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A MEASURE OF THE SHADOW ECONOMY IN A SMALL ECONOMY: EVIDENCE FROM HOUSEHOLD-LEVEL EXPENDITURE PATTERNS

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In this paper we measure the size of the shadow economy in North Cyprus by using micro-econometric approaches and then calculate its implications on national accounts and fiscal balances. There is a relatively new strand of literature that focuses on comparing income–expenditure patterns of households to calculate the degree of underreporting of income levels by self-employed and privately employed individuals, as compared with public servants. We use the 2008 Household Budget Survey of North Cyprus and analyze the differences in food consumption patterns among three kinds of employees: self-employed, privately employed, and public. We found that self-employed and privately employed individuals underreport their income levels by 20 percent and 13 percent, respectively, compared with publicly employed individuals. This has important implications for the aggregate economy in North Cyprus, where we estimate that the shadow economy created by underreporting is as much as 8.6 percent of GNP and 11.1 percent of total tax revenue.

JEL Codes: D10, H24, H26

Keywords: household surveys, North Cyprus, shadow economy, tax evasion, underreporting

1. Introduction

There has been quite a lot of interest in measuring the size of the unregistered output and income. Several names are used to define such concealed economic activities, including underground, black, unobserved, or shadow.[1] In view of the extraordinary problem of estimating such a complex phenomenon as a shadow economy, one has to think of some brilliant methods of measurement. It was P. Cagan who first devised a simple currency-ratio method and obtained a rough quantitative measure of the size of the United States' shadow economy in the 1950s (Feige, 1997). Interest in this subject has grown so much that scholars have not

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[1]For more details on the names, see Thomas (1992), Feige (1997), Tanzi (2000), and Schneider (2012). We prefer to use "shadow economy" for the purposes of this study.

only improved on Cagan's monetary approach but have also developed other approaches where national accounts, household expenditures, and labor statistics have been utilized.

To date, all these different methods have been classified as macro (indirect) or micro (direct) methods (Yılmaz, 2006; Schneider, 2012). Due to the fact that the findings from macro approaches do not provide policy makers sufficient guidance for alleviating the problem of shadow economic activities, micro (direct) methods have been utilized more frequently. In general, one can argue that macro methods are more useful for the awareness of the public, including policy makers, whereas micro methods provide specific information and characteristics about shadow economic activities which provide very useful guidance for policy makers.

In this study we use a micro approach that was pioneered by Pissarides and Weber (1989) (henceforth PW) to measure underreporting of income. They used household-level data in the U.K. to measure the degree of underreporting by self-employed individuals as opposed to salaried workers. Their model has two critical assumptions: (1) there is no systematic difference in reporting of expenditures between these two groups; and (2) the marginal propensity to consume (MPC) for food out of actual income is the same between salaried and self-employed workers. We apply this method to North Cyprus with some modifications.

The case of North Cyprus is interesting for researchers in this area. In developed countries there are tighter government controls and harsher penalties on unreported income levels. However the same is not true in a developing country and North Cyprus is no exception. There is almost no penalty to tax evasion,[2] and the government monitoring is very minimal and corrupt at best. Thus those working as self-employed as well as salaried workers in the private sector do have plenty of opportunities to hide their actual income from the authorities, which could result in substantial tax revenue losses. In fact the government has legislated several policies to fight against the shadow economy in the second half of the last decade. We focus on a time period right after these policy changes.

We make several contributions in this paper. The literature for North Cyprus on this topic is very limited. First, we reconfirm the previous findings on income underreporting in North Cyprus by using a more recent time period and econometrically improved methodology. Second, we divide the workers into three groups—(1) salaried public, (2) salaried private, and (3) self-employed—and find significant underreporting among them. Most of the previous literature only differentiated between public servants and self-employed individuals. We believe that our distinction is important, especially for developing countries where privately employed salaried individuals could also easily engage in tax evasion. Finally, we extend the previous literature by combining our findings with information on the number of registered workers to estimate the shadow economy as a percentage of GNP due to income underreporting, and calculating the losses in tax revenues as

[2]According to the existing regulations, if a taxpayer is caught evading then there is no imprisonment and the amount to be collected is negotiated with the taxpayer. Furthermore, the tax office is heavily understaffed and thus the audit probability is very low. The audits are initiated based on complaints from the public.

a result of this. This final step has not previously been done and we believe it has important implications for the aggregate economy.

