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**The Size and Development of the Shadow Economies in the  
Asia-Pacific**

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## 1. Introduction

As crime and shadow economy activities are a fact of life around the world, most societies attempt to limit these activities through various measures including punishment, prosecution and education. Gathering statistics on who is engaged in underground (or criminal) activities, the frequencies with which these activities are occurring and their magnitude, is crucial for making effective and efficient decisions regarding the allocations of a country's resources and for optimal public policy decisions. Unfortunately, it is very difficult to get precise information on these shadow (or underground) activities in terms of value added or labor market involvement, because all individuals engaged in these activities wish not to be identified.

Why are we interested in the shadow economy? Particularly in academia, applied economic research generally assumes a greater emphasis on the quantitative approaches to estimation and forecasting and little or no attention to the quality of the data used in the estimation process. To the casual observer the shadow economy has a number of important implications: (i) unreliable data affects the credibility of any statistical estimate attempting to model an economic phenomenon; (ii) it may give rise to inefficient policy prescriptions, particularly if it is driven by changes in published data; (iii) significant shadow economy activity deprives the government of much needed tax revenue to fund public works; and (iv) a large shadow economy promotes unfair price competition affecting those businesses who choose to voluntarily comply with their tax obligations.

In this paper we will provide the first known estimates of the shadow economy for eighteen (18) countries in the Asia-Pacific region over the last ten years. From these estimates we draw conclusions on how such activities have changed during this time. To do so we will use a well-known technique for estimating the shadow economy, often referred to as the currency-demand approach. We will test its robustness with an alternative and recently introduced methodology into this literature known as the Multiple Indicator – Multiple Cause approach or MIMIC for short. With these two independent means for estimating the shadow economy, our findings suggest that our estimates may sensibly reflect the 'true' extent of shadow economy activities in these countries. The conclusions that we draw are in line with expectations – that countries with relatively thin tax compliance initiatives experience greater

shadow economy activity when compared to those countries that are more actively involved in limiting such activities.

The remainder of this paper is organized as follows. Section 2 introduces a working definition of the shadow economy while Section 3 elaborates on the existing methodologies that have been used to estimate the shadow economy abroad. The two distinct approaches used to estimate the shadow economy for these eighteen Asian-Pacific countries are discussed in Sections 4 and 5. In Section 4 Australia is used as a case study to highlight how we go about estimating the shadow economy and examining the reliability of the estimates. In Section 5, using the same approach and methodology, the results for the remaining seventeen countries are reported and discussed. These estimates are then used to provide the first know (preliminary) measures of the size of the shadow economy labour force for these countries. In Section 6 we present our major conclusions.

## **2. Definition of the Shadow Economy**

The literature on the shadow economy lacks a coherent definition of the type of activities one might expect to find taking place in the shadow economy. Consequently academic's interpretation of what activities ought to be included has produced various estimates for any one particular country. Smith (1985, p.18) provides a very broad definition of the shadow economy as 'market based production of goods and services, whether legal or illegal, that escape detection in the official estimates of GDP'. However it is quite important to think about the definition of the shadow economy from two perspectives: (i) why might we be interested in obtaining estimates of the shadow economy in the first place; and (ii) how we might go about obtaining such estimates. If, for example, we are interested in obtaining estimates of the shadow economy to measure the extent of tax evasion or by how much the estimate of national output is underestimated, then we require a definition of shadow economy activities to be consistent with the national accounting convention. Consequently a commonly used working definition is that the shadow economy consists of unmeasured economic activity that has contributed to value added according to the national accounting convention but is not recorded because of the failure to report income in whole or in part. If, on the other hand, we have a specific methodology for obtaining estimates of these illicit activities, then this definition will need to be specifically focused on activities that will be

measured by this approach. For example, the use of a currency demand approach (*to be discussed below*) to estimate the shadow economy assumes that transactions in the shadow economy are settled in cash. Although this may be predominantly true, this methodology will not capture situations where the bartering of services is used as a means of exchange. Appropriately then we may refer to the estimate of these illicit activities using the currency demand approach as the *cash economy*, which principally is a sub-set of the broader definition intended by the term *shadow economy*.

As the conceptual framework and the objectives for measuring the shadow economy still leaves open a lot of questions, Table 1 may be helpful for developing a better gauge for what might be a reasonable consensus definition of the legal and illegal shadow economy activities.

**Table 1: A Taxonomy of Types of Underground Economic Activities<sup>a</sup>**

Type of Activity	Monetary Transactions		Non Monetary Transactions	
<b>ILLEGAL ACTIVITIES</b>	Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling and fraud		Barter of drugs, stolen goods, smuggling etc. Produce or growing drugs for own use. Theft for own use.	
	<b>Tax Evasion</b>	<b>Tax Avoidance</b>	<b>Tax Evasion</b>	<b>Tax Avoidance</b>
<b>LEGAL ACTIVITIES</b>	Unreported income from self-employment; Wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work and neighbour help

**Notes: (a)** Structure of the table is taken from Lippert and Walker (1997, p. 5) with additional remarks.

From Table 1 it is evident that the shadow economy may include unreported income from the production of legal goods and services either from monetary or barter transactions - hence all economic activities that would attract taxation and get reported as value added in the national accounts. Nevertheless a precise definition seems quite difficult, as “the shadow economy develops all the time according to the ‘principle of running water’: it adjusts to changes in

taxes, to sanctions from the tax authorities and to general moral attitudes, etc.” (Mogensen, et. al. 1995 p. 5).

In this paper we adopt a very specific definition of the shadow economy - consistent with (i) our objectives of estimating unobserved output and in-line with the national accounting convention and (ii) our methodology, which assumes that shadow economy activities are settled in cash. Essentially then we will present estimates of the cash economy rather than the shadow economy per se.

### **3. Methodologies Used to Estimate the Shadow Economy**

There appears to be a number of broad categories into which attempts to measure the shadow economy fall. Although each approach differs from application to application, the underlying conclusions from the majority of these studies (and this paper) are that the shadow economies worldwide have been growing over time. Our objective is to briefly review these methodologies and to discuss the advantages and disadvantages of each. To measure the size and development of the shadow economy three different approaches are most widely used. These are briefly discussed in the following three subsections.

