

MEMORANDUM

No 10/2004

**The shadow economy in Norway: Demand for currency
approach**

Isilda Shima

ISSN: 0801-1117

Department of Economics
University of Oslo



This series is published by the
University of Oslo
Department of Economics

P. O.Box 1095 Blindern
N-0317 OSLO Norway
Telephone: + 47 22855127
Fax: + 47 22855035
Internet: <http://www.oekonomi.uio.no/>
e-mail: econdep@econ.uio.no

In co-operation with
**The Frisch Centre for Economic
Research**

Gaustadalleén 21
N-0371 OSLO Norway
Telephone: +47 22 95 88 20
Fax: +47 22 95 88 25
Internet: <http://www.frisch.uio.no/>
e-mail: frisch@frisch.uio.no

List of the last 10 Memoranda:

No 09	Steinar Holden. Wage formation under low inflation. 22 pp.
No 08	Steinar Holden and Fredrik Wulfsberg Downward Nominal Wage Rigidity in Europe. 33 pp.
No 07	Finn R. Førsund and Michael Hoel Properties of a non-competitive electricity market dominated by hydroelectric power. 24 pp.
No 06	Svenn-Erik Mamelund An egalitarian disease? Socioeconomic status and individual survival of the Spanish Influenza pandemic of 1918-19 in the Norwegian capital of Kristiania. 24 pp.
No 05	Snorre Kverndokk, Knut Einar Rosendahl and Thomas F. Rutherford Climate policies and induced technological change: Impacts and timing of technology subsidies. 34 pp.
No 04	Halvor Mehlum, Edward Miguel and Ragnar Torvik Rainfall, Poverty and Crime in 19 th Century Germany. 25 pp.
No 03	Halvor Mehlum Exact Small Sample Properties of the Instrumental Variable Estimator. A View From a Different Angle. 14 pp.
No 02	Karine Nyborg and Kjetil Telle A dissolving paradox: Firms' compliance to environmental regulation. 30 pp.
No 01	Taryn Ann Galloway To What Extent Is a Transition into Employment Associated with an Exit from Poverty?. 34 pp.
No 39	Atle Seierstad Piecewise deterministic optimal control problems. 86 pp.

A complete list of this memo-series is available in a PDF® format at:
<http://www.oekonomi.uio.no/memo/>

The shadow economy in Norway: Demand for currency approach

by

Isilda Shima,

University of Turin ¹²

and

Ragnar Frisch Centre for Economic Research
University of Oslo

Abstract

The main purpose of this study is to measure the level of the shadow economy in Norway following the demand for currency approach. The question analysed is how well does this approach capture the level of shadow economy in front of a decreasing level of currency in circulation and an increasing use of electronic payment system. In this study is found a decreasing level of the shadow economy in Norway since mid 1990s starting with 8,8 percent of the shadow economy relative to GDP in 1991, up to 10.2 percent in 1995 and there after declining to a level of 5.6 percent of GDP in 2002. The explanation for the decline of the level of shadow economy relative to GDP could be the fact of a decreasing demand for currency for transaction going along with an increase of electronic payments instruments. Also, in Norway, a broad tax reform was implemented in 1992 with the purpose of reducing tax-induced distortions by lowering the tax rates and broadening the tax base. One of the main causes of the shadow economy, is considered to be the burden of direct and indirect tax to the individuals, but the complexity of the tax system is also an important factor that may have an impact on the level of shadow economy.

JEL classification: H26, E41, C22.

Key words: Tax evasion, shadow economy, currency demand, econometrics

¹ I thank Steinar Strøm, University of Oslo and University of Turin for help with the paper.

² Emailaddress: shima@econ.unito.it

1. INTRODUCTION

After a period of recession the Norwegian economy experienced a strong recovery and a period of expansion in 1993-1998. Over this period the real GDP growth averaged around 4.2 % per year reaching a cyclical peak in 1998. Since 1999 the GDP growth has declined and reached 1.3 % real GDP growth in 2002. Other important facts during this period is the reform of the tax system in 1992 aiming to reduce the distortions caused by taxes by lowering the tax rates and broadening the tax base.

The issue we will discuss in this paper is the size and development of the shadow economy. Schneider (2002) estimated the size and development of the shadow economies of 22 transition economies and 21 OECD countries using the currency demand approach, following and extending the procedure developed by Klovland (1984). Referring to these estimates the size of the shadow economy as percent of GDP using that currency demand method was 19% in 2002 compared to the level of 14.8 % in 1990. These figures appear to be relatively high considering the characteristics of the Norwegian economy, the developments of the Norwegian tax system and developments of the payment system and the level of currency in circulation. The main purpose of my study is to replicate the procedure developed by Schneider with some relevant changes and attempt to correct the assumptions subject to criticism.

The reasons why we should expect a lower level of the shadow economy than reported by Schneider and a possible decline in tax evasion activities are the following:

- Income tax system has continuously been reformed since the late 1980s with the implication of less progressive taxes. In Appendix A we show the income tax schedule in 1980, 1990 and 2000. Also in Norway, in 1992, a broad tax reform was implemented with the purpose of reducing tax-induced distortions by lowering the tax rates and broadening the tax base.

- The reform was also a further step toward a more neutral tax system with respect to type of economic activity and the organizational and financial structure of such activity. Thus, the structure of the economy has changed towards a structure where the opportunities for working in the shadow economy have been reduced. There have been changes in the industrial structure towards more firms with more employees and less self employed, more government employees, lower unemployment rate, higher incomes and higher wages in the regular economy. Consequently these changes have reduced the opportunities to evade taxes and also the incentives to take on side jobs in the shadow economy.

Our finding indicates a decreasing level of the shadow economy in Norway since mid 1990s, declining to a level of 5.6 percent of GDP in 2002. All the reasons mentioned above can be considered as a possible explanation for this decline of the level of shadow economy relative to GDP.

2. COMMENTS ON THE CURRENCY DEMAND METHOD

This is one of the most widely used methods to estimate the level of the shadow economy assuming that transactions in the shadow economy are in form of cash as a possibility to escape tax authorities without leaving traces. The method was introduced by Cogan (1958) who studied the correlation between currency demand and tax variables, the latter considered to be one of the main causes of the hidden economy. Guttmann (1977) developed further this approach studying the ratio between currency and demand deposits in the absence of the tax evasion, with an application on data from the United States after II World War period.

