

WP 2001-09
July 2001



Working Paper

Department of Applied Economics and Management
Cornell University, Ithaca, New York 14853-7801 USA

Measuring the Shadow Economy in Bulgaria

Steven Kyle
Andrew Warner
Lubomir Dimitrov
Radoslav Krustev
Svetlana Alexandrova
Krassen Stanchev

It is the Policy of Cornell University actively to support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age or handicap. The University is committed to the maintenance of affirmative action programs which will assure the continuation of such equality of opportunity.

**MEASURING THE SHADOW ECONOMY
IN BULGARIA**

Cornell University

Steven Kyle Ph.D.

Harvard University

Andrew Warner Ph.D.

Agency for Economic Analysis and Forecasting

Lubomir Dimitrov

Radoslav Krustev

Institute for Market Economics

Svetlana Alexandrova Ph.D.

Krassen Stanchev Ph.D.

JULY 2001

This work was supported by USAID's consulting assistance on economic reform (CAER II Project). The objectives of the project are to contribute to broad-based and sustainable economic growth and to improve the policy reform content of USAID assistance activities that aim to strengthen markets in recipient countries. Services were provided by the Harvard Institute for International Development (HIID) and its subcontractors. It was funded by the U.S. Agency for International Development, Bureau for Global Programs, Field Support and Research, Center for Economic Growth and Agricultural Development, Office of Emerging Markets, contract PCE-C-00-95-00015-00, Task Order #39. Work subsequent to the conclusion of this contract was performed at Cornell University.

Abstract

GDP accounts are customarily compiled in several alternative ways, each aggregating transactions in different ways, but all (at least in theory) adding to the same total. Two of the most common aggregations are that focused on expenditures (based on the standard national income accounting identity of $C + I + G + X - M$) and that based on revenues, or incomes. The two methods should, of course, add to the same number since they measure different sides of the same activity: what money people receive on the one side, and what they do with it on the other.

However, Bulgarian GDP statistics using the revenue approach give growth rates 2 percentage points lower than the expenditure approach for 1998 and 1999. In other words, data based on what people actually spend show growth rates of 5.4% (1998) and 4.4% (1999), while official figures based on revenues are 3.5% and 2.4%, respectively. This can be interpreted as evidence that there are underreported incomes. It is of interest not only for statistical but also for economic policy purposes to have more detailed information about the discrepancies between official statistics and activities not covered by the official statistical system. It is particularly interesting to know the size and structure of unreported, hidden economic activities, or what has come to be called the "shadow economy." Currently published estimates of the size of the shadow economy vary from 20 to 25% of officially measured GDP, implying that this is a far larger issue than that implied by the differential growth rates cited above.

The objective of this study is to estimate the size of the informal sector, its structure, and the dynamics of its development since Bulgaria ended its long standing centrally directed command economy. Different methods were used to get results that are compatible for international comparisons; also, alternative calculations allow a range of estimates which can help to balance the methodological weaknesses of the individual approaches.

The basic rationale of Physical Input Approaches to measuring the size of the shadow economy is that energy consumption (electricity, plus other sources) in a given country is proportional to total economic activity and any change in energy consumption which does not correspond to changes in the measured total activity level of the country indicates a change in the size of the shadow economy. These results provide useful indicators of changes in the shadow economy over time, but cannot be used to quantify its absolute size since this depends on an initial estimate of its size in the base year. This estimate is necessarily arbitrary to some degree in the absence of specific micro-level data allowing definition of an explicit relationship between energy use and economic activity. Results show that the Bulgarian shadow economy in 1998 declined below the estimated base year (1989) share of 30%. According to our calculations the share of the shadow economy in 1998 GDP in Bulgaria was 22%. The largest shares were observed in 1990 (32.2%) and 1996 (34.4%), declining thereafter.

This study has shown that though the size of the shadow economy has declined from its peaks in the mid 1990's, it remains a sizable portion of the Bulgarian economy. While in many ways shadow activities have the potential to be dynamic growth sectors, bringing them into official economy would help spread the burden of social programs more broadly. Our results show that a substantial portion of the response to policy initiatives is effectively hidden from official view. Thus, an ability to correctly estimate the size and structure of the shadow economy will not only provide more accurate statistics but can help improve growth policies as well.

I. Introduction¹

It has been reported in the popular press that statisticians assume in their analyses approximately 9 trillion USD of world-wide output is not reported,² largely due to the existence of the shadow economy³. Friedrich Schneider⁴ concludes that shadow activity is nearly 15% of officially reported world GDP based on research carried out in 76 developed and emerging economies. This shows that the informal sector can be as important as the official economy, especially when it accompanies the economic development of the transition countries. According to an estimate made by Johnson, Kaufman and Zodia-Lobaton⁵ the shadow economy in the transition countries varies between 7 - 43% for the period 1989-1993.

There are many causes for the existence of the shadow economy, but some of the most important can be readily identified. These are high tax burdens, weak banking systems, business regulations and legislation, inefficiency of government institutions, and high unemployment rates. The shadow economy tends to be greater in the developing and transition countries due to more corruption and low incomes.

To date there is no precise definition of the shadow economy. Schneider and Enste define it as a multitude of activities that are not reported by the official statistics. According to Feige⁶ the development of the shadow economy is due to regulations and rules imposed on business by the state. De Sato⁷ has also contributed to the explanation of the shadow economy phenomenon. He holds that the quality of regulations as well as their enforcement are of great importance for the development of the shadow economy and emphasizes the change in the attitude of economic agents towards institutions and the legislation, especially in the transition countries.

Philip Smith⁸ has referred to the unofficial economy as "market-based production of goods and services, whether legal or illegal that escapes detection in the official estimates of GDP." However, this description is almost as broad as the term shadow economy. An alternative possibility is to define the concept in terms of its causes or indicators - a more

¹ The team would like to extend special gratitude to the experts from the Agency for Socio-Economic Analysis, especially Docho Mihaylov, Director for carrying out the field work and initial analysis, Ms Evdokiya Nikolova - a student at Harvard University, for contributing to the first chapter of the report, as well as to Dr. Friedrich Bauersachs, Senior Economist at the Institute for Market Economics for his comprehensive consultations during preparation of the final report.

² The Shadow Economy, *The Economist*, August 28, 1999, Vol. 352.

³ IMF estimated global GDP in 1998 was 39 trillion USD, almost 9 trillion USD ($9 \cdot 10^{12}$) of activity equivalent approximately to the American output went undetected, *ibid*.

⁴ Schneider, Friederich and Dominic Enste, *Shadow Economies Around the World – Size, Causes, and Consequences*, Jena, 1999.

⁵ *Studies of Illegal and Unreported Activity* (Michigan: WE Institute for Employment Research, 1996) and *Journal of International Affairs*, Vol. 53.

⁶ See: Philip Smith, *Assessing the Size of the Underground Economy. The Canadian Statistical Perspectives*, *Canadian Economic Observer*, Catalogue number 11-010, 18 March 1994.

⁷ See: de Sato *The Other Path*, NY: Harper & Row, 1989. Sato's formulation is based on the cases formulated in the context of Peru's economic development (that Peru is governed by a set of laws that are relatively less efficient than those that guide the informal sector).

⁸ Philip Smith (1994): "Assessing the size of the Underground Economy: the Canadian Statistical Perspective", *Canadian Economic Observer*, Catalogue No.: 11-010, 3.16-33, at 3.18.

detailed classification has therefore been given by Schneider and Enste⁹ who divide underground economic activities in several categories by three factors: monetary and non-monetary transactions; illegal and legal activities. Legal activities are further divided into those associated with tax evasion or tax avoidance¹⁰. A good way to generalize these definitions would be to think of shadow economic activities as those which provide a way to avoid taxes.

For the last three years the development of the Bulgarian economy has been characterized by macroeconomic stability and financial soundness. At the same time the state has extended control over business activities by increasing the number of the legal regulations concerning licensing, permissions and registration. Current licensing and registration procedures impede business activity and create favorable conditions for corruption in state and local administration. Surveys of the Institute for Market Economy in Sofia show that business regulation and constantly changing regulations are important reasons for firms to prefer the informal sector of the economy¹¹.

