the student who provides babysitting services are engaging in tax evasion by not declaring their earnings. However, from the policymaker's point of view, they are clearly in a different category to the well organised criminal gangs living off the proceeds of extortion, drug trafficking and smuggling<sup>9</sup>. What all these agents have in common is that they conceal their income from the authorities. Thus, from the perspective of the economist and statistician, this commonality is sufficient to justify the estimation of an aggregate number. From the perspective of policymakers, who need to weigh the potential benefits in terms of increased tax revenues and reduced criminality against the costs of enforcing compliance, disaggregate figures would be preferable.

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9. Policymakers who are keen on being re-elected will view some forms of criminal activity as less or more serious than others depending on how they consider the electorate to perceive them.

### 3. Some theoretical background

A range of factors are assumed to influence the participation of economic agents in the grey economy, such as high tax rates; penalties for tax evasion and extent of enforcement; the rate of unemployment; poverty; the unavailability of goods and services in the formal market; working hours (especially of civil servants); tax morality; and cultural attitudes towards the state<sup>10</sup>. However, theoretical discussions of these and other factors are relatively few<sup>11</sup>. Those that have been published can be classified into two groups, micro and macro.

Three of the most significant micro theoretical studies that consider the relationship between taxation and informal activities are Allingham and Sandmo (1972), Cowell (1990), and Andenberg *et al.* (2003).

The Allingham and Sandmo study attempts to show that an increase in the tax burden will lead to an increase in underreported income. The authors distinguish between two types of tax evader: the 'myopic' evader, who ignores the potential risks in the future; and the 'consistent' evader, who realises that by evading taxes today he is placing himself in a worse position tomorrow. By looking at this distinction in the context of a dynamic mathematical model, and drawing on Becker's work on the economics of crime as well as Arrow's work on the economics of uncertainty, the authors arrive at the somewhat obvious conclusion that "the consistent individual will always declare more than the myopic" (*ibid.*, p. 337). Other commonsense conclusions include the statements that "an increase in the probability of detection will always lead to a larger income being declared" (p. 330) and "a rise in the penalty rate will lead to an increase in declared income" (p. 332).

Allingham and Sandmo's model has been very influential, albeit indirectly, since many empirical studies are based on the assumption that the informal economy is directly proportional to the tax burden or to tax enforcement.

The second of our micro studies is that of Cowell (1990) who, in a very rigorous and widely cited analysis of tax evasion, assumes that the tax evader is a gambler (or at least behaves like one) in the sense that the decision of a rational taxpayer to evade the payment of taxes will depend on the probability of getting caught, and thus suffering the consequent financial and/or penalty.

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10. Some of these are mentioned by Frey and Weck-Hanneman (1984), Loayza (1996) and Ernste and Schneider (1998).

11. There is, however, a significant body of theoretical literature on the closely related topic of crime. For example, see Ehrlich and Liu *et al* (2004). For a survey of the literature on corruption, see Aidt (2003).



Cowell begins with a simple two-agent model, government and taxpayers, in which: a) the taxpayer is assumed to have a fixed gross income which is liable to tax; b) income tax is proportional to income; c) the probability of tax evasion being discovered and punished is fixed; and d) the amount of tax on concealed income is subject to a surcharge. Making additional assumptions about the taxpayer's utility function and the relationship between risk aversion and consumption, Cowell uses mathematical analysis to conclude "that people with higher risk tend to evade more" (*ibid.*, p. 60). He then proceeds to expand the model by introducing additional and more realistic assumptions which lead him to draw further insights into the behaviour of tax evaders. Some of these assumptions are, like those of Allingham and Sandmo, of the commonsense variety, e.g. "the greater the inequality of income will induce greater evasion" (Cowell, 1990, p. 107). Other findings however have clear policy implications. For example, "If the authorities tighten up on the enforcement of the tax law, then some taxpayers will switch from evasion to avoidance [...] and, on the whole, it will be the risk-averse and the rich who... can afford the financial advice [...] required in order to make the switch" (*ibid.*, p. 178).

A more recent micro-theoretical study is that of Anderberg *et al.* (2003). The authors confine their analysis to informal activities which are illegal, thus ignoring legal household production and tax avoidance, for example. They provide a micro-founded framework to study the relationship between tax policy and the informal economy, arguing that tax rates are less important in determining grey activities than tax enforcement, a point similar to that made by Allingham and Sandmo (1972). However, tax policy and enforcement are complementary in their model.

Anderberg *et al.*'s study can be criticised in various ways. Some of the assumptions they make seem unrealistic, even when taking into account the theoretical context of their model. For example, they assume that the poor are more engaged in tax evasion than other socio-economic groups. Even if we accept this assumption, the rich are more likely to account for a larger proportion of concealed income and hence a larger percentage of lost tax revenues to the state.

One of the few macro-theoretical analyses is McGee and Feige (1989) who discuss the 'unrecorded' economy in the framework of the Phillips curve. In response to the stagflation in western economies during the 1970s, the authors attempt to show that macroeconomic policies which ignore the informal economy are a form of 'policy illusion' which can result in stagflation in the formal economy. They develop a model in which different scenarios are analysed according to whether the informal activities are exogenously or endogenously determined. The authors use the

Phillips curve to show that monetary and fiscal policies based on automatic stabilisers can produce destabilising effects when they are contaminated by inaccurate information due to the presence of informal economic activity.

How should governments avoid policy illusion? According to McGee and Feige, by "*eliminating* the unrecorded sector so that the reliability of the information system is restored or by measuring correctly the magnitude of the existing distortion and recalibrating policy instruments" (1989, p. 98, my italics). What policymakers should refrain from is shifting from one policy to another without first ascertaining whether the measured economy accurately reflects the actual economy. Adopting new policies may simply create new problems or, as McGee and Feige put it in the context of a shift from a full-employment monetary target to a price stability target, "such a shift in policy [...] can alleviate the problem of stagflation at the cost of high interest rates and burgeoning deficits" (p. 97).

The implications of McGee and Feige's comments is that if the hidden economy distorts economic policies, then there will, by implication, be a vicious cycle of hidden activities leading to inappropriate monetary and fiscal policies which in turn lead to a larger unrecorded economy, and so on. And yet despite this theoretical prognosis, there is no convincing empirical study linking the size of the informal economy in developed economies with economic instability<sup>12</sup>.

The theoretical literature has, with the exception of Allingham and Sandmo, had a relatively minor impact on the large number of empirical studies. These studies can be categorised under an expanding number of methodologies, and it is to these that we now turn our attention.

#### **4. Proliferating methodologies**

Depending on how and what one chooses, there are about 14 methodologies which have been used to estimate the size of the grey economy. Table 2 presents a taxonomy of these methodologies together with examples of studies. We have classified them under six headings: direct surveys/audits; monetary measures;

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12. The vast body of literature on the causes of economic instability has yet to incorporate the notion of an 'unrecorded' economy as even a peripheral let alone central explanation. Instead, most studies focus on the factors inherent in the dynamics of the capitalist system. For a recent example, see Cowling (2006) and the references therein. There is also the counterargument that the informal economy, far from resulting in economic instability, may actually help stimulate economic activity which would otherwise not be undertaken. For example, Dilnot & Morris (1981) state that "The existence of small amounts of economic activity on which the marginal rate of tax is zero, much of which would simply not be undertaken at all if it were confined to the formal economy, may reduce the disincentive effects of taxation and add to social relationships" (p. 72). Matthews (1982) follows a similar line of argument, but in the context of unemployment; for a critique of Matthews, see Thomas (1988).

income and expenditure measures; indirect non-monetary indicators/measures; multiple indicators-multiple causes (MIMIC) models based on the concept of latent variables; and labour market studies which compare the official with the actual labour force. Alternative taxonomies include the distinction between micro and macro approaches or between direct and indirect methods, or a combination of these. The taxonomy we use is very broad in order to accommodate the ever increasing number of methodologies.

#### **4.1 Direct surveys/audits**

##### **4.1.1 Micro-surveys of the informal sector**

Lubell (1991) argues that the definition of the informal economy used by researchers in developing countries is not always based on a legal definition but rather refers to entrepreneurial activity and is identified by two characteristics: (i) small size (micro-scale) and (ii) the extent to which an enterprise avoids official regulations and taxes. If informal activities are defined to exclude criminal activity there are, according to Lubell, similarities between the grey economy in developed countries and the informal economy in the developing world (e.g. smallscale production, sub-contracting, no accounts kept, etc.).