Tanzi (1980, 1983) developed a more sophisticated approach, where the main assumptions are that the underground economic activities are a direct consequence of the high taxes, currency is used mainly to carry out shadow transactions, the velocity of illegal money is the same as that of legal money. Estimating econometrically the currency demand equation, the attempt is to measure the incomes that were generated through the excessive use of currency and that presumably were not reported to the tax authorities. On data from Norway and Sweden Klovland (1984) applied a similar approach.

This method has been subject of criticism especially with the fact that not all the transactions in the hidden economy are paid by cash, (approximately 80 % of the transactions, a statement sustained by a study Isachsen and Strøm (1985) using a survey method in Norway). The assumption of equal velocity in the shadow and legal economy is not a very realistic one and trying to distinguish between these two should be taken into consideration when estimating the level of shadow demand for currency. Also the assumption of non- existing shadow economy in the initial year is a very strong one.

3. DATA

The main source for the data set I have been using is national accounts statistics made available by Statistics Norway. The period covered by the analysis is 1990-2002. The national account statistics are designed to provide a consistent and comprehensive survey of the national economy. The data on consumption, price index and GDP are

provided by the section “Production and Income, Main Aggregates”. Indirect tax, direct tax and revenue items for constructing HHI (Herfendal-Hirschman index) were made available by the section “General Government, Revenue and Expenditure by type”.

Regarding the monetary aggregates, like M1 and currency in circulation, the data I use are provided by the Norges Bank for the period of 1990-2002. Also the data regarding the sight deposit interest rates and bond interest rates were accessible to the Statistics of Norges Bank. The statistics of Norges Bank provide as well detailed information about the payment system and payment instruments. Since 1987, Norges Bank has published an annual statistical report on payment system trends and prices. The report also includes the most important events in the area of payment systems. The data are based on information from banks, banking data centres, the Banks’ Central Clearing House (BBS), Bank-Axcept AS, card companies and oil companies. Due to the problems involved in gathering the data, the quality and availability of electronic payment cards has been limited before 1990. Also from the data it appears that before 1990 the electronic payment cards were mostly used to withdraw money from ATM and the data provided were mostly in number of transactions and were not available in amount of payments. The Norges Bank report is only available online.

4. DESCRIPTION OF THE MODEL AND THE VARIABLES

Observing directly the level of transactions in the hidden economy is not possible so what we can modestly do is to follow an indirect method using the variables that may cause the variation in transactions.

Our model will relate some explanatory variables to currency demand, where the most important variables will be the direct tax, including social security contributions, indirect tax and the variable of electronic payment, a widely mean used for transactions.

The dependent variable is real currency per capita which is the annual average value of the currency and coins in circulation being deflated by the price index where 1990 is equal to 100.

The currency demand equation proposed by Schneider (2001), following also Klovland (1984), is:

$$\ln(\text{CURt}/\text{POPt}) = \ln(\text{CUR}_{t-1}/\text{POP}_{t-1}) + \ln(\text{Ct}/\text{Pt}) + \ln(\text{IRt}) + \ln(\text{EP}_{t-1}/\text{POP}_{t-1}) + \ln(\text{DTt}) + \ln(\text{IDTt}) + \ln(\text{TSt}) + \varepsilon_t$$

Description of the variables

- CUR_t/POP_t is the dependent variable. It is defined as the real per capita currency in circulation.

The explanatory variables are:

- CUR_{t-1}/POP_{t-1} is defined as the real per capita currency in circulation with one lag.
- C_t/P_t is the household consumption per capita deflated by the price index.
- IR_t is the interest rate and in this case I have used bonds interest rate since it performed better in the analysis than sight deposit interest rates.
- EP_{t-1}/POP_{t-1} is the amount of electronic payment per capita made by domestic credit cards.
- DT_t is the direct tax rate relative to the gross labor costs.
- IDT_t is the indirect tax rate relative the gross domestic product.
- TSt is a variable that is meant to reflect the complexity of tax system using the Herfendal-Hirschman index.

The expected impact of the respective independent variables is:

1 – Complexity of the tax system (TSt) is expected to have a positive impact since a complex tax system is a cause of inducing people to evade. The variable that was used by Schneider following Clotfelter (1983) to measure the complexity of the tax system is the Herfendal-Hirschman index separated into 2 terms:

$$HHIt = \sum_{i=1,m} (REVit)^2 + \sum_{j=1,n} (TEXMjt)^2$$

$REVit$ consists of I -th public revenue share of the total revenue, which amount for all revenue items in a year t . Tax exemption ($TEXMjt$), includes the j -th exemption of the total exemptions in a year referring to indirect and direct taxes. For statistical reasons these two items are combined into a common one.

The revenue items used to define this index are the current revenues which consist of:

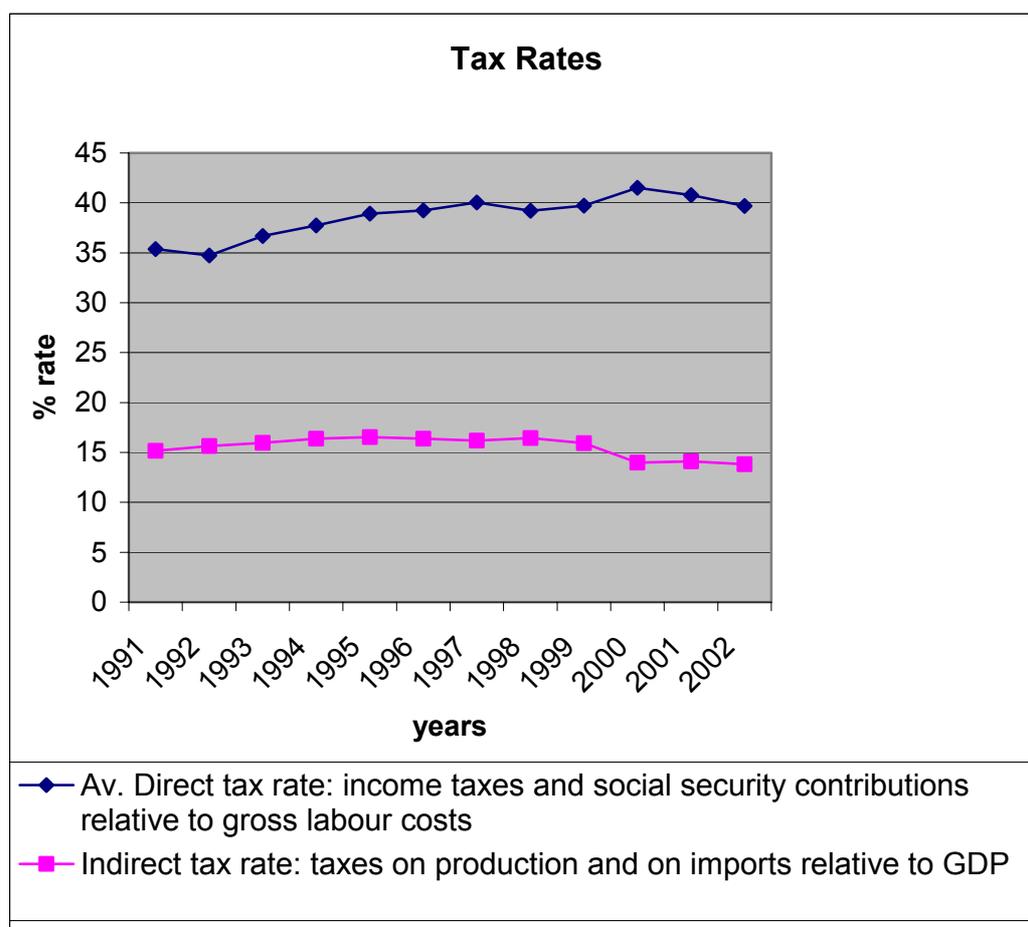
- property income fees (administrative fees and charges, interest and dividends);
- tax revenues(tax on production and imports, social security contributions, current taxes on income and wealth excluding extraction of petroleum);
- other current transfers;
- operating surplus;
- capital revenues (capital transfers, inheritance and gifts taxes).

Referring to Schneider and Neck (1993) they sustain that a complex income tax schedule allows for more possibilities of legal tax avoidance than a simple one by providing tax exemptions and reductions of various kinds.

2- Taxes are current and potential cost of doing business for firms and a current and potential cost of living for individuals. Because of this they may affect the immediate choices of firms and individuals regarding buying goods, evading or avoiding taxes, or not reporting incomes.

Gutmann (1977) suggests that higher taxes induce people to work “underground”. Nevertheless tax evasion must be due to the agents decisions in which the expected gain of evading taxes has to be balanced against the costs (extra tax and penalty in case of detection) of evading taxes and being caught.

a) Indirect tax rate (IDTt) is defined as the percentage of indirect taxes (VAT, investment taxes and excise duties) relative to the GDP. The Norwegian tax system is characterized by a relatively high income from the indirect tax and it represents nearly 30 % of the total tax revenue. Indirect tax rate is expected to have a positive impact on tax evasion since, also in this case, an increase of indirect tax may encourage people to work in the irregular market.



Source: Statistics Norway (Graph (1))

As we can see from this Graph(1) both direct and indirect tax ratios have been slightly increasing up to 1999 and decreased for the following years.

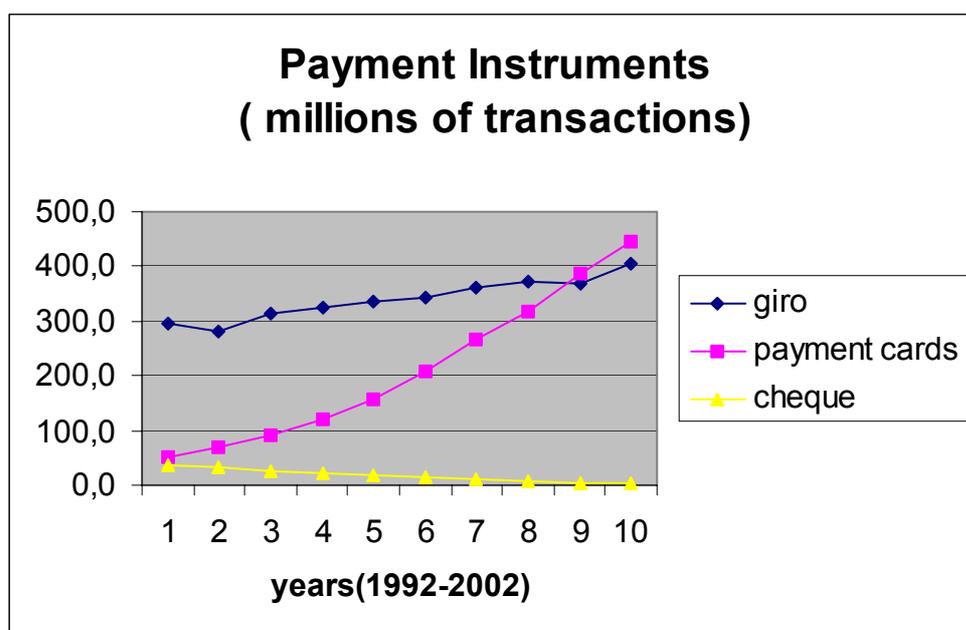
b) The direct tax rate (DTt), where contributions to the security payment system are included, is expected to have a positive impact on currency demand since it

is the main cause of inducing people to work in the shadow economy. Total average direct tax rate is calculated as the sum of all income taxes (social security contributions by employees included) paid on wages and salaries relative to gross labour costs where labour costs¹ are the total costs of having an employee, and include direct costs and indirect costs.

3- Interest rate (IR_t) is also an important variable. The key rate in Norway is the interest rate on banks' deposits of Norges Bank, which is called the sight deposit rate. Changes in Norges Bank's sight deposit rate will normally have a strong impact on short-term money market rates. Interest rate of bank deposits, as a measure of the opportunity cost of holding currency outside banks, is expected to have a negative impact on currency demand. The intention is to use sight deposits interest rates and bonds interest rates and try to see the difference or which one explains better the expected negative effect on the demand for currency.

4- Amount of payments made by domestic credit cards (EP_{t-1}/POP_{t-1}).