#### ***3.1 Direct Approaches***

These are micro approaches that employ either well-designed surveys or samples and tax auditing or other similar compliance methods. Sample surveys designed to estimate active involvement in shadow economy activities have been widely used in a number of countries.<sup>1)</sup> The main disadvantage of these methods is that they are susceptible to a number of common problems: average precision and results that depend greatly on the respondents’ willingness to co-operate and respond truthfully. It is therefore difficult to assess the growth of the undeclared work from such direct questionnaires. Most respondents surveyed hesitate to confess fraudulent behavior and quite often their responses are rarely reliable, making it difficult to calculate a reliable estimate (at least in monetary terms) of the extent of

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<sup>1)</sup>The direct method of voluntary samples and surveys has been extensively applied to Norway by Isachsen, Klovland and Strom (1982); and Isachsen and Strom (1985). For Denmark this method was applied by Mogensen (et. al., 1995) in which they report ‘estimates’ of the shadow economy of 2.7 percent of GDP for 1989, 4.2 percent of GDP for 1991, 3.0 percent of GDP for 1993 and 3.1 percent of GDP for 1994.

undeclared legitimate activities. The main advantage however arises from the detailed information on the nature of the shadow economy activities that may be possible from direct questioning. However it should be noted, as one might expect, that the results from these surveys are very sensitive to the way in which the questionnaires are formulated<sup>2)</sup>.

Estimates of the shadow economy can also be based on the discrepancy between income declared for tax purposes and that measured by either random or targeted auditing initiatives. Fiscal auditing programs have been particularly effective in this regard. Designed to measure the amount of undeclared taxable income, they have been used to calculate the shadow economy in several countries.<sup>3)</sup> A number of difficulties beset this approach. Firstly, using tax compliance data is equivalent to using a (biased) sample of the population. Why? Since, in general, auditing compliance initiatives are not random but based on characteristics of filed tax returns, such a sample is not necessarily random and therefore is not representative of the whole population. This factor is likely to bias compliance-based estimates of the shadow economy. Secondly, estimates based on tax audits reflect that portion of shadow economy income that the authorities succeeded in discovering and this is likely to be only a fraction of total hidden income. Furthermore these audits are unlikely to detect activities that are paid for in cash. The auditing approach is better able to detect instances of overstating expenditures or concealing income earned from recorded transactions (such as interest earnings and dividend payments) than cash-based transactions. So, it is unlikely that surveys and tax auditing capture all shadow activities, and at best they can be seen as providing a lower bound estimate of the shadow economy. They are unable (at least at present) to provide estimates of the development and growth of the shadow economy over a longer period of time. As already argued, they have at least one considerable advantage - they can provide detailed information about shadow economy activities and the structure and composition of those who work in the shadow economy, but again this information may be very limited.

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<sup>2)</sup> The reader should consult Mogensen et. al (1995) for a detailed treatment on the advantages and disadvantages of this approach.

<sup>3)</sup> For the United States see IRS (1979, 1983), Simon and Witte (1982), Witte (1987), Clotefelter (1983), and Feige (1986). For a more detailed discussion, see Dallago (1990) and Thomas (1992).

### ***3.2 Indirect Approaches***

These approaches, so called ‘indicator’ approaches, are mostly macroeconomic ones and use various economic and other indicators that contain information about the development of the shadow economy over time. Currently there are a number of indicators that have been proposed as providing ‘trails’ that one may use to track the size and growth of the shadow economy over time.<sup>4)</sup>

#### *3.2.a The Discrepancy between National Expenditure and Income Statistics*

This approach is based on discrepancies between national income and expenditure statistics as reported in the national accounts. In national accounting the income measure of GDP should theoretically be equal to the expenditure measure of GDP. Thus, if an independent estimate of the expenditure side of the national account is available, the gap between the expenditure measure and the income measure can be used as an indicator of the extent of the shadow economy.<sup>5)</sup> However, since national accounts statisticians will be anxious to minimize this discrepancy, the initial discrepancy or first estimate, rather than the published discrepancy should be employed for this purpose. If all the components of the expenditure side are measured without error, then this approach would indeed yield a good estimate of the scale of the shadow economy. However, unfortunately, this is not the case and the discrepancy, therefore, reflects all omissions and errors everywhere in the national accounts statistics as well as the shadow economy activity. These estimates should therefore be treated at best as very crude estimates of the shadow economy and of questionable reliability.<sup>6)</sup>

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<sup>4)</sup> The less frequently used transactions and physical input approach have not been discussed here. The reader may wish to consult Schneider and Enste (2000) for a discussion on these.

<sup>5)</sup> See for example, Franz (1983) for Austria; MacAfee (1980) O’Higgins (1989) and Smith (1985), for Great Britain; Petersen (1982) and Del Boca (1981) for Germany; Park (1979) for the United States. For a survey and critical remarks, see Thomas (1992).

<sup>6)</sup> A related approach is pursued by Pissarides and Weber (1988). They use micro data from household budget surveys to estimate the extend of income understatement by the self-employed. This micro approach is susceptible to more or less the same difficulties arising from the national accounts statistics methodology just described.

### *3.2.b The Discrepancy between the Official and Actual Labor Force*

A decline in the participation rate for the official economy may be interpreted as an indication of increased activity in the shadow economy. If total labor force participation is assumed to be constant, a decreasing official participation rate can be seen as an indicator of an increase in the activities in the shadow economy, *ceteris paribus*.<sup>7)</sup> The weakness of this approach is that changes to the observed participation rate may be due to a number of factors other than the shadow economy. Moreover, people can work in the shadow economy and have a job in the ‘official’ economy, which *ceteris paribus*, would imply no change in the participation rate. Therefore estimates from such an approach should be viewed as weak indicators of the size and development of the shadow economy over time.

### *3.2.c The Currency Demand Approach*

The currency demand approach introduced by Cagan (1958) calculated a correlation between currency demand and the tax pressures (as one cause of the shadow economy) for the United States over the period 1919 to 1955. Some twenty years later, Gutmann (1977) used a similar approach, (without statistical methods) to estimate the shadow economy in the United States. He specifically looked at the ratio between currency and demand deposits over the years 1937 to 1976 as a basis for his inference about what had happened to the size of the US shadow economy overtime.