In theory and practice the most common methods for measuring the shadow economy are the following:

The direct approach¹² is based on a direct inquiry with the firm managers, state and local administration representatives by means of interviews and questionnaires. An advantage of this method is the variety of the information collected about the structure of the shadow economy, and the incentives that lead to it. The outcome of such research depends on the way the questionnaire is formulated and the willingness of the businessmen to give truthful answers. The disadvantage of the approach is the degree of reliability of the information given the illegal nature of many shadow activities. This presents difficulties for estimation of the actual size of the shadow economy. For this reason, the direct approach is not much used in practice.

Commonly used indirect methods for estimation are based on differences between national expenditures and revenues, an assessment of the labor market analyzing the differences among the officially registered employment, the unemployment rate and the number of people who are actually employed within the economy¹³.

Another indirect method is the currency demand approach¹⁴ used in the estimation of the informal economy in OECD countries by Schneider, Johnson, and Kaufman. In the past few years an assessment of the shadow economy through energy consumption costs has been applied by Kaufman and Kaliberda¹⁵. This method is appropriate for comparative analyses.

⁹ Friedrich Schneider and Dominic Enste (1999): "Shadow Economies Around the World—Size, Causes, and Consequences", *Lectiones Jenenses*, Heft 20, 9.

¹⁰ Schneider and Enste, 9.

¹¹ See: *In Search for Growth: Policies and Lessons from Bulgarian Transition*, *IME Newsletter*, Vol. 5, No 11-12, 1999.

¹² The direct approach is used by Isachsen Krovland and Storm (1982) for the estimation of the SE in Norway and Denmark.

¹³ See Friedrich Schneider and Domonic Este, "Shadow Economies Around the World- Size, Causes, and Consequences", *Max-Planck-Institute for Research into Economic Systems*, 1999.

¹⁴ The currency demand approach has been used by Cagan (1958) and further developed by Vito Tanzi (1980-1983).

¹⁵ See: Kaufman and Kaliberda, *The Underground Economy in Poland*.

The physical (electricity) approach has been applied by Johnson and Lacko to the transition countries for the period 1989-1995. According to this method, the size of the shadow economy in GDP for Bulgaria was 26.1% (1989-1990), 32.7% (1990-1993) and 35% (1994-1995).

The objective of the analysis reported in this paper is to estimate the proportion of the informal sector in the economy, its structure, and the effect on the economic growth of the economy.

II. GENERAL METHODS FOR EVALUATING SIZE AND EFFECTS OF THE SHADOW ECONOMY

SIGNIFICANCE OF THE STUDY

In order to become a member of the EU Bulgaria has to show strong and sustainable GDP growth to catch up with the lowest income economies in the Union. If research on shadow activities proves a high relative share of shadow economy to official GDP, this finding can reveal an important resource for economic growth and the number of years needed for convergence to the EU average would be drastically reduced. Government measures can be targeted toward improving the business environment and removing administrative barriers to small and medium enterprises (SMEs).

Reducing the tax burden, which is usually associated with the main motive for being in the shadow economy, can decrease the costs for firms to stay in the shadow sector. This will increase the tax base significantly and improve the tax collection ratio. Though these are benefits and costs to informal operations, on the macro level the total effect of the SE in Bulgaria should be negative because companies cannot use various public and private services. The most obvious example is the tendency to avoid the bank services. This results in reduced volume of sales, especially for exports. While the shadow sector may be quite flexible on local markets, it is less competitive on external markets. The negative impact of the SE on national competitiveness is the main disadvantage for a small economy like Bulgaria, which should have an export-oriented policy. Monitoring key economic statistics, we can point out the following indicators that suggest a high level of the shadow economy in Bulgaria and justify our survey on the subject:

1. The transition from planned to market economy. Following the collapse of the planned economy in the late 80's, the newly established private sector is concentrated in the service sector in the form of SMEs. These are characterized by frequent changes of main activities, non-bank sources of financing, short business history and institutional gaps. This makes the work of the NSI (National Statistical Institute) extremely complicated as it is practically impossible to cover the fast moving private sector, even if it is official and legally operating. In addition, with the transition to a market economy, the NSI has had to introduce a new system of national accounts and operate in a totally different environment from that which existed under the old regime.

2. In kind production. This is very important in rural areas, but significant in kind production is also found in the big cities, especially in the service sector. It is a traditional phenomenon for Bulgaria and quite typical for planned economies when the quality and variety of goods and services was poor. In depth estimates of the share of in kind production are presented in the annual report of the AEAF¹⁶ for 1997 and estimate that about 10-20% of household incomes come from in-kind production (20-40% for rural areas and 5-10% for large towns). These activities are difficult to calculate in the official GDP figures, and serious underestimation is likely to exist.

3. Different outcomes from expenditure and income approaches for GDP. One of the indicators for the existence of a shadow economy is the different result that comes from the expenditure and income approaches for measuring the GDP. While in accounting terms these methods should produce equal results, in the case of Bulgaria the approach that sums sectoral value added gives growth rates about 2 percentage points lower than the expenditure approach for 1998 and 1999. In other words, the expenditure approach shows 5.4% and 4.4% GDP growth for 1998 and 1999 respectively, while official numbers are 3.5% and 2.4%. This is probably the consequence of the firms' tax avoidance.

4. Aging population and high social insurance burden. The dependency ratio for Bulgaria (the ratio of the pensioners to employees) is very high – the highest of all applicant and member countries of the EU. In combination with the pay-as-you-go pension system the incentives to avoid the social insurance burden are enormous. Typical practice for SMEs is to pay taxes on the legally required minimum wage and deliver the rest of the remuneration unofficially. Though the share of the private sector in gross value added is 65.3% for 1999 and 63.3% in the total number of employees, the revenues to the National Social Insurance Institute amount to much less than 50% (official numbers not published).

5. Currency substitution. During the financial crises of the early 1990's and 1996-1997 a large share of national savings was transformed into foreign currency. Some of the transactions were made in foreign currencies and the phenomenon seems to have persisted. With the introduction of the currency board just a small amount of de-dollarization took place in the short run. Around 50% of total bank deposits are held in foreign currency, chiefly United States dollars (USD). The prices of real estate are still quoted in USD. USD are still offered in the exchange offices as their rates (adjusted for a variety of commissions and fees) for buying and selling USD have been continuously below the official rate of the central bank.

6. Geographical situation and cross-border trade. Bulgaria is situated on the junction of many international roads associated with legal or illegal traffic of goods and people. Many unregistered transactions and incomes are not adequately covered in the official statistics, which can be also a factor for the immense supply of foreign currencies.

Various methods have been created to estimate the size of the shadow economy of a country¹⁷. Among the most widely used have been the currency demand approach, the physical input (electricity) approach and different survey (direct) approaches. In Bulgaria

¹⁶ See "Bulgaria 1997 Economic Survey", Agency for Economic Analysis and Forecasting, Sofia, 1998, part 3: "The crowding out effect of the economy in kind over the market economy", p. 28.

¹⁷ For a detailed description of each method along with its shortcomings and applications in different countries, see Schneider and Enste, 1999.

only the indirect approach based on currency demand has been used so far. Under the assumption that underground transactions are made with cash payments, an increase in the demand for currency would be translated into an increase in the shadow economy. A currency demand function is built with all possible factors affecting demand, and estimated econometrically over time. Then an estimate of the SE is given by the difference in the money demand when the tax burden and government regulations are at their lowest and highest levels. Note that we have no way of assessing the unofficial activities unless we assume a constant velocity of money over time and within the official and unofficial sectors.