The remainder of this paper is organized as follows. In the next two sections we review the existing literature on tax evasion in general, and the shadow economy in North Cyprus and Turkey, and present the theoretical framework. Then we provide information on the dataset and present summary statistics for the main variables. The econometric method is introduced in Section 4, followed by the estimation of food consumption for different household groups. The size of the income underreported and its implications for national accounts and fiscal balances are presented under empirical findings. The paper concludes by outlining a number of policy implications.

2. Literature Review and Theoretical Considerations

2.1. *Literature Review*

The two broad methods used in the literature to measure shadow economy are micro and macro methods. Micro approaches, which are mainly based on surveys, cover the areas of tax, labor market, and household income–expenditure patterns. These surveys are able to provide considerable detailed information on tax evasion, labor force occupations, hours worked, incomes, and households' income–expenditure characteristics and patterns. Macro approaches usually use time series of macroeconomic indicators including labor force, population, fiscal (tax-expenditures) and monetary aggregates, and income–expenditure aggregates to measure the size of the shadow economy. Since working in the shadow economy involves law-breaking, those doing so will try to hide their income to reduce probability of detection. However, some actions will show up at the macroeconomic level and it is these statistical fingerprints that are sought by the macro methods.

Over the last 20 years, the PW method has been applied to many countries. Johansson (2005) found, using household-level data from 1994 to 1996, that the self-employed in Finland underreported their income by 16–40 percent. Fortin *et al*. (2010) estimated the degree of underreporting in Canada. The authors applied a modified PW method to six non-durable goods and found that the amount of underreporting amounted to 4.6 and 5.7 percent of GDP in Quebec in 1997 and 2002, respectively. Schuetze (2002) on the other hand found that the self-employed underreported between 11 and 23 percent of their income in Canada during the 1969–92 period. Gibson *et al*. (2009) saw roughly 40 and 50 percent income underreporting in Korea and Russia, respectively. Hurst *et al*. (2010) found that the self-employed systematically underreported their income by as much as 30 percent in the U.S. Kapociute (2013) found a wide range of 14–89 percent income underreporting for Australian self-employed households for the years 2001 and 2003–05. All of these studies show significant tax evasion even in the developed countries.

Besim and Jenkins (2005) extended the PW model to differentiate between salaried workers in the private and public sectors. Using the same assumptions as above, the authors show that in North Cyprus there is underreporting of income

in the private sector, according to workers' surveys. The magnitude is less than that for the self-employed but still ranges between 11 and 13 percent. This finding shows that in countries where there is not much control in the private sector, tax evasion can be a serious problem even among legally employed salaried individuals. Contrary to our study, Besim and Jenkins (2005) do not estimate the shadow economy.

With regard to macro methods, there also exists a rich literature. The most cited and recent work is by Schneider (2012), where a Multiple Indicator and Multiple Cause (MIMIC) is used together with a currency demand approach. The MIMIC procedure assumes that the shadow economy remains an unobserved phenomenon (latent variable) which can be estimated using quantitatively measurable causes of illicit employment (e.g., tax burden and regulation intensity), and indicators reflecting illicit activities (e.g., currency demand, official GDP, and official working time). The same study estimates the shadow economy to be 13.9 percent in OECD countries, 26.2 percent in 116 developing countries, and 33.7 percent in 25 transitional economies. These findings indicate that shadow economic activities are greater in developing economies relative to developed economies.

Scholars have begun working on the shadow economy in Turkey since the beginning of the 1990s. The initial work was done more with monetary approaches which were widely used back then. Derdiyok (1993) employed the monetary approach method, also referred to as Tanzi's approach, and estimated the size of the shadow economy to be between 24 and 47 percent for the years 1960 and 1991. Altuğ (1999), using wages of informal employment, estimated the shadow economy to be 35 percent of the GDP in 1998. According to Yılmaz (2006), the modified currency ratio has been giving reasonable results, although this approach has certain deficiencies in the case of Turkey. The same author estimates the shadow economy to be fluctuating between 4.9 and 178 percent for the years 1970 to 2004. The tax audits method used by Ilgin (1999) explored more the degree of underreporting. Estimates also show that the authorities were not able to capture much of the activities back then. All these studies are summarized in Table 1.