Schneider defined this variable as the number of valid electronic payment cards held by the public. An important fact related to the use of electronic payment cards is the use of these means to withdraw cash from ATMs (automat cash withdrawal) as well as to purchase goods and for other purposes. The value of cash withdrawals was around 44 % of household consumption, but 47% of good purchases are mostly done by the use of bank cards and they cover the public's transaction requirements in everyday life. Together with cash and cards, the various giro services are the most widely used payment instruments in Norway.



Source: Statistics Norway & Norges Bank (Graph (2))

¹ Included in direct costs we find costs such as wages and salaries, holiday pay and other costs for days not worked. Indirect costs include salaries in kind, costs for safety and health, social contributions, taxes and training costs.

It is important to maintain the security aspect with regard to customer confidence in the instruments (Graph 2). ATM are also increased and widely spread around Norway and it provides cash by using the payment cards outside banks.

Giro services consist of:

- electronic giros: terminal payments –closed network, terminal payments over the Internet, payments by phone, direct debits;
- paper based giros: mail giros, giros delivered at the counter of which cash payments and account debits, various giros registered in banks, terminal payments sent as money orders.

Bank and credit cards are the most popular payment instrument. Most of the non-cash payments are done through them and both bank and people find that electronic alternatives are faster and less expensive than paper-based giros.

Using bank and credit cards as a substitute for currency we would expect a negative effect on the demand for currency. But since they also are extensively used to withdraw money from ATMs this could increase the currency in circulation. This may imply that the effect on currency regarding the variable of Eurocheques system is ambiguous.

The variable Schneider used was number of valid Eurocheque-card held by the public. In contrast to Schneider what I use is real per capita amount of payments made by domestic credit cards (EP_{t-1}/POP_{t-1}). Domestic credit cards include “Kjøpekort”, “Reserve konto”, “Multikort”, “X-tra Kapital”, “Her & Nå” and “Cresco Card” in Norway and abroad. Per capita amount of payments made by domestic credit cards used mostly for purchasing goods and services without including cash withdrawal from ATMs is expected to have an impact on currency demand, which is negative.

5-Intensity of regulations

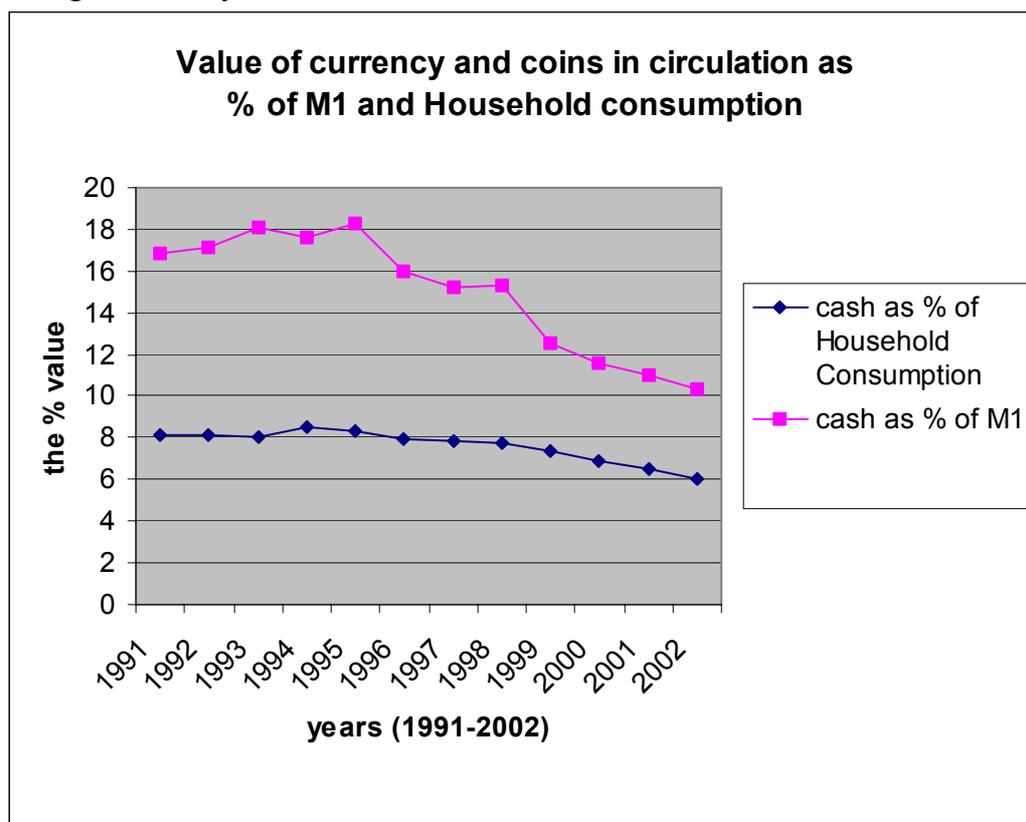
Intensity of regulation is meant to represent the state regulatory activities and is expected that an increase in regulations and enforced laws will induce people to work underground. Referring to Schneider (2001) this variable is a extremely crude measure and open to criticism. The regulations included in the variable used by Schneider are those concerning foreign labor, social security, working hours and other working conditions. While I was not able to come up with a clear definition and measure of this variable, I have not included it in the demand equation for currency.

Individuals working in the shadow economy range from individuals working in the regular market, individuals who do not participate in regular labor market to those who are not allowed to participate in this market. Thus, if a country has a high and persistent rate of unemployment we would expect also a high level of the shadow economy. If so there will be more job supplied to the shadow labor market, more incomes generated in the irregular economy, and less income tax and social security contributions declared to tax authorities.

From 1993 to 2000 the rate of unemployment measured by the labor force survey has been decreasing from 6.5% to 3.4%. Following the economic reasoning we would expect a lower participation in the shadow labor market and a lower activity level in the shadow economy. Taking into consideration this fact I tried to replace the variable intensity of regulation by the unemployment rate.

6- Real consumption per capita (Ct/Pt) is defined as the household consumption per capita deflated by the price index.

Consumption of goods and services include direct purchases in Norway by non-resident households, but not direct purchases abroad by resident households. Graphically (Graph 3) we can recognize a declining value of cash holding as percent of private consumption from 8% in 1992 to 7.1% in 2002 indicating a decreasing frequency of using currency for transaction purposes. This is sustained also by the graphical representation with a fall of currency as percent of money supply M1 from 17% to 11.7 % in 2001. M1 includes the money-holding sector's notes and coins in NOK and transaction deposit accounts with Norges Bank and banks, in NOK and foreign currency.