In Bulgaria, a study of the transactions demand for money was conducted by Nenovsky and Hristov of the Bulgarian Central Bank¹⁸. In the concluding section of their paper they estimate the size of the Bulgarian Shadow Economy using the following procedure:

1. Tax burden is approximated by the ratio of Taxes to Total Consumer Expenditure.
2. Money used in the Shadow Economy equals the difference between money demand with and without taxes.
3. The velocity of money is assumed to be the same in the shadow and the official economy.
4. After computing the portion of money in transaction used in the shadow economy (C) as a percentage of the one used in the official economy, consumer expenditures in the unofficial sector are the product of this quantity of money and velocity:

Equation 1

$$E = C * V$$

Consumer expenditures are 80% of GDP, so underground income is calculated as

Equation 2

$$Y_{shadow} = \frac{E}{0.8}$$

The shadow economy is thus calculated on a monthly basis starting from the middle of 1997, yielding averages of 15.2% for 1997, 35.3% for 1998 and 24.1% for 1999.

There are a number of problems with the money demand approach in general - a comprehensive list has been given in Schneider and Enste,¹⁹ a part of which is reflected in the points below:

- 1) The approach does not capture unofficial activities in which money does not exchange hands, eg., barters.

¹⁸ Nikolai Nenovsky and Kalin Hristov (1999): "A Study of the Money in Transaction after Establishing the Currency Board in Bulgaria," working paper, Bulgarian National Bank.

¹⁹ Schneider and Enste (1999), 48-50.

- 2) Tax burden is often assumed to be the main cause of shadow economy, thus if there are other significant factors, the result would be an underestimate.
- 3) Changes in money demand might not necessarily translate into changes in the size of the shadow economy: the former might be due to a slowdown in demand deposits.
- 4) As mentioned above, the velocity of money may not be constant, and moreover it may not be the same in the official and unofficial sectors. While this is a major weakness of the model, as Nenovsky and Hristov acknowledge, it is difficult to measure the velocity of money in the official economy, and impossible to measure it in the informal economy. However, without an assumption for this variable, the analysis cannot proceed. In practice, the authors suggest that money changes hands more quickly in the shadow than in the official sector, which results in an underestimate of the shadow economy size.
- 5) In the particular case of Bulgaria, the instability of the Bulgarian lev (BGN) has prompted the use of foreign currency, mainly US dollars and German Marks, yet the portion of it to the amount of Bulgarian currency circulating in the shadow economy is impossible to estimate. If we suppose that the value of dollars or marks is at least as much as the one of the BGN, then the black market estimates would double, becoming 30%, 70% and 48% respectively for 1997-99.

The general objections to the money demand approach are quite important in the case of Bulgaria. The bank crisis in 1996 led to a dramatic fall in bank assets as well as in the money multiplier and money velocity. This practically makes the money demand approach useless for Bulgaria, as the key assumption of constant velocity does not hold. Table 4 included in the appendix shows the velocity of money, calculated for M3, has increased from 1.54 in 1992 to 4 in 1997. It is only possible to analyze the period after the introduction of the currency board (July 1, 1997) as done in the above survey.

Compared with GDP, the drop in total assets was followed by a drop in domestic credit. The level of bank intermediation was reduced, and it is not possible to distinguish between the reasons for the increased cash transactions and the dollarization of the economy. It would definitely be mistaken to attribute it only to the shadow economy, since the normal reaction of economic agents would be to avoid the unstable bank system and to prefer cash transactions. During the three year period of macroeconomic stabilization, confidence in the banking system is in a process of slow recovery. It is inevitably accompanied by a decrease in money velocity and the assumption of constant velocity can provide inaccurate estimates of the shadow economy even for the last three years of financial stabilization. For these reasons, we believe that the physical input approach is a much better tool for evaluation of shadow activities in Bulgaria. It also provides a longer time series for comparison of the current situation with the pre-transition period.

III. ALTERNATIVE ESTIMATION: THE PHYSICAL INPUT APPROACH

Given the problems with the Money Demand approach, we turn to an alternative macro-estimation of the shadow economy in Bulgaria using energy consumption. Among those who have previously used this approach are Kaufmann and Kaliberda²⁰. We also try to measure the total economic activity level (TA) in Bulgaria by assuming that the electricity/energy consumption in the country is proportional to the total activity TA. Thus, any change in energy consumption which is not matched by a corresponding change in the total activity level in the country, should reflect a change in its shadow economy (SE) level. In other words, the growth in the ratio of energy to total activity is an indicator of the growth in the parallel markets of a country. We can then establish a formula for the level of the shadow economy as a percentage of the GDP which we denote by SE.

By our assumption of constant proportion of energy to total activity,

Equation 3

$$TA_n = E_n * \frac{TA_{base}}{E_{base}}$$

where subscripts n and base stand for the base year and the year in question, and E denotes Energy (or Electricity) consumption. We also have

Equation 4

$$SE = \frac{TA - Y}{Y} = \frac{TA}{Y} - 1$$

where Y is the country's GDP, let $SE_{base} = x$ be the fraction of shadow economy of GDP in the base year. Then

Equation 5

$$TA_{base} = Y_{base} (1 + x)$$
$$TA_n = E_n * \frac{Y_{base} (1 + x)}{E_{base}} = (1 + x) * \frac{Y_{base} * E_n}{E_{base}}$$

20 Daniel Kaufmann and Aleksander Kaliberda (1996): "Integrating the unofficial economy into the dynamics of post socialist economies: A framework of analyses and evidence," Washington, D.C., The World Bank, Policy research working paper, 1691.

So for the shadow economy in year n we have:

Equation 6

$$SE_n = \frac{TA_n}{Y_n} - 1$$
$$SE_n = (1 + x) * \left(\frac{Y_{base}}{E_{base}} / \frac{Y_n}{E_n} \right) - 1$$

From the formula we see that, *ceteris paribus*, the shadow economy is determined both by the level of the shadow economy in the base year and the ratios of GDP to energy consumption in the base and given years. Note that here the term base year simply refers to the starting year of our calculations, and once we know the shadow economy in a given year, and the relevant statistics for energy consumption and GDP, we can recursively find the shadow economy levels for the subsequent years. Unfortunately, this convenience of easy calculations also underlies the shortcoming of the method. We can never find an absolute value for the shadow economy size without using some exogenous estimate for its size in the base year.

In case we are only interested in how a change in the shadow economy in the base year alters the shadow economy in the current year (say we want to see how robust our calculations are in case the level of shadow economy in the base year is allowed to vary within a range of error), then the formula for changes follows from above by subtraction:

Equation 7

$$\Delta USE_n = Ix * \left(\frac{Y_{base}}{E_{base}} / \frac{Y_n}{E_n} \right)$$

We now see that, holding everything else constant, the change in the SE in any given year is proportional to the change in SE in the base year. The coefficient of proportionality, however, is not necessarily 1 — it depends on the ratios of GDP to energy consumption in the base as well as the current year.

As mentioned above, E in the formulae could either refer to energy or electricity consumption. The standard approach considers electricity consumption in the economy as a whole. In the current paper we try to make the measures of shadow activities more precise by looking at total energy consumption as well; also we deviate from the standard approach in that we compute the shadow economy size separately in the different sectors. We believe that the latter is the best way to capture the structural changes that have been taking place extensively in all transition economies since the change of regimes.

We thus compare four modifications of the Physical Input approach: by looking at electricity consumption separately for sectors, and as a whole to compare with the standard approach and existing results; we then compute equivalent values by replacing electricity with total energy consumption. The latter should reflect the substitution effect that takes place among the energy sources when their prices change relative to the corresponding CPI and inflation rates.

ELECTRICITY - TOTAL CONSUMPTION AND CONSUMPTION BY SECTORS

The advantage of the electricity approach is the accuracy of the data for electricity consumption. The standard method considers only total electricity consumption in the economy. However, when significant structural changes take place, economic production can shift from energy intensive industrial sectors to services or agriculture, which are characterized by low or zero electricity consumption. In the case of Bulgaria this process cannot be ignored.