The MIMIC approach has been relatively more popular in the more recent studies. Schneider and Savaşan (2007) used the MIMIC approach, which checks the effects of multiple indicators on the shadow economy, and measured the size of the shadow economy to be 31 and 35 percent in 1999 and 2005, respectively, for Turkey. The most recent study by Schneider (2013b) finds that the shadow economy is lower relative to previous years, being 28 percent of GDP. The main conclusion is that the shadow economy of Turkey is still large but has been declining.

There are also a number of studies about South Cyprus, which is a neighboring economy of North Cyprus. Georgiou and Syrichas (1994), using Tanzi's approach, estimated the shadow economy for the years 1960–90 to be between a low of 2.7 per cent in 1962 and a high of 10.3 percent in 1990. Fethi *et al*. (2006), using the same approach, calculated the shadow economy to be on average 9.41 percent of the GDP for the period 1960–2003. In a more recent study by Schneider (2013a), the size of the shadow economy is reported to be 25.6 percent of GDP, relatively much higher than in previous studies. This and other findings show that using different methods will give different results.

TABLE 1
PRIOR RESEARCH ON SHADOW ECONOMY IN TURKEY, SOUTH CYPRUS, AND NORTH CYPRUS

Author(s)	Method/Approach	Period/ Year	Shadow Economy (% of GDP)	Country
Derdiyok (1993)	Monetary approach	1960–91	24–47	Turkey
Özsoylu (1993)	Transaction approach	1990	11.5	Turkey
Temel *et al.* (1994)	Discrepancy method	1987–92	1.48–3.61	Turkey
	Econometric method	1970–2004	6.34–20.2	
Ilgin (1999)	Tax audit	1960–93	43–259	Turkey
Altuğ (1999)	Informal employment wage method	1998	35	Turkey
Us (2004)	Physical input approach	1978–2000	–1–33	Turkey
Yılmaz (2006)	Modified currency ratio	1970–2004	4.9–178	Turkey
Schneider and Savaşan (2007)	MIMIC	1999–2005	31.1–35.1	Turkey
Schneider (2013b)	MIMIC	2012	28	Turkey
Georgiou and Syrichas (1994)	Monetary approach	1960–90	2.7–10.3	South Cyprus
Fethi *et al.* (2006)	Monetary approach	1960–2003	9.41	South Cyprus
Schneider (2013a)	MIMIC	2012	25.6	South Cyprus
Besim and Jenkins (2005)	Household expenditure surveys	1998	11–13	North Cyprus
Besim and Jenkins (2006)	Informal labor value added approach	1996	17.5	North Cyprus
		2000	16.2	

With regard to North Cyprus, not many studies exist. Besim and Jenkins (2005), using a rich household expenditure survey dataset with a modified PW model, estimated the underreporting of self-employed and private sector employees to be 11 and 13 percent, respectively, in 1998. The same authors, using a value added approach, estimated the shadow economy created by informal employment to be 17.5 percent in 1996 and 16.2 in 2000. In this paper we use the PW method to estimate the degree of underreporting by the households in North Cyprus in 2008 and then use these estimates to get an estimate of the aggregate shadow economy. We present the theoretical considerations in the next section.

2.2. *Theoretical Considerations*

In order to estimate the degree of income underreporting among privately- and self-employed individuals, we will utilize reduced form Euler equations in which consumption function is estimated under certain assumptions. In what follows we summarize the method first proposed by PW.

The key equation to be estimated is the log-linear Engel curve that is the first order approximation to each household's intertemporal optimization problem:

$$\ln C_{ij} = \beta_0 + \beta_1 \ln Y_{ij}^{p} + \beta_2 X_{ij} + \varepsilon_{ij}, \tag{1}$$

where C_{ij} is the consumption of the household, Y_{ij}^{p} is the permanent income of the household, X_{ij} is the household characteristics that affect the consumption decision, and ε_{ij} is white noise. The subscript i refers to households and j refers to different groups such as the publicly employed, privately employed, and self-employed ($j = 1,2,3$). In what follows we will use food expenditures for C_{ij} since

food consumption is the least likely to be time invariant. We also assume that everybody in the sample reports the correct food expenditures in the survey.