Source: Statistics Norway & Norges Bank (Graph3)

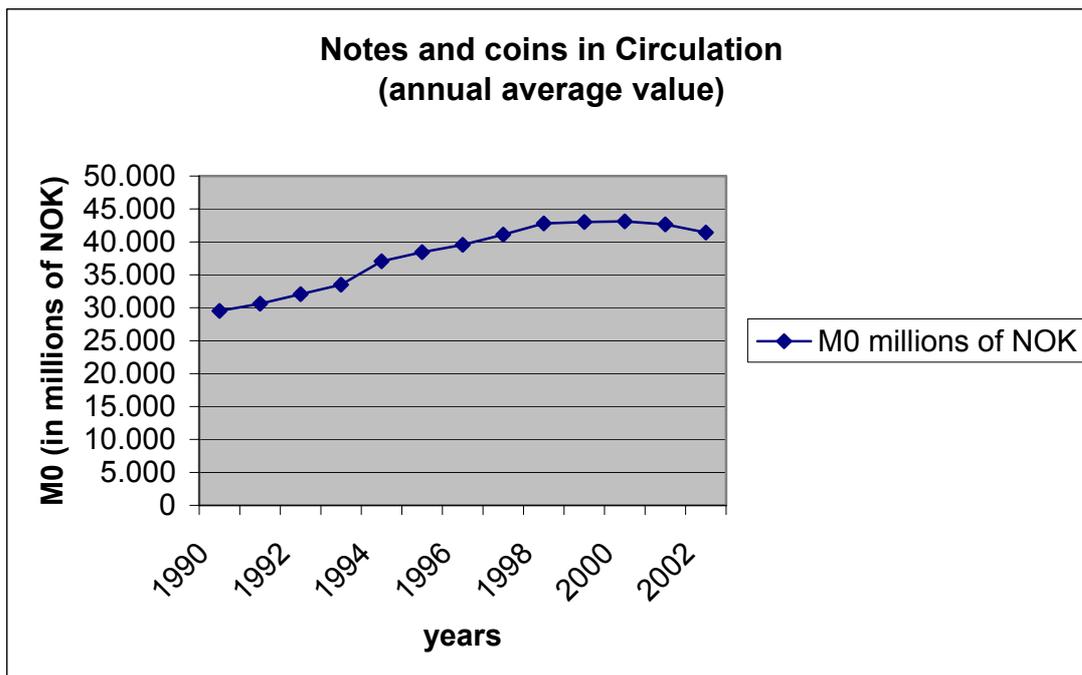
7- Lagged dependent variable of currency, M0 per capita, (CUR_{t-1}/POP_{t-1}) is defined as Banks' and the money-holding sector's notes and coins and deposits with Norges Bank. Banks' deposits with Norges Bank comprise current account (sight) deposits

and fixed-rate (time) deposits (F-deposits), from Norges Bank's monthly balance sheet. This variable is expected to be positively related to the dependent variable.

The currency and coins in circulation increased steadily except for a decline in 2001. One of the reasons could be the continued increase of using electronic payment system during this last 2 decades or better electronic payment cards as well as the replacement of 1000 NOK note. So, the electronic payment system can affect the demand for currency for transaction purposes and provide a substitute of currency.

The values of cash in circulation has risen by about 10 percent from 1992 to 2001 (Graph 4) and has fallen slightly as a share of GDP and household consumption (Graph 3). This may indicate that cash is used less frequently for transaction purposes, which may also indicate a lower level of tax evasion and criminal activity.

Also the composition of cash in circulation has changed indicating an increase of coins and decline of notes in circulation. The largest share of notes in circulation is that of 1000 NOK which is mostly related to hoarding and use for transaction purposes in shadow economy.



Source: Statistics Norway (Graph 4)

5. ESTIMATION RESULTS

Schneider estimated currency demand based on an ordinary least squares procedure using annual data. What I do is to estimate the demand for currency equation following Prais-Winsten (see latest STATA version) transformed regression estimator of a linear regression of dependent variable that is corrected for first-order serially

correlated residuals. The Prais-Winsten (see latest STATA version) estimator is a generalized least squares estimator. The advantage of this procedure is that it preserves the first observation instead of dropping it, as is the case in the iterative method developed by Cochrane-Orcutt (see latest STATA version) (estimation procedure followed by Tanzi(1980)). Note that all estimates from this estimation are conditional on the estimated value of rho where rho is the autocorrelation parameter that minimizes the sum of squared error of the transformed equation. This means that robust variance estimates in this case are only robust to heteroscedasticity and are not generally robust to misspecification of the functional form or omitted variables.

Independent variables	Estimates (t values in parenthesis)	95% confidence interval
Real currency per capita lagged	0.066 (5.94)	[0.035 ; 0.097]
Consumption per capita	0 .602 (3.29)	[0.0948 1.1107]
Direct tax	2.66 (2.86)	[0.0601 4.0733]
Bonds interest rate	-0.131 (-2.48)	[-0.277 0.01547]
Indirect tax	0.57 (5.85)	[0.299 0 .8409]
Per capita elec. payment	-0.27 (-5.82)	[-0.410 -0.1452]
HHI	0 .89 (3.84)	[0.245 1.530]
Constant	1.716 (1.95)	[-0.724 4.156]
Test statistics		
R ²	0.998	
RMSE	0.00954	
Darwin Watson	1.717	
Breusch-Godfrey	11.12	
Rho	0.45	

The estimation of the functional form is intertwined with the estimate of rho. For these reasons, it is probably best to interpret robustness in the spirit of White's (1980) original paper on estimation of heteroscedastic consistent covariance matrices. This robust new estimator takes into account the possibility that observations contribute differentially (i.e., have different variability) or said in another way, this alternative variance estimator produces consistent standard errors even if the data are weighted or the residuals are not identically distributed.

As we can see all coefficients have the expected signs. In all cases the t-values indicates that the coefficients are different from zero and significant at 95% level. Also the R-square is relatively high sustaining the fact that the model explains well the variance in the dependent variable. As we can see from the table, the significance tests performed well. The value of Durbin-Watson statistic test for first-order serial correlation in the disturbances is at a satisfactory level.