Assuming a constant GDP/electricity ratio with 1989 as a base year, we test the assessment of the shadow economy with the standard approach and structural adjustments. We use real GDP data that we compute based on the Bulgarian GDP in 1989 and indexes of GDP growth for the years 1989-1998. Assuming a "base" level x of the shadow economy in 1989, we use the available data for GDP and electricity consumption to generate estimates of the levels of the shadow economy in the years 1990-1998. For example, since the GDP levels for 1989 and 1990 are respectively 39,579 and 35,977 while the Electricity consumption levels are 38,816 and 47,528 respectively, by formula (1) the shadow economy in 1990 is

Equation 8

$$SE_{1990} = (1 + x) * \left(\frac{Y_{base} / Y_{1990}}{E_{base} / E_{1990}} \right) - 1$$
$$SE_{1990} = (1 + x) * \left(\frac{39,579 / 35,977}{38,816 / 47,528} \right) - 1 = (1 + x) * 1.347 - 1$$

Similarly, we proceed to find the levels for subsequent years. Finally, we need an estimate for the shadow economy in the base year, x . Since it is difficult to give a precise value for that, we consider a range of possible values and show that while the trends in the shadow economy growth are the same regardless of the starting values, some of these starting points result in negative estimates of SE/GDP for some years, and so are likely to be too low²¹.

To adjust the estimation for the structural changes, we divide the GDP into two sectors: industry and other. We take the ratio of value added to electricity consumption for each sector and calculate the shadow economy by sectors. In Table 1 the data for the sectoral approach is calculated for a uniform distribution of the shadow economy by sectors in the base year. Figure 1 shows how these methods differ for a given base year level of the SE. Below we test how asymmetric distribution by sectors can affect the final results.

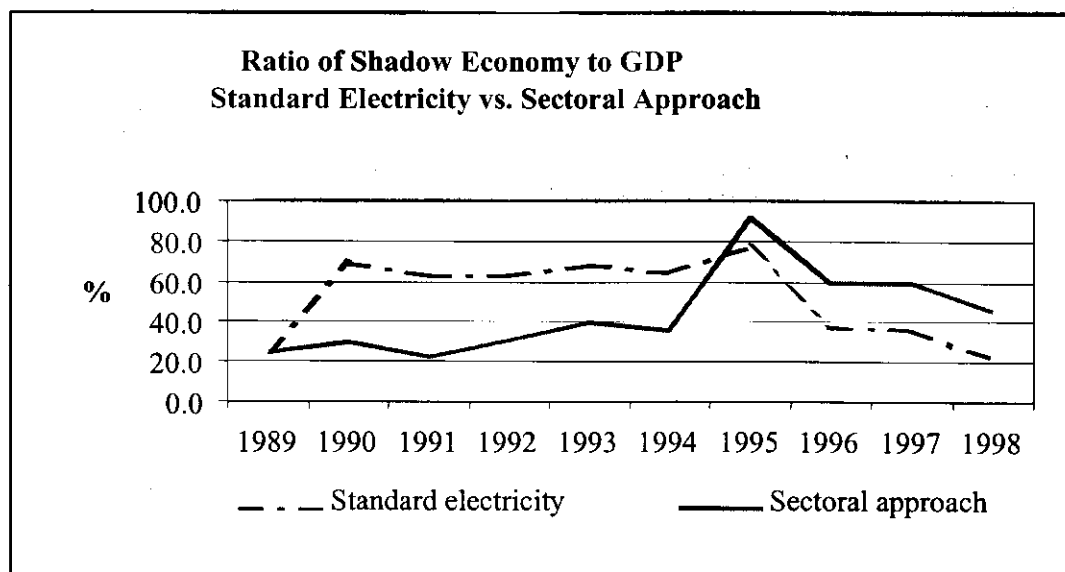
²¹ See appendix.

Table 1
Electricity Approach, Share of Shadow Economics in GDP
under Alternative Base Year Estimates of SE/GDP

	Standard	Sectoral	Standard	Sectoral	Standard	Sectoral
1989	20.0	20.0	25.0	25.0	30.0	30.0
1990	61.9	24.5	68.7	29.6	75.4	34.8
1991	56.2	16.6	62.7	21.2	69.2	25.9
1992	56.1	23.5	62.6	28.1	69.1	32.7
1993	61.4	30.9	68.1	35.6	74.8	40.3
1994	57.3	28.1	63.8	32.7	70.4	37.4
1995	70.1	75.1	77.2	81.5	84.3	88.0
1996	31.8	49.7	37.3	55.1	42.8	60.5
1997	30.4	48.5	35.8	53.9	41.2	59.2
1998	16.6	36.0	21.5	40.8	26.4	45.6

When calculating the relative shares of shadow economy, the final results are strongly dependent on the assessment for the shadow economy in the base year. Such an assessment can be quite misleading, but regardless of the initial share the dynamic trends are not affected. The graph below shows estimates for different scenarios for the base year.

Figure 1



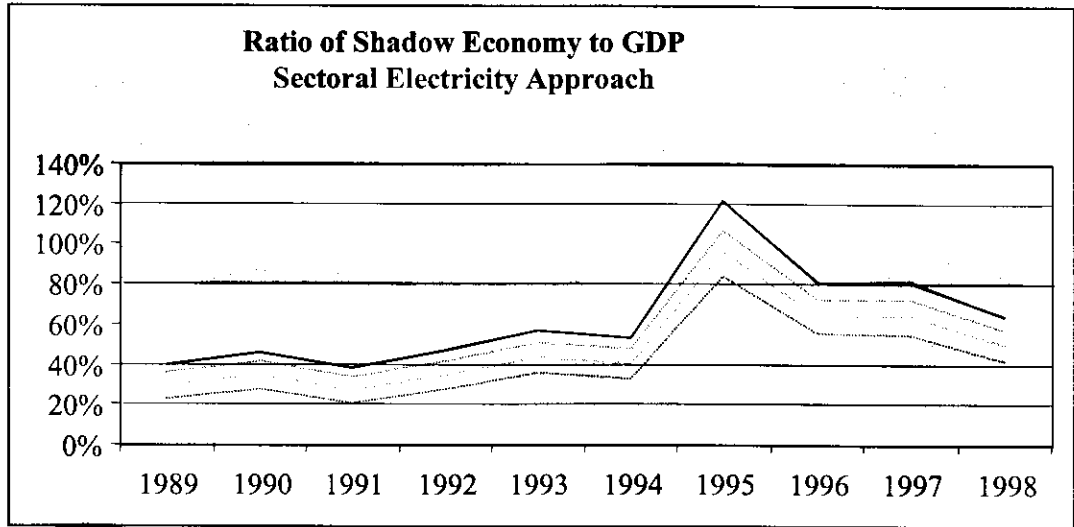
The advantages of the sectoral approach are that we have additional figures for the shadow economy by sectors, and we can distribute the concentration of the informal activity by sectors. In this study we have disaggregated the GDP figures into two sectors: industry and others (including services and agriculture). The data for agriculture and services is reliable on an aggregated level, but on a disaggregated level is strongly biased by the form of ownership. In 1989 most agricultural production was concentrated in the state owned co-operative farms, and the consumption of electricity was adequately counted for the sector. With the land restitution, these state farms were liquidated and production was thereafter attributed to small private farms. In most cases these are individual households and their electricity consumption is counted as household consumption. This is also true for most of the micro firms operating in the service sector. The relative shares of the shadow economy to GDP can also vary with different scenarios for the distribution of shadow economy by sectors in the base year.

In Table 2 and Figure 2 we show calculations for different sectoral distribution of the relative shares. However intuition suggests that in the case of Bulgaria, the share of shadow activities in the industrial sector is much lower than it is in the service sector. The reasons are both methodological failures that do not allow the statistical institutions to capture the total activity in the service sector and the flexibility of the service sector to underreport revenues for avoidance purposes. It is also important to note that in the base year 1989 the methods used for calculating GDP did not accurately cover many services, since the government supplied most of them at zero cost to the consumer.

