Non-Observed Economy vs. the Shadow Economy in the EU: The Accuracy of Measurements Methods and Estimates revisited

Philippe Adair

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Philippe Adair

Faculty of Economics and Management, ERUDITE, University Paris Est Créteil, France.

Email: adair@u-pec.fr

Abstract

The Non-Observed Economy (NOE) *vs.* the shadow economy remains a controversial issue. Illegal, underground and informal activities encapsulated within the NOE/shadow economy display large discrepancies throughout the European Union. First, a tractable taxonomy of the aforementioned market activities is designed according to both definition and scope, whereupon a wide spectrum of estimation methods applies. Second, direct measurements provided by tax audits, household informal expenditure and labour market surveys provide piecemeal information regarding such unobserved activities; a cross-section survey issued from a unique questionnaire applied to all European countries in 2007 and again in 2013 deserves special attention. Third, indirect macroeconomic measurements are drawn from discrepancies on the market for goods and services on the money market and on the labour market, whereas the DYMIMIC (dynamic multiple indicators-multiple causes) method carves the trends of the shadow economy (hereafter SE). Fourth, the estimates of the EU shadow economy drawn from the DYMIMIC model are compared with the assessment of the NOE according to national accounts adjustments; the relevance of major determinants of the NOE/shadow economy -tax burden as well as the characteristics of the informal workforce, is discussed.

Keywords: Estimates; European Union; Measurement Methods; National Accounts; Shadow Economy.

JEL: C18, E1, H26, K42, O52

1. Issues

Since the first report for the European Commission (Barthélémy et al, 1990), the European Union (hereafter EU) initiated several studies upon undeclared economic activities, which escape social regulations and tax compliance as well as statistical recording. The topic has been expanding throughout the late 1970s; since then, experts loosely used various terms as synonyms to capture these activities *e.g.* "black, concealed, hidden, informal, irregular, non-observed, shadow, subterranean, underground, unofficial, unrecorded", etc (Feige, 1989; Thomas, 1992; *The Economic Journal,* 1999*;* Schneider and Enste, 2000).

However, definition and scope differ among scholars, as well as the magnitude and trends according to measurement methods. The path towards a tractable taxonomy remains work in progress, although major steps have been achieved in the past decades. The ILO (1993) provided guidelines for statistics on the informal sector and enlarged the scope towards informal employment (ILO, 2002), which became part of the *Manuel on the informal economy* (ILO, 2013). Alongside OECD and the IMF, the ILO co-authored the *Handbook for Measurement of the Non-Observed Economy* (OECD, 2002), which coined the Non-Observed Economy (hereafter NOE) from the United Nations System of National Accounts (SNA) perspective. The United Nations Economic Commission for Europe launched two surveys on national practices regarding the NOE in national accounts (UNECE, 2003, 2008). The SNA was revised in 2008, the revision of which was transposed into the European System of Accounts (ESA) in 2010 and the Eurostat national accounts update include some components of the NOE in 2014.

Meanwhile, Schneider and Williams (2013), Schneider (2015) and Schneider et al. (2015) provided extensive updates of the "shadow economy" (hereafter SE) estimates based upon a calibrated structural model (DYMIMIC), while other scholars used Dynamic General Equilibrium (DGE) models that reached similar magnitude and trends of the SE (Elgin and Schneider, 2016). National accountants (Ven, 2017) and Feige (2015) dismissed such so-called "black box modelling" upon the SE as inaccurate and overstated. Indeed the topic of NOE vs. SE is controversial. How should the NOE/SE be accounted for? How large or small a share of GDP does it represent in the EU countries? Are the trends declining since the 1990s?

Section 2 is devoted to definition and scope: NOE is designed as a set of eight types or seven categories of activities liable to taxes that are encapsulated within five categories: Illegal economy, underground economy and the informal economy are market activities, whereas production for own final use is non-market output.

Section 3 examines the spectrum of definitions and estimation methods, both direct and indirect. Seven different methods fall into two broad categories. It first presents direct measurements provided by tax audits, household informal expenditure surveys and labour market surveys; a special attention is paid to the cross-section survey issued from a unique questionnaire applied to all European countries in 2007 and repeated in 2013.

Section 4 deals with indirect macroeconomic measurements that are drawn from discrepancies between income and expenditure on the commodity market, discrepancies on the money market and discrepancies on the labour market, as well as from non-monetary (*i.e.* qualitative) modelling of latent variables and multiple indicators-multiple causes (MIMIC).

Section 5 compares the estimates of the NOE from EU national accounts with those of the SE drawn from the DYMIMIC model; it discusses the impact of some major determinants such as tax pressure and the informal workforce.

Section 6 briefly recapitulates the strengths and weaknesses of both methods and sketches a research agenda.

2. Non-Observed Economy and the Shadow Economy: Definition and Scope.

2.1. The components of NOE.

NOE, a useful typology albeit not an analytical classification, is the outcome of an ongoing process of extensive coverage upon productive activities, in order to design an exhaustive standardized definition for measuring concealed GDP.

National accountants have traditionally sought to incorporate undeclared production, incomes and expenditures by reconciling income, expenditure and output estimates of GDP. According to international principles of national accounting, GDP includes all types of value added in the economy as evidenced by voluntary transactions where payments are made, including illegal and barter transactions. GDP also includes some production without transactions such as imputed rents and household production for own use. The first and most important distinction must be drawn between market traded and non-market traded goods and services, both being included in the GDP. The second distinction concerns the compliance with legal standards: illegal activities are criminal, whereas other unobserved activities are legal. A third distinction relates to the nature of the flow: according to the value added approach of GDP, activities that produce an output are included, whereas income transfers (pilfering, theft extortion or money laundering) are not. According to the current nomenclature from Eurostat tabular approach, the NOE comprises five broad categories of activities, namely *Underground, Illegal*, *Own-account, Informal*, and *Statistical deficiencies*. (See Figure 1).

Figure 1. NOE categories and types

Observed Economy	*Non Observed Economy*	Current nomenclature (Eurostat tabular approach)	Former nomenclature
Registred/reported activities	*Underground activities*	N1 (producers deliberately not registering) + N6 (producers deliberately misreporting)	T1 (non-response to surveys) T2 (out of date registers) T3 (non-deliberate unregistered units) T4 (misreporting of production) T5 (intentionally not registered)
	Illegal activities	N2 (producers deliberately not registering)	T7 (unregistered units)
	Own account activities	N3 (producers not required to register)	
	Informal activities	N4 (Legal persons not surveyed + N5 (Registered entrepreneurs not surveyed)	T6 (unregistered small scale units)
	Statistical deficiencies	N7 (Other statistical deficiencies)	T8 (other types of undercoverage)

Source: UNECE (2003), Eurostat (2014).

Underground activities (N1 + N6) are legal but deliberately concealed from public authorities to avoid (i) the payment of income tax, value added taxes as well as social security contributions; (ii) meeting legal standards (minimum wages, maximum hours, safety or health standards, etc.); (iii) complying with administrative procedures (completing statistical questionnaires or other administrative forms). "Underground economy" should not be mixed with illegal activity as Lippert and Walker (1997) suggest. Tax evasion (i.e. non-reported income and non-issuance of receipts) is illegal, although it relates to legal activities. It should not be confused with tax avoidance (i.e. fringe benefits, legal tax planning), which is legal.

Illegal activities generate goods and services forbidden by law (e.g. fencing, pimping and drug trafficking) including those that are carried out by unauthorised producers (e.g. unlicensed practice of medicine), whereas income transfers without voluntary exchange are not included. Customs data are biased and the fact that total amount of drug trafficking remains stable whereas the phenomenon is assessed to be expanding is rather puzzling (OECD, 2009).

Informal activities are conducted by unincorporated enterprises in the household sector generating market production that do not comply with labour market regulations; they are unrecorded and/or their size is below a specified threshold of staff employed (e.g. less than five). This is the very definition of the informal sector according to the ILO (1993).

Household production for own final use is consumed or capitalised by the households themselves: own-account fixed capital formation including house building and major repairs

(owner imputed rents) and services of paid domestic servants. Do It Yourself (DIY) home repairs and improvements range from 1% to 3% of GDP in Denmark, Sweden, Germany and the United Kingdom (OECD, 2004); a part of which is included in the GDP. Barter and in-kind exchanges between households are unregistered and not liable to tax should also be included.