Assumption 1: Public, private, and self-employed individuals all report accurate food expenditure in surveys.

Obviously it is not possible to estimate equation (1) since the permanent income of the households is not known. However it is very likely that the true and permanent incomes are highly correlated and can be modeled as follows:

$$\ln Y_{ij}^{T} = \ln Y_{ij}^{P} - \ln p_{ij} + \ln v_{ij}, \tag{2}$$

where Y_{ij}^{T} is the true income of the households and v_{ij} is the unpredictable component which is assumed to be uncorrelated with observable household characteristics (X_{ij}). The other component, $\ln p$, is a random variable that determines the volatility of reported income; it is assumed to have the same mean but different variance among the three employment types.

Assumption 2: The differences between reported and permanent incomes of the households in all the employment groups on average are equal (i.e., p_{ij} is equal for all $j = 1,2,3$).

Finally we introduce differences in the reported income levels among three employment types. We first assume that those who work in the public sector report their true incomes in the household surveys. It is likely that public employees could also work in the shadow economy and thus underreport their incomes. Even if that is the case, this method would at worst be estimating the lower bound for underreporting.

Assumption 3: Households whose entire income is received from public sector employment report their true incomes in the household surveys.

However, those who are self-employed or work in the private sector could underreport their income to the tax authorities by some factor k.

$$Y_{ij}^{R} = k\, Y_{ij}^{T}, \tag{3}$$

where Y_{ij}^{T} is the "true income" of the household. For public employees $k = 1$ (no underreporting), but for the other two employment types, $k > 1$. The higher values of k indicate more underreporting. Combining (2) and (3), we have:

$$\ln Y_{ij}^{p} = \ln Y_{ij}^{T} - \ln p + \ln k. \tag{4}$$

Substituting (4) into log-linear Engel equation (1), we obtain the following:

$$\ln C_{ij} = \beta_0 + \beta_1[\ln Y_{ij}^{T} - \ln p + \ln k] + \beta_2 X_{ij} + \varepsilon_{ij}. \tag{5}$$

Using Assumption 2 and after some simplification, we can write our main equation to be estimated as follows:

$$\ln C_{ij} = \beta_0 + \beta_1 \ln Y_{ij}^R + \beta_2 X_{ij} + \gamma D_i + \mu_{ij}, \tag{6}$$

where D_j is a dummy variable that identifies the employment group to be compared with the public employees. We thus estimate equation (6) separately for privately and self-employed households. Equation (6) is the key equation that was estimated by PW. An implicit assumption in this equation is that the marginal propensity to consume out of permanent income is the same for all the employment types. In other words, when we estimate these reduced form Euler equations, we expect to have the same slope for each group.[3]

Assumption 4: The MPC for food out of permanent income is the same for all the individuals.

Through simple algebra we can show that the degree of underreporting can be approximated by using the estimated coefficients from the previous equation as

$$\ln k = \frac{\hat{\gamma}}{\hat{\beta}_1}. \tag{7}$$

Equation (7) will be our main point of interest where we will test the following two hypotheses.

Hypothesis 1: $\hat{\gamma} > 0$. There will be income underreporting of private and self-employed households compared to public employees.

Hypothesis 2: The amount of underreporting among the self-employed will be higher than among privately employed households.

3. Data

We use the 2008 Household Budget Survey of North Cyprus to estimate equation (6). The survey was conducted by the State Planning Organization (SPO) of North Cyprus in 2008. Households were selected randomly and asked questions about their spending habits and demographic information. Socioeconomic information was also collected on all members in the household. The income information is especially useful since the respondents were asked to report their incomes from various sources.