Table 2
Sectoral Approach, SE/GVA (%), Sectoral Approach
with Different Assumptions for the Distribution of SE by Sectors in Base Year

	Total (uniform)	Industry	Others	Total	Industry	Others	Total
1989	25.0	10.0	46.9	25.0	30.0	17.7	25.0
1990	29.6	15.8	49.2	30.2	36.8	19.6	29.5
1991	21.2	13.5	35.6	22.7	34.2	8.7	20.8
1992	28.1	6.2	73.5	30.5	25.5	39.0	27.3
1993	35.6	6.0	106.2	39.3	25.3	65.3	34.4
1994	32.7	2.9	102.5	36.0	21.6	62.4	31.7
1995	81.5	19.8	236.0	91.6	41.6	169.3	78.2
1996	55.1	27.0	134.5	59.8	50.1	88.0	53.6
1997	53.9	23.7	134.1	59.6	46.2	87.7	52.0
1998	40.8	15.1	107.6	45.2	36.1	66.4	39.3

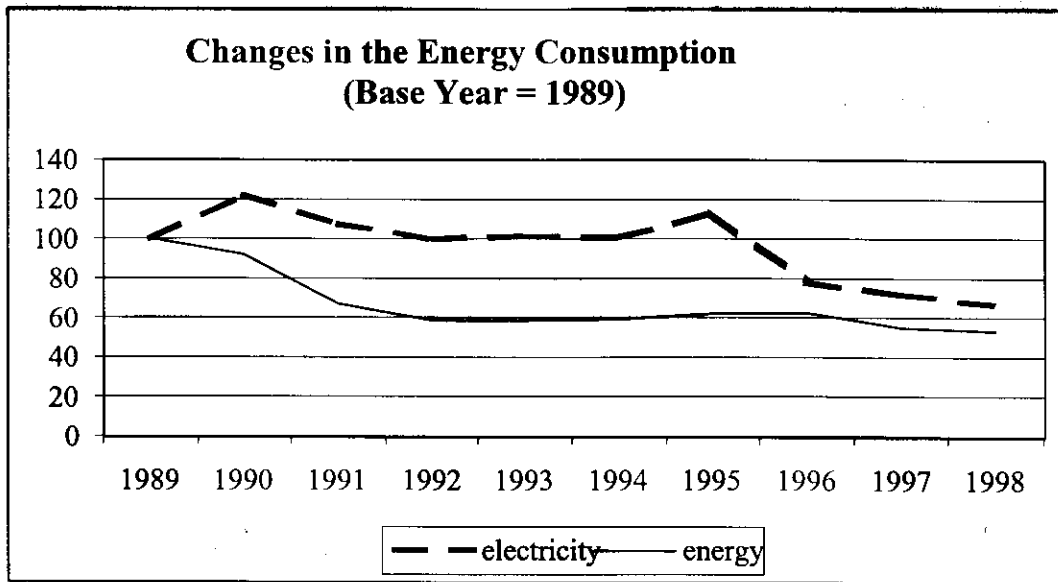
Figure 2



ENERGY APPROACH

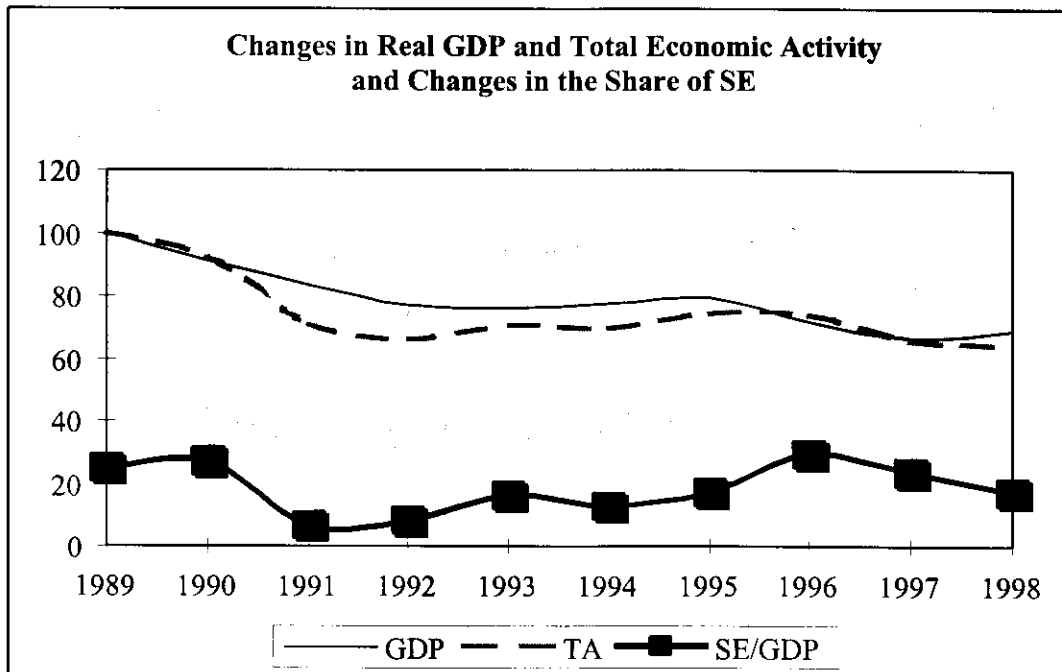
The electricity approach is based on the empirical assumption that the ratio of GDP to electricity consumption is constant. In the long-run changes in relative prices of energy resources or other supply side effects can force the consumers to substitute different sources of energy. (See Figure 3) The substitution effect can seriously affect the assessment of the shadow economy.

Figure 3



To calculate a better estimate of the shadow economy, we compare the consumption of total energy sources, including electricity, coals, fuel, gas, and heating, calculated in terajoules. The decrease in energy consumption is even greater than the drop in electricity. This means that some of the consumers have shifted from other sources of energy to electricity, leading to changes in the ratio of GDP to electricity and overestimation of the shadow activity. Accordingly, to improve the quality of the physical input approach, we substituted total energy consumption for electricity in the calculations outlined above. This method is a reliable tool to remove any substitution effects that might distort the estimates. A slight concern in using the total energy approach is the probability of statistical errors in the energy consumption data and the chance that hidden consumption may exist for some sources such as kerosene, diesel or petrol.

Figure 4



In order to calculate the actual sizes of the Bulgarian shadow economy in the years 1990-1998, we need to know the level for the base year 1989 (see formula (1) above). There exist estimates in the economic literature, yet given the inaccurate and contradictory results those yield, we allow for a range of possible values of the shadow economy level in 1989. Thus, as in the electricity approach above, we can get a sense of what ranges the shadow economy levels move in and see that the trends in these levels are unaffected.

Figure 5
Shadow Economy Levels for the Years 1989-1990 in Bulgaria,
Based on Different Values for the Shadow Economy in 1989