Tanzi (1980, 1983) extended on Cagan’s approach by estimating a currency demand equation for the United States for the period 1929 to 1980 as the basis for calculating the shadow economy. His approach assumed that shadow (or hidden) transactions are predominantly undertaken in the form of cash payments, because such activities leave no observable traces for the authorities to follow up and prosecute. An increase in the size of the shadow economy will therefore show up as an increase the demand for currency (more so now in light of growing currency substitutes). A number of causal factors, such as the direct and indirect tax burden, which are assumed to be the major factors causing people to work in the shadow

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<sup>7)</sup> Such studies have been undertaken for Italy, see e.g., Contini (1981) and Del Boca (1981); for the United States see O’Neill (1983), for a survey and critical remarks, see Thomas (1992).



economy, were included in the estimation equation in addition to the usual variables namely, income and interest rates.<sup>8)</sup>

The increase in currency, that which is unexplained by the conventional or normal factors (interest rates, income, etc) is attributed to the factors motivating participation in the shadow economy (tax burden, etc). Estimates of the size of the shadow economy can be calculated in a first step by comparing the difference between the level of currency when the direct and indirect tax burden (and government regulations) are held at their lowest value, and the development of currency with the current (much higher) burden of taxation and government regulations. Assuming in a second step the same income velocity for currency in the shadow economy as in the legitimate economy, the size of the shadow can be computed and compared to the official measure of GDP.

The currency demand approach is one of the most commonly used approaches and has been applied to many OECD countries.<sup>9)</sup> As we will be adopting a modified version of this approach, which we think is more efficient, it is appropriate at this stage to note some of the common objections of the currency demand methodology.<sup>10)</sup> Although some of these criticisms may never be resolved, the alternative methodology (*to be discussed below*) that we will employ in Section 4 will demonstrate the relative robustness of the currency demand approach in estimating (in monetary terms) the size of the shadow economy. The most commonly raised objections to this method are as follows:

- (i) Not all transactions in the shadow economy are paid for in cash. For 1980, Isachsen and Strom (1985) used the survey method to find out that in Norway roughly 80 percent of all transactions in the hidden sector were paid in cash. The size of the total shadow economy (including barter) may thus be even larger than had been previously estimated.
- (ii) Most studies consider only one particular factor, the tax burden, as a cause of the shadow economy. Other factors (such as the impact of regulation, taxpayers' attitudes

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<sup>8)</sup> The estimation of such a currency demand equation has been criticized by Thomas (1999) but part of this criticism has been considered by the work of Giles (1999a, 1999b) and Bhattacharyya (1999), who both use the latest econometric techniques. We adopt a similar approach in this paper.

<sup>9)</sup> See Schneider (1997, 1998), Johnson, Kaufmann and Zoido-Lobaton (1998a) and Williams and Windebank (1995).

<sup>10)</sup> See Thomas (1992, 1999), Feige (1986) and Pozo (1996).

toward the state, 'tax morality', etc) are not specifically considered because reliable data on these variables for most countries is not available. If, as seems likely, these other factors also have an impact on the extent of the hidden economy, estimates of the shadow economy that take these into account might produce estimates that are larger than those reported in most studies which have excluded them.<sup>11)</sup>

- (iii) The traditional currency demand model used for estimating the size of the shadow economy uses the ratio of currency to current deposits as a dependent variable. Garcia (1978), Park (1979), and Feige (1996) have pointed out that increases over time in the currency-demand deposit ratio (for the United States) was due largely to a slowdown in demand deposits rather than to an increase in currency caused by activities in the shadow economy.
- (iv) Blades (1982) and Feige (1986, 1996), criticize Tanzi (1983) on the grounds that the US dollar is used as an international currency and therefore its demand is affected by international factors not specifically accounted for in the model. Tanzi (1983) could possibly have considered (and controlled for) the US dollars that are used as an international currency and held in cash hoards abroad.<sup>12)</sup> Moreover, Frey and Pommerehne (1984) and Thomas (1986, 1992, 1999) claim that Tanzi's parameter estimates are not very stable.<sup>13)</sup>
- (v) Another weak point in the estimation is the assumption that the velocity of money is the same for legitimate and the shadow economy. Hill and Kabir (1996) for Canada, and Klovland (1984) for the Scandinavian countries, argue that there is already considerable uncertainty about the velocity of money in the official economy and with

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<sup>11)</sup>One (weak) justification for the use of only the tax variable is that this variable has by far the strongest impact on the size of the shadow economy in the studies known to the authors. The only exception is the study by Frey and Weck-Hannemann (1984) where the variable 'tax immorality' has a quantitatively larger and statistically stronger influence than the direct tax share in the model approach. In the study of Pommerehne and Schneider (1985), for the U.S the tax variable dominated the other factors, which included regulation, tax immorality and minimum wages. The tax variable contributed roughly 60-70 percent of the size of the shadow economy. See also Zilberfarb (1986).

<sup>12)</sup> In another study, Tanzi (1982, esp. pp. 110-113) explicitly deals with this criticism. A very careful investigation of the amount of USD used abroad and US currency used in the shadow economy has been undertaken by Rogoff (1998). He concludes that large denomination bills play a significant role both in criminal and the shadow economy activities.

<sup>13)</sup> However in studies for European countries Kirchgassner (1983, 1984) and Schneider (1986) reach the conclusion that the estimation results for Germany, Denmark, Norway and Sweden are quite robust when using the currency demand method. Hill and Kabir (1996) find for Canada that the rise of the shadow economy varies with respect to the tax variable used; they conclude when the theoretically best tax rates are selected and a range of plausible velocity values is used, this method estimates underground economic growth between 1964 and 1995 at between 3 and 11 percent of GDP. "[Hill and Kabir (1996, p. 1553)].

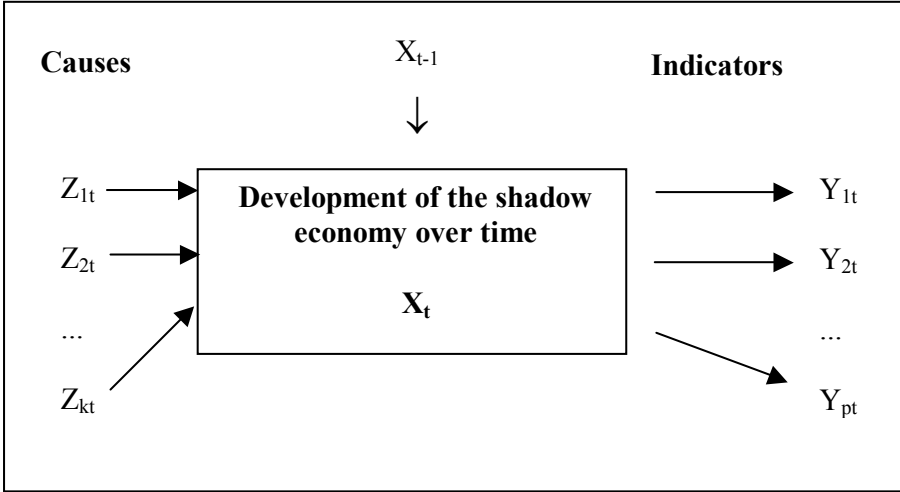
that said, the velocity of money in the hidden sector is even more difficult to estimate. Without prior knowledge of the velocity of currency in the shadow economy, one has to accept the assumption of ‘equal’ money velocity in the two sectors.