Most of the studies discussed by Lubell (1991) are concerned with the informal sector in the urban centres of less developed countries (LDCs), and take the form of surveys based on questionnaires completed by field workers. After surveying the studies, Lubell concludes that:

- (i) informal activities absorb between 40% and 60% of the urban labour force;
- (ii) petty trading and manufacturing are the main activities in the informal sector;
- (iii) the heads of informal enterprises earn more than the official minimum wage or the average wage in the formal sector, but employees earn less;
- (iv) there are strong backward linkages to formal sector supplies, but only weak forward ones.

The field studies provide interesting insights into petty trading and manufacturing in LDCs but, owing to the definition of the informal sector adopted by Lubell (1991) and the authors of the numerous studies he surveys, they tell us little about the extent of criminal activities, a significant factor in many LDCs. However, some of the studies discussed by Lubell allude to the corruption of local government or police officials in the context of the regulation of trading and manufacturing. More

the importantly, the studies also make it clear that there is a close relationship between informal activities and poverty.

**Table 2 - Taxonomy of methodologies**

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<p>Direct Surveys/Audits</p> <ul style="list-style-type: none"> <li>• Micro-surveys of informal sector</li> <li>• Tax audits</li> </ul>	<p>Surveys discussed in Lubell (1991), University of Laval study (1986)</p> <p>Inland Revenue Service (US)</p>
<p>Monetary Measures</p> <ul style="list-style-type: none"> <li>• Denomination of bank notes</li> <li>• Currency ratio/demand method</li> <li>• Transactions method</li> </ul>	<p>Journalists, among others</p> <p>Cagan (1958), Gutmann (1977), Tanzi (1980, 1983), and Bhattacharyya (1990, 1999)</p> <p>Feige (1979,1989)</p>
<p>Income &amp; Expenditure Measures</p> <ul style="list-style-type: none"> <li>• GDP income/expenditure discrepancies</li> <li>• Household income/expenditure discrepancies</li> <li>• Consumer expenditure: single equation approach</li> <li>• Consumer expenditure: demand system approach</li> </ul>	<p>MacAfee (1980)</p> <p>Dilnot and Morris (1981)</p> <p>Pissarides and Weber (1989)</p> <p>Lyssiotou <i>et al.</i> (2004)</p>
<p>Indirect Non-monetary Indicators/Measures</p> <ul style="list-style-type: none"> <li>• Ranking Method</li> <li>• Electricity Consumption</li> <li>• Detection-controlled Estimation</li> </ul>	<p>Frey and Hannelore Weck (1983)</p> <p>Johnson <i>et al.</i> (1997)</p> <p>Feinstein (1999)</p>
<p>MIMIC/Latent Variable Models</p>	<p>Frey and Weck-Hanneman (1984),</p>
<p>Labour Market Measures</p>	<p>Giles (1999a, 1999b), Chaudhuri <i>et al.</i> (2006)</p> <p>Contini (1981, 1989)</p>

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Very few direct surveys of the grey economy in developed countries have been undertaken. One such survey was conducted in 1986 by three economists at

Quebec's Université Laval and reported by Smith (1997)<sup>13</sup>. A questionnaire was completed anonymously by 2,134 respondents in Quebec<sup>14</sup>. Of these respondents, 31% acknowledged that they had engaged in some form of grey economic activity, either as consumers or as suppliers of goods and services. The survey also revealed that the average declared income of workers in the Quebec grey economy was 50% of the sample average. The survey led the Laval economists to conclude that the grey economy of Quebec was about 1.4% of Quebec's GDP.

The key issue that the Laval study highlights is of course to what extent the veracity of the respondents can be trusted. Specifically, the income declared by covert workers may be underreported, and some of the remaining 69% of respondents who did not confirm participating in the grey economy were possibly not revealing the truth. In any case, the number of such direct surveys are too few to draw any general conclusions about their usefulness given these reservations.

#### **4.1.2 Tax audits**

An example of a tax audit is the Taxpayer Compliance Measurement Program (TCMP) conducted by the Inland Revenue Service (IRS) in the United States. TCMPs are intensive audits conducted for both households and small businesses using a large sample<sup>15</sup>.

The TCMP statistics are used to estimate the value of taxes owed but not paid (the tax gap). The tax gap for households in the late 1980s was reported by Feinstein (1999) to be in excess of \$100 billion, although the specific years are not reported exactly.

The IRS method has numerous drawbacks, including the following:

- (i) A tax audit cannot, for obvious reasons, collect data on criminal activities.
- (ii) The tax yield is likely to be less compared with ordinary audits. Feinstein (1999) points out that in 1988 the TCMP audit produced an average yield of \$300 compared with \$5,500 for ordinary audits in the mid-1990s.
- (iii) The marginal cost of a TCMP audit is, according to Feinstein (1999), lower than the marginal benefit.
- (iv) The sample may not be representative of the population<sup>16</sup>.

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13. The Italian Statistical Office has also carried out some direct surveys.

14. Smith does not however state how many questionnaires were distributed.

15. Feinstein (1999) reports that the 1988 TCMP involved the auditing of 50,000 households.

16. This is a problem with all audits and surveys and is not unique to the TCMP.

- (v) Such audits can only provide point estimates of tax evasion rather than time series data for all informal activities.

## **4.2 Monetary measures**

Monetary measures have tended to be the most widely used estimates of the informal economy. These measures can be classified into three categories: the currency ratio/demand method and the transactions method, which are the most widely used, and a more minor category, the denomination of banknotes indicator, which we briefly consider first.

### **4.2.1 Denomination of banknotes**

It has been argued that the volume of large denomination banknotes in circulation provides a good indication of the level of informal economic activity. Any increase in the volume indicates an increase in the informal economy. However, the problem with this hypothesis is that it naively assumes that illegal economic transactions are facilitated in cash only, thus ignoring barter, cheques and, in the electronic age, credit cards. It also ignores the various legitimate reasons why the demand for large denominations may at various times increase. For example, Dilnot and Morris (1981) and O'Higgins (1989) argue that inflation results in people holding more cash and, specifically, larger denominations. A more general criticism is that such an approach cannot provide an accurate estimate of the size of the informal economy, but only a very rough indication of its prevalence<sup>17</sup>.

One of the main reasons why large denominations are commonly believed to play a role in the informal economy can be directly ascribed to journalists<sup>18</sup>, whose reporting of criminal activities has tended to play on such myths.

### **4.2.2 Currency ratio/demand method**

Cagan (1958) was the first to develop the currency ratio method when he attempted to explain the long-term variation of the ratio of currency to the money supply in the US.

Following a decline from the 1870s to 1930, the currency ratio in the US increased significantly over the next 15 years. From a low of about 7% in 1930, it rose to 20% during the Second World War. In considering the causes of these movements in the ratio, Cagan looked at a large number of explanatory variables including the cost of

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17. MacAfee (1980) also casts doubts on the usefulness of taking large denominations to measure informal economic activity.

18. For example, Dilnot and Morris (1981) cite two articles, one in *Fortune* on 9 October 1978 and the other in the *Financial Times* on 9 April 1979.

holding currency, the volume of retail trade, the volume of travel, tax evasion arising from taxes on transactions, and black markets. Using a simple statistical analysis based on time-series data, Cagan concluded that "a price and income variable [...] have been major determinants of the demand for currency relative to deposits" (*ibid.*, p. 327). However, these two variables, which are used as proxies for some of the explanatory variables mentioned above, "cannot explain exceptional wartime increases in the currency ratio" (*ibid.*). This led Cagan to conclude that "Only attempts to conceal income payments in order to evade high tax rates seem capable of creating enough additional demand for currency to account for the wartime increases" (*ibid.*).

Although Cagan's paper was published in 1958, it was not until Gutmann's 1977 paper that measuring the grey economy started to become a popular topic for economic research<sup>19</sup>.

Gutmann (1977) defines the 'subterranean' economy as the "vast amount of nonreported income and nonreported work and employment" (p. 26). When discussing the participants in the subterranean economy, Gutmann includes potentially anyone involved in cash transactions, e.g. "retailing, personal services [...] illegal and quasi legal activities [...] Restaurants, car washing [...] garages, bars [...] payments for part-time work [...] bribes" (*ibid.*).