6. THE SIZE OF THE SHADOW ECONOMY

After estimating the currency demand equation and obtaining the estimates we proceed as follows:

- For each year the predicted level of real currency per capita in circulation can be calculated using the preceding regression equations.
- Predicted level of the dependent variable C (predicted with tax) can be calculated.
- We solve the equations by assuming that the tax rate is at a minimum level, while the variables and the coefficients of the other variables remain unchanged, with the intent to capture the effect of the tax variable on the demand for currency.
- The resulting value of the currency is then defined as C1 (predicted with min tax).

One of the main causes of the hidden economy is the direct tax and social security tax burden. The assumption of an economy without taxes is not a very realistic one when estimating currency demand equation.

What Schneider did was to calculate the demand for currency by assuming a minimum level of tax for the period while the variables and the coefficients of the other variables remain unchanged.

What I do is to calculate the demand for currency by including the variables of the first regression keeping also the indirect tax rate variable and excluding the direct tax rate variable while the variables and the coefficients of the other variables remain unchanged. A justification could be the fact that people working underground generate hidden incomes which can avoid direct taxation and social security contributions payments but they cant fully avoid the indirect taxation or VAT.

- The difference between C1 and C gives the estimate of how much currency holding is tax induced, presumably because of the attempt to evade the direct taxes. Taking out from the log values the results attained (the predicted level of currency per capita with the tax variable and the predicted level of currency per capita without the direct tax variable included in the regression) we can proceed by calculating the difference which is supposed to be the illegal money generated from the direct tax variable, which is:

$$E=C - C1$$

where:

E- is the currency related to the shadow economy.

C- is the currency predicted with all the tax variables

C1- is the currency predicted including only the indirect tax rate variable

The difference between M0 (currency and coins in circulation) and the calculated illegal money (E) yields “legal money” used for transaction purposes.

Dividing GDP by legal money gives an estimate of the income velocity of legal money. This method has been subject of criticism related to the assumption of equal income velocity of legal and illegal money and the fact that it doesn't allow for hoarding. So some modifications to this method would be to separate the total currency into currency in active use (CA) from currency in hoarding (CH), which would help to compute different velocities of legal and illegal money.

The currency in hoards can be estimated following a method suggested by Boeschoten and Fase (1992) where the basic idea is that higher denomination notes have longer life and return less frequently to the central bank, a phenomenon that they attribute to hoarding. The smallest notes usually are used for transactions purposes. The difference in rate of return between higher denomination notes to smaller ones will provide the hoarding demand for the higher ones. The rate of return is defined as the number of times per year a bank note of a certain denomination returns on average to the central bank.

The argumentation could be that the greater degree of currency hoarding in the hidden sector, the lower the velocity would be in the regular economy. In the case of Norway the level of hoarding figured out to be not significant. The same conclusion was cited by Boeschoten and Fase (1992) for Norway and Belgium. So I have not corrected for this and I do not distinguish between the velocity of illegal and legal money.

The velocity was computed following the assumption of equal velocity of M1 and currency in the shadow economy.

Thus

$$V= GDP/ (M1- HC)$$

where:

- M1 include currency in circulation and time deposits,
- HC is the illegal currency.

An estimate of the underground economy can be obtained by multiplying illegal money (HC) by the velocity of money (V). The results are given in Table 1.

From Table 1 we observe that the shadow economy as percent of GDP increased until 1995 and thereafter it has declined. The explanation for this decline of the level of shadow economy relative to GDP could be the fact of decreasing demand for currency for transaction going along with an increasing use of electronic payments instruments.

TABLE 1

Year	Nominal GDP (million of NOK)	Shadow Economy as % of GDP
1991	769782	8.88
1992	790300	8.78
1993	830416	9.68
1994	873410	9.78
1995	937445	10.28
1996	1026924	8.90
1997	1111349	8.47
1998	1132134	8.35
1999	1233039	6.87
2000	1469075	6.46
2001	1526601	6.16
2002	1520728	5.68

Also in 1992, a broad tax reform was implemented with the purpose of reducing tax-induced distortions by lowering the tax rates and broadening the tax base. In Appendix A I show the tax structure in 1980, 1990 and 2000 and it can easily be observed that the tax rates have been cut drastically in this period. From previous studies one of the main causes of the shadow economy is considered to be the burden of direct and indirect tax to the individuals, but the complexity of the tax system is also an important factor, which may influence the level of the shadow economy.

As Table 1 demonstrates the shadow economy in Norway is estimated to be equal to 8.8 percent of GDP in 1991, increasing to 10.2 percent in 1995 and thereafter declining to a level of 5.6 percent of GDP in 2002.

These estimates should be compared to the Schneider estimates of the size of the shadow economy in Norway as percentage of GDP using the currency demand method. He got 19 percent of GDP in 2002 and 14.8 percent of GDP in 1990. These figures, and in particular the increase in the 1990s, sounds relatively high considering the characteristics of Norwegian economy, the developments of Norwegian tax system and developments of the payment system together with the level of currency in circulation.

7. UNCERTAINTY

It is important to understand what is the uncertainty associated with the results attained about the level of the shadow economy as percentage of GDP. To illustrate the uncertainty in the estimate I have estimated the shadow economy under three different assumptions as regarding money velocity. The results are shown in Table 2.

V1- is the velocity of legal currency computed by dividing GDP to the difference between M1 and illegal money (CH) where the illegal money are generated by calculating the demand for currency using the mean value of indirect tax rate when all the other coefficients are kept unchanged and the direct tax variable is left out.

V2- is computed in the same way as V1 but in stead of the mean value of the indirect tax coefficient I use the lower value of the confidence interval and as expected the illegal money will be lower and the velocity will be lower.

V3- the same procedure is followed also here but now the illegal money are computed using the high value of the confidence interval of the indirect tax coefficient. In this case the level of illegal currency will be higher and as expected the velocity will be higher.