2.2. Coverage of the NOE in the EU: the long road to exhaustiveness.

As Blades and Robert (2002) put it, non-observed does not mean non accounted activities: National Accounts do adjust for various types of NOE; thus the ratio of NOE to GDP is meaningful and should comply with the European statistical framework (Eurostat).

A tentative measurement of NOE in OECD countries was set up in the 1980s as regards tax evasion and undeclared work, misappropriated in kind incomes and production of illegal goods and services: Figures amounted from 2 up to 5% of GDP in the 1970s (Blades, 1982).

A second survey in 2001-2002 (UNECE, 2003) covered 16 European countries: six from the EU and nine candidate countries, plus Croatia. The methods enhancing exhaustiveness in the national accounts capture informal and underground activities, although it may not be possible to identify and classify them separately in most EU countries, Italy been excepted.

In 2005-2006 A third survey (UNECE, 2008) enlarged the sample to 18 countries (17 EU Members States plus Croatia) and the new nomenclature of NOE activities applied (See Figure 1). Neither coverage nor dates do match due to a different scheduling across countries as well as to the non-binding requirement of such surveys. Countries with the largest coverage display the highest NOE magnitude; conversely, countries with the smallest coverage display the lowest NOE magnitude. A comparison between countries providing NOE estimates for the previous survey shows that trends remain stable in Belgium, whereas they decline (Bulgaria, Hungary and Latvia) or increase (Czech Republic, Italy, Lithuania and Poland). This could be due to the change in nomenclature but not necessarily to the improvement in coverage as for the complying Eastern European countries. As for Belgium, one may suspect that adjustments use the same parameters; therefore, it is no surprise that the NOE remains stable (See Table 1).

In 2012, the OECD used the same nomenclature to survey 12 countries (Gyomai and Ven, 2014; Ven, 2017), out of which six were already included in the 2005-2006 survey (UNECE, 2008). Trends decline (Austria, Czech Republic, Hungary and Poland) or increase (Belgium, Italy, Netherlands and Sweden), mostly because coverage improved.

Despite the agreement of EU countries as regards compliance with the European System of Accounts (ESA 2010), the adjustment process in order to include the NOE experienced slow completion. In 2014, Eurostat required that N2 be included in the GDP for 2010 and it would

slightly increase the share of NOE in the GDP for most countries. However, coverage remains disparate and a few countries prove reluctant to disclosure (See Table 4 in the appendix).

Table 1. Share (%) of NOE in GDP according to National Accounts adjustments in early and late 2000s

	2001-2002 UNECE survey (9 EU and candidate countries)										2005-2006 UNECE survey (18 EU and candidate countries)									2012 OECD survey (12 EU countries)					
Country	% of GDP	Year	T1	T2	T3	T4	T5	T6	T7	T8	% of GDP	Year	N1	N2	N3	N4	N5	N6	N7	% of GDP	Year	N1+ N6	N2	N3+ N4+N5	N7
Austria											7.9	2001	Yes		Yes	Yes	Yes	Yes	Yes	7.5	2008	2.4	0.2	1.5	3.5
Belgium	3-4	1997				Yes	Yes	Yes		Yes	3.5	2002	Yes		Yes			Yes	Yes	4.6	2009	3.8			0.7
Bulgaria	16	2000	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10.2	2001	Yes	Yes	2.5	Yes	Yes	Yes	Yes						
Croatia	8	1999	Yes	Yes	Yes	Yes	Yes		Yes	Yes	13.9	2002	3.9	1.3	0.2	0.0	0.4	6.3	1.9						
Cyprus																									
Czech Rep.	9	1998	Yes	Yes	Yes	Yes		Yes	Yes	Yes	9.3	2000	0.5	0.2	1.3	1.5	1.0	4.4	0.3	8.1	2009	6.3	0.4	1.3	0.2
Denmark																									
Estonia	Not stated		Yes		Yes	Yes	Yes	Yes	Yes	Yes	8.9	2002	4.2	0.6				3.2	0.9						
Finland											Not stated		Yes		Yes			Yes							
France																				6.7	2008	3.7		2.9	0.2
Germany	Not stated										Not stated														
Greece																									
Hungary	16	1997	Yes	Yes		Yes	Yes	Yes			11.9	2000	Yes	Yes	Yes			Yes	Yes	10.9	2009	3.1	0.8	3.1	3.9
Ireland	4	1998			Yes	Yes	Yes																		
Italy	15	1998		Yes		Yes	Yes				16.7	2003	7.2		Yes	Yes	Yes	Yes		17.5	2008	16.2			1.2
Latvia	17	1998	Yes	Yes	Yes	Yes		Yes		Yes	12.5	2000	7.2	1.5		2.5		1.2	0.1						
Lithuania	17.9	1998	1.2s		1.4	13.6		1.2		0.4	18.9	2002	0.45	0.6				17.5	0.35						
Luxembourg																									
Malta																									
Netherlands											1	1995						Yes	Yes	2.3	2007	0.8	0.5	0.5	0.5
Poland	13	1998				Yes	Yes	Yes	Yes		15.7	2002	3.4	0.6			0.0	7.8	3.9	15.4	2009	12.7	0.9	2.8	0.2
Portugal																									
Romania	Not stated	1998				Yes	Yes	Yes			17.7	2002	Yes		Yes			Yes	Yes						
Slovak Rep.	21.6	1998	3.2		3.7	6	1.3		0.6	6.9										15.6	2009	12.1	0.5	2.9	0.2
Slovenia																				10.2	2007	3.9	0.3	2.8	3.1
Spain											11.2	2000	Yes			Yes		Yes	Yes						
Sweden											1.3	2000		Yes				Yes	Yes	3	2009				
UK	Not stated										Not stated		Yes		Yes		Yes	Yes	Yes	2.3	2005	1.5		0.5	0.3

Source: Adair (2012), Gyomai and Ven (2014), UNECE (2003, 2008), Ven (2017).

3. Measurement Methods and Estimates: Three Direct Approaches.

Direct investigations are provided by tax audits, household expenditure surveys and labour market surveys. They are used in order to collect raw data or control the various estimates computed through indirect approaches.

3.1. Tax Audits

Audits investigating tax compliance focus on targeted sub samples that are not representative of the population. They cannot collect data on illegal activities. They provide point estimates rather than time series data. Indirect detection controlled estimations are based on characteristics of potential offenders, providing both the estimates of the probability of compliance *vs*. violation (by means of maximum likelihood) and the proportion of violations remaining undetected (applying Bayes' law). However, violation and detection prove uneasy to disentangle. Surveys underestimate the size of the SE (Giles 1999; Schneider and Enste 2000). The same comments apply to social security contributions. In this connection, administrative data and findings from labour inspectorates may be useful, but international comparisons based primarily on these sources have not taken place yet.

3.2. Households' expenditure and labour market: the 2007 and 2013 Eurobarometers.

Sparse households' expenditure surveys have been carried on the relevant assumption that it is easier to collect data from the customers on the demand side than from those who provide their provisioning on the supply side.

As regards the labour market surveys, the Labour Force Survey designed by Eurostat does not address informal employment. However, a few surveys were undertaken in the 1980s by Statistical Offices (Italy, Netherlands and Spain) and NGOss (Germany and Norway), displaying a large difference between Northern and Southern European countries (OECD, 2004).

Box: the *Rockwool Foundation* pilot survey on undeclared work

At the start of the millennium, comparable surveys conducted with the same questionnaires by the *Rockwool Foundation* in Northern Europe find that "black" hours worked are just over 1% in Great Britain, 2-3% in Sweden and about 4% in Denmark and Germany. Estimates seem to have slightly increased overtime as regards Denmark and Germany. Percentages of GDP when informal work is valued at the actual prices paid by purchasers are lower than when it is valued at formal prices; the former measurement seems quite realistic. On the one hand, there is a lack in coverage for non-wage payments; on the other hand, wages are valued according to average legal wages whereas a valuation according to average wages paid for informal employees would cut off the magnitude to less than half of the official figures.