- (vi) Finally, the assumption of no shadow economy in a base year is open to criticism. Relaxing this assumption would again imply an upward adjustment of the figures attained in the bulk of the studies already undertaken. The approach used in Section 4 of this paper does not depend on this assumption.

### *3.3 A Model Approach*

The methodologies described so far were designed to estimate the size of the shadow economy through one indicator that is assumed to capture all effects of the shadow economy. However, it is obvious that its effects show up simultaneously in the production, labor, and money markets. An even more important critique is that the causes that motivate activity in the shadow economy are taken into account only in some of the monetary approach studies and even then only one or two of these causes are usually considered. The model approach explicitly considers multiple causes leading to the existence and growth of the shadow economy over time. The empirical method used is quite different from those used so far. It is based on the statistical theory of unobserved variables, which considers multiple causes and multiple indicators of the phenomenon to be measured. For the estimation, a factor-analytic approach is used to measure the hidden economy as an unobserved variable over time. The unknown coefficients are estimated in a set of structural equations within which the “unobserved” variable cannot be measured directly. The DYMIMIC (dynamic multiple-indicators multiple-causes) model consists in general of two parts, (i) the measurement model that links the unobserved (or latent) variables to observed indicators, and (ii) the structural equations model which specifies causal relationships among the unobserved variables. In this case, there is one unobserved (or latent) variable, the size of the shadow economy. It is assumed to be indirectly observable by a set of indicators of the shadow economy, thus capturing the structural dependence of the shadow economy on variables that may be useful in predicting its movement and size in the future. The interaction over time between the causes  $Z_{it}$  ( $i = 1, 2, \dots, k$ ), the size of the shadow economy  $X_t$ , and the indicators  $Y_{jt}$  ( $j = 1, 2, \dots, p$ ) is shown in Figure 1.

**Figure 1: Development of the shadow economy over time.**



There is a large body of literature<sup>14)</sup> on the possible causes and indicators of the shadow economy, in which the following three types of causes are distinguished:

**Causes**

- (i). The burden of direct and indirect taxation, both actual and perceived: a rising burden of taxation provides a strong incentive to work in the shadow economy.
- (ii). The burden of regulation as proxy for all other state activities: it is assumed that increases in the burden of regulation provides a strong incentive to enter the shadow economy.
- (iii). The ‘tax morality’ (citizens’ attitudes toward the state), describes the readiness of individuals (at least potentially) to leave their official occupations or engage after hours in shadow economy activities. It is assumed that a declining tax morality tends to increase the size of the shadow economy.<sup>15)</sup>

<sup>14)</sup>Thomas (1992); Schneider (1994a, 1997); Pozo (1996); Johnson, Kaufmann and Zoido-Lobaton (1998a, 1998b); and Giles (1999a, 1999b).

<sup>15)</sup> When applying this approach for European countries, Frey and Weck-Hannemann (1984) had difficulty obtaining reliable data for the regulation and tax morality variables. Hence, their study was criticized by Helberger and Knepel (1988), who argued that these results were unstable with respect to changing variables in the model over the years.

## Indicators

A change in the size of the shadow economy may be reflected in the following indicators:

- (i). Development of monetary indicators: if activities in the shadow economy increase, additional monetary transactions are required, particularly if cash is used to avoid detection.
- (ii). Development of the labor market: increasing participation of workers in the shadow economy may result in a decrease in participation in the official economy. Similarly, increased activities in the shadow economy may be reflected in shorter working hours in the official economy by those heavily engaged in such activities.<sup>16</sup>
- (iii). Development of the production market: an increase in the shadow economy means that inputs (especially labor) may move out of the official economy (at least partly), depressing the growth rate of officially measured output.

The latest use of the model approach has been undertaken by Giles (1999a, 1999b), Giles, Tedds and Gupsa (1999) and Giles and Tedds (2002). They estimate a comprehensive (dynamic) MIMIC model to get a time series index of shadow economy output for New Zealand and Canada, which they then estimate a separate “cash-demand model” to obtain a benchmark for converting this index into percentage units. Unlike earlier empirical studies of the shadow economy, they paid proper attention to the non-stationary, and possible co-integration of time series data in both models. Again this MIMIC model treats hidden output as a latent variable, and uses several (measurable) causal and indicator variables. The former include measures of the average and marginal tax rates, inflation, real income and the degree of regulation in the economy. The latter include changes in the (male) labor force participation rate and in the cash/money supply ratio. In their cash-demand equation they allow for different velocities of currency circulation in the hidden and recorded economies. Their cash-demand equation is not used as an input to determine the variation in the hidden economy over time – it is used only to obtain the long-run average value of hidden/measured output, so that the index for this ratio predicted by the MIMIC model can be used to calculate a level and the percentage units of the shadow economy over time. Giles latest combination

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<sup>16</sup> It is possible that the participation rate as well as the number of hours worked may be unaffected by shadow economy activity if such activities are undertaken after hours or on weekends when individuals are not working in the legitimate economy.

of the currency demand and MIMIC approach clearly shows that some progress in the estimation technique of the shadow economy has been achieved and a number of critical points have been overcome.

#### **4. Case Study 1: Australia**

Among the many estimates of the shadow economy abroad, Bajada (2002) produced a time series estimate of the cash economy in Australia for the period 1968 to 2000. The estimates are based on an approach that assumes individuals are motivated to avoid the payment of taxes or prevent the loss of any government welfare assistance by expressly requesting cash when receiving payment so as to minimize their chances of being detected. For this reason Bajada (2002) argues that it makes good sense to approach the method of estimating the size of the underground economy by examining the money supply for clues to its size. Using a variant of the monetary approaches of Cagan (1958) and Tanzi (1983), Bajada estimates the size of the Australian cash economy to approximately 14.5% of GDP.

To produce an estimate of the cash economy for Australia we estimate a demand for money (currency) equation different from the traditional approach of estimating money demand (for example, using M1 as the dependent variable). We introduce additional regressors (tax burden, welfare payments, etc) to the standard income and interest rates explanation in order to satisfactorily explain holdings of currency, allowing for the possibility of a cash economy. The choice of functional form for the estimated equation was based on the Davidson-MacKinnon J-test for model selection and an Error Correction Model (ECM) was found to be the most preferred model specification.