We separated households into public, private, and self-employed, according to their income sources. Previous literature does not have a consensus on classification. Some research focused only on the head of the household's income, while some focused on both the head's and the spouse's income. We classified households according to the three categories mentioned above if *all* of the labor income came from only the three sources mentioned above for both the head and the spouse in the household. This is a more conservative definition than the

[3]We show in the Appendix that relaxing this assumption and estimating equation (6) by interacting employment dummy with the household income does not change the main results.

one used by PW, who classified households as being self-employed if 25 percent of the income came from self-employment. Furthermore, if a public sector employee receives income from other types of employment (which is likely in North Cyprus), these households are not included in our benchmark group. Our classification should be viewed as a lower bound on the underreporting. Consistent with the previous literature, we also excluded the self-employed households in agriculture since they may grow their own food, which makes their food consumption inconsistent.

We also estimated food equations by using non-labor income. Our survey asked the respondents about their amount of income from alternative sources such as rent, interest, and retirement. It is likely that household spending on food may be related to total income and not just labor income (Hurst and Lusardi, 2004). Thus, we estimated our equations by using both types of income.

Another novelty of our dataset is that it contains information on *net income* as opposed to pre-tax income. Other studies that used data on developed countries took pretax income information and calculated net income by making some restrictive assumptions. Given that the marginal tax rates on self-employed and salaried workers could be different, or that the self-employed could have more opportunities to take advantage of deductions on their tax returns, the calculation of net earnings will be problematic. Therefore the MPC may not be correctly calculated. Summary statistics of the main variables used are shown in Table 2.

Table 2 shows an anomaly in the dataset. The mean expenditure on food is not much different among the three groups, but their reported income levels are significantly different from each other. For example, those who work in the private sector report earnings of almost 40 percent less than those who work in the public sector, but they report only 14 percent less in food consumption. The self-employed report around 24 percent less income, but their food consumption is almost the same as that for the public sector employees. There are no significant differences in the household size. Therefore this table indicates that, if the expenditures on food are reported accurately, either (1) the marginal propensity to consume food is significantly different between public sector employees and others, or (2) there is income underreporting in the household surveys by privately employed and self-employed individuals.

TABLE 2

Summary Statistics of the Main Variables in the Dataset

	Public Employee	Private Employee	Self-Employed
Annual household income (TL)	48,384	28,833	33,652
Monthly food consumption (TL)	693	552	682
Implied monthly food spending as a percentage of income (%)	17.2	22.9	24.3
Household size	3.4	3.5	3.7
Sample size	605	641	256
Assuming same food consumption ratio, income should be (TL)		38,512	47,581

4. Econometric Analysis

We estimate equation (6) using the two-stage least squares (2SLS) technique where we use instrumental variables in the first stage to estimate household income. In line with the previous literature, we have the following working assumptions. First, we assume that the MPC for food out of permanent income is equal among different groups. Second, we assume that all types of workers report their food expenditures accurately on household surveys. However, only the public sector employees reported their incomes accurately. Private sector employees and self-employed individuals misreported their incomes by some percentage. The reported incomes are assumed to be a good proxy for permanent income.

We control for household preferences in our estimations. In line with previous research, we control for household size and the age of the household's head. It is highly likely that the reported income is endogenous. Therefore, we will estimate the above equation by the Instrumental Variables (IV) method. The set of instruments we use are the number of cars owned by the household and the number of rooms in the house. These exogenous variables have previously been used as instruments and we test their validity in our estimations. Table 3 estimates equation (6) separately for the three employment groups.

Table 3 shows that the elasticity of food consumption (coefficient on log income) is significantly different between different employment groups. For example, a 1 percent increase in household income of those who receive their entire income from public sector employment will increase their monthly food consumption by 0.48 percent. The same increase for privately and self-employed households will have, respectively, a 0.58 and 0.67 percent increase in food consumption. This contradicts Assumption 4. However, we should keep in mind that this difference is due to underreporting of income by private and self-employed individuals. Thus we pool those working in the public sector separately with those in the private sector and self-employed and estimate equation (6).