Inspiring from the *Rockwool Foundation* methodology (See box), the first European survey on a stratified households sample in each of the 27 EU countries took place in 2007 and was repeated in 2013 (EEC, 2007; 2013), providing a comprehensive basis for comparison. Both Eurobarometers address household expenditure on informal goods and services, undeclared work (or informal employment according to ILO) and attitude towards fraud; criminal activities and sub-contracting were not investigated (See Table 2).

The demand for non-declared goods and above all for services comes from rather young (below 40 years old) and well educated customers. Supply is provided by local networks (neighbours, family and friends) in two cases out of five and by self-employed and firms in one case out of five. Lower prices as compared to official provisioning is the main drive in two thirds of cases but purchase is no related to prices in one case out of four and this should be explained.

On the demand side, purchasers of non-declared goods and services are usually in higher numbers than those who perform undeclared work, and there is a weak correlation between these two categories.

Undeclared work is paid for in two cases out of three; it is performed by males (twice as many as females), respectively on a regular or periodical basis in half and one third of cases, at most during five weeks a year on average in households services, construction and manufacturing industries.

Cash payments for ("envelope") wages are widespread in Eastern Europe, enabling businesses to save on tax and social security contributions; there is a high rate of non-response for most countries, and the sub-sample is not representative.

Undeclared work or cash payments are not widespread as compared with the share of interviewees who know an undeclared worker; one may suspect that undeclared work is understated in most countries wherein the rate of non-response tops EU 27 average. It is rather unfortunate that Kayaoglu and Williams (2017) focus on dependent employees (envelope wages), who are only a fraction of informal employment issue they address.

Attitude (morale) towards fraud is computed with a non weighted score scaling from 1 (no tolerance) up to 10 (tolerance without restriction), as regards 5 questions related to fraud on social security (households and firms), non-tax reporting, fraud on social benefits- and fraud in public transportation.

These methods provide biased estimates in as much as respondents may understate their job status. Also, it unlikely that such surveys will be used frequently implemented and provide time series.

Table 2. Expenditure on non-declared goods and services (demand) and undeclared work (supply) in the EU (2007 and 2013)

2007 Country	Sample*	Demand (%)	Undeclared work (%)	Wages paid in cash (%)**	Knows an undeclared worker (%)	2013 Country	Sample*	Demand (%)	Undeclared work (%)	Wages paid in cash (%)**	Knows an undeclared worker (%)
Austria	1,009	*17*	*7* (R=7)	*4* (NR=5)	36 (NR=*13*)	**Austria**	1,022	*14*	*5* (NR=5)	2 (NR=8)	31 (NR=*10*)
Belgium	1,040	*18*	*6* (R=1)	*6* (NR=0)	*56* (NR = 2)	**Belgium**	1,040	*15*	*4* (NR=1)	4 (NR=1)	*40* (NR=1)
Bulgaria	1,000	*14*	*5* (R=6)	*14* (NR=*13*)	*39* (NR=*20*)	**Bulgaria**	1,018	*16*	*5* (NR=2)	6 (NR=7)	*33* (NR=9)
Croatia	-	-	-	-	-	**Croatia**	1,000	17	*7* (NR=4)	8 (NR=6)	*41* (NR=5)
Cyprus	503	2	1 (R=4)	*4* (NR=3)	35 (NR=8)	**Cyprus**	505	16	2 (NR=1)	2 (NR=5)	*39* (NR=3)
Czech Rep.	1,024	*15*	*7* (R=3)	3 (NR=4)	*40* (NR=7)	**Czech Rep.**	1,000	*19*	*4* (NR=3)	5 (NR=2)	*33* (NR=5)
Denmark	1,007	*27*	*18* (R=1)	2 (NR=1)	*65* (NR = 1)	**Denmark**	1,004	*23*	*9* (NR=0)	2 (NR=2)	*59* (NR=1)
Estonia	1,004	*14*	*11* (R=5)	*8* (NR=4)	38 (NR=6)	**Estonia**	1,003	*12*	*11* (NR=4)	5 (NR=4)	*33* (NR=3)
Finland	1,026	*11*	4 (R=2)	3 (NR=0)	37 (NR = 2)	**Finland**	1,003	*11*	3 (NR=3)	1 (NR=1)	30 (NR=2)
France	1,039	10	*6* (R=1)	1 (NR=3)	*47* (NR=2)	**France**	1,027	9	*5* (NR=6)	1 (NR=1)	*38* (NR=2)
Germany	1,510	6	3 (R=2)	1 (NR=3)	33 (NR=6)	**Germany**	1,499	7	2 (NR=4)	1 (NR=3)	27 (NR=6)
Greece	1,000	*17*	4 (R=1)	3 (NR=0)	*47* (NR = 3)	**Greece**	1,000	*30*	3 (NR=4)	*7* (NR=5)	*54* (NR=4)
Hungary	1,000	*12*	*7* (R=4)	*8* (NR=8)	*45* (NR=8)	**Hungary**	1,033	*11*	*4* (NR=2)	6 (NR=9)	29 (NR=9)
Ireland	1,003	8	4 (R=11)	2 (NR=25)	27 (NR=*14*)	**Ireland**	1,003	10	2 (NR=4)	2 (NR=5)	25 (NR=6)
Italy	1,017	*12*	3 (R=6)	*7* (NR=14)	*39* (NR=*15*)	**Italy**	1,016	*12*	2 (NR=5)	2 (NR=8)	*37* (NR=*10*)
Latvia	1,010	*24*	*15* (R=4)	*17* (NR=5)	*61* (NR=4)	**Latvia**	1,006	*28*	*11* (NR=4)	*11* (NR=6)	*46* (NR=4)
Lithuania	1,017	*12*	*7* (R=2)	*11* (NR=3)	*40* (NR=7)	**Lithuania**	1,027	*14*	*8* (NR=3)	6 (NR=4)	35 (NR=6)
Luxembourg	510	*14*	*5* (R=1)	1 (NR=1)	*48* (NR=1)	**Luxembourg**	510	*14*	*5* (NR=1)	3 (NR=2)	35 (NR=1)
Malta	500	*17*	2 (R=1)	1 (NR=3)	34 (NR=6)	**Malta**	500	*23*	1 (NR=3)	0 (NR=5)	20 (NR=9)
Netherlands	1,001	*27*	13 (R=1)	2 (NR=*11*)	*66* (NR=1)	**Netherlands**	1,019	*29*	*11* (NR=1)	3 (NR=1)	*55* (NR=2)
Poland	1,000	8	5 (R=4)	*11* (NR=5)	*45* (NR=5)	**Poland**	1,000	5	3 (NR=3)	5 (NR=5)	28 (NR=5)
Portugal	1,002	7	3 (R=4)	*4* (NR=*10*)	25 (NR=*10*)	**Portugal**	1,015	10	2 (NR=3)	3 (NR=4)	28 (NR=7)
Romania	1,004	*11*	4 (R=7)	*23* (NR=*31*)	29 (NR=*10*)	**Romania**	1,027	10	3 (NR=9)	7 (NR=20)	20 (NR=13)
Slovakia	1,075	*15*	*6* (R=2)	*7* (NR=*11*)	*39* (NR=5)	**Slovakia**	1,000	*17*	*5* (NR=3)	7 (NR=5)	*36* (NR=6)
Slovenia	1,037	*17*	*5* (R=3)	*5* (NR=3)	*52* (NR=4)	**Slovenia**	1,017	*22*	*7* (NR=3)	4 (NR=5)	*48* (NR=5)
Spain	1,007	6	3 (R=2)	*5* (NR= 9)	27 (NR=7)	**Spain**	1,003	8	*5* (NR=2)	5 (NR=4)	*33* (NR=4)
Sweden	1,001	*23*	10 (R=1)	3 (NR=0)	*56* (NR=3)	**Sweden**	1,006	*16*	*7* (NR=0)	1 (NR=0)	*39* (NR=1)
UK	1,313	9	2 (R=3)	1 (NR=2)	24 (NR=2)	**UK**	1,306	8	3 (NR=0)	2 (NR=2)	15 (NR=1)
EU27	*26,659*	*11*	*5 (R=3)*	*3 (NR=6)*	*38 (NR=7)*	*EU27*	*26,563*	*11*	*4 (NR=3)*	*3 (NR=4)*	*32 (NR=5)*

Note: figures above or equal to EU 27 average in italics. NR: Non-response (Refusal and don't know). * Population aged 15+. ** Sub-sample of dependent employees = 11,066

Source: Our compilation (EEC, 2007; 2013).