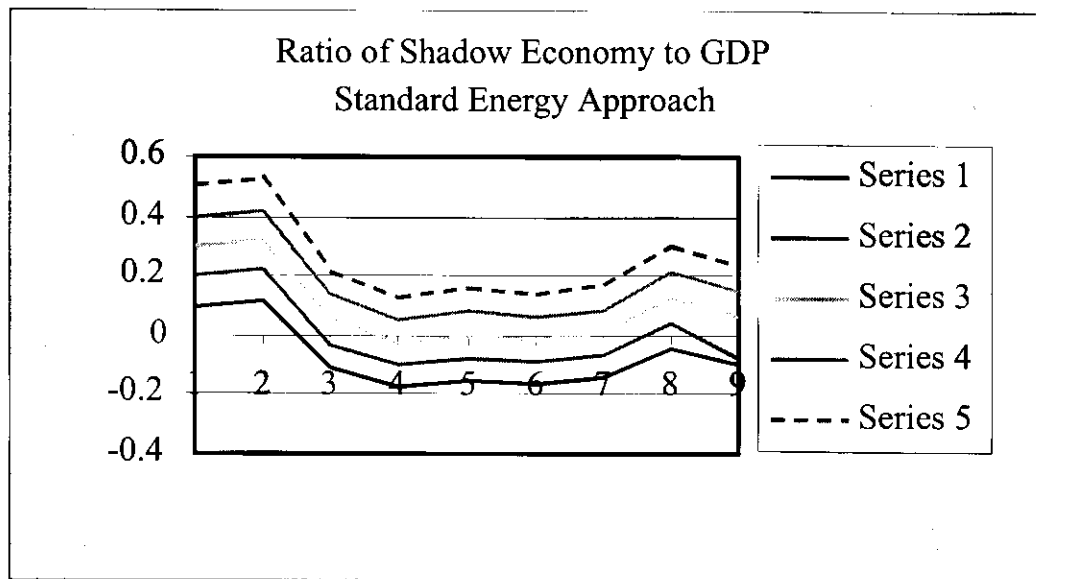
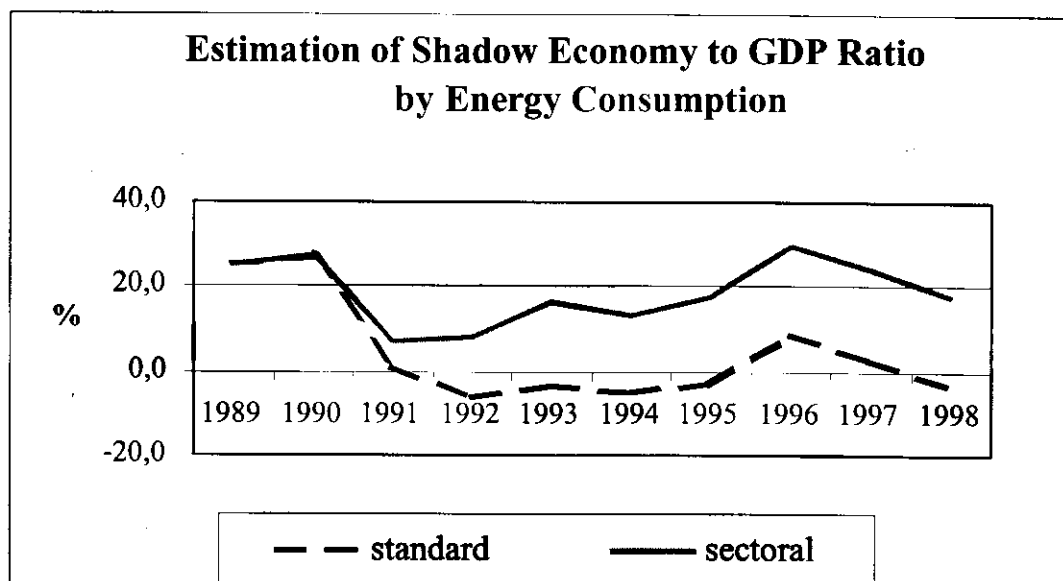


Figure 5 shows that regardless of the initial level of the shadow economy in 1989, the pattern of change across the years of transition is, of course, identical. However, it is also clear that the lowest three estimates for initial values generate negative results in the middle years. This gives some basis for accepting higher initial estimates for SE/GDP.

However, before accepting these results we must consider that just as with the standard electricity approach, the above results suffer from omission of the sectoral changes in the economy. If we believe that the black markets flourish most in the service (and agricultural) sectors and least in industry, and consider the fact that the participation of industry in the Bulgarian GDP has almost halved since 1989 while the agricultural sector has stayed almost the same, we can see how such distortion can significantly modify the overall results.

We refine the method of looking at total energy consumption by considering energy consumption in the different sectors. For correspondence to the electricity results, we break the economy into the same two sectors, industry and everything else (service and agriculture). The difference in results between the standard and sectoral approach is shown in Figure 6 for a shadow economy of 25% in the base year.

Figure 6



**Table 3
Energy Approach, SE/GDP (%)**

	Standard	Sectoral	Standard	Sectoral	Standard	Sectoral
1989	20.0	20.0	25.0	25.0	30.0	30.0
1990	21.9	22.0	26.9	27.1	32.0	32.2
1991	-2.9	2.8	1.1	6.8	5.2	10.8
1992	-10.0	3.7	-6.2	8.0	-2.5	12.4
1993	-7.5	11.8	-3.7	16.5	0.2	21.3
1994	-9.0	8.6	-5.2	13.0	-1.4	17.3
1995	-6.7	13.3	-2.8	17.5	1.1	21.6
1996	4.3	24.8	8.6	29.6	13.0	34.4
1997	-1.5	19.5	2.6	23.8	6.7	28.2
1998	-8.0	12.8	-4.1	17.4	-0.3	21.9

With the above four methods we capture the structural change and substitution effects that Eilat and Zinnes²² proposed as a way to reflect changes in efficiency (in use of electricity) by considering the changing fraction of the private sector over time. We already include a partial estimate of efficiency in the sectoral division of the shadow economy. Private ownership has the largest share in the service sector in the economy, so to an extent its growth is accounted for in the growth of the service sector in the Bulgarian GDP, and the latter we capture in our new sectoral approach.

²² Eilat, Yair and Clifford Zinnes, The Evolution of the Shadow Economy in Transition Countries: Consequences for Economic Growth and Donor Assistance, CAER Discussion Paper No. 83, September 2000.

IV. CONCLUSIONS

The physical input approach provides easy estimates of SE trends, but it is not a precise tool. Energy consumption can be biased by different factors that affect final results as we see in the case of Bulgaria. The energy approach can be more reliable for economies with stable growth paths, which do not witness dramatic structural shifts. However, for transition economies like Bulgaria, the energy consumption approach as well as the currency demand approach should be used only as an indicative measure of SE dynamics. We believe that some structural factors of the traditional electricity approach are eliminated with our sectoral approach when we use total energy consumption instead of electricity consumption.

We believe the most reliable method that can be used as an indicator for the shadow economy is the total energy approach by sectors. Calculations from this method show that the shadow economy in 1998 has declined below the level of the 1989 base-year level. If we take what we believe as a realistic assumption of 30% level of SE in 1989, the SE economy in 1998 as a share of official GDP should be 22%. The absolute peaks of the shadow activity are calculated for 1990 (32.2%) and 1996 (34.4%). Since 1996 we observe a declining trend in the relative share of the shadow economy. This is not surprising given the fact that the introduction of the currency board in mid-1997 marked a steady rise of tax revenues to GDP. The high inflation period of 1990-1995, the hyperinflation in 1996 and the beginning months of 1997 boosted the nominal tax revenues at a much faster rate than social compensations, thus creating strong incentives for households and businesses to escape from the official economy. With macroeconomic stabilization and the accompanying price and trade liberalization, the shadow economy has shrunk. The process, however, succeeded only partially, as administrative and the tax burdens remain the main influence for businesses to operate in the informal sector.

APPENDIX

Table 4
Selected Indicators of the Bank Sector in Bulgaria
 (From 1991 until 1995, SSB is not included)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Non-performing credits (%)				55.50	74.10	74.00	21.20	13.40	13.40
Assets/GDP*		2.28	2.23	1.80	1.13	1.30	0.32	0.35	0.35
Velocity of M3*		1.54	1.53	1.58	1.76	2.25	4.00	3.55	3.50
Money multiplier	3.77	-	4.75	4.92	4.55	5.31	2.77	2.76	2.86
Credits/GDP (%)		100.38	107.10	89.58	66.93	75.63	20.89	21.60	20.0

* Note: The bank assets cover both local and foreign currencies, but M3 does not include foreign currencies in cash outside the banks, as the BNB does not assess the amount of foreign currencies used for cash transactions or cash saving

Table 5
Electricity Consumption (in kWh)

	Total	Agriculture + Forestry	Industry	Construction	Households	Others
1989	38,816	1,069	20,773	994	10,183	5,797
1990	47,528	994	19,149	896	10,475	5,116
1991	42,000	866	14,925	606	10,405	3,226
1992	38,899	686	13,173	421	9,685	3,856
1993	39,628	556	12,353	382	10,021	4,722
1994	39,306	563	12,793	304	9,806	4,672
1995	43,750	539	14,075	356	10,956	15,185
1996	30,479	600	13,236	251	11,486	4,906
1997	28,031	355	11,355	303	9,882	6,136
1998	25,960	233	11,049	265	10,540	3,873

Source: Bulgarian Statistical Abstract, various years

Table 6
Electricity Consumption (in kWh)