Unlike Cagan, Gutmann does not use statistical analysis, but simply decomposes the US money supply, M1, into two components, currency and demand deposits, and looks at their movement as well as the ratio of currency to deposits over the period 1937-76. Following a low of \$219 of currency per \$1,000 of demand deposits in 1941, the ratio rose to \$363 per \$1,000 in 1945. After declining in the post-war period, it continued to rise steadily after 1961. Guttmann's explanation for the increase in the circulation of currency, especially after 1961, is that it "lubricates a [...] whole subterranean economy" (p. 26). This explanation is based on the assumption that the period 1937-41 was "normal". In other words, during this period the currency demand for illegal purposes was zero.

There are several shortcomings with Gutmann's analysis which we shall discuss later, after considering other studies using the currency ratio/demand approach. However, at this juncture it is worth highlighting that there is a clear political agenda underlying Gutmann's estimates. For example, his introduction states: "The

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19. Interestingly, Gutmann (1977) makes no reference to Cagan (1958).

subterranean economy [...] was created by government rules and restrictions. It is a creature of the income tax, of other taxes, of limitations on the legal employment of certain groups and of prohibitions on certain activities" (p. 27). And he continues, "we should recognize that the subterranean economy is created by government [...]" We should admit that the increasing public contempt for the tax system and government regulation is causing the subterranean economy to grow more rapidly" (*ibid.*). Thus the policy implications are clear: reduce income tax, and reduce regulations.

One of the most influential studies using the cash ratio approach is that of Tanzi (1980), whose starting point is the relationship between the demand for currency and taxes. Assuming that economic agents engage in "underground" activities in order to circumvent their tax obligations, an estimate of the tax elasticity of currency demand can then be used to calculate the stock of currency held in the informal sector. Following in the steps of Cagan (1958), Tanzi uses time-series data to run a simple econometric equation. The dependent variable is the ratio of currency to deposits, using M2 as the measure of the money supply.

Although Tanzi gives prominence to tax evasion as the motivating force for informal economic activity, he also includes three other explanatory variables: per capita income; the ratio of total wages and salaries in personal income; and the rate of interest on time deposits. An increase in real per capita income results in a fall in the currency ratio. The ratio of total wages and salaries in personal income is assumed to be positively related to the currency ratio since wages are paid predominantly in cash, and the rate of interest on time deposits is used as a measure of the opportunity cost of holding cash.

Tanzi's model for the period 1929-76 is:

$$\ln ( C / M2) = a_0 + a_1 \ln T + a_2 \ln W + a_3 \ln Y + a_4 \ln R \quad (1)$$

where  $C$  is the stock of currency holdings,  $T$  is a tax variable,  $W$  represents the share of wages and salaries in personal income,  $Y$  is real per capita income, and  $R$  is the rate of interest on time deposits.

All the independent variables except  $Y$  are found to be significant, which leads Tanzi to state that (1) establishes "a connection between changes in the level of income taxes and changes in the  $C/M2$  ratio. This connection can be attributed to



the existence of a tax induced 'underground' or 'subterranean' economy in which transactions are carried out mainly through the use of currency" (*ibid.*, pp. 444-45).

Assuming that the income velocity of money in the underground economy is the same as that in the legal economy, then the size of the former can be approximated by multiplying the income velocity of money in the legal economy by the stock of money in the underground sector. Tanzi does this by first solving equation (1) for the 1976 values of the independent variables, and then by obtaining predicted values for  $C$ . The difference between predicted and actual values that can be attributed to underground economic activity. Tanzi estimates the size of the US underground economy to be between 3.4% and 5.1% of GNP.

In Tanzi (1983) two equations similar to (1) but using an adjusted tax variable are estimated, and the period extended to 1980. In one equation, the adjusted tax term is  $(1 + TW)$  and in the other equation is  $(1 + T)$ , where  $TW$  is the weighted average tax rate on interest income and  $T$  is the ratio of total income tax to adjusted gross income. Estimating the equation with  $(1 + TW)$ , Tanzi calculates the underground economy to be between 5.19% and 6.07% of GNP for the period 1977-1980, whereas the equation with  $(1 + T)$  provides an estimate of between 3.60% and 4.49% of GNP.

A variant of the Cagan (1958) and Tanzi (1980, 1983) approaches is that of Bhattacharyya (1990). This is a more sophisticated study which departs from the currency demand estimations of Cagan and Tanzi in two important respects: first, it deliberately excludes taxation as an explanatory variable; and second, the modelling strategy and procedure rely heavily on appropriate diagnostic testing.

Assuming that transactions in the underground economy take the form of cash payments, Bhattacharyya (1990) writes the maintained hypothesis as:

$$M = M_R + M_{UR} \tag{2}$$

where  $M$  is the total demand for currency and  $M_R$  and  $M_{UR}$  represent the demand for currency in the recorded and unrecorded sectors, respectively. Assuming that a) the demand for money in the recorded economy is a function of income ( $Y_R$ ), a short-term rate of interest ( $R$ ), and the retail price index ( $P$ ), and b) the demand for money in the unrecorded economy is a function of underground income ( $Y_h$ ), Bhattacharyya derives the following equation:

$$\ln M_t = \ln a_1 + (\beta_1 + \delta_1 D) \ln Y_{Rt} + \beta_2 \ln R_t + \beta_3 \ln P_t + \left( \sum_{i=2}^4 a_i Y_{Rt}^i \right)^{(\beta_4 + \delta_2 D_t)} / H_1(\cdot) + e_t + v_t \quad (3)$$

where  $H_1(\cdot) = a_1 Y_{Rt}^{(\beta_1 + \delta_1 D_t)} R_t^{\beta_2} P_t^{\beta_3}$ ,  $D_t$  is a dummy variable included to pick up the structural break at the end of the 1973 oil crisis, and  $\varepsilon_t$  and  $v_t$  are disturbance terms. The estimates obtained from (3) are found to satisfy a variety of diagnostic tests including the Lagrange Multiplier test for serial correlation and the Autoregressive Conditional Heteroscedasticity test.

Using the results of (3) and the assumption that  $Y_m = \sum \alpha_i Y_{Rt}$ , Bhattacharyya reports estimates for the underground economy on a quarterly basis. As a percentage of recorded GNP the estimates vary from 3.75% in the second quarter of 1960 to a peak of 11.13% in the first quarter of 1977. Between the first quarter of 1978 and the fourth quarter of 1984 the estimates vary from 10.91% to 7.65%.

The currency ratio/demand approach has been criticised for the following reasons:

- (i) In the case of Gutmann (1977), the assumption that there is a period during which there was no informal activity is clearly absurd (see Thomas, 1999).
- (ii) Gutmann offers no explanation for his assumption that the velocity of circulation is the same in both the formal and informal economies.
- (iii) Thomas (1989) points out that the estimates of Gutmann (1977), Tanzi (1980, 1983) and other currency demand studies using US data may in fact be measuring the underground economy of other countries rather than that of the US. This is especially so in the case of Latin America, where US dollar holdings are large due to the currency's popularity as a hedge against political and economic instability, added to which is its widespread use in money laundering related to the drugs trade.
- (iv) The approach is based on the grossly unrealistic assumption that transactions are purely carried out in cash (see Porter and Bayer, 1989, Ernste and Schneider, 1998 and Thomas, 1999).
- (v) In the case of Tanzi (1983), Thomas (1986 and 1989) and Porter and Bayer (1989) show that the econometric model is misspecified and unstable.
- (vi) Bhattacharyya (1990) is a technically more advanced study than its predecessors, but suffers from much the same problem, i.e. it lacks theoretical

foundations. Thus, "Bhattacharrya has nothing to offer policymakers in terms of links between the black economy and its economic causes" (Thomas, 1999, p. 386).

#### 4.2.3 Transactions method

An alternative to the currency ratio/demand approach is that of the monetary transactions method developed by Feige (1979, 1980 and 1989b), which concentrates on the volume of payments rather than changes in the demand for currency. Feige's starting point is Fisher's equation of exchange,  $MV = PT$ . If independent estimates of  $MV$  and  $PT$  are not equal then the discrepancy can be attributed to underground economic activity. If, however,  $PT$  (which includes both formal and informal transactions) cannot be estimated, then estimates of  $MV$  can still be used to ascertain the size of the underground sector.