4. Measurement Methods and Estimates: Indirect Approaches.

Indirect macroeconomic measurements are drawn from discrepancies between income and expenditure on the commodity market, discrepancies on the money market and discrepancies on the labour market, as well as from qualitative non-monetary modelling of latent variables and multiple indicators-multiple causes models using monetary calibration (DYMIMIC).

4.1. Discrepancies between income and expenditure on the market for goods and services.

By definition, the income approach of GDP should reach the same outcome as the expenditure approach; hence, any discrepancy such as income being larger than expenditure, indicates the existence of a 'hidden' economy (excluding criminal activities). Several European countries investigated the income-expenditure gap, among which the UK has documented this gap, due to tax evasion, relying on household living standards surveys. According to restricted or extensive assumptions, the range of estimates varies from less than 3% up to over 10% of GDP. This method covers only the "underground economy" NOE type.

Dilnot and Morris (1981) use a disaggregated analysis which examines both the income and expenditure behaviour of a sample of 1,000 households drawn from the UK *Family Expenditure Survey* (FES) and then extend the analysis to the whole FES sample of 7,200 households in order to track 'black' economic activity (including tax evasion and social security fraud). After correcting the data for deficiencies and relying on a sample of households whose expenditure exceeds 1.15 of their reported income, the estimate ranges between 2.3% and 3% of GDP (1977). The main drawback is the assumption that the FES is a reliable source of information, despite the fact that the rate of non-response is 30%; actually, the "black economy" is underrated, because self-employment is under-reported in the FES.

Pissarides and Weber (1989) use a food consumption function to estimate the size of the black economy from the FES, assuming that only self-employed underreport their income. The estimates for underreporting amounts to 5.5% of GDP (1982). This method has several shortcomings: Some employees may engage in self-employment and conceal their income. The relevant assumption that food expenditure is more accurately recorded than other items of expenditure overlooks the fact that luxury items of expenditures (including food) may be underreported. Savings are not taken into account. Preferences are assumed to be identical, whatever the households' characteristics may be.

Lyssiotou et al (2004) use a single equation for a complete demand system encompassing six categories of non-durable goods. It is based on cross-section individual household data from the FES, and includes both wages and self-employment incomes. It avoids the confusion

between preference heterogeneity and income effects, and takes into account the household characteristics to calibrate the size of the black economy in the UK amounting 10.6% of GDP (1989). The model does not reach a complete demand system; pensioners and single parents are excluded from the sample; the preferences of self-employed are rather peculiar.

Estimates based on discrepancies between income and expenditure, whatever the methods used, capture only a part of NOE and face several shortcomings. On the one hand, statistical offices may be prone to political influence; there are incentives for higher estimates when the country is a large tax burden and lower estimates when experiencing financial assistance (Tanzi, 1999). Measurement is inadequate because Income and Expenditure are not estimated according to independent sources (Barthélémy, 1988; Feige, 1989; Thomas, 1992). On the other hand, missing income and non-reported revenue may not be linked. In addition, tax evaded income maybe overestimated due to the fact that the level of earnings of the informal workers could be too low to pay taxes (Bhattacharyya, 1999).

4.2. Discrepancies regarding monetary aggregates on the money market

Monetary measures can be classified into two categories: the currency ratio/ demand method and the transactions method.

4.2.1. Currency ratio/demand method

The method pioneered by Gutmann (1985) does not use any statistical analysis, but simply disentangles the money supply, M1, into two components, currency and demand deposits, and examines their movement as well as the ratio of currency to deposits over the period 1937-76. He assumes that non-declared transactions are paid in cash, and that the velocity of circulation is the same in both the formal and 'underground' economies; he takes into account the variation of the cash/deposits (C/D) ratio according to the basic period (or year) considered as an indicator of the 'underground' economy.

The currency demand approach pioneered by Cagan (1958) is advocated by Tanzi (1982). Tanzi assumes that economic agents involve in 'underground' activities in order to escape taxes; thus an estimate of the tax elasticity of currency demand can be used to calculate the stock of currency held in the underground economy. Provided that the income velocity of money in the underground economy is the same as that in the legal economy, then the size of the former can be approximated by multiplying the income velocity of money in the legal economy by the stock of money in the underground economy.

Tanzi (1982) runs a simple econometric equation on US time-series data for the period 1929-76. The dependent variable is the ratio of currency to deposits, using M2 as the measure of

money supply. Other independent variables are *per capita* income, the ratio of total wages and salaries in personal income, and the rate of interest on time deposits as a measure of the opportunity cost of holding cash. The currency ratio is negatively related to *per capita i*ncome, whereas the ratio of total wages and salaries (paid in cash) is positively related to the currency ratio. The connection between changes in the level of income taxes and changes in the $C/M2$ ratio is imputed to the 'underground' economy.

The currency demand approach has been criticised on three grounds (Thomas, 1999). A base year or period is needed, but the assumption of a period during which there was no informal activity is absurd. The assumption that the velocity of circulation is the same in both the official and informal economies requires some explanation. The assumption that transactions are carried out in cash only is unrealistic. Hence, Tanzi's econometric model is misspecified and proves unstable.

4.2.2 Transactions method

The monetary transactions method developed by Feige (1989) takes Fisher's equation of exchange as a starting point and assumes that transactions are paid in cash as well as in cheques; he attributes the underground economy to the discrepancy between independent estimates of MV and PT (which includes both formal and informal transactions). Following the Cambridge equation of exchange, total income is computed from recorded and unrecorded income: In order to estimate unrecorded income, Feige assumes that there was a period (*i.e.* a benchmark year) during which all income was properly recorded.

If the assumption that non-declared transactions are not exclusively paid in cash seems realistic, it may also over-estimate the extent of these transactions, since cheques are also used to carry out transfers without relationship with non-declared transactions.

Feige's method has been criticised because its estimates are sensitive to the choice of initial period (Tanzi, 1982) and lack empirical validity (Thomas, 1992).

All monetary approaches provide, in absolute value, a large spectrum of estimates in terms of GDP: Feige's ratio is increasingly higher than Gutmann's ratio which in turn is higher than Tanzi's ratio. In terms of logarithms, they seem to show either a growing trend (currency demand) or cycles which converge or diverge according to countries (cash ratio, transactions) (Schneider and Enste, 2000).

Despite several restrictions they point out, Schneider and Enste (2000) and Schneider (2015, 2016) use extensively the Cagan-Tanzi currency demand approach to calibrate the DYMIMIC model. The main reason seems to be that, due to the availability of time series data, estimates

provide trends and enable cross-section comparisons. However, the model should not apply to short-run data: According to Ahumada et al. (2008), in order to avoid the problem of initial condition (or benchmark), the model should only be designed and computed to account for long run trends.

All monetary models eschew economic theory as regards behaviour on the money market, especially preferences relating to the various ways whereby currency is used and kept (species, current accounts), which can vary according to the institutional framework and periods considered. Savings or currency hoarding are not taken into account (Thomas, 1999), possibly causing an overestimation or, in case of previous hoarding, causing an underestimation of the hidden economy; Bhattacharyya (1999) assumes that these two opposite forces cancel themselves but provides no evidence. According to Giles (1999) monetary approaches overestimate the size of the SE.

4.3. Discrepancies on the labour market

Contini (1981) examines the growth of the "irregular labour market" (*i.e.* jobs outside the social security system) in Italy during the 1960s and 1970s, which is due to three factors: The labour supply is driven by the preference of workers for flexibility in their allocation of time as well as the avoidance of unemployment, the labour demand from small-scale enterprises for workers prepared to earn less than on the regular labour market, tax evasion by employers in the form of the non-payment of payroll taxes and indirect charges (50% -70% to the basic pay) given the existence of strict job protection legislation. Contini's estimates of the size of the irregular labour force reach 16% - 18% of the total labour force in the late 1970s. Given the fact that high levels of unemployment seem to be in pace with the underground economy, the deficiency within employment estimates or the so-called 'implicit labour supply' fills the gap between official labour force participation and the effective labour force participation measured through various investigations, surveys and computations. The official labour force is thus raised by a coefficient resulting from the conversion of the multiple job holding and non-declared activity into full-time employment. Then, it is multiplied by the value added per unit of employment (VAPUE) in order to compute the missing output. Italy carried out the calculation of implicit labour supply, which reached 17.7% of GDP in 1987 and was officially included within national accounts.