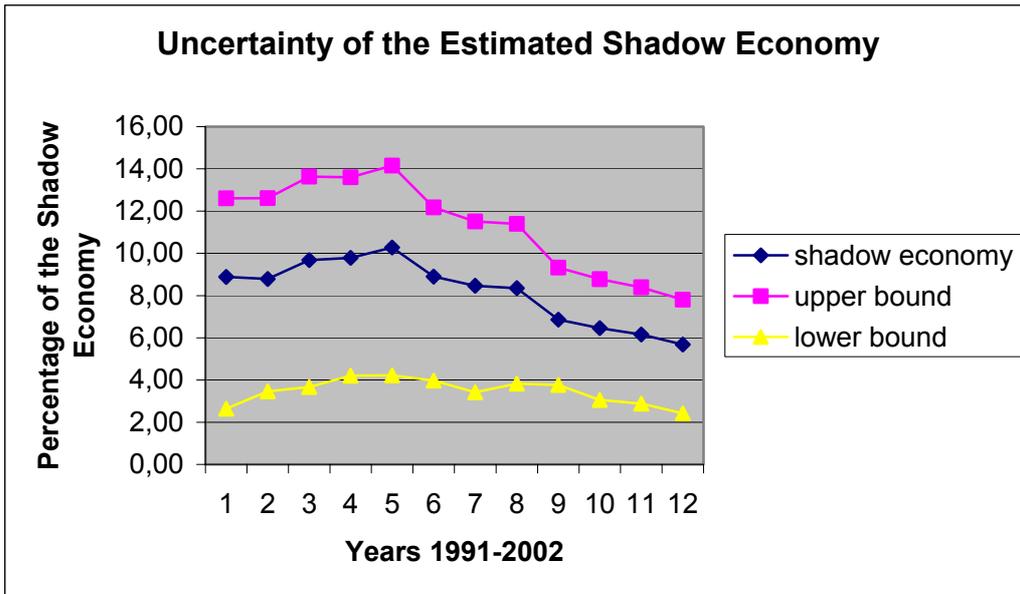
The velocity of legal money and estimates of illegal money at mean value and respective confidence interval values of the shadow economy are given in Table 2.

The development of the shadow economy through the 1990s, with upper and lower bounds, is given in Graph 5. As observed from the graph I find that the level of the shadow economy in year 2002 is 5.68 percent and the uncertainty about this level goes from 2.42 percent in the case of lower bound and about 7.81 in the case of upper bound.

Thus, trying to take into consideration the uncertainty of illegal money the size of the shadow economy relative to GDP in 2002 is estimated to be in the range 2.4 to 7.8 percent, a range which his considerably below the estimate of the shadow economy given by Schneider.

TABLE 2

YEAR	Vel.1	Illegal C1 (mill.nok)	Vel.2	Illegal C2 (mill.nok)	Vel.3	Illegal C3 (mill.nok)	Shadow economy1 % of GDP	Shadow economy2 % of GDP	Shadow economy3 % of GDP
1991	4.61	14845.17	4.34	4416.54	4.76	20372.39	8.88	2.64	12.61
1992	4.59	15115.78	4.36	5962.10	4.75	20959.89	8.78	3.47	12.61
1993	4.91	16356.83	4.64	6203.66	5.09	22238.32	9.68	3.67	13.63
1994	4.56	18717.34	4.32	8047.18	4.72	25155.06	9.78	4.20	13.60
1995	4.92	19579.38	4.64	8040.97	5.09	26048.28	10.28	4.22	14.15
1996	4.51	20256.36	4.30	9040.74	4.65	26909.92	8.90	3.97	12.17
1997	4.47	21042.41	4.26	8498.00	4.60	27823.62	8.47	3.42	11.51
1998	4.39	21514.46	4.19	9201.72	4.52	28562.77	8.35	3.83	11.40
1999	3.84	22066.60	3.68	8797.43	3.92	29283.46	6.87	3.77	9.32
2000	4.21	22542.93	4.05	8462.07	4.30	29949.53	6.46	3.06	8.77
2001	4.20	22405.37	4.04	8328.60	4.29	29892.16	6.16	2.88	8.39
2002	4.04	21550.82	3.89	7118.32	4.12	29029.61	5.68	2.42	7.81



Graph 5

8. DISCUSSION

As demonstrated above I have found a decreasing level of the shadow economy in Norway since mid 1990s. This could be explained by the fact that the decreasing demand for currency for transaction purposes goes along with an increase of electronic payments. The increasing use of these means of payment which is easily controlled by IRS is followed by a better transparency towards auditing of tax authorities and minor propensity to escape and evade taxes and as a consequence a lower level of the shadow economy may be the result.

As I mentioned above I have tried to replace the variable of intensity of regulation with the unemployment rate justified by the fact that this variable may be positively related to the participation to the shadow labor and by the fact that from 1993 to 2000 the rate of unemployment measured by labor force survey has been decreasing from 6.5% to 3.4%. The inclusion of this variable didn't perform satisfactory. Thus, the intuition that a decrease of unemployment rate would imply also a lower participation to the shadow labor market followed by a lower level of shadow economy was not explained by including this variable into the regression.

The Norwegian tax system is characterized by a relatively high income from indirect taxes, which represent 30 % of total tax revenue. The personal income tax and tax on net wealth of individuals represent around 33 % of total tax revenue. It is more difficult to avoid the indirect tax rate since the incomes generated in the shadow economy do not fully escape the indirect tax when money is used for consumption purposes or purchasing goods.

In 1992, a broad tax reform was implemented with the purpose of reducing tax-induced distortions by lowering the tax rates and broadening the tax base, paying

particular attention to the taxation of personal and corporate capital income. Wage income is taxed by a progressive rate structure, but less progressive than before and the capital income of individuals and corporations is taxed at a uniform rate of 28%. This difference in marginal tax rates between wages and capital income may create an incentive to evade taxes at high income levels, but from previous studies there is no evidence that top marginal tax rate payers engage in tax evasion more than the low income earners (Slemrod 1985).

9.REMARKS AND CONCLUSIONS

Following the approach of demand for currency the level of underground economy as percentage of GDP in the Norwegian economy has been increasing until 1995 and since then it has declined.

The attempt to distinguish between currency in active use and hoarding in the case of Norway was not very significant since hoarding was really low. An important fact is the rise in using electronic payment system for transactions purposes, which has effected the demand for currency transactions. An increasing use of this competing mean of payment in front of a decreasing demand for currency translates into a lower tendency among people to evade taxes. As a result a lower level of underground economy following my approach is indicated.