Feige (1989b) summarises the procedure as follows: let

$$Y_T = Y_R + Y_U \quad (4)$$

where  $Y_T$  is total income,  $Y_R$  is recorded income and  $Y_U$  is unrecorded income. Also assume that  $PT$  is made up of transactions using cash and cheques. We can then write:

$$PT = CV_c + DV_d \quad (5)$$

where  $C$  is the stock of currency,  $D$  represents checkable deposits,  $V_c$  is the currency velocity and  $V_d$  is the checkable deposit velocity. Assuming total transactions to be proportional to total income and using the Cambridge version of Fisher's equation i.e.  $PT/Y = K$ , together with (4) and (5), Feige obtains:

$$Y_U = [(CV_c + DV_d)/K] - Y_R \quad (6)$$

Given estimates of total payments and recorded income, we can estimate the size of the underground economy. However, as can be seen from (6),  $Y_U$  cannot be estimated unless  $K$  is known. To overcome this problem, Feige assumes that there was a period during which all income was properly recorded. In Feige (1979, 1980) he opts for 1939 as the benchmark year for which he calculates  $K$  to be 10.3. By estimating  $PT$  and substituting the value of  $K$  into equation (6), the underground

economy is estimated to be between 13.2% and 21.7% of GNP in 1976 and between 25.5% and 33.1% in 1978. In Feige (1989b) the period of estimation is extended to 1981, and the author concludes that the informal economy in the United States is "between \$280 billion and \$420 billion, amounting to 16-24% of reported gross income in 1981" (Feige, 1989b, p.54).

The assumptions underlying Feige's estimates have been criticised by Thomas (1989) and Porter and Bayer (1989) for lacking empirical validity. Tanzi (1983) also suggests that Feige's estimates are sensitive to the choice of initial period. The criticism made by Thomas (1989) of the currency ratio/demand method mentioned in sub-section 4.2.3, namely that the widespread use of the dollar in countries other than the US distorts any analysis of the informal economy in the US, applies here as well. Indeed, in a later study Feige (1997) concedes that between 25% and 45% of US currency is held abroad.

### **4.3 Income and expenditure measures**

#### **4.3.1 GDP income/expenditure discrepancies**

Starting with the assumption that the income measure of GDP is supposed to be the same as the expenditure measure, some economists have argued that any discrepancy between the two measures, specifically if income GDP is larger than expenditure GDP, indicates the existence of a "hidden" economy.

A widely cited study using this approach is that of MacAfee (1980), who defines the hidden economy as "the economic activity generating factor incomes which cannot be estimated from the regular statistical sources used to compile the income measure of gross domestic product" (p.81). MacAfee considers the problem of including criminal activities in his definition and concludes: "The difficulties of measurement, combined with *the incongruity of relating an increase in crime with an increase in economic activity*, suggest that the inclusion of crime...is problematical and that estimates of value added arising from crime should *await better data*" (1980, p. 84, my italics).

MacAfee (1980) proceeds on the assumption that the expenditure measure of GDP in the UK is unbiased because it is compiled using the Family Expenditure Survey (FES), which is supposedly reliable. Respondents to the FES have, according to MacAfee, little reason to lie except in the case of sensitive items. Any underreporting is thus likely to be small. In contrast, the income measure of GDP is compiled using data from the UK's Department of Inland Revenue. Thus, there is far more scope for underreporting actual income, especially by the self-employed.

The difference between UK estimates of GDP based on expenditure and those based on income is called the 'initial residual difference' (IRD). The IRD is, according to MacAfee (1980), affected by underreporting of factor incomes, timing errors (transactions recorded in different time periods), and other estimation errors (e.g. sampling errors). MacAfee shows that the IRD as a percentage of the expenditure measure of GDP increased significantly in the UK from less than 0.3% in 1960 to almost 4% in 1974, and then declined between 1974 and 1978.

MacAfee's methodology is however problematic because:

- (i) it excludes criminal activities;
- (ii) it does not address the fact that timing differences in transactions can affect the survey results, as the author indeed concedes (see Dilnot and Morris, 1981);
- (iii) it assumes that the FES data are unbiased.

A more general criticism is offered by Thomas (1999), who points out that (i) the two measures of national income are not statistically independent, sharing similar components; and (ii) sometimes national income can be larger than national expenditure, as has been the case in Switzerland, implying a negative black economy. Tanzi (1999) argues that GDP data are sometimes subject to political interference. This is particularly true in some developing countries when seeking to obtain credit from the main lending institutions such as the IMF and the World Bank. Even in developed economies, allegations of data manipulation are not unknown.

#### **4.3.2 Household income/expenditure discrepancies**

As an alternative to looking at GDP income/expenditure discrepancies, Dilnot and Morris (1981) use a disaggregated analysis which examines the income and expenditure behaviour of individuals. The authors begin with a detailed analysis of 1,000 households taken from the FES, and then extend the analysis to the whole FES sample of 7,200 households. Dilnot and Morris do not clearly define what they mean by 'black' economic activity, although they do state that: "Our approach, in principle, includes [...] tax evasion and social security fraud" (*ibid.*, p. 66).

Having examined and corrected the data for deficiencies, Dilnot and Morris analyse a sample of households whose expenditure exceeds 1.15 of their reported income.

They then estimate the size of the UK black economy in 1977 to be between 2.3% and 3% of GNP.

The main drawback of this approach is that, just like MacAfee (1980), it assumes that the FES is a reliable source of information. But as the authors admit: "we must expect that [...] individuals with something to hide will be more reluctant to respond to an official survey [...] and therefore the Family Expenditure Survey under-represents the black economy" (Dilnot and Morris, 1981, p. 68). After having considered the figures for the self-employed, they add: "self-employment is under-reported in FES" (*ibid.*, p.72).

#### 4.3.3 Consumer expenditure: the single equation approach

Whereas Dilnot and Morris (1981) analyse discrepancies between total household income and expenditure, Pissarides and Weber (1989) use a single equation consumption function for food to estimate the size of the black economy in the UK. The black economy is defined as consisting of "activity that should normally be reported and taxed but is not" (*ibid.*, p.18). For empirical purposes, the authors assume that "only the self-employed under-report their income" (*ibid.*).

Pissarides and Weber use data from the FES to estimate consumption functions for food which are then inverted to calculate actual rather than reported income. Food expenditure is chosen on the assumption that it is more accurately recorded than other items of expenditure. "It is highly unlikely that the person filling in the diary [...] will conceal some seemingly small food expenditure for tax reasons" (*ibid.*, p. 18).

The consumption function estimated is as follows:

$$\ln C_{ij} = Z_{iaj} + \beta_j \ln Y_{ti} + \gamma_j SE_i + \eta_i \quad (7)$$

where  $C_{ij}$  is the consumption of item  $j$  by household  $i$ ,  $Z$  is a vector of household characteristics,  $a_j$  is a vector of parameters,  $\beta_j$  is the marginal propensity to consume good  $j$ ,  $Y_{ti}$  is the after tax income of household  $i$ ,  $SE$  is a dummy for the self-employed (1 if the head of the household is self-employed, and 0 if the head of the household is an employee), and  $\eta_i$  is an error term.

Equation (7) is estimated for blue and white collar households. Based on the estimates, Pissarides and Weber (1989) draw the following conclusions:

- (i) The self-employed spend more on food than employees;
- (ii) The standard deviation of income for the self-employed is twice as high as for employees;
- (iii) The marginal propensity to consume is similar for employees and the self-employed;
- (iv) The self-employed consume more than employees, after adjusting for income and household characteristics.

They then use the results to calculate the variances and covariances of the average underreported income for white and blue collar households, and find that the mid-point estimate for mean underreporting, in other words the black economy coefficient, is 1.55. This produces an estimate of the size of the UK black economy at 5.5% of GDP.

There are a number of shortcomings with this method:

- (i) As the authors acknowledge, some employees may be engaged in self-employment, thus concealing their true income.
- (ii) The authors' confidence that food expenditure is accurately reported could well be misplaced. Anyone underreporting their income may also be underreporting their expenditure. In the case of food this would apply to expensive items. There is also the related issue of where food is consumed. Not all food is consumed in the home or in restaurants: some is also consumed at the workplace.
- (iii) The method ignores savings. Households could be financing the consumption of luxury food items from their savings and not from current income.
- (iv) As Lyssiotou *et al.* (2004) note, the method assumes homogeneous preferences or, as they put it, "An important limitation of the simple linear equation approach [...] is that it imposes separability in the components of income. [...] This implies *absence of preference heterogeneity* associated with the sources of income: all differences in consumer demand are attributed to differences in (mis)reported income" (*ibid.*, p. 628, my italics). They correctly go on to point out that, for any given level of income, expenditure can vary between households due to a number of demographic and other characteristics, such as the age profile of a household, housing tenure, geographical location, etc. (*ibid.*, p. 629)<sup>20</sup>.

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20. This applies not only to food consumption but to "any peculiarity associated with the pattern of spending that does not reflect misreporting of household income".