We present the first stage estimation results in Table 4. We can see that our instrumental variables have the expected signs in both specifications. We can also reject the null hypothesis that household income is exogenous (the robust chi-

TABLE 3
Estimating Food Consumption Separately for Each Group

	Public Employees	Private Employees	Self-Employed
Log (income)	0.484***	0.584***	0.666***
	(0.09)	(0.126)	(0.261)
Household head's age	0.012***	0.013***	0.012***
	(0.003)	(0.002)	(0.003)
Household size	0.152***	0.118***	0.092***
	(0.251)	(0.018)	(0.03)
Constant	0.251	–0.644	–1.355
	(0.92)	(1.25)	(2.63)
N	605	641	256

Note: Numbers in parentheses are standard errors.
***Significant at 1% level or better.

TABLE 4
First Stage Estimations

	Privately Employed	Self-Employed
Employment dummy	–0.363***	–0.422***
	(0.0281)	(0.038)
Age of household head	0.0020*	0.004***
	(0.0014)	(0.002)
Household size	0.0159	0.0122
	(0.0096)	(0.013)
Number of cars	0.212***	0.188***
	(0.019)	(0.025)
Number of rooms	0.051***	0.062***
	(0.011)	(0.013)
Constant	9.98***	9.87***
	(0.075)	(0.098)
Sample size	1246	861
R-square	0.35	0.24
F-value	138.20	53.62
Robust chi-square for H_0: Lnincome is exogeneous (p-value)	22.20 (0.000)	31.57 (0.000)

Note: Dependent variable is log (household income). Standard errors are in parentheses.
***Significant at 1% level or better, **Significant at 5% level or better, *Significant at 10% level or better.

TABLE 5
2SLS Results of Estimating Equation (6)

	Privately Employed	Self-Employed
Log (income)	0.544***	0.602***
	(0.078)	(0.098)
Dummy	0.080***	0.138**
	(0.040)	(0.062)
Age of household head	0.012***	0.011***
	(0.002)	(0.002)
Size of household	0.131***	0.131***
	(0.014)	(0.017)
Constant	–0.328	–0.917
	(0.810)	(1.006)

Note: Standard errors are in parentheses.
***Significant at 1% level or better, **Significant at 5% level or better, *Significant at 10% level or better.

square value is significant at better than the 1% level). According to Stock and Watson (2007), "when there is a single endogenous regressor, a first-stage F-statistic less than 10 indicates that the instruments are weak" (p. 441). We see in Table 4 that the F-statistic in first stage estimations is greater than 10 in both cases; thus we conclude that our instruments are valid.

Table 5 shows the coefficient estimates of equation (6) using 2SLS. The results show that privately and self-employed households on average spent more on food consumption. The coefficient of dummy shows these average differences. Further-

TABLE 6
DEGREE OF UNDERREPORTING IN NORTH CYPRUS

Type of Estimation Methods Used	Privately Employed	Self-Employed
Pissarides and Weber (1989)	13.7%	20.5%
Besim and Jenkins (2005) (shown in the Appendix)	10.7%	19.8%
Degree of underreporting (average)	12.2%	20.2%

more, a 1 percent increase in income earned from private sector employment causes a 0.54 percent increase in food consumption, and the same increase in self-employment income causes 0.60 percent increase. We use these estimates to calculate the degree of underreporting among different employment groups according to equation (7).

Table 6 reports the degree of income underreporting in North Cyprus in 2008 using two different approaches. For privately employed individuals, the calculated underreporting of labor income is 10.7 and 13.7 percent, and for self-employed households it is 19.8 and 20.5 percent. These values do not change significantly if we use total household income instead of labor income.[4] Given that these two approaches have very similar predictions, in what follows we use the average of the two estimates to predict aggregate underreported disposable income.

In conclusion, we find that there is a significant income underreporting among privately- and self-employed individuals compared to publicly-employed households. By comparing the discrepancy between food expenditure and reported income levels, we find that in North Cyprus, according to the household surveys, privately employed individuals hide around 12 percent of their labor earnings, and the self-employed under-declare their earnings by about 20 percent. If the same pattern holds when individuals report their earnings to the tax officials, there is considerable tax evasion in the country. We discuss the implications of underreporting for the national accounts and tax revenues in the next section.

5. Implication of Underreporting for National Accounts and Fiscal Balances

The analysis has proved that underreporting is widespread among both the self-employed and private sector employees on a payroll, with an average of 20.2 percent and 12.1 percent, respectively. This fact obviously has certain implications for both national accounts and fiscal balances. Given the degree of underreporting and with a proper approach, the relevant income groups' created income that is not reflected in the national accounts can be estimated.