The size of the underground economy is derived by measuring the excess sensitivity of taxes and welfare benefits on currency demand, that is whether changes in taxes and welfare benefits change real per capita currency holdings ( $C$ ) in addition to the effects on disposable income ( $YD$ ). The demand for currency is also driven by other explanatory variables, namely, (i) the interest rate ( $R$ ); (ii) the rate of inflation ( $\pi$ ) - rising rates of inflation, for example, erode the value of money and induce individuals to hold less of it; (iii) private consumption expenditure as a percentage of GDP ( $E$ ) - to capture currency demand arising as a result of

consumption expenditure (derived demand) in the legitimate economy by subterranean participants; and (iv) technological change ( $Tr$ ).

As currency is the principal means of exchange in the cash economy we can summarize this in the following specification of currency demand:

$$C = f(YD, R, \pi, E, Tr) \quad (1)$$

In this specification taxation ( $T$ ) and welfare benefits ( $Wf$ ) affect currency holdings through disposable income, which implies that (1) could alternatively be written as

$$C = f(Y - T + Wf, R, \pi, E, Tr) \quad (2)$$

It is however the excess sensitivity of  $T$  and  $Wf$  on currency that is important. Therefore we estimate currency demand using the following general specification

$$C = f(Y - T + Wf, T, Wf, R, \pi, E, Tr) \quad (3)$$

Currency in circulation in the absence of an underground economy (illegal currency) is found by subtracting these excess sensitive components. Multiplying the velocity of currency in the legitimate economy to the volume of illegal currency produces an estimate of the size of the cash economy. In Table 2 are the estimates of the ECM estimation. GSTD denotes a GST dummy variable to account for the introduction of the GST in 2000 while D2, D3 and D4 are seasonal dummies.

**Table 2: Estimation Results**

Dependent Variable: First Difference of (Natural) Logarithm of Real Currency per Capita (1967.2 to 2000.4)					
Variable	Coefficient	t-ratio	Variable	Coefficient	t-ratio
Constant	0.071	0.17	$\Delta(\pi)$	-0.012	2.79
Ln(T)	0.057	2.11	$\Delta\ln(W)$	-0.031	2.11
ln(R)	-0.007	1.42	$\Delta\ln(E)$	0.138	3.00
Ln( $\pi$ )	-0.010	3.23	Ln( $C_{t-1}$ )	-0.169	3.28
Ln(E)	-0.070	1.42	D2	-0.012	2.89
Ln(Y)	0.144	2.48	D3	-0.011	2.16
$\Delta\ln(Y)$	0.535	8.44	D4	-0.007	1.45
$\Delta\ln(T)$	0.157	4.69	GSTD	0.014	1.40
$\Delta\ln(R)$	-0.016	1.23			

Adjusted $R^2 = 0.74$	Durbin-Watson = 1.98
Number of observations = 135	RESET(3) <sup>a</sup> = 4.66
LM Statistic = 22.22	RESET(4) <sup>b</sup> = 3.08
ARCH = 1.76	

Notes: (a) includes  $\Delta\ln(C_t)^2$  and (b) includes  $\Delta\ln(C_t)^2$  and  $\Delta\ln(C_t)^3$  as additional regressors.

Most of the coefficients on the variables have the expected signs. The coefficient on interest rate is negative reflecting the opportunity cost on holding currency while the coefficient on disposable income is positive reflecting our expectations that for increases in economic growth there would arise a corresponding increase in the use of currency following increases in aggregate demand. The coefficient on the excess sensitivity of taxes is positive reflecting an incentive to conceal income from the tax authorities by demanding currency for the payments of goods and services. Interestingly the sign of the coefficient on welfare benefits is negative suggesting that those agents, who may be unemployed and receiving welfare benefits while working in the underground economy, trade-off work in the underground sector for more leisure when welfare benefits relative to their potential disposable income increases. The trend variable was found to be positive but insignificant and so it is not reported. It may be that such a variable is capturing both growing underground activities and technological development and producing a ‘net’ effect.

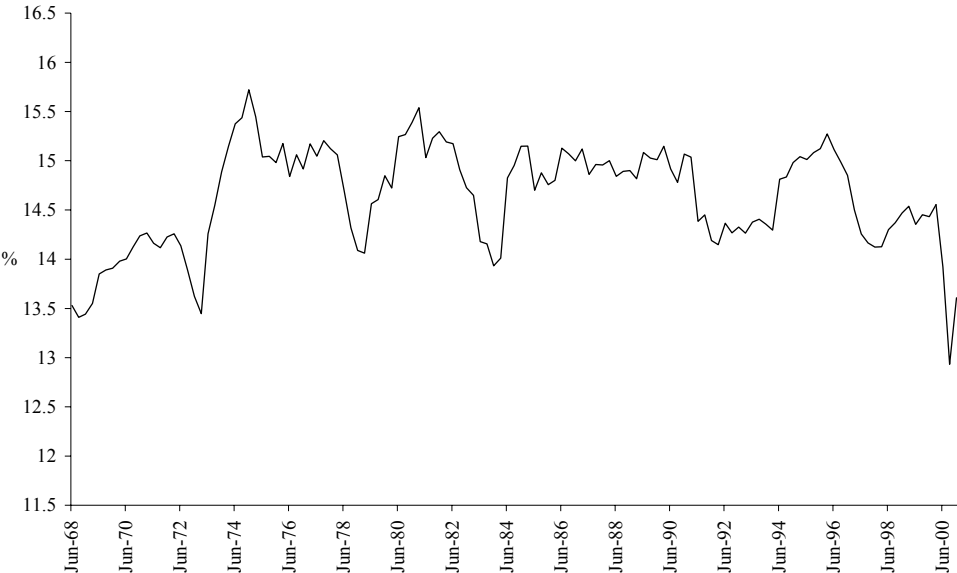
Most of the  $t$ -statistics are significant at the 1% level and the adjusted  $R^2$  is 0.74. The Ramsey (1969) RESET test shows no indication of mis-specification at the 1% level. Furthermore this specification for currency demand does not exhibit autocorrelated (Durbin and Watson, 1951) or heteroscedastic (ARCH) (Engle, 1982) disturbances. The calculated  $\tau$  statistics for the Augmented Dickey-Fuller (ADF) equation (not shown here) to test the existence of a unit



root in the residuals are larger in absolute terms than the critical values. On the basis of such evidence we may infer that the regression equation is cointegrated. From these results we plot the cash economy in Australia for the period 1968 to 2000 in Figure 2.