Such a method faces two major drawbacks. On the one hand, the official definition of the labour force (according to ILO) does not include either children or retired people in the informal work force, which will then be underestimated. On the other hand, the World Bank (2007) points out

that the distinction between the formal and informal labour market is blurred. On the other hand, the basic assumption, which in turn leads to an overestimation, is that the VAPUE in the underground economy is the same as in the official economy: There are reasons to believe that the VAPUE of the former is weaker than in the latter, since most workers in the informal economy have less human capital and/or equipment, thus yielding a lower productivity (Tanzi, 1999). However, Giles (1999) and Schneider and Enste (2000) contend that labour force participation data are biased and underestimate the size of the informal economy.

4.4. Estimates from real and monetary modelling

Most macro-economic methods are based on one indicator – currency demand, electricity consumption or unreported labour activity – in order to capture the overall NOE; thus the estimate takes into account only one among its several components.

4.4.1. Electricity consumption methods

The rationale for electricity consumption assumes it is a good proxy for both official and unofficial economic activities, and the methods provide time series data that has been used by East European countries before joining the EU. Kaufmann and Kaliberda (1996) derive an estimate of unrecorded GDP from the difference between the growth of official GDP and the growth of the overall use of electricity. Lackó (2000) takes into account the households activities, which include DIY and home production, thus allowing a broader scope and providing higher estimates. Unfortunately, the size of the SE is exogenous and remains unexplained. Both methods can be criticised on two points: all unofficial activities do not require extra electricity consumption (*e.g.* street trading); variations in the elasticity of electricity/GDP do occur and are due to factors that may not be related to unofficial activities of the households and the firms.

Although it displays a flatter trend than monetary methods and, electricity consumption method overstates NOE in comparison with national accounts estimates (UNECE, 2003)

However, strangely enough, Medina and Schneider (2017) use light intensity as a calibration method for SE DYMIMIC estimates.

4.4.2. Dynamic Multiple Indicators, Multiple Causes (DYMIMIC).

DYMIMIC is a special type of structural equation modelling based on the statistical theory of latent (i.e. unobserved) variables that has several advantages. First, it relies on multiple data sources to capture as many components of informal economic activity. Second, it can determine

both the size and development of informal economic activity over time and enables to rank various countries.

The model consists in two parts: The measurement model links the latent variable – the size of SE – to observed indicators, whereas the structural model specifies the causal relationships among the latent variables. The quantitative variables relate to institutional constraints (actual tax burden, share of public employment in total labour force) and real GDP growth, as well as to the labour market (male participation rate, rate of unemployment, hours worked). The perceived tax burden and attitude towards fraud are the qualitative variables (Frey, Weck-Hannemann, 1984).

This method has been applied to a repeated cross-section analysis of 17 OECD countries (1960, 1965, 1970, 1975, 1978), in order to compare and to rank European countries according to the magnitude of the SE; relative values used for rankings are converted into absolute values through a calibration procedure. Weekly hours worked appear to be the most important indicator. There is also evidence of some causality (in Granger's sense) from measured activity to informal activity but the reverse does not show up. However, the estimators are very unstable according to the periods considered, so that the same explanatory variables can account for upturns as well as slowdowns (Helberger and Knepel, 1988).

This approach faces several criticisms: The share of public employment is a very rough proxy of regulation constraints, whereas the number of regulations would be more accurate; building a single index of tax morality from US data is disputable; weekly working hours in the manufacturing industries is not a representative and comparable indicator for the countries' sample. Schneider (2009b) acknowledges that MIMIC remains an exploratory method and has still to become an explanatory method.

Giles (1999) advocates this method whereby the informal economy follows the peaks and troughs of the business cycle. However, at least as regards the calibration model (*i.e.* currency demand) criticisms of monetary aggregates apply as well as econometric issues regarding the calibration procedure (Breusch, 2005).

In this respect, Dybka et al. (2017) design a hybrid model in order to avoid ad hoc identifying assumptions including external benchmarking.

5. The EU Shadow Economy.

5.1. Comparing EU Countries: A DYMIMIC-Currency Demand approach

Schneider (2009) designs a dynamic MIMIC (DYMIMIC) model with frequent updates (Schneider et al, 2015; Elgin and Schneider, 2016; Leandro and Schneider, 2017). Its purpose

is to derive an index from qualitative and quantitative causal variables or factors, which is then combined through a benchmark procedure with a currency demand equation in order to calibrate (i.e. transforming ordinal into cardinal values in terms of % of GDP) the size and development of the SE (See Schneider and Williams, 2013).

We first present the causal variables; then we discuss the trends concerning European countries. Elgin and Schneider (2016) point out that the estimates obtained using the model over a large sample imply that the all the seven causal variables of shadow economies have similar effects in magnitude. Between 1999 and 2010 unemployment and self-employment on average have the largest impacts, followed by tax morale, growth of GDP per-capita, business freedom, indirect taxes and personal income tax.

Table 3 allows to examine the magnitude of the SE relative to GDP according country ranking, as well as the trends over a fifteen-year period (1999-2013).

Unemployment sheds little light on the SE and Enste (2010) provides unconvincing results in this connection. Although poorer countries as regards GDP *per capita*, in Southern and Eastern Europe, experience inefficient regulations and have the largest share of SE, it does not explain why some richer countries (Denmark and Belgium) reach a fairly high size in NOE.

The size of SE grows moving from West to East and also from North to South, although without displaying a clear pattern. Dividing the EU 28 into quartiles, the average size over the period ranges from below 10% (Austria) up to 17% (Ireland) as for the first quartile, beyond 24% (Spain) as for the second quartile, beyond to 27% (Estonia) as for the third quartile and beyond 33% (Bulgaria) as for the last quartile. Ranking remains stable overtime. [1]

With respect to the EU average, the size of the SE fluctuates but declined throughout the 2000s, although experiencing an upturn over 2008-2010 (See also Schneider, 2015). Actually, monetary time series may fluctuate much more than non-monetary variables.

This declining trend may be explained thanks to improving regulations and enforcement policies, as well as tax cuts (Schneider, 2009b).

Among non-monetary variables, tax morale is presumably asymmetrical: It may sharply decrease albeit it will slowly increase.

Last but not least, the DYMIMIC/currency demand method provides estimates that seem oversized for two main reasons. First, the scope of the SE is restricted to underground, informal and household activities, regardless of illegal activities (N2), whereas currency demand applies

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[1] Trends from Schneider's figures are consistent with those of Afonso and Almeida (2017) using the MIMIC method and focusing upon the PIIGS (Portugal, Italy, Ireland, Greece and Spain) over 1980-2013. However, including Ireland proves inconsistent over 1999-2013.

to all NOE categories; therefore calibration exceeds the scope. Second, so-called official GDP is somehow adjusted as regards a fraction of NOE types, thus fully adjusted GDP (*i.e.* including all NOE types) should generate a lower NOE/GDP ratio.

Hassan and Schneider. (2016) acknowledge that the MIMIC and/or currency demand approach achieves high SE estimates. They claim that DIY (do-it-yourself) activities, help from neighbours and friends (N3), as well as criminal activities (N2) are at least partly included. Once deducted these activities roughly 65% of the SE remains, which should more accurately reflect its "true" size.

We calculated the average true size of the SE (See last column in Table 3), using the 0.65 coefficient suggested by Hassan and Schneider (2016, 29). It does not affect the country ranking, whereas it shrinks the absolute magnitude of SE estimates, which gets closer to albeit above the NOE estimates, with few exceptions (e.g. Austria).