In this respect, we first compare the income declared in household surveys with the average reported income of both self-employed and private sector employees. Table 7 shows that in 2008 the average reported after-tax income of the

[4]The results of the estimation using total household income are available from the authors upon request.

TABLE 7
Implication for National Accounts and Fiscal Balances

Row		Private Sector Employees	Self-Employed-Employers
1	Reported income (TL)*	28,833	33,652
2	Degree of underreporting (%)	12.2	20.2
3	True disposable income (TL)	32,765	42,065
4	Unreported income (TL) (**3–1**)	3,973	8,413
5	Registered contributors**	50,627	11,218
6	Unreported income (annually) (TL) (**4*5**)	201,169,844	94,377,034
7	Shadow economy (unrecorded GNP) (**6***100/66)	305,332,598	143,244,059
8	Shadow economy % of GNP (**7**/GNP)	5.9	2.7
9	Total shadow economy % of GNP	8.6	
10	Tax losses	128,741,500	
11	Tax losses % of total tax revenue	11.1	
12	Tax losses % of budget deficit	27.1	

Source:
*Ministry of Finance (2012). **Social Security Office (2012).

self-employed was 33,652 TL, and for private employees it was 28,833 TL (Row 1). Given the estimated degree of underreporting, this implies that each self-employed and private sector employee underreported 8413 TL and 3973 TL of their disposable income, respectively, in 2008 (Row 4). Considering the number of registered self-employed and private employees (total contributors), the total amount of concealed disposable income is calculated to be 94 million TL and 201 million TL, respectively[5] (Row 6). Obviously, this is a lower bound estimate, as it includes only households with 100 percent income from both self-employment and private sector employment.

We are also able to get an estimate in our analysis of the shadow economy created by the two groups. Due to the fact that the Statistics Office use household surveys in addition to secondary data to estimate the national income, our underreporting estimates can be used to calculate the value added created by the households that are not reflected to surveys. Thus, income not reflected in surveys implies income not included in national income accounts. According to the national accounts of North Cyprus, disposable income is approximately 66 percent of the total GNP in 2008 (SPO, 2010). Given this ratio, an estimated 295 million of concealed annual disposable income implies a total of 448.5 million TL of shadow GNP (Row 7). So, by this method, the study estimates that the two analyzed employment groups in North Cyprus created gross national income that was as much as 8.6 percent of official GNP and not reflected in official national accounts (Row 9). This measure should be used to correct national income accounts. We expect that this is useful for policy makers.

Our measurement of the shadow economy does not include all the activities that are not captured by the national accounts. This approach measures shadow

[5]The calculated unreported income does not cover those who are not registered with the tax office. In other words, the unregistered self-employed and employees working informally are not part of this analysis.

economic activities generated by registered households who are self-employed and private sector employees. Those who are not registered and are informal self-employed and employees are not measured in this study. So, our 8.6 percent of shadow economy estimate is a lower bound.

We also use a fiscal approach to estimate the tax losses as a result of income underreporting. Since there are no proper statistics on the tax base of the country, the study cannot estimate how large the actual tax base should be. However, using as an indicator the tax burden, which defines the amount of taxes paid by people in a year with respect to GNP, we can estimate the tax revenue losses. According to the State Planning Organization (2010), the tax burden was 28.7 percent in 2008. This implies that there was 128 million TL in tax revenue losses to the budget, which is 11.1 percent of the budget tax revenues. These tax revenue losses could have financed 27.1 percent of the budget deficit in 2008 (Rows 10–12).

These results imply that tax losses in North Cyprus due to income underreporting are significant. We combine the individual underreporting percentages estimated by the income discrepancy approach with the official statistics on registered users to estimate the amount of registered but underreported disposable income. This also allows us to calculate the tax revenue losses because the tax authorities are unable to detect these undeclared amounts. Given the current lax in regulations and corruption in the government, it is not a huge surprise to the authors to see around 11.1 percent loss of total tax revenue. However if the policy makers are seriously concerned with fighting the shadow economy in the country, these numbers should cause some concern; we hope that our findings could raise more awareness in North Cyprus and other developing countries who share similar characteristics.

