



ISTITUTO DI STUDI E ANALISI ECONOMICA

The Changing Nature of the OECD Shadow Economy

by

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ABSTRACT

As recently suggested, the shadow economy and its determinants (taxation, regulations, corruption, etc.) are linked such that just two stable equilibria are possible. In the good one there is a small hidden sector, large fiscal revenues and honest/appreciated institutions. The other (bad) equilibrium is quite the opposite. Our paper examines the links between these variables in relatively uncorrupt systems. Unlike the mainstream literature, we suggest that a continuum of SE equilibrium rates can emerge and that taxation and underground activities can be positively correlated. Empirical evidence for OECD countries broadly supports the model.

Keywords: shadow economy; multiple equilibria; taxation; rule of law.

JEL Classification: H26, K42, O17.

NON-TECHNICAL SUMMARY

The Shadow Economy (SE) is of great importance for the economy because it has relevant repercussions on the many aspects of economic and social life of a country. Despite of that, only recently the economic literature addressed its pervasive nature.

In the spirit of Allingham-Sandmo (AS, 1972), the economic literature has been associating the presence of SE mainly with taxation - the bigger the tax burden, the greater the hidden income. Basically, tax evasion is a gamble taken by private agents and limited “public-sector” feedbacks are considered. Recently, another strand of the research (Johnson et al., 1997; Friedman et al., 2000) underlines the importance of institutional failures, such as excessive regulations, inefficiency of the bureaucracy and corruption. Its basic message is that there are links between SE and its causes such that just two extreme, stable, equilibria are possible. In the “good” one, a wide tax base and large public revenues are ruled by an efficient and uncorrupt government, which rises the costs to be underground (i.e. the expected penalty and the exclusion from appreciated public services). In this optimal situation, public institutions are honest and well functioning because sufficiently supported by large flows of public receipts. In the “bad” equilibrium, the spiral works in the opposite direction, unavoidably leading to inefficient and corrupt institutions operating side-by-side to a large irregular sector. In contrast to the AS framework, it implies that higher tax burdens can be associated with less SE.

Against this backdrop, we offer some additional theoretical considerations supported by an empirical analysis. The main novelty of our paper lies in arguing that moving away from the bad equilibrium may lead to different good equilibria. In fact, the recent literature focuses in particular on the bad equilibrium because it deals with underdeveloped/transitional countries, leaving unexplored important questions on uncorrupt governments’ choices. It motivates the present work. Since outside the bad equilibrium, in fact, these governments may prefer to be revenue-maximizing or tax rates minimizing. From the optimal SE ratio standpoint, government’s choices are clearly not neutral and may restore the AS positive relationship between tax rates and tax evasion. In addition, as for the revenue-maximizing case, we claim that important feedbacks between the variables emerge – good/large institutions need high tax rates/revenues and may incur in over-regulation; public expenditures may suffer from decreasing productivity in hampering the SE, calling for ever growing tax receipts. Thus, a relatively uncorrupt revenue-maximizing government may suffer from non-zero tax evasion both for taxation and for institutional reasons.

Our model raises important testable implications, when the experiments deal with relatively uncorrupt economic systems – i) honest bureaucracies may suffer from a significant share of SE, ii) higher tax rates can be associated with more SE, iii) the efficiency of the public sector could be positively related to SE, iv) capitalistic (i.e. with a small public sector) countries should show the minimum, although strictly positive, SE ratio. The first two items are in contrast to the institutional literature. In particular, the second implies that some situations may cause the AS tradition switching over the recent approach. The third suggests the presence of non linear relationships between some of the variables involved. The latter logically follows from the others.

The empirical analysis of the underground economy must be led and valued, by definition, very carefully. Therefore, while broadly confirming the theoretical model, the exercises here proposed can realistically offer only some indicative correlations. On the positive side, dealing with OECD countries we afford to perform panel estimations over several years. This is hardly found in literature, which is usually limited to cross-section analyses. Finally, what pointed out in this paper contributes to the ongoing debate, corroborating previous empirical results and offering new insights.

LA NATURA CANGIANTE DEL SOMMERSO NEI PAESI OCSE

SINTESI

L'economia sommersa è fenomeno pervasivo e permanente e l'analisi economica che la riguarda sembra potersi suddividere in due tronconi. Il