The basic idea of my approach is to study what is the level of demand for currency generated by the tax variable and how well does this approach capture the level of shadow economy in front of a decreasing level of currency in circulation and an increasing use of electronic payment system. In 1992 it was implemented a broad tax reforms with the aim to reduce tax-induced distortions by lowering the tax rates and broadening the tax base. The reform was also a further step toward a more neutral tax system with respect to type of economic activity and the organizational and financial structure of such activity. The results attained for the level of tax evasion may support the positive results of this reform.

When accounting for uncertainty we get a range for the size of the shadow economy between 4 % and 12% with a mean value of 8.9 % in 1996 when the decline of the shadow economy as percentage of GDP started and between 2.42 % and 7.81% with a mean value of 5.68 % in 2002.

Bearing in mind the trend of tax rate, the direct and indirect one, increasing use of electronic payment means, decreasing demand for currency for transactions purposes, the reform of the tax system toward a more neutral one, it is reasonable to conclude that the shadow economy relative to GDP has declined in Norway during the recent years.

APPENDIX A

Tax functions 1980, 1990 and 2000. NOK 2000 values

The tax function is a step-wise linear function. If the marginal tax rates are uniformly increasing with income, then the tax function has a strict progressive structure.

Let T denote the amount of taxes paid and let Y denote wage income. Let subscript i denote the tax bracket i, and let Y_i denote the lower bound in the tax bracket and Y_{i+1} the upper bound. T_i is the amount of taxes paid when wage income Y is within these bounds. Let t_i denote the marginal tax rates when the income Y is within the income bracket i, defined by the upper and lower bounds. Thus

$$T_i = T_{i-1} + t_i(Y - Y_i), \text{ for } Y_i \leq Y \leq Y_{i+1}$$

Table A1. Tax function 1980. NOK 2000 values.

Wage income Y	Tax T
$Y \leq 23619$	0.078
$23619 \leq Y \leq 26243$	$0.524Y - 1842$
$26243 \leq Y \leq 29524$	$0.513Y - 3901$
$29524 \leq Y \leq 41990$	$0.313Y - 4340$
$41990 \leq Y \leq 45926$	$0.285Y - 3165$
$45926 \leq Y \leq 81355$	$0.296Y - 3670$
$81355 \leq Y \leq 93952$	$0.324Y - 5948$
$93952 \leq Y \leq 117572$	$0.384Y - 11585$
$117572 \leq Y \leq 159562$	$0.434Y - 17463$
$159562 \leq Y \leq 185806$	$0.484Y - 25442$
$185806 \leq Y \leq 212050$	$0.544Y - 36590$
$212050 \leq Y \leq 238294$	$0.604Y - 49313$
$238294 \leq Y \leq 282908$	$0.654Y - 61288$
$282908 \leq Y \leq 361639$	$0.704Y - 75353$
$361639 \leq Y \leq 478686$	$0.744Y - 89389$
$478686 \leq Y \leq 492858$	$0.694Y - 65904$
$492858 \leq Y \leq 755296$	$0.734Y - 85619$
$755296 \leq Y$	$0.754Y - 100725$

Table A2. Tax function. 1990. NOK 2000 values

Wage income Y	Tax T
$Y \leq 27856$	0.078
$27856 \leq Y \leq 30057$	$0.338Y - 7243$
$30057 \leq Y \leq 72718$	$0.3042Y - 6227$
$72718 \leq Y \leq 153775$	$0.338Y - 8684$
$153775 \leq Y \leq 199152$	$0.438Y - 24062$
$199152 \leq Y \leq 258393$	$0.608Y - 57918$
$258393 \leq Y$	$0.693Y - 79881$

Table A3. Tax function. 2000

Wage income Y	Tax T
0 – 35 513	0.078Y
35 513 – 166 364	0.2964·Y – 7 756
166 364 – 277 800	0.358·Y – 18 004
277 800 – 762 700	0.493·Y – 55 507
762 700 –	0.553·Y – 101 269

References

Boeschoten, W.C and M.M.G Fase 1992, The demand for large bank notes, *Journal of Money, Credit and Banking*, **24**, 319-337.

Clotfelter, C.T.C 1983, Tax evasion and tax rates: an analysis of individual returns, *Review of Economics and Statistics*, **65**, 363-373

Isachsen, A , Klovland J. and S. Strøm (1982):The hidden economy in Norway, in Tanzi Vito(ed), *The underground economy in the United States and Abroad*, Heath, Lexington, 209-231.

Isachsen, A and S. Strøm (1980), The hidden economy : The Labor Market and Tax Evasion, *Scandinavian Journal of economics*, **82**, 304-311.

Isachsen, A. and S.Strøm,1985, The size and growth of hidden economy in Norway, *Review of Income and Wealth*,**31**, 21-38.

Klovland, J 1984, Tax evasion and demand for currency in Norway and Sweden. Is there a hidden relationship? *Scandinavian Journal of Economics*, **86**, 423-439.

Neck, R., Schneider,F. (1993), The development of the shadow economy under changing tax systems and structures, *Finanzarchiv*, **50/3**, 344-369.

Schneider, F and Enste,D. (2000), Shadow economy around the world: sizes, Causes and consequences, *The Journal of Economic Literature* **38/1**, 77-114.

Schneider, F. (2001) Increasing shadow economies in OECD countries: Some further explanations. *Annual Public Choice Meetings*, March 2000, Charleston S.C.

Schneider, F. 2002, *The size and development of the shadow economies of 22 Transition and 21 OECD countries*. IZA DP No.514.

Slemrod, Joel B, 1985. "[An Empirical Test for Tax Evasion](#)," *The Review of Economics & Statistics*, Vol. 67 (2) pp. 232-38. MIT Press

Tanzi, V. (1983) The underground economy in the United States: Annual estimates 1930-1980. *IMF Staff papers*, **30**, 232-305.

Tanzi, V. (1982), A second (and more skeptical) look at the underground economy in the United States, in : Tanzi, V. (1982): *The underground economy in the United States and Abroad*, Lexington, 38-56

Annual report on payment systems 2001- Norges Bank

Tanzi,V. (1980): The underground economy in the United States: Estimates and implications, *Banca Nazionale del Lavoro*, **135**, 427-453

Tanzi,V. (1999): Uses and abuses of estimates of underground economy, *The Economic Journal* **109/456**, 338-340

Thomas,J.(1999) Quantifying the Black economy: Measurement without theory' Yet again? *The Economic Journal* **109/456**, 381-389