	Total	Agriculture	Industry	Service/Others
1989	38,816	1,069	21,767	15,980
1990	47,528	994	20,045	15,591
1991	42,000	866	15,531	13,631
1992	38,899	686	13,594	13,541
1993	39,628	556	12,735	14,743
1994	39,306	563	13,097	14,478
1995	43,750	539	14,431	26,141
1996	30,479	600	13,487	16,392
1997	28,031	355	11,658	16,018
1998	25,960	233	11,314	14,413

Source: Bulgarian Statistical Abstract, various years

Table 7
Electricity Consumption (in kWh) - Two Sector Division

	Total	Industry	Others
1989	38,816	21,767	17,049
1990	47,528	20,045	16,585
1991	42,000	15,531	14,497
1992	38,899	13,594	14,227
1993	39,628	12,735	15,299
1994	39,306	13,097	15,041
1995	43,750	14,431	26,680
1996	30,479	13,487	16,992
1997	28,031	11,658	16,373
1998	25,960	11,314	14,646

Source: Bulgarian Statistical Abstract, various years

Table 8
Real GDP - Total and by Sectors

	Agriculture	Industry	Services	GVA	GDP
1989	4,394.000	23,507.000	11,742.000	39,643.000	39,579.000
1990	4,231.422	20,568.630	11,213.610	36,013.657	35,977.310
1991	4,413.373	16,249.210	10,451.080	31,113.671	32,955.220
1992	3,760.194	15,209.260	7,639.743	26,609.201	30,549.490
1993	2,624.615	14,266.290	7,685.581	24,576.486	30,091.240
1994	2,873.954	15,122.270	7,447.328	25,443.549	30,632.890
1995	3,290.677	14,305.660	7,745.221	25,341.563	31,521.240
1996	3,047.167	12,617.600	7,024.916	22,689.679	28,337.590
1997	4,049.685	11,191.810	5,669.107	20,910.600	26,353.960
1998	4,106.381	11,673.060	5,697.453	21,476.889	27,276.350

Source: Bulgarian Statistical Abstract, various years

Note: The above figures were calculated from indexes for GDP growth from 1989 to 1998 (1989=100) and actual levels of GDP for 1989.

Table 9
Two-Sector Division of GDP

	Industry	Other	GVA	GDP
1989	23,507.0	16,136.0	39,643.0	39,579.0
1990	20,568.6	15,445.0	36,013.7	35,977.3
1991	16,249.2	14,864.5	31,113.7	32,955.2
1992	15,209.3	11,399.9	26,609.2	30,549.5
1993	14,266.3	10,310.2	24,576.5	30,091.2
1994	15,122.3	10,321.3	25,443.5	30,632.9
1995	14,305.7	11,035.9	25,341.6	31,521.2
1996	12,617.6	10,072.1	22,689.7	28,337.6
1997	11,191.8	9,718.8	20,910.6	26,354.0
1998	11,673.1	9,803.8	21,476.9	27,276.4

Source: Bulgarian Statistical Abstract, various years

Table 10
Energy Consumption in Bulgaria (in terajoules)

	Agriculture					
	Total	+ Forestry	Industry	Construction	Households	Other
1989	773,551	-	437,640	-	-	-
1990	714,096	39,955	379,848	23,170	156,986	114,137
1991	521,006	31,929	283,541	12,818	121,422	71,296
1992	448,004	22,775	212,529	9,767	140,612	62,321
1993	453,259	17,844	204,229	7,166	155,797	68,223
1994	454,094	18,852	220,836	7,077	139,423	67,906
1995	478,974	16,433	250,251	6,676	142,587	63,027
1996	481,382	18,121	244,879	6,134	148,323	63,925
1997	422,798	14,799	223,793	5,678	123,628	54,900
1998	408,846	13,674	186,196	4,395	136,609	61,661

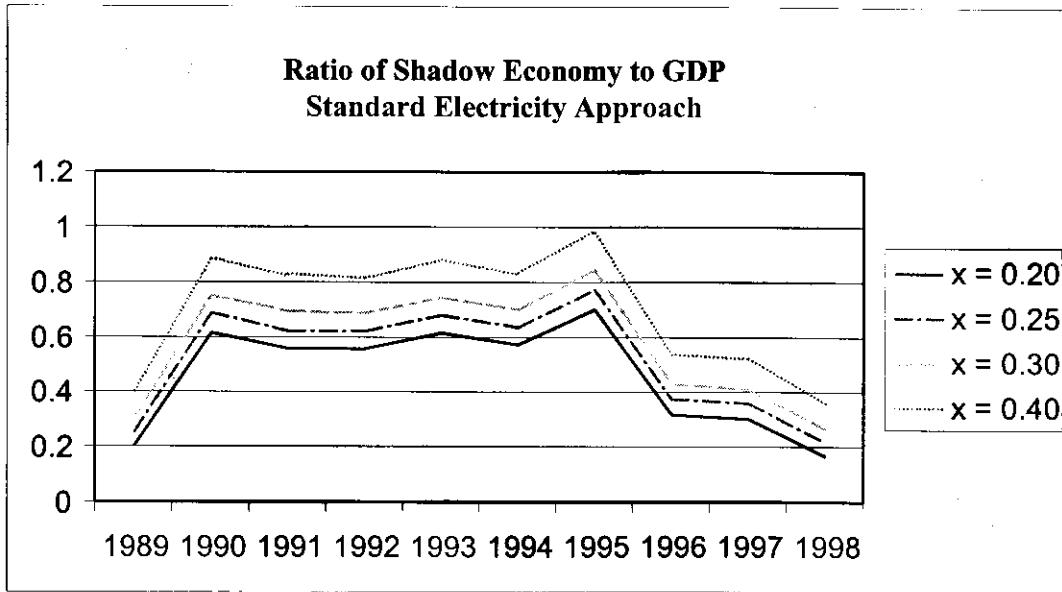
Source: Bulgarian Statistical Abstract, various years

Table 11
Energy Consumption in Bulgaria (in terajoules) - Two Sector Division

	Total	Industry	Other
1989	773,551	437,640	335,911
1990	714,096	403,018	311,078
1991	521,006	296,359	224,647
1992	448,004	222,296	225,708
1993	453,259	211,395	241,864
1994	454,094	227,913	226,181
1995	478,974	256,927	222,047
1996	481,382	251,013	230,369
1997	422,798	229,471	193,327
1998	408,846	190,591	211,945

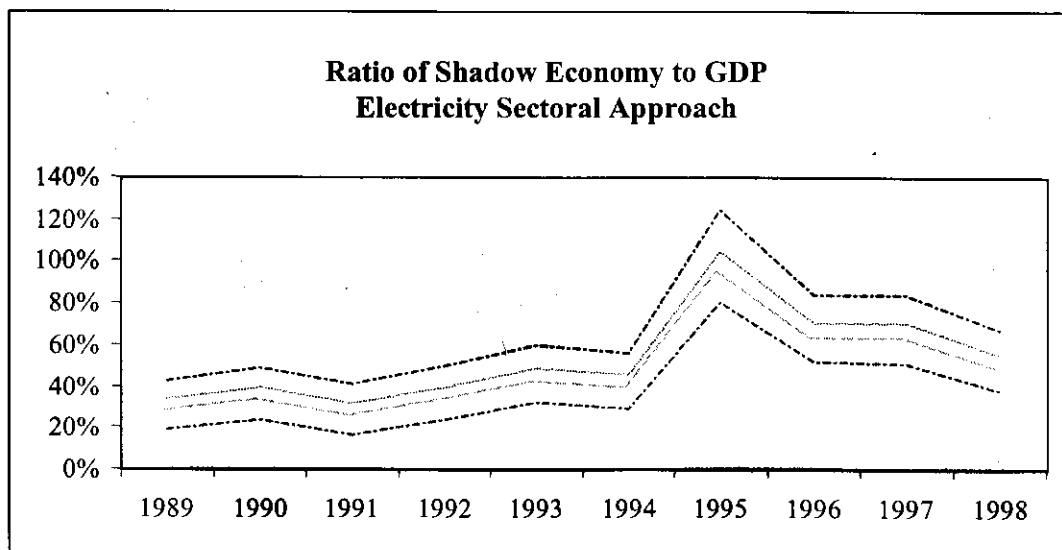
Source: Bulgarian Statistical Abstract, various years