There are three stylized facts of the cash economy evident from Figure 2. First, the cash economy exhibits cyclical behaviour, which appears to coincide with the cyclical behaviour of the legitimate economy. Second, the cash economy in Australia has been relatively stable as a percentage of GDP, although there is some evidence of a mild decline at least during this period. This is not the case however for the period prior to 1978. Since 1978 the cash economy has averaged just shy of 15% of GDP. Third, in the lead up to the GST (in July 2000), the cash economy declined and the extent of this decline has by far exceeded any decline in the cash economy that has occurred during an economic downturn. This may be due to a number of factors including the impact of the tax mix and timing of consumption around the time of the introduction of the GST.

**Figure 2 – The Cash Economy in Australia**

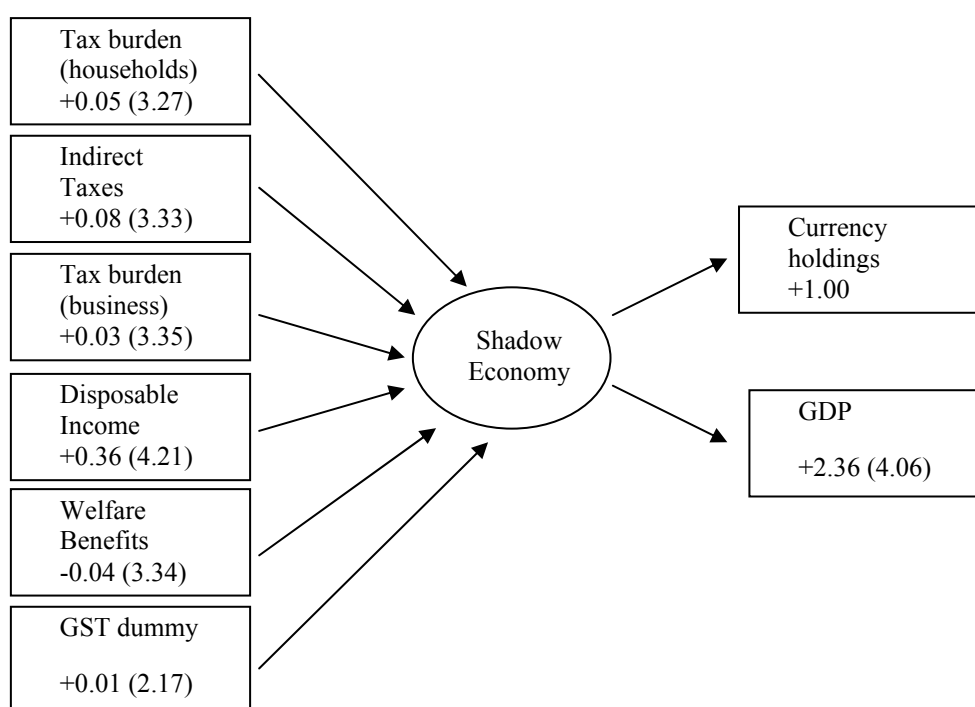


In the remainder of this section we attempt to test the robustness of this result by using an alternative methodology that estimates a single latent variable from a number of causal and indicator variables (MIMIC – see Section 3). The latent variable is a hypothetical construct

that is not directly observable but it is known that the causal variables determine the size of the latent variable, which in turn has operational implications for the indicator variables. In using this methodology to examine the results presented in Figure 2, we will produce an index rather than an absolute measure of the variable in question. Typically the currency demand approach would be used to provide a benchmark estimate from which an absolute time series measure of the shadow economy may be constructed from this MIMIC index. In this paper we will adopt this approach and compare the results. We will also briefly look at the business cycle characteristics from Figure 2 with those estimated using the MIMIC approach.

The causal indicators that we have used in this MIMIC estimation include a measure of the tax burden (both the average direct and indirect tax rate), the proportion of welfare benefits to disposable income, and real disposable income per capita (to account for the incentives to participate in the cash economy from changes to take-home-pay). As this includes an implicit account for taxes, we expect this variable to outweigh the effects of taxes as separate variables in the model. Our results confirm this expectation. We have not included a measure of regulatory intensity here because such a variable is not readily available. If one was to include a reliable measure of such variable, we might expect the estimates of the cash economy to be much larger than those reported from either the currency demand or the MIMIC approach. The indicator variables include real currency per capita in circulation (since much of the shadow economy activities are settled in cash) and real gross domestic product per capita (as one may expect to find a correlation between the business cycles of the shadow and legitimate economies). The results from the (dynamic) MIMIC model estimation are presented graphically in Figure 3. The t-statistics are reported in parenthesis and the coefficient on currency holdings is constrained to +1.00 in order to identify the system and make the parameter estimates more easily comparable to one another.

**Figure 3 - MIMIC Modeling Results**

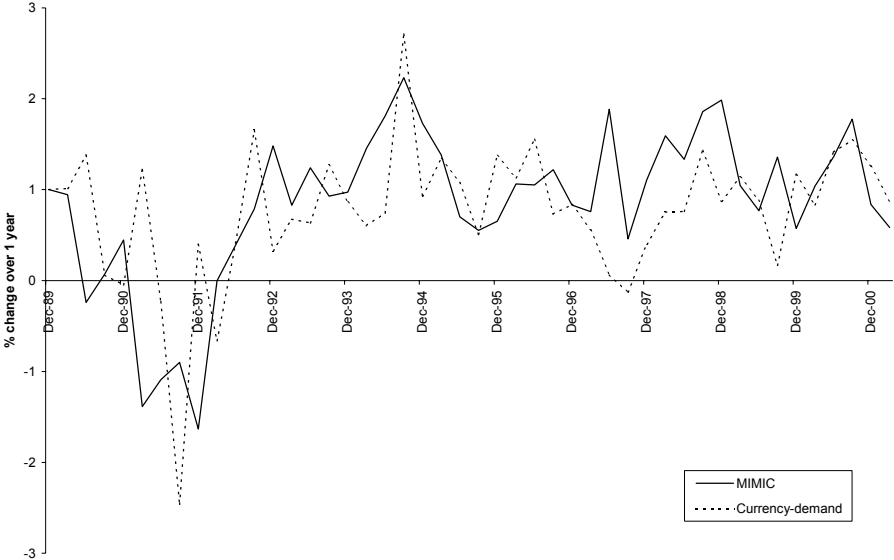


As with the currency demand approach, the data used in the MIMIC estimation was difference after testing for the presence of a unit root in the data and again we paid special attention to the possibility of co-integration of the time series data. Once estimated we examined the statistical significance of the model using various goodness of fit measures and the Q-plot of the standardized residuals, the standard techniques used in MIMIC modeling. The non-central  $\chi^2$  statistic ( $\chi^2=3.80$ ;  $p$ -value=0.58) is a test for the fit of the structural model. As the  $\chi^2$  statistic tests the MIMIC against the alternative that the covariance matrix of the observed variables is unconstrained, a large  $p$ -value represents an acceptance of this null hypothesis. The  $p$ -value suggests a good fit for the structural model. The parameter estimates have the expected signs and each estimate is significant at the 5% level.<sup>17</sup> Consistent with our expectations, each tax variable is positively related to shadow economy activity and interestingly, the model suggests that indirect taxes play a major role in influencing the extent of illicit activity in Australia.