6. Conclusions

In this study we analyzed the degree of income underreporting in North Cyprus and estimated the size of the shadow economy, as well as its impact on tax revenues for the government. We were able to use household-level data from 2008 that has information on food expenditure and income. By comparing households that receive their entire income from self-employment and private-sector employment with public-sector-employee households, we estimate the degree of income underreporting. We then used these estimates to calculate a lower bound for the shadow economy and the amount of tax losses in North Cyprus.

Consistent with the previous literature, we found that self-employed and privately employed individuals underreported their incomes in household surveys. In North Cyprus in 2008, self-employed individuals underreported around 20 percent, and privately employed individuals underreported around 12 percent of their net income compared to public sector employees. These percentages are only lower bound on total tax evasion as our analysis only looks at individuals who receive their entire earnings from private-sector or self-employment.

We also calculate the implications of such underreporting for the aggregate economy. Using the information on the number of registered self-employed and privately employed individuals in North Cyprus, we found that the lower bound for the shadow economy of North Cyprus is 8.6 percent of GNP. The effect of such

unreported income was around 11.1 percent of uncollected tax revenues, which could be used to finance 27 percent of North Cyprus's budget deficit in 2008.

Our results have several policy implications. With the exception of Besim and Jenkins (2005), the previous literature on income underreporting made a distinction only between self-employed and publicly employed individuals. However, in developing countries it is likely that those working in the private sector are also engaging in tax evasion by implicitly agreeing with their employer in an underreporting of their earnings. Thus, we believe that privately employed individuals should also be compared with public sector employees in this regard.

The second contribution of this paper is to calculate the impact of income underreporting on the aggregate economy, including both the national accounts and fiscal balances. The previous literature calculated only tax evasion, whereas in this study we estimated the implications of underreporting on national accounts as a percentage of GNP. In addition, we measured the tax losses caused by underreporting from a fiscal perspective.

The reasons behind income underreporting are not discussed in this research. However, given the large impact on the aggregate economy and fiscal balances, we believe that further research is needed in this area. In North Cyprus, the likely sources of tax evasion are high marginal tax rates, the lack of penalties in cases of detection, inadequate auditing, a corrupt political system, and people's distrust of the government. These are also potential characteristics in other developing nations. Therefore, given the large impact of tax evasion on national accounts, we believe that governments should tackle the issue of income underreporting in more detail.

Appendix

We also estimate the reduced form equations for three employment groups by interacting the employment dummy with log of household income. This method has been used previously by Besim and Jenkins (2005); thus we replicate our analysis using this method. Details can be found in Besim and Jenkins (2005).

$$\ln C_{ij} = \beta_0 + \beta_1 \ln Y_{ij}^R + \beta_2 X_{ij} + \gamma D_i + \beta_3 (\ln Y_{ij}^R \cdot D_i) + \mu_{ij}. \tag{6A}$$

Given this specification, the difference between the true and reported income for the average incomes of the households is given by the following:[6]

$$\ln \bar{Y}^T - \ln \bar{Y}^R = \frac{\gamma}{\beta_1}. \tag{7A}$$

The results of estimating (6A) are given in Table A1. The degree of underreporting using this specification is 10.7 percent for privately employed and 19.8 percent for self-employed individuals. These numbers are close to the values we obtained using the PW method.

[6]Refer to Besim and Jenkins (2005) for details.

TABLE A1

Results of Estimating Equation (2)

	Privately Employed	Self-Employed
Log (income)	0.785***	0.761***
	(0.144)	(0.125)
Dummy	5.948***	8.145***
	(1.558)	(1.451)
Dummy* log (income)	–0.566***	–0.773***
	(0.147)	(0.136)
Age of household head	0.012***	0.011***
	(0.002)	(0.002)
Size of household	0.138***	0.136***
	(0.013)	(0.017)
Constant	–2.906*	–2.622**
	(1.512)	(1.294)

***Significant at 1% level or better, **Significant at 5% level or better, *Significant at 10% level or better.

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