However, the magnitude and accuracy of this figure should be discussed. On the one hand, stating that over one third (0.35) of the SE is made of the N3 + N2 categories does not fit the data of EU countries for which the share of NOE components are available (See Table 1). On the other hand, if those activities are included and they should be indeed according to the NOE standard definition, why should they be dropped?

Using a Dynamic General Equilibrium (DGE) model, Elgin and Oztunali (2012) notice is that the 1999-2007 part of their dataset is almost perfectly correlated with the SE data reported by Schneider, supporting the hypothesis that the size of the SE is countercyclical. Elgin and Schneider (2016) acknowledge that DGE and DYMIMIC models reach similar conclusions, although the former smooths the fluctuations that are displayed in the latter.

Table 3: Ranking of EU countries according to the size of the shadow economy (% of GDP)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average 1999-2013	'True value'* Average 1999-2013
Austria	10	9.28	10.03	9.97	9.99	9.9	9.67	9.31	9.23	9.83	10.11	10.05	9.75	10.18	10.13	*9.83*	*6.39*
Luxembourg	10	9.37	10	10.91	11.33	11.23	11.56	10.2	10.26	10.38	11.16	10.85	10.63	11.63	13.47	*10.87*	*7.06*
UK	12.8	12.33	12.89	12.94	13.5	13.55	13.74	13.99	14	15.03	15.08	15.26	14.43	13.84	13.78	*13.26*	*8.62*
Netherlands	13.3	12.6	12.9	13.94	14.88	14.5	14.39	13.94	14.12	14.38	16.18	16.56	16.01	16.21	16.38	*14.69*	*9.55*
France	15.7	14.32	14.44	15.09	15.63	15.41	15.77	15.17	14.79	15.1	16.37	14.86	14.43	14.98	15.03	*15.14*	*9.84*
Germany	16.4	15.74	15.27	16.57	17.4	16.78	16.45	14.31	13.94	14.66	16.27	15.65	15.18	15.91	15.96	*15.77*	*10.25*
Ireland	16.1	14.33	14.18	15.88	16.2	16.47	16.26	16.66	17.55	20.17	21.14	20.22	17.77	16.65	15.56	*17.01*	*11.05*
Sweden	19.6	17.87	17.86	18.13	19.45	19.33	19.25	18.43	18.26	18.54	19.9	18.84	18.53	18.65	18.95	*18.77*	*12.20*
Finland	18.4	18.08	16.7	17.7	18.7	18.66	18.9	17.73	17.43	18.79	20.32	20.09	19.47	20.44	20.68	*18.81*	*12.22*
Czech Rep.	19.3	18.87	18.02	20.36	20.6	20.18	19.73	17.23	16.76	18	19.66	19.99	18.58	18.48	18.47	*18.95*	*12.32*
Denmark	18.4	17.65	17.85	18.07	18.37	18.7	17.88	17.82	18.47	19.38	21.39	21.51	20.05	20.15	19.91	*19.04*	*12.37*
Slovak Rep.	18.9	19.24	18	26.56	21.98	21.14	19.29	19.08	22.14	27	26.47	24.77	23.52	23.71	19.85	*22.11*	*14.37*
Belgium	22.7	20.81	22.32	22.75	23.76	23.16	22.9	21.82	21.7	23.22	23.91	23.79	23.45	24.56	25.34	*23.08*	*15.00*
Spain	23	18.87	19.6	20.59	22.54	21.47	22.17	21.57	24.99	28.85	30.4	30.86	28.59	27.62	28.11	*24.61*	*16.00*
Portugal	23	23.26	23.99	25.49	26.02	25.74	26.45	25.37	24.12	25.29	26.02	26.94	27.3	25.97	26.42	*25.43*	*16.53*
Hungary	25.4	23.49	24.3	25.64	27.1	26.42	26.18	25.76	25.47	26.84	28.97	27.94	25.2	24.37	23.88	*25.8*	*16.77*
Latvia	30.8	28.53	26.71	26.11	26.2	23.95	23.59	22.64	24.35	33.94	34.75	31.07	24.29	20.96	19.92	*26.52*	*17.24*
Malta	27.4	27.16	28.48	31.03	30.7	31.7	30.06	32.53	32.46	21.83	22.42	21.84	21.29	21.5	21.62	*26.8*	*17.42*
Poland	27.7	32.78	31.2	28.8	29.42	26.36	23.37	22	21.46	24.18	27.49	28.48	27.76	26.87	26.62	*26.97*	*17.53*
Slovenia	27.3	26.95	25.96	27.7	28	27.03	26.9	25.86	25.16	26.28	28.14	29.01	29.48	29.97	29.49	*27.55*	*17.91*
Estonia	33	33.14	23.17	24.7	24.96	25.41	22.48	19.69	21.08	35.64	43.86	37.82	24.96	21.7	22.94	*27.64*	*17.97*
Italy	27.8	25.55	26	26.35	26.73	27.03	26.75	28.47	27.48	29.16	31.58	30.22	31.22	32.02	32.01	*28.56*	*18.56*
Lithuania	33.8	35.38	28.75	28.93	25.07	25.49	24.79	24.87	26.41	34.52	39.13	34.36	26	21.85	21.95	*28.75*	*18.69*
Croatia	33.8	36.71	30.34	27.09	23.01	25.92	25.91	24.26	25.48	26.06	29.83	30.34	31.66	32.1	31.61	*28.94*	*18.81*
Cyprus	29.2	28.64	27.77	29.61	33.11	33.18	34.26	34.35	36.42	37.26	29.34	29.75	30.59	32.64	33.79	*31.99*	*20.79*
Greece	28.5	28.11	27.61	30.02	28.8	28.17	29.46	28.47	29.85	30.65	35.72	37.62	42.34	43.67	39.39	*32.56*	*21.16*
Romania	34.3	35.3	35.01	31.56	37.12	32.61	33.98	30.16	30.8	33.13	35.29	33.5	31.9	32.13	30.65	*33.16*	*21.55*
Bulgaria	36	42.52	37.56	31.63	31.86	31.65	32.49	33.15	33.11	34.42	35.97	37.3	33.99	33.59	35.55	*34.72*	*22.57*
EU Average	*23.307*	*23.31*	*22.03*	*22.65*	*22.94*	*22.5*	*22.31*	*21.6*	*22*	*24.02*	*25.6*	*24.98*	*23.51*	*23.3*	*23.12*		

Source: Our compilation from Hassan and Schneider (2016). *: We use a 0.65 coefficient suggested by Hassan and Schneider (2016, 29).

5.2. Tax burden and NOE: some ambiguous links.

The robustness of the explanation that connects tax pressure with NOE is far from being proven. The average (or marginal) tax rate of taxation may not matter as much as the tax structure with respect to basis and thresholds; unfortunately, the latter varies across countries and among tax payers (*e.g.* bachelor, families, etc) according to the average wages (OECD, 2006, 2009).

As regards levels, the correlation between NOE (as % of GDP) and tax burden (including Social Security contributions, as % of GDP) is poor and improves but a little whenever logarithms are computed. The upper bond of the countries with the highest share in NOE (above the EU average) does not include those that have the largest percentage of tax burden in terms of GDP. Correlation is poor for the group of so-called Southern countries (Greece, Italy, Spain and Portugal) also including Belgium and Sweden, which obviously are not located in the same area.

As the difference between the level of tax collected and the total tax owed, the tax gap can broadly be split into two types of activities, tax evasion and tax avoidance. Raczkowski and Mróz (2016) contend that the level of the tax gap is rather negatively correlated with GDP, i.e. the higher the GDP is, the lower the tax gap as the percentage of the GDP. However, Italy is an exception (See Table 4 in the appendix). The distribution of tax gaps does not match that of the SE (Schneider, 2016), neither does the tax gap distribution of Muller et al (2013).

5.3. Labour market segmentation and informal workforce.

According to Packard et al (2012), the labour market is segmented between formal and informal workforce. The latter consists in informal dependent employment and informal self-employment (ILO, 2013). They observe significant differences in the composition and profile of the informal workforce across the EU countries. In Bulgaria, Romania and Slovenia, the informal workforce is roughly evenly split between dependent workers without a legal contract and the nonprofessional self-employed. In contrast, informal self-employment is the dominant form in the Czech Republic, Hungary, Lithuania, Poland and Slovakia. This split also applies to Greece, Italy, Portugal and Spain. Unfortunately, Eurostat does not investigate informal employment in the labour force survey.