#### 4.3.4 Consumer expenditure: the demand system approach

To avoid some of the problems associated with the single equation approach, Lyssiotou *et al.* (2004) use a complete demand system based on cross-sectional individual household data from the FES. They argue that the advantages of a complete demand system over the single equation method are that it avoids bias arising from confusing preference heterogeneity with income effects, and that it dispenses with the need to categorise households by source of income. The authors define the black economy as "economic activities that are hidden from public authorities to avoid taxation" (*ibid.*, p. 622).

Lyssiotou *et al.* (2004) consider two sources of income (wages and self-employment income) and six categories of non-durable goods (food, alcohol, fuel, clothing, personal goods/services and leisure goods/services). They then estimate the following demand system:

$$\begin{aligned} \omega_{ih} = & \alpha_i + \sum_j \alpha_{ij} z_{jh} + \delta_i y_h^s + \beta_i [\ln Y_h + \ln(\theta_o y_h^w + \theta_1 y_h^s)] \\ & + \lambda_i [\ln Y_H + \ln(\theta_o y_h^w + \theta_1 y_h^s)]^2 + v_{ih}, \end{aligned} \quad (8)$$

where  $\omega_{ih}$  is the budget share for good  $i$  in household  $h$ ;  $z$  is the vector of household characteristics (age of household head, location, occupation, etc.);  $y_h^w$  and  $y_h^s$  are the wage and self-employment proportions of observed household income  $Y_h$ ;  $\delta_i$  is the preference heterogeneity associated with self-employment income;  $\theta$  is the black economy coefficient (i.e. the factor by which the observed income must be multiplied in order to equal actual income); and  $v_{ih}$  is an error term<sup>21</sup>.

The estimation of (8) leads Lyssiotou *et al.* (2004) to derive values for the black economy coefficients of 2.18 for blue collar households and 1.64 for white collar households. These values are then used to calibrate the size of the black economy in the UK as 10.6% of GDP, which is about double the estimate provided by Pissarides and Weber (1989), and over three times the value calculated by Dilnot and Morris (1981).

In justifying their methodology, Lyssiotou *et al.* (2004) state that it avoids the criticism of measurement without theory because it "is based on sound principles of consumer behaviour" (p. 624). While we would not dispute the methodology's link to consumer theory, it is a purely statistical exercise that, like Pissarides and Weber

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21. For a full explanation of all the parameters, see Lyssiotou *et al.* (2004). Our intention is to give the reader a flavour of the approach rather than a full technical description.



(1989), has little to say about how the informal economy functions. There are also several other significant problems:

- (i) A demand system approach requires much more information than the single equation methodology they are trying to improve on, as the authors acknowledge. This can lead to measurement error problems.
- (ii) Their sample choice deliberately excludes pensioners and single parents on the grounds that they wish to avoid "preference peculiarities" (*ibid.*, p. 629). However, it is precisely pensioners and single parents who have a strong incentive to participate in informal activities.
- (iii) The results for the preference heterogeneity effects lead the authors to conclude that the higher self-employed income is in a household, the higher the share of necessities (food and fuel) in expenditure. "Possibly this is because these households tend to have life styles favouring more spending on necessities rather than luxuries" (*ibid.*, pp. 634-35). This statement is however completely counter-intuitive.

#### **4.4 Indirect Non-monetary Indicators/Measures**

##### **4.4.1 Ranking method**

Frey and Hannelore Weck (1983) use a combination of weights and sensitivity analyses to rank countries in terms of the prevalence of the 'shadow' economy. The weights are "inferred on the basis of the knowledge gained from the literature" (*ibid.*, p. 28), and the sensitivity analysis is based on "various determinants in the writings on the subject" (*ibid.*).

The novelty and shortcomings of this method is acknowledged by Frey and Hannelore Weck when they state: "While the procedure used here may seem unfamiliar and naïve to economists, it is considered scientifically acceptable in psychology" (*ibid.*, p.29). It is of little surprise that this approach has not been widely adopted. Moreover, for the policymaker, the knowledge that one's country is ranked as having a 'large', 'medium', or 'small' informal economy is of no help in the design of appropriate policies. The ranking method was a precursor of the MIMIC model method, which we discuss in sub-section 4.5.

##### **4.4.2 Electricity consumption**

Johnson *et al.* (1997) look at the 'unofficial' economy in transition economies. The unofficial economy constitutes any "activity that is not reported to the state statistical office" and "is almost never reported to the tax authorities" (*ibid.*, p. 173). The word "activity" is used to refer to entrepreneurial activity in the production of

goods by firms, and does not preclude corruption in the form of bribes. The authors assume that economic agents switch from formal to informal activity due to taxation, government regulation and the unavailability of public goods.

Using electricity consumption as a proxy for overall GDP, Johnson *et al.* (1997) compare this with actual GDP. The difference between the two represents the size of the unofficial economy. The use of electricity consumption as a proxy for total economic activity is justified on the grounds that "around the world, the short-run electricity-to-GDP elasticity is usually close to 1" (Johnson *et al.*, 1997, p. 174).

We shall not dwell on the obvious shortcomings of this methodology<sup>22</sup> other than to quote Weitzman (1997), who states "It would be easy to spend time taking potshots at this kind of methodology *because it offers a big, fat target*" (p. 231, my italics).

#### **4.4.3 Detection-controlled estimation**

This approach attempts to measure the extent of tax non-compliance. Hence, like the ranking method and the denomination of banknotes approach, it does not provide a direct estimate of the size of the informal economy. The methodology, a summary of which is contained in Feinstein (1999), consists in setting up a model with two mathematical expressions:

- 1) Potential offenders with a specified probability of violation (non-compliance);
- 2) Monitors (regulators) with a specified probability of detection, conditional on non-compliance occurring.

The two expressions are jointly estimated and the resulting values are used to construct an estimate of the proportion of violations which have not been detected. Feinstein acknowledges two major drawbacks with this methodology. First, it is a purely statistical approach with no reference to the reasons for non-compliance. Second, it suffers from the problem of identification. This is because it "decomposes a single observable variable, detected violations, into two disjoint causal expressions, violation and detection" (*ibid.*, p. 366).

Detection-controlled estimation can at best only provide an indication of the extent of tax evasion, rather than a measurement of it. Hence, it needs to be used in conjunction with other more direct approaches.

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22. See Ernste and Schneider (1998) for specific criticisms.

#### 4.5 MIMIC models

MIMIC models draw heavily on the theory of latent (or unobserved) variables in econometrics. In general, MIMIC models are made up of two parts: the measurement model and the structural model. The former is intended to link latent variables to observed indicators, whereas the latter specifies the causal relationships among the latent variables. In the case of the informal economy, there is only one latent variable, i.e. its size.

The first attempt to use a MIMIC model to estimate the size of the informal economy was by Frey and Weck-Hanneman (1984), who estimated the size of the 'hidden' economy in 17 OECD countries for the period 1960-1978. The authors did not define what they mean by a 'hidden' economy.

Frey and Weck-Hanneman identified four determinates of informal activity:

- (i) the burden of the state on economic agents (e.g. actual and perceived tax burden; share of public employees in total labour force);
- (ii) tax morality;
- (iii) the rate of unemployment;
- (iv) the level of economic development.

There are also three indicators: male participation rates, hours worked and real GDP growth.

Using the MIMIC model, the authors find that there are three statistically significant determinants: share of direct taxation in GDP; share of public sector employees in total labour force, and tax immorality. Of the three indicators, hours worked is the most important.

The MIMIC model yields *relative* values which Frey and Weck-Hanneman use to rank the hidden economies of the 17 OECD countries. These rankings are then converted into *absolute* values as a percentage of GNP for 1978.<sup>23</sup>

The Frey and Weck-Hanneman approach has several shortcomings:

- (i) There is no definition of the 'hidden' economy;

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23. For technical details of the calibration procedure, see Frey and Weck-Hanneman (1984) and Giles (1999a and 1999b).

- (ii) Using the share of public employees in the total labour force as an indicator of the burden of regulation is questionable. The number of regulations would seem a more obvious and direct measure;
- (iii) Tax morality is a very complex issue which cannot simply be measured by an index. Attitudes to tax are governed by historical, social and cultural factors. Even if the index was reliable, using an index constructed from US data (as the authors do) is certainly not representative of all countries;
- (iv) The authors use the working assumption that weekly working hours in the metal industry is a representative and comparable indicator for the sample countries. This is not convincing and requires explanation;
- (v) The authors assert that Japan's small hidden economy is due to a very low tax burden and regulation. However, this ignores other possible explanations, such as the fact that the long working hours in Japan may preclude the opportunity to engage in hidden activities.