<sup>17</sup> For reasons already discussed, the parameter estimate for welfare benefits relative to disposable income is negative and consistent with the sign from currency demand approach.

With the parameter estimates on the causal variables it was then possible to construct an index of the growth rate of the shadow economy for Australia. A similar growth rate index was constructed from the currency demand estimate of the shadow economy reported in Figure 2, and both of these are plotted in Figure 4. It appears from this figure that there is a great deal of similarity in the general cycles produced by each model and so providing one positive cross-check that the estimates arrived at by the currency demand approach are robust when compared with the results from this independent estimation technique.

**Figure 4 – Comparing the MIMIC and Currency demand Model Results – Annual Growth Rates**



A second cross-check is from a comparison of the level estimates of the shadow economy. Using the currency demand approach to benchmark the starting values of the shadow economy, the MIMIC index was used to generate the level path (as a % of GDP) for the shadow economy. The results are quite comparable and the differences between the two estimates are presented in Table 2 that follows.

**Table 2: Comparing Estimates (% of GDP) – Currency Demand versus MIMIC**

	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>
<b>(A) Curr-Dmd</b>	14.90	14.57	14.37	14.49	14.92	15.19
<b>(B) MIMIC</b>	14.63	13.40	14.72	14.77	15.76	15.05
<b>(A-B) Diff</b>	0.27	1.17	-0.35	-0.28	-0.85	0.14
	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>Average</b>
<b>(A) Curr-Dmd</b>	15.09	14.25	14.45	14.54	13.81	<b>14.60</b>
<b>(B) MIMIC</b>	15.21	15.27	15.46	14.79	13.98	<b>14.82</b>
<b>(A-B) Diff</b>	-0.12	-1.02	-1.01	-0.24	-0.16	<b>-0.22</b>

The currency-demand approach produced smaller estimates of the shadow economy for 8 of the 11 yearly estimates presented in Table 2. However the estimates from both the currency-demand and the MIMIC approach are remarkably similar, only 0.22% of GDP separates them on average.

In the following section we employ the two methodologies to estimate the size of the remaining Asian-Pacific nations in our sample. We follow this up by a discussion of these results.

## **5. Case Study 2: The Asia-Pacific Region**

Quite often for individual countries and on occasions for a select and small groups of countries (e.g. selected OECD or transition countries), research has been undertaken to estimate the size of the shadow economy and its labor force using a variety of approaches. In what follows is an attempt to estimate the size (in terms of GDP) and labour force of the shadow economy for eighteen Asia-Pacific nations since 1989/90. This is the first known attempt to estimate the size of the shadow economy and its labor force using a standardized estimation technique that will allow for a direct comparison between the countries in question.

To estimate the size of the shadow economy for these countries we employ the currency demand and the MIMIC approach as described in the previous section. The results are presented in columns 2 to 4 of Table 3. If one first starts with the latest results (2000-01), the largest shadow economy estimate is for Thailand, with 51.9% of official GDP being the equivalent measure of shadow economy in that country. This is followed by Sri Lanka

(43.7% of GDP) and the Philippines (42.6% of GDP). The next class of estimates includes India (22.8% of GDP), Israel (21.9% of GDP) and Taiwan (19.6% of GDP). At the lower end of the scale is China (13.4% of GDP)<sup>18)</sup>, New Zealand (12.9% of GDP) and Japan (11.3% of GDP). If we turn to the development of the shadow economies for these eighteen countries since 1989/90, we see that the shadow economy on average climbed from 20.9% of GDP to 22.9% of GDP by 1994-95 and then to 26.1% by 2000-01. On average the shadow economy for these eighteen countries increased by 5.2% of official GDP. The effect is even more significant for the less developed countries: Bangladesh with a shadow economy of 26.2% during 1989-90 climbed to 34.9% by 2000-01; Thailand with a shadow economy measuring 44.2% in 1989-90 climbed to 51.9% by 2000-01. We might expect this result because these countries have relatively poor monitoring and compliance instruments that can be used to limit the growth of these clandestine activities.

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<sup>18)</sup> The calculation of the shadow economy for China is very difficult and the values may be questioned because only a part of China has so far been developed into a market economy. A great part of China may still be classified as a planned economy and due to this mix of systems the calculated figures may be not very reliable.

**Table 3: The Size of the Shadow Economy and of the Shadow Economy Labor Force of 18 Asia-Pacific Countries**

Country	Size of the Shadow Economy (in % of “official”GDP)			Shadow Economy Labor Force (Average 1998/99)		
	Average 1989/90	Average 1994/95	Average 2000/2001	Persons (millions)	in % of “official” Labor Force	in % of Population
1 Australia	15.0	15.0	14.3*	1.1	11	5.8
2 Bangladesh	26.2	30.2	34.9	17.72	27.7	14.1
3 China	-	10.2	13.4	152.43	20.5	12.3
4 Hong Kong	13.0	15.3	16.5	0.46	13.2	8.1
5 India	18.1	20.3	22.8	117.23	27.2	11.9
6 Indonesia	10.4	15.4	18.9	30.74	31.3	15.1
7 Israel	14.3	17.1	21.9	0.51	16.7	8.2
8 Japan	8.8	10.6	11.3	4.76	7.1	3.8
9 Korea (South)	19.4	22.4	26.7	4.51	19.6	9.7
10 Malaysia	26.4	28.3	30.9	2.25	25.1	10.1
11 Nepal	32.6	33.4	37.4	3.34	30.4	14.4
12 New Zealand	9.2	11.3	12.9	0.18	9.2	4.7
13 Pakistan	28.2	31.4	35.9	15.23	31.0	11.6
14 Philippines	34.2	38.4	42.6	9.82	30.6	13.0
15 Singapore	9.4	11.2	13.7	0.21	10.2	6.3
16 Sri Lanka	30.4	35.3	43.7	2.54	31.3	13.3
17 Taiwan	15.3	17.4	19.6	1.95	14.5	8.7
18 Thailand	44.2	48.3	51.9	14.83	40.0	20.1
<b>(Unweighted) Average of the 18 Countries</b>	<b>20.9</b>	<b>22.9</b>	<b>26.1</b>	<b>21.14</b>	<b>22.0</b>	<b>10.6</b>