Figure 7
Bulgarian Shadow Economy Levels Based on a Range of Possible Levels in 1989



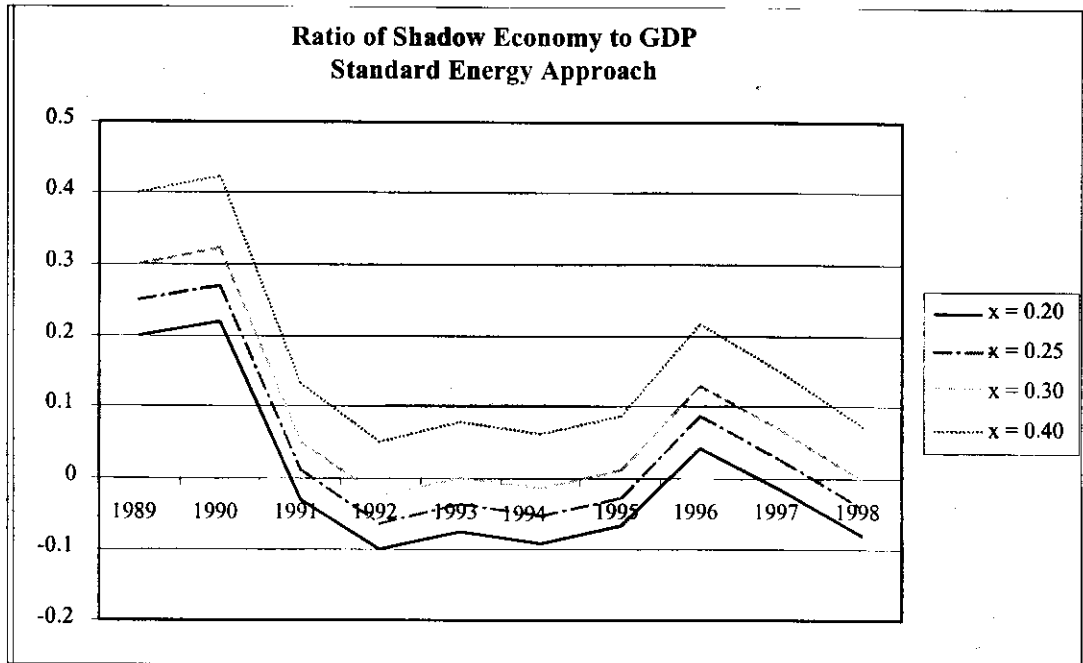
Source: Figures for electricity consumption and real GDP from the tables above, and calculations by formula (1) in the text; x = level of the shadow economy in 1989.

Figure 8
Shadow Economy Levels Based on the Same Range of Possible Levels of the Shadow Economy in 1989 as Above



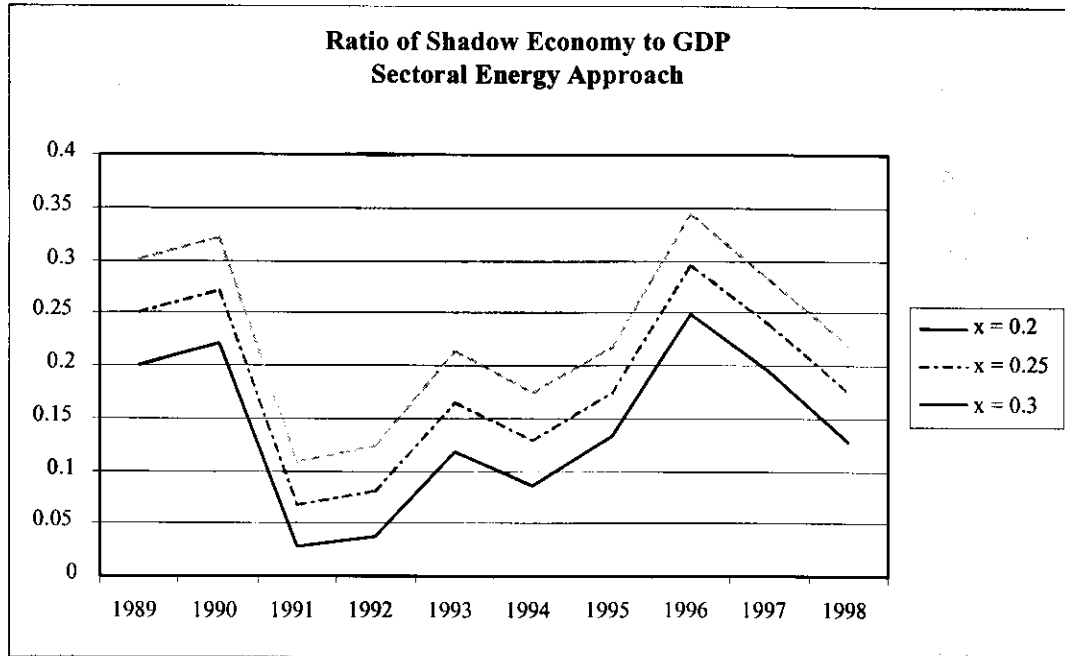
Source: Figures for electricity consumption and real GDP from the tables above, and calculations by formula (1) in the text; x = level of the shadow economy in 1989.

Figure 9
Shadow Economy Levels Based on a Range of Possible
Values for the Shadow Economy X in the Base Year 1989



Source: Figures for energy consumption and real GDP from the tables above, and calculations by formula (1) in the text; x = level of the shadow economy in 1989.

Figure 10
Shadow Economy Levels, Computed by Estimating the Shadow Economy
in the Industry and Non-Industry Sector of the Economy



Source: Figures for energy consumption and real GDP from the tables above, and calculations by formula (1) in the text; x = level of the shadow economy in 1989.

OTHER A.E.M. WORKING PAPERS

WP No	Title	Fee (if applicable)	Author(s)
2001-08	On Obnoxious Markets		Kanbur, R.
2001-07	The Adoption of International Labor Standards Conventions: Who, When and Why?		Chau, N. and Kanbur, R.
2001-06	Income Enhancing and Risk Management Perspective of Marketing Practices		Peterson, H. and W. Tomek
2001-05	Qual-Quant: Qualitative and Quantitative Poverty Appraisal: Complementarities, Tensions and the Way Forward		Kanbur, R. (Editor)
2001-04	Fifty Years of Regional Inequality in China: A Journey Through Revolution, Reform and Openness		Kanbur, R. and X. Zhang
2001-03	Cross-Border Externalities, International Public Goods and Their Implications for Aid Agencies		Kanbur, R.
2001-02	The Role of Curvature in Estimating Accurate Dual Functions		Tauer, L.
2001-01	Cooperation Among Competitors: The Japanese Super-Premium Cold Chain		Hayashi, K., and J. M. Hagen
2000-18	Optimal Land Conversion at the Rural-Urban Fringe with Postivie and Negative Agricultural Externalities		Peterson, J. M., and Boisvert, R.
2000-17	Commodity Price Behavior: A Rational Expectations Storage Model for Corn		Peterson, H., and Tomek, W.G.
2000-16	The Race to the Bottom From the Bottom		Chau, N. H., and Kanbur, R.
2000-15	Analyzing Future Growth in Angola: A Simple Macroeconomic Framework		Kyle, S.
2000-14	Forecasting Industrial Sales in Bulgaria: A Leading Indicator Approach		Kyle, S., and Tsalinski T.
2000-13	A Vector Autoregression Analysis of Bulgarian Inflation		Kyle, S., and Tzvetan, T.

Paper copies are being replaced by electronic Portable Document Files (PDFs). To request PDFs of AEM publications, write to (be sure to include your e-mail address): Publications, Department of Applied Economics and Management, Warren Hall, Cornell University, Ithaca, NY 14853-7801. If a fee is indicated, please include a check or money order made payable to Cornell University for the amount of your purchase. Visit our Web site (<http://www.cals.cornell.edu/aem/>) for a more complete list of recent bulletins.