Frey and Weck-Hanneman (1984) are aware of (ii) and (iii) when they state "An important shortcoming of our study is the weakness of the data at our disposition. This applies *especially* to tax morality and to regulation" (p. 47, my italics).

Following in the footsteps of Frey and Weck-Hanneman, Giles (1999a) also uses the latent variable methodology. A MIMIC model is used to derive an index which is then combined with a currency demand equation in order to calibrate the size of the hidden economy in New Zealand. As with Frey and Weck-Hanneman, no definition of the term 'hidden' is given.

Giles's currency demand equation draws on Bhattacharyya (1990) but differs from it in two respects: (i) it allows for different velocities of circulation in the formal and informal sectors, rather than assuming these are the same; and (ii) it allows for the non-stationarity of the time-series data. Giles's approach estimates the New Zealand hidden economy to be between 6.8% and 11.3% during the period 1968-1994.

Although the modelling procedure followed by Giles (1999a) emphasises diagnostic testing such as tests for cointegration, causality, functional form, etc., it completely lacks any theory<sup>24</sup>.

#### 4.6 Labour market measures

Shifts from the formal to the informal labour market have been used as an indication of growth in the informal economy. An example often quoted is Contini (1981), who examines the growth of the irregular labour market in Italy during the 1960s and 1970s. Irregular is defined as "all jobs outside the social security system" (*ibid.*, p. 403). However, Contini (1989) acknowledges that household production and non-market activities as well as criminal activities also constitute the 'hidden' economy: "The underground (hidden) economy in its broadest sense includes all four activities" (*ibid.*, p. 248).

According to Contini (1981), the irregular labour market in Italy grew in size during the 1960s and 1970s due to three factors:

- (i) The preference of workers for flexibility in their allocation of time as well as the avoidance of unemployment, even if it meant receiving lower rates of pay than in the regular labour market;
- (ii) The increasing demand by small-scale enterprises for workers prepared to earn less than the official market rates;
- (iii) Tax evasion by employers in the form of the non-payment of payroll taxes. More specifically, "payroll taxes and indirect charges add 50% - 70% to the basic pay. This is [...] a powerful incentive for tax evasion on the side of the employers" (*ibid.*, p. 240)<sup>25</sup>.

Contini surveys some other Italian studies related to the informal labour market, citing for example studies showing that in the 1970s, over 5% of the labour force held two or more jobs. Home-working was, and presumably still is, another

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24. An attempt to marry theory with empiricism is made by Loayza (1996), who applies a MIMIC model to estimate the size of the informal economy in Latin America. Informal activity is defined by Loayza as "the set of economic units that do not comply with government taxes and regulations" (*ibid.*, p.130). Loayza's MIMIC model is developed using endogenous growth theory and is based on the argument that informal economic activity arises when excessive taxes and regulations exist in conjunction with the inability to enforce compliance. More recently, Chadhuri *et al.* (2006) have used a MIMIC model to estimate the size of the 'shadow' economy in the states of India. The shadow economy is defined to include "income from legal and illegal activities that cannot be accounted for by the standard measurement procedures used in compilation of national income accounts" (*ibid.*, p. 429). An interesting feature of their approach is the inclusion of social and political variables such as per capita newspaper circulation and government ideology.

25. Contini also cites strict job protection legislation as a reason.

significant aspect of the Italian informal economy. The number of home-workers engaged in the clothing and textile industry was estimated to be 500,000 in the early 1970s, and in 1978 there were estimated to be around 1 million clandestine workers in the agricultural sector. Contini's own estimates of the size of the irregular labour force correspond to between 16% and 18% of the total labour force at the end of the 1970s (see Contini, 1989).

Using estimates of the informal economy (excluding criminal activities) based on labour market measures, Contini quotes studies indicating that the size of the informal economy in Italy during the mid to late-1970s was between 6% and 10% of GDP.

Using the informal labour market as an indicator of the size of the informal economy has two drawbacks. First, there is a problem of defining what constitutes formal and informal. As the World Bank points out, there is a blurring between the two. "Some formal market jobs or enterprises can be classified as informal if it is found that they have poor work protection or if the life style and opportunities they entail are considered undesirable" (World Bank, 2007). Second, due to the illegal nature of some activities and/or the illegal status of many workers in the informal labour market, the data cannot be considered as reliable.

Before we begin to discuss the literature, we provide a brief summary of the specific criticisms of the various methodologies in Table 3.

**Table 3 - Summary of specific criticisms of methodologies**

<b>Methodology</b>	<b>Criticisms</b>
Direct Surveys/ Audits	<ul style="list-style-type: none"> <li>• Veracity of respondents cannot be trusted</li> <li>• Sample may not be representative of the population</li> <li>• Estimates are for a specific point in time</li> </ul>
Monetary Measures	<ul style="list-style-type: none"> <li>• Unrealistic assumptions are made (e.g. cash transactions only, a period in which informal activity did not exist, etc.)</li> <li>• Econometric results are sensitive to choice of period</li> </ul>
Income & Expenditure Measures	<ul style="list-style-type: none"> <li>• Assumes FES data are unbiased</li> <li>• Measures of income and expenditure are not statistically independent</li> <li>• National income can be less than national expenditure</li> <li>• Measurement error problems exist</li> </ul>
Indirect Non-monetary Indicators/Measures	<ul style="list-style-type: none"> <li>• The ranking method is naive</li> <li>• Unrepresentative proxy (electricity consumption approach)</li> <li>• Identification problem (detection controlled estimation)</li> </ul>
MIMIC/Latent Variable Models	<ul style="list-style-type: none"> <li>• Weakness of data</li> <li>• Questionable assumptions</li> <li>• Tax morality index problematic (Giles's approach)</li> </ul>
Labour Market Measures	<ul style="list-style-type: none"> <li>• Problem of definition</li> <li>• Data unreliable due to clandestine nature of work &amp; illegal status of employees</li> </ul>

## 5. General criticisms of the literature

The definition of the informal economy (or any of the many other terms) remains problematic. As we have seen in Section 4, some researchers avoid providing a definition, others provide a definition which includes criminal activities, whereas others exclude such activities. Tanzi (1999) correctly points out that the unresolved question of a consensus definition "is not a minor or semantic issue but one of fundamental importance" (p. 339).

As far as the estimates of the informal economy are concerned, we have seen how much variation is provided by the many studies we have reviewed. The variation is not only between different studies but also within the same studies. This is starkly illustrated by Table 4, which shows the large variation in estimates obtained using the money demand method.

The five studies listed in the table are for the underground economy in Canada, and were undertaken by four authors, either jointly or separately. The estimates vary from a low of 4.9% of GNP in 1976 obtained by authors A and B using Tanzi's methodology, to 27.5% of GNP in the same year and by the same authors, but using Feige's approach. In their 1989 study the same authors used the Feige method to estimate the Canadian underground economy in 1982, yielding a range of 10.5%-12.8% of GNP, which represents, in percentage terms, less than one-half of the equivalent 1976 estimate. If we accept that both the 1976 and 1982 estimates are correct, it is difficult to believe that the underground economy in Canada has shrunk to less than half its former size in just six years. Thus, Table 4 illustrates why we should be sceptical about estimates of the informal economy<sup>26</sup>.

A running theme in Section 4 was the lack of theory to support the empirical estimates. This is the most serious shortcoming of the studies we have reviewed, and is a criticism forcefully made by Thomas (1999).

In 1946 A. F. Burns and W. C. Mitchell published a book titled *Measuring Business Cycles*, which addresses the empirical study of cyclical fluctuations of economic variables. In his seminal review article of the Burns and Mitchell book, Koopmans (1947) criticised the study for being too empiricist in the sense that "The various

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26. Our scepticism is reinforced by Tables A and B in the Appendix which show wide variations in estimates derived from different methodologies used over the past 30 years. This has led Tanzi (1999) to state "These ranges do not give one great confidence in the estimations and leave one confused as to what to do with them" (p. 346).



choices as to what to 'look for', what economic phenomena to observe, and what measures to define and compute, are

**Table 4 - Estimates of the 'underground' economy in Canada\***

Author(s)	Date of study	Target Year	Method	Estimate (% of GDP)
A and B	1981	1976	Money demand (Gutmann)	15.7
		1976	Money demand (Feige)	27.5
		1976	Money demand (Tanzi)	4.9 - 7.7
A	1984	1980	Money demand	9.3
		1980	Money demand (Feige)	14.1
C	1985	1981	Money demand (Tanzi)	5.7
A and B	1989	1982	Money demand (Feige)	10.5 - 12.8
D, A and B	1993	1984	Money demand (Feige)	19.3
		1990	Money demand (Gutmann)	21.6
		1990	Money demand (Tanzi)	14.6

\* This is an extensively adapted version of Table 3 in Smith (1997). All the studies use the same definition of the underground economy which is: "market-based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of GDP" (Smith, 1997, p. 15).

made with a minimum of assistance from theoretical conception or hypotheses regarding the nature of the economic processes by which the variables studied are generated" (p. 161). And he continues: "The rejection of the help that economic theorizing might give leaves a void" (p. 164). The overly empiricist approach not only leaves a void for the researcher but, just as importantly, for the policymaker. "Without resort to theory [...] conclusions relevant to the guidance of economic policies cannot be drawn" (p. 167). Coming from one of the pioneers of economic empiricism, these are indeed strong critical comments.