Notes: (\*) 1999/00 estimate

Having examined the size of the shadow economy in terms of value added, we now turn our attention to the size of the shadow economy labour force. By definition every activity in the shadow economy involves a “shadow” labor market. The ‘shadow labor market’ includes all cases where the employees and/or employers occupy a ‘shadow economy position’ from which they earn an income and is concealed from the authorities. Why do people work in the shadow economy? In the official labour market, the cost to firms when having to ‘legitimately’ employ someone are increased tremendously by the burden of tax and social contributions on wages, as well as by the legal and administrative regulation that the firm is expected to comply with.<sup>19)</sup> For some OECD countries, these costs may exceed the wage effectively paid to the worker – providing a strong incentive to participate in the shadow economy. Lemieux, Fortin, and Fréchet (1994), using micro data from a survey conducted in Quebec City (Canada), provide a framework of the labor supply decision by workers participating in the shadow economy. In particular, their study provides some insight into the size of the distortion caused by income taxation and the welfare system. The results of this study suggest that hours worked in the shadow economy are quite responsive to changes in the net wage in the regular (official) sector. Their empirical results attribute this to a misallocation of work from the official to the informal sector, where it is not taxed. In this case, the substitution between labor-market activities in the two sectors is quite high. These empirical findings clearly indicate, “participation rates and hours worked in the underground sector also tend to be inversely related to the number of hours worked in the regular sector” (Lemieux, Fortin, and Fréchet 1994 p. 235). These findings also demonstrate that (i) there is a large negative elasticity of hours worked in the shadow economy with respect both to the wage rate in the regular sector, and (ii) there is a high degree of mobility between the two sectors, giving the impression of a very dynamic shadow economy.

Illicit work can take many forms, for example, a second job either during or after regular working hours, work by individuals who do not participate in the official labor market and clandestine or illegal immigrants who actively engage in the shadow economy to prevent detection and deportation. Empirical research on the shadow economy labour market is even more difficult than estimating the aggregate size of the shadow economy particularly because

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<sup>19)</sup>This is especially true in Europe (e.g. in Germany and Austria), where the total tax and social security burden adds up to 100% on top of the wage effectively earned.



one has very little knowledge about how many hours on average a shadow economy worker is actually working.<sup>20)</sup>

The following results of portraying the shadow economy labor force are based on the Worldbank database on informal employment in major cities all over the world (see footnote 20). Columns 5 to 7 of Table 3 provide the estimates of shadow economy labour market for these eighteen Asia-Pacific nations.<sup>21)</sup> The values of the shadow economy labor force are calculated in absolute terms and in percent of the official labor force, under the assumption that in rural areas the shadow economy is at least as high as in the cities. This is a conservative assumption, as in reality the shadow economy will most likely be even larger in rural areas.<sup>22)</sup> The following results are preliminary and should be treated as a first attempt to calculate the shadow economy labor force for these countries.

If we consider the size of the shadow economy labor force as a percentage of the “official” labor force, we see once again that Thailand (for the year 1989/90) has by far the biggest shadow economy labor force (40% of the official labour force), followed by Indonesia (31.3%) and Sri Lanka (31.3%). In the middle field are Malaysia with 25.1%, China with 20.5% and Korea (South) with 19.6%. At the lower end is Singapore with 10.2%, New Zealand with 9.2%, and Japan with 7.1% of the “official” labor force. From these results one may conclude that the shadow economy labor force has reached quite a considerable size. If we consider these figures in absolute terms (millions of people) the larger nations have the biggest shadow economy labor force. For example, China has 152.4m ‘full-time shadow economy workers’, followed by India with 117.2m and by Indonesia with 30.7m.<sup>23)</sup>

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<sup>20)</sup>For developing countries some literature about the shadow labour market exists, e.g. the latest works by Dallago (1990), Pozo (1996), Loayza (1996), especially Chickering and Salahdine (1991).

<sup>21)</sup> There is a particularly strong relationship and “social networking” that takes place between those people who are active in the shadow economy, as one would expect to find in the official labor market. Pioneering work in this area has been done by L. Frey (1972, 1975, 1978, 1980), Cappiello (1986), Lubell (1991), Pozo (1996), Bartlett (1998) and Tanzi (1999).

<sup>22)</sup> The assumption that the shadow economy labor force in the cities is at least as large as in the rural areas, is a very modest one (see Lubell (1991) and Bartlett (1998)). Lubell (1991), Pozo (1996) and Chickering and Slahdine (1991) argue that the shadow economy labor force is up to twice as high in rural area compared to the major cities. But as there exists no (precise) figures on this ratio, the assumption of equal size may be justified and at best provides a lower bound estimate.

<sup>23)</sup> It should be clearly emphasized, that the following values have been calculated under the extreme assumption, that a “full-time shadow economy worker” is as productive as his colleague in the official economy. If this were not the case, these figures would increase. Moreover the assumption of a full time shadow economy worker is extreme. Most people working in the shadow economy have an ‘official’ job, as well so that the figures on ‘full time shadow economy workers’ is an artifact – it is a construction of the number of ‘job’ supporting shadow economy activities.

## **6. Conclusion**

The existence of a shadow economy affects the quality of national accounts data as well as fiscal data reported in government budgetary papers. Not only does individual and business participation in the shadow economy contribute to lower tax revenue, it also affects the quality of economic and social information which policymakers use to gauge their economic policies. The fact that the size of the shadow economies in each of the eighteen Asia-Pacific nations that we have estimated in this paper have grown considerably since 1989/90, suggests that national accounts data is on average significantly underestimated. The results appear more so for those countries that have inefficient means of detecting and discouraging shadow economy activities. Immediately this casts doubts on the quality of data on economic growth, inflation, the size of the business cycle, the rate of unemployment, the volume of savings and the level of productivity in the economy in each of these countries. The doubts are greater of course for those less developed countries. From such data distortions only poor policy prescriptions can follow.

Nevertheless, in an age when there has been a growth in government regulation and scrutiny of the tax collection system, international evidence, particularly that presented in this paper, suggests quite clearly that the size of these shadow economic activities is growing world wide. It is important then that governments should take seriously the issue relating to the shadow economy by considering the rules, regulation, taxes and welfare benefits which may have sparked the enthusiasm to participate in these activities and to actively pursue policies to combat these areas of growing noncompliance.

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