Undeclared jobs seem to rise during recovery and to contract during recession, as for Spain and Italy where informal employment is widespread and provides flexibility to various sectors. As documented by Bajada and Schneider (2009), opportunities in the SE are fuelled by the expansion of the official economy that is pro-cyclical and unemployment does not provide job opportunities in the SE; thus there is no trade-off between economies because the income effect

offsets the substitution effect. This may also explain differences across European countries that do not experience the same trends.

Correlation between NOE (as a % of GDP) and self-employment (as a % of non-agricultural employment) is poor. The upper bond of the countries which have the highest share in NOE are also those which have the largest percentage of non-agricultural self-employed population: Correlation is high for Southern countries (Greece, Italy, Spain and Portugal). As regards the lower bound of countries with the smallest share in NOE (Ireland, France, Netherlands, UK and Austria), the percentage of non-agricultural self-employed population is far from being the lowest and no correlation shows up. Although self-employed is the working group that complies the less with tax requirements (underground economy) and represent a significant fraction of unincorporated enterprises (informal economy), self-employed population is not a satisfactory proxy for NOE.

6. Discussion and conclusion.

The DYMIMIC vs. National Accounts controversy looks like another hare-tortoise contest. In contrast with the fable, DYMIMIC runs faster than National Accounts, but neither reach the finishing line[2]. The former provides oversized estimates of the NOE, whereas the latter lags behind due to the lack of exhaustiveness.

So far the DYMIMIC model was presented as exploratory and did not require a priori specified factor. Recently, it has been claimed as explanatory (Elgin and Schneider, 2016), although there is no explicit theory behind the model and econometric issues require robustness checks.

Macro-econometric models make strong assumptions, use highly aggregated data and have little control over what exactly is being measured; it is unclear whether NOE includes adjusted GDP or not. They provide times series that prove cheap to compute.

Similarly, there is no model in national accounts, it is the framework and procedures that shape the estimates. Including standardised data on the illegal NOE type helps completing the scope since 2014, although exhaustiveness is far from achievement. NOE estimates may be conservative in as much as adjustments already include some components, although parameters are not disclosed. Data are computed at a highly disaggregated level and double counting is avoided, but timely regular estimates are lacking and should become available.

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[2] The absence of some available NOE estimates for informal labour provided by national accounts, and the use of undeclared work figures from 2013 Eurobarometer that do not fit in the Eurostat nomenclature, alongside disparate dates makes EC (2016, table 1, 3) a very misleading paper.

In the absence of consensus on the most reliable method (*e.g.* time-series data *vs.* cross-section surveys), it seems that the search for an optimal indicator is still beyond reach. One may share the claim from Ven (2017) advocating that both the national accounts and macro-econometric models share the best in order to improve the scope and measurement of NOE, starting with the disclosure of their data and procedures.

Moreover, the unemployment challenge is back on the agenda and calls upon both standardized data and closer monitoring of undeclared work (EC, 2016), provided that data resist political interference (Tanzi 1999) or misuses (Dixon 1999).

References

Adair, P. 2009. Economie non observée et emploi informel dans les pays de l'Union européenne – Une comparaison des estimations et des déterminants, *Revue Economique,* 60(5): 1117-1153.

Adair, P., Nezhyvenko, O. 2016. Sex work vs. sexual exploitation in the European Union: What are the likely guesstimates for prostitution?" Proceedings 6th Economics & Finance Conference, OECD, Paris, September 6-9. IISES, pp. 27-50 DOI: 10.20472/EFC.2016.006.002

Afonso, O., Almeida, F. 2017. The non-observed economy in the European Union, *Applied Economics Letters*, 24(1): 14-18

Ahumada, H., Alvaredo, F., Canavese, A. 2008. The monetary method to measure the shadow economy: The forgotten problem of the initial conditions, *Economics Letters*, 101: 97–99.

Barthélémy, P. 1988. The macroeconomic estimates of the hidden economy: a critical analysis, *Review of Income and Wealth*, 34(2): 183-208.

Bajada, C. and Schneider, F. 2009. Unemployment and the Shadow Economy in the OECD, *Revue Economique* 60(5): 1033–1067.

Barthélémy, P., Miguelez, F., Mingione, E., Pahl, R. and Wenig, A. 1990. *Underground Economy and Irregular Forms of Employment (travail au noir).* Commission of the European Communities, Brussels.

Bhattacharyya, D. K. 1999. On the Economic Rationale of Estimating the Hidden Economy, *The Economic Journal* 109: 348-359.

Blades, D. 2011. Estimating value added of illegal production in the Western Balkans. *Review of Income & Wealth*, 57(1): 183-195.

Blades, D., Roberts, D. 2002. Measuring the Non Observed Economy, *Statistics Brief* 5, November, OECD.

Breusch, T. 2005. Estimating the Underground Economy using MIMIC Models, The Australian National University, November, Canberra.

Cagan, P. 1958. The demand for currency relative to the total money supply, *Journal of Political Economy* 66: 303-328.

Contini, B. 1989. The irregular economy of Italy: a survey of contributions. In: Feige, E.L. (Ed.), pp. 237-250.

Dilnot, A., Morris, C.N. 1981. What do we know about the black economy? *Fiscal Studies* 2(1): 58-73.

Dixon, H. 1999. Controversy: on the use of the 'hidden economy' estimates, *Economic Journal* 109: 335-337.

Dybka, P., Kowalczuk ,M., Olesinski, B., Rozkrut, M., Torój, A. 2017. Currency demand and MIMIC models: towards a structured hybrid model-based estimation of the shadow economy size. Warsaw School of Economics, Working Papers Series N° 2017/030, September

EC. 2004. *European Employment Observatory Review*, Autumn, European Commission Directorate-General for Employment, Social Affairs and Equal Opportunities, Brussels.

EC. 2006. *Non Observed Economy in National Accounts,* Economic and Social Council, Expert Group on National Accounts, Economic Commission for Europe, Brussels.

EC 2007. *European Employment Observatory Review*, Spring, European Commission Directorate-General for Employment, Social Affairs and Equal Opportunities, Brussels.

EC. 2016. *European Semester Thematic Factsheet- Undeclared Work.* European Commission, November. https://ec.europa.eu/.../european-semester_thematic-factsheet_undeclared *work*

EEC. 2013. *Undeclared Work in the European Union*, European Commission, Directorate General Employment & Social Affairs, Special Euro barometer 402, Brussels.

EEC. 2007. *Undeclared Work in the European Union*, European Commission, Directorate General Employment & Social Affairs, Special Euro barometer 284, Brussels.

Elgin, C., Oztunali, O. 2012. Shadow economies around the world: model based estimates. Working Paper 2012/05, Boğaziçi University, Department of Economics.

Elgin C. and Schneider F. 2016. Shadow Economies in OECD Countries: DGE vs. MIMIC Approaches. *Boğaziçi Journal Review of Social, Economic and Administrative Studies,* 30(1): 51-75.

Ernste D. 2010. Shadow Economy – The Impact of Regulation in OECD-countries. *International Economic Journal* 24(4): 555-571

Eurostat. 2014. *Essential SNA: Building the basics,* chapter 6*:* The Informal Sector, pp. 121-134, Methodologies and working papers, European Union, Luxemburg

Feige, E. L. 2016. Reflections on the Meaning and Measurement of Unobserved Economies: What do we really know about the "Shadow Economy"? *Journal of Tax Administration* 2(1): 5-41

Frey, B. S., Weck-Hannemann, H. 1984. The hidden economy as an 'unobserved variable, *European Economic Review* 26: 33-53.

Gutmann, P. 1985. "The subterranean economy, redux". In Gaertner, W. and Wenig, A. Eds. *The Economics of the Shadow Economy*, Springer Verlag, Berlin, pp. 2-18

Giles, D. E. A. 1999. Measuring the Hidden Economy: Implications for Econometric Modelling, *The Economic Journal*, 109: 370-380.

Gyomai, G., Ven van de, P. 2014. The Non Observed Economy in the System of National Accounts, *OECD Brief*, 18, June.

Hassan, M., Schneider, F. 2016. Size and Development of the Shadow Economies of 157 Countries Worldwide: Updated and New Measures from 1999 to 2013. IZA DP No. 10281 October

Helberger, C., Knepel, H. 1988. How big is the shadow economy? A re-analysis of the unobserved-variable approach of Frey and Weck-Hannemann, *European Economic Review* 32: 965-976.

Kaufmann, D., Kaliberda, A.1996. Integrating he unofficial into the dynamics of post-socialist economies, in: Kaminsky, B. Ed. *Economic Transition in the Newly Independent States*, M. E. Sharpe, pp. 81-120.

Kayaoglu, A., Williams, C. C. 2017. Beyond the declared/undeclared economy dualism: evaluating individual- and country-level variations in the prevalence of under-declared employment. *International Journal* of *Economic Perspectives*. Forthcoming.

Lackó, M. 2000. Do Power Consumption Data Tell the Story? Electricity Intensity and Hidden Economy in Postsocialist Countries, in Maskin, E. and Simonovits, A. Eds. *Planning, Shortage, and Transformation.* MIT Press, Cambridge (Mass.) and London, pp. 345-366.

Medina L., Schneider, F. 2017. Shadow Economies around the World: New Results for 158 Countries over 1991-2015. Johannes Kepler Linz University working paper 1710, July.

Lippert, O., Walker, M. Eds. 1997. *The Underground Economy: Global Evidence of its Size and Impact,* Frazer Institute, Vancouver.

Lyssiotou, P., Pashardes, P., Stengos, T. 2004. Estimates of the black economy based on consumer demand approaches, *Economic Journal* 114:.622-640.

Muller, P., Conlon, G., Lewis, M., Mantovani, I. 2013. From Shadow to Formal Economy: Levelling the Playing Field in the Single Market. European Parliament http://www.europarl.europa.eu/studies

OECD. 2002. *Handbook for Measurement of the Non-Observed Economy*, OECD, Paris.

OECD. 2004. *Employment Outlook*, chapter 5, "Informal Employment and Promoting the Transition to a Salaried Economy", pp. 225-289, OECD, Paris.

OECD. 2006. *Employment Outlook,* table 2 - *Evolution of the tax burden 2000-2005, www.oecd.org/dataoecd/50/39/36371872.pdf*

OECD. 2009. *Employment Outlook*, OECD, Paris.

Packard T., Koettl J., Montenegro C.E. 2012. *In From the Shadow – Integrating Europe's Informal Labor*. The World Bank

Pissarides, C., Weber, G. 1989. An expenditure-based estimate of Britain's black economy, *Journal of Public Economics* 39(1):.17-32.

Raczkowski, K., Mróz B. 2016. Tax gap in the global economy, *Argumenta Oeconomica* Working paper, Wroclaw University of Economics.

Schneider F. 2015. Size and development of the shadow economy of 31 European countries and 5 other OECD countries from 2003 to 2015: Different Developments. http://www.econ.jku.at/membrs/Schenider/filers/publications/2015/ShadEcEurope31.pdf. [31.3.2016]

Schneider, F. 2009a. The Size of the Shadow Economy in 21 OECD Countries (in % of 'official' GDP) using the MIMIC and currency demand approach: From 1989/90 to 2009, Working Paper, April, University of Linz.

Schneider, F. 2009b. Size and Development of the Shadow Economies in Germany, Austria and other OECD Countries, *Revue Economique* 60(5): 1079-1116.

Schneider, F. and Enste, D. H. 2000. Shadow Economies: Size, Causes and Consequences, *Journal of Economic Literature*, 38: 77-114.

Schneider, F., Raczkowski, K., Mróz, B. 2015. Shadow economy and tax evasion in the EU, *Journal of Money Laundering Control* 18(1): 34-51

Schneider, F. and Williams, C. C. 2013. The Shadow Economy. The Institute of Economic Affairs- IEA, London.

Tanzi, V. Ed. 1982. *The Underground Economy in the US and Abroad*, Lexington Books

Tanzi, V. 1999. Uses and Abuses of Estimates of the Underground Economy', *Economic Journal* 109: 338-347.

Thomas, J. J. 1992. I*nformal Economic Activity*, LSE Handbooks in Economics, Harvester Wheatsheaf.

Thomas, J. J. 1999. Quantifying the Black Economy: 'Measurement without Theory' yet again? *Economic Journal*, 109: 381-389.

UNECE. 2003. *Non-Observed Economy in National Accounts – Survey of National Practices*, United Nations Economic Commission for Europe, Geneva.

UNECE. 2008. *Non-Observed Economy in National Accounts – Survey of National Practices*, United Nations Economic Commission for Europe, Geneva.

World Bank. 2007. Concept of informal sector, http:/Inweb18. worldbank.org/eca/eca.nsf/Sectors.

Ven van de P. 2017. The Non-Observed Economy in the System of National Accounts. *Illicit Financial Flows and Underground Economy in Developing and Developed Countries: A Mirror Conference,* Leuven, 22-23 May.

Appendix

Table 4. Illegal production (N2) in the EU countries

Country	Year*	% of GDP	Year**	% of GDP	Year***	% of GDP	Country	Year*	% of GDP	Year**	% of GDP	Year***	% of GDP
Austria			2008	0.2	2010	0.16	**Italy**					2010	1
Belgium					2010	0.37	**Latvia**	1998	0.97	2000	1.5	2010	
Bulgaria	1999	1.3			2010	0.21,	**Lithuania**	1998	0.5	2002	0.9	2010	0.9
Croatia	2003	0.52	2006	0.86	2010	0.7	**Luxembourg**					2010	0.23
Cyprus					2010	1.09	**Malta**					2010	0.3
Czech Rep.					2010	0.53	**Netherlands**			2007	0.5	2010	0.38
Denmark					2010	0.14	**Poland**	1998	0.13	2009	0.9	2010	
Estonia	1998	0.8	2006	0.6	2010	0.52	**Portugal**					2010	0.35
Finland					2010	0.1	**Romania**					2010	0.46
France					2010		**Slovak Rep.**	1998	0.59	2009	0.5	2010	
Germany					2010	0.1	**Slovenia**			2007	0.3	2010	0,36
Greece					2010		**Spain**					2010	0.87
Hungary					2010	0.85	**Sweden**					2010	0,14
Ireland					2010	0.73	**UK**					2010	0.58

Source: * UNECE (2003); ** Blades (2011); *** Adair and Nezhyvenko (2016)

Table 5. Tax gaps in the EU (% of GDP)

Member State	2011	Member State	2011	Member State	2015	Member State	2015
Luxembourg	1.2	**Portugal**	2.4	**Luxembourg**	1.7	**Portugal**	7.5
Austria	1.3	**Sweden**	2.6	**Ireland**	2.9	*EU 28*	7.7
UK	1.4	**Denmark**	2.7	**Denmark**	3.1	**France**	8.2
Ireland	1.5	**Lithuania**	2.7	**UK**	3.2	**Latvia**	8.3
Greece	1.6	**Romania**	2.7	**Netherlands**	3.5	**Bulgaria**	8.3
Netherlands	1.7	**Poland**	2.8	**Austria**	4.3	**Poland**	9
Slovak Rep.	1.7	**Malta**	2.9	**Finland**	5	**Belgium**	9.4
Czech Rep.	2	**Belgium**	3	**Croatia**	5.2	**Malta**	10.1
Germany	2	**Cyprus**	3.1	**Cyprus**	5.8	**Hungary**	10.5
France	2	**Bulgaria**	3.2	**Germany**	6	**Spain**	10.6
Spain	2.3	**Hungary**	3.2	**Sweden**	6.5	**Lithuania**	11
Latvia	2.3	**Slovenia**	3.3	**Slovak Rep.**	6.9	**Greece**	11.2
EU 27	2.3	**Estonia**	3.5	**Czech Rep.**	7.3	**Romania**	12.1
Finland	2.4	**Italy**	3.8	**Slovenia**	7.5	**Estonia**	12.9
				Portugal	7.5	**Italy**	13.5

Source: Muller et al (2013), Raczkowski and Mróz (2016)