Drawing on Koopmans, Thomas (1999) levels a similar criticism against the existing black economy literature. He argues that many of the empirical studies seek to obtain an aggregate number of the size of the informal economy without asking pertinent questions about the motivation and *modus operandi* of the agents involved.

This "has led economists into a blind alley in which the question of size has become an end in itself [...] No genuine policy conclusions emerge from the exercise, although some have been tacked on, varying according to the political persuasion of the author concerned" (*ibid.*, p. 387).

## **6. Conclusions**

After 50 years of research on the size of the informal economy, what have we learnt? First, as the plethora of adjectives to describe informal activities indicates, there remains no consensus on an appropriate term and, more importantly, on what is to be measured. Second, this lack of consensus is also to be found in the large number of methodologies and estimates. This has obvious policy implications. The policies associated with an informal economy accounting for only 2% of GDP are clearly not the same as those that would be required if it represented 30% of GDP. Frey (1989) recognises the difficulty of identifying what constitutes a problematic size of informal economy when he states "nobody can a priori say which size of the unobserved economy is socially optimal" (p.126).

Rather than concentrating on obtaining an aggregate number which cannot be relied upon with confidence, we instead argue that economists need to collaborate with specialists from other disciplines such as criminologists and sociologists in order to understand the functioning of the grey economy, especially the linkages between the many forms of legal and illegal activities. Consideration also needs to be given to a number of factors often ignored or insufficiently analysed as determinants of participation in informal activities. While much coverage has been given to factors such as the tax burden, onerous government regulations and the availability (or otherwise) of public goods, relatively little has been written about the role of poverty, cultural attitudes towards the state, the legal status of immigrant workers, the role of professionals (lawyers, accountants, etc.) in criminal activities, and social and political attitudes towards different forms of crime. Such a multidisciplinary approach is more likely to yield fruitful results for politicians who need to design appropriate policies rather than estimating an aggregate number which, ultimately, is nothing more than a "guesstimate", irrespective of the sophistication of the estimation techniques.

**Table A. Selection of estimates of the informal economy**  
(by chronological order of study)

Study	Year of study	Estimation Method	Estimation Year/Period	Estimation Country/Region	Estimate <sup>1</sup> (% of GDP or GNP)
Gutmann	1977	Currency Ratio	1976	USA	9.4% (GNP)
Feige	1980	Transactions Method	1976-78	USA	13.2% - 33.1% (GNP)
Dilnot & Morris	1981	Household Income/ Expenditure	1977	UK	2.3%-3.0% (GNP)
Tanzi	1983	Currency Ratio	1930-80	USA	0.6% - 6.1% <sup>2</sup> (GNP) 1.7% - 4.5% <sup>3</sup> (GNP)
Frey & Weck-Hanneman	1984	MIMIC Model	1978	OECD Countries	8.7% <sup>4</sup> (GNP)
Contini	1989 <sup>5</sup>	Labour Market	1977	Italy	7.5% (GNP)
Pissarides & Weber	1989	Consumer Expenditure (single equation)	1982	UK	5.5% (GDP)
Bhattacharrya	1990	Currency Demand	1960-84	UK	3.8%-11.1% (GNP)
Loayza	1996	MIMIC Model	1993	Latin America	38.8% <sup>6</sup> (GDP)
Johnson <i>et al</i>	1997	Electricity Consumption	1989-95	Former Soviet Union Former Eastern Europe	12.0%-36.2% <sup>7</sup> (GDP) 16.6%-21.3% <sup>8</sup> (GDP)
Giles	1999	MIMIC Model	1968-94	New Zealand	6.8%-11.3% (GDP)
Lyssiottou <i>et al</i>	2004	Consumer Expenditure (demand system)	1993	UK	10.6% (GDP)
Chaudhuri <i>et al</i>	2006	MIMIC Model	1994/95	Selected Asian Countries	25.6% <sup>9</sup> (GDP)

1. The figures for Tanzi (1983) and Bhattacharrya (1990) have been rounded to one decimal figure.

2. Using weighted average tax rate. The lower figure is for 1930 and the higher figure for 1980.

3. Using average tax rate. The lower figure is for 1932 and the higher figure for 1980.

4. Average for 17 countries. Highest figure is 13.2% for Sweden and lowest figure is 4.1% for Japan.

5. The study was originally published in Italian in 1979 and the result is reported in Contini (1989).

6. Average for 14 countries. Lowest figure is 18.2% for Chile and highest is 65.6% for Bolivia.

7. Average for 11 countries. Lowest figure is 6.5% for Uzbekistan in 1995 and highest is 63.5% for Georgia in 1994.

8. Average for 6 countries. Lowest figure is 5.8% for Slovakia in 1995 and highest is 30.6% for Hungary in 1992.

9. Average for 14 countries. Highest figure is 48.3% for Thailand and lowest figure is 10.6% for Japan. I have excluded the figure for China since Chaudhuri *et al* (2006) state that this is not reliable.

## Appendix (cont.)

**Table B. Selection of estimates of the informal economy**  
(*by country/region*)

Study	Year of study	Estimation Method	Estimation Year/Period	Estimation Country/Region	Estimate <sup>1</sup> (% of GDP or GNP)
<b>Gutmann</b>	1977	Currency Ratio	1976	USA	9.4% (GNP)
<b>Feige</b>	1980	Transactions Method	1976-78	USA	13.2% - 33.1% (GNP)
<b>Tanzi</b>	1983	Currency Ratio	1930-80	USA	0.6% - 6.1% <sup>2</sup> (GNP) 1.7% - 4.5% <sup>3</sup> (GNP)
<b>Dilnot &amp; Morris</b>	1981	Household Income/ Expenditure	1977	UK	2.3%-3.0% (GNP)
<b>Pissarides &amp; Weber</b>	1989	Consumer Expenditure (single equation)	1982	UK	5.5% (GDP)
<b>Bhattacharya</b>	1990	Currency Demand	1960-84	UK	3.8%-11.1% (GNP)
<b>Lyssioutou <i>et al</i></b>	2004	Consumer Expenditure (demand system)	1993	UK	10.6% (GDP)
<b>Contini</b>	1989 <sup>4</sup>	Labour Market	1977	Italy	7.5% (GNP)
<b>Giles</b>	1999	MIMIC Model	1968-94	New Zealand	6.8%-11.3% (GDP)
<b>Frey &amp; Weck-Hanneman</b>	1984	MIMIC Model	1978	OECD Countries	8.7% <sup>5</sup> (GNP)
<b>Johnson <i>et al</i></b>	1997	Electricity Consumption	1989-95	Former Soviet Union Former Eastern Europe	12.0%-36.2% <sup>6</sup> (GDP) 16.6%-21.3% <sup>7</sup> (GDP)
<b>Loayza</b>	1996	MIMIC Model	1993	Latin America	38.8% <sup>8</sup> (GDP)
<b>Chaudhuri <i>et al</i></b>	2006	MIMIC Model	1994/95	Selected Asian Countries	25.6% <sup>9</sup> (GDP)

1. The figures for Tanzi (1983) and Bhattacharya (1990) have been rounded to one decimal figure.
2. Using weighted average tax rate. The lower figure is for 1930 and the higher figure for 1980.
3. Using average tax rate. The lower figure is for 1932 and the higher figure for 1980.
4. The study was originally published in Italian in 1979 and the result is reported in Contini (1989).
5. Average for 17 countries. Highest figure is 13.2% for Sweden and lowest figure is 4.1% for Japan.
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7. Average for 6 countries. Lowest figure is 5.8% for Slovakia in 1995 and highest is 30.6% for Hungary in 1992.
8. Average for 14 countries. Lowest figure is 18.2% for Chile and highest is 65.6% for Bolivia.
9. Average for 14 countries. Highest figure is 48.3% for Thailand and lowest figure is 10.6% for Japan.  
I have excluded the figure for China since Chaudhuri *et al* (2006) state that this is not reliable.

## References:

- Aidt, T.S. (2003) "Economic analysis of corruption: a survey", *Economic Journal*, Vol. 113, November, pp. 632-652.
- Allingham, M. G. and Sandmo, A. (1972) "Income tax evasion: a theoretical analysis", *Journal of Public Economics*, 1, pp. 323-338.
- Anderberg, D., Balestrino, A., and Galmarini, U. (2003) "Search and taxation in a model of underground economic activities", *Economic Enquiry*, Vol. 41, No. 4, pp. 647-659.
- Bhattacharyya, D.K. (1990) "An econometric method of estimating the 'underground economy', United Kingdom (1960-1984): estimates and tests", *Economic Journal*, Vol. 100, No. 402, pp. 703-717.
- Bhattacharyya, D.K. (1999) "On the economic rationale of estimating the hidden economy", *Economic Journal*, Vol. 109, June, pp. 348-359.
- Cagan, P. (1958) "The demand for currency relative to the total money supply", *Journal of Political Economy*, 66, pp.303-328.
- Chaudhuri, K., Schneider, F., and Chattopadhyay, S. (2006) "The size and development of the shadow economy: an empirical investigation from states of India", *Journal of Development Economics*, Vol. 80, No. 2, pp. 428-443.
- Contini, B. (1981) "Labour market segmentation and the development of the parallel economy: the Italian experience", *Oxford Economic Papers*, Vol. 2, pp 401- 12.
- Contini, B. (1989) "The irregular economy of Italy: a survey of contributions" in Feige, E.L. (1989a), pp. 237-250.
- Cowell, F.A. (1990) *Cheating the Government: The Economics of Evasion*, MIT Press.
- Cowling, K. (2006) "Prosperity, depression and modern capitalism", *Kyklos*, Vol. 59, No. 3, pp. 369-381.

- Dilnot, A. and Morris, C.N. (1981) "What do we know about the black economy?", *Fiscal Studies*, Vol. 2, No. 1, pp. 58-73.
- Dixon, H. (1999) "Controversy: on the use of the 'hidden economy' estimates", *Economic Journal*, Vol. 109, June, pp. 335-337.
- Ehrlich, I. and Liu, Z. (eds) (2004) *The Economics of Crime*, The International Library of Critical Writings in Economics Series, Edward Elgar.
- Ernste, D. and Schneider, F. (1998) "Increasing shadow economies all over the world -fiction or reality?" IZA Discussion Paper No 26.
- Feige, E. L. (1979) "How big is the irregular economy?", *Challenge*, 22, pp. 5-13.
- Feige, E. L. (1980) "A new perspective of macroeconomic phenomena – the theory and measurement of the unobserved sector of the United States: causes, consequences, and implications", American Economic Association Proceedings, pp. 1-63.
- Feige, E. L. (ed) (1989a) *The underground economy: tax evasion and information distortion*, Cambridge University Press.
- Feige, E.L. (1989b) "The meaning and measurement of the underground economy" in Feige, E.L. (1989a), pp. 13-56.
- Feige, E.L. (1997) "Revised estimates of the underground economy: implications of US currency held abroad" in Lippert, O. and Walker, M. (1997), pp. 151-208.
- Feinstein, J.S. (1999) "Approaches for estimating noncompliance: examples from federal taxation in the United States", *Economic Journal*, Vol. 109, June, pp. 360-369.
- Frey, B.S. and Hannelore Weck, H. (1983) "Estimating the shadow economy: a 'naive' approach", *Oxford Economic Papers*, 35, pp. 23-44.
- Frey, B.S. and Weck-Hanneman, H. (1984) "The hidden economy as an unobserved variable", *European Economic Review*, Vol. 26, pp. 33-53,

- Frey, B.S. (1989) "How large (or small) should the underground economy be?" in Feige, E.L. (1989a), pp. 111-126.
- Giles, D.E.A. (1999a) "Modelling the hidden economy and the tax-gap in New Zealand", *Empirical Economics*, 24, pp. 621-640.
- Giles, D.E.A. (1999b) "Measuring the hidden economy: implications for econometric modelling", *Economic Journal*, Vol. 109, June, pp. 370-380.
- Guttman, M. (1977) "The subterranean economy", *Financial Analysts Journal*, 34, pp. 24-27.
- Johnson, S., Kaufmann, D., and Shleifer, A. (1997) "The unofficial economy in transition", *Brookings Papers in Economic Activity*, Vol. 1997, No. 2, pp. 159-239.
- Kaldor, N. (1956) *Indian tax reform: report of a survey*, Ministry of Finance, Government of India.
- Kesselman, J.R. (1997) "Policy implications of tax evasion and the underground economy" in Lippert, O. and Walker, M. (1997), pp. 294-317.
- Killam, T.G. (1997) "The illicit underground substance economy: an RCMP perspective" in Lippert, O. and Walker, M. (1997), pp. 103-107.
- Koopmans, T.C. (1947) "Measurement without theory", *Review of Economic Statistics*, Vol. 29, No.3, pp. 161-172.
- Lippert, O. and Walker, M. (eds) (1997) *The underground economy: global evidence of its size and impact*, Frazer Institute, Vancouver.
- Loayza, N.Y. (1996) "The economics of the informal sector: a simple model and some empirical evidence from Latin America", *Carnegie-Rochester Conference Series on Public Policy*, 45, pp. 129-162.
- Lubell, H. (1991) *The informal economy in the 1980s and 1990s*, Development Centre Studies, OECD, Paris.

- Lyssiottou, P., Pashardes, P., and Stengos, T. (2004) "Estimates of the black economy based on consumer demand approaches", *Economic Journal*, Vol. 114, July, pp.622-640.
- MacAfee, K. (1980) "A glimpse of the hidden economy in the national accounts", *Economic Trends*, February, No. 316, pp. 81-7.
- Matthews, K. (1982) "Demand for currency and the black economy in the UK", *Journal of Economic Studies*, 9, pp.3-22.
- McGee, R.T. and Feige, E.L. (1989) "Policy illusion, macroeconomic instability, and the unrecorded economy", in Feige, E.L. (1989a), pp 81-109.
- O'Higgins, M. (1989) "Assessing the underground economy in the United Kingdom", in Feige, E.L. (1989a), pp. 175-195.
- Porter, R.D. and Bayer, A.S. (1989) "Monetary perspective on underground economic activity in the United States" in Feige, E.L. (1989a), pp. 129-157.
- Pissarides, C. and Weber, G. (1989) "An expenditure-based estimate of Britain's black economy", *Journal of Public Economics*, Vol. 39, No. 1, pp.17-32.
- Smith, A. (1981) "The informal economy", *Loyds Bank Review*, July, pp. 45-61.
- Smith, P.M. (1997) "Assessing the size of the underground economy: the Statistics Canada perspective" in Lippert, O. and Walker, M. (1997) pp. 11-36.
- Tanzi, V. (1980) "The underground economy in the United States: estimates and implications", *Banco Nazionale del Lavoro Quarterly Review*, 135, pp. 427-453.
- Tanzi, V. (1983) "The underground economy in the United States: annual estimates, 1930-80", *Staff Papers*, International Monetary Fund, Vol. 30, pp. 283-305.



- Tanzi, V. (1999) "Uses and abuses of estimates of the underground economy", *Economic Journal*, Vol. 109, June, pp. 338-347.
- Thomas, J. (1986) "The underground economy in the United States: comments on Tanzi", *Staff Papers*, International Monetary Fund, Vol. 33, No. 4, pp. 782-788.
- Thomas, J. (1988) "The politics of the black economy", *Work, Employment & Society*, Vol. 2, No. 2, pp. 169-190.
- Thomas, J. (1989) "Indirect monetary measures of the size of the black economy: a sceptical note", Mimeo.
- Thomas, J. (1999) "Quantifying the black economy: 'measurement without theory', yet again?" *Economic Journal*, Vol. 109, June, pp. 381-389.
- Weitzman, M.L. (1997) "Comments and discussion", in Johnson *et al* (1997), pp. 230-235.
- World Bank (2007) "Concept of informal sector", <http://Inweb18.worldbank.org/eca/eca.nsf/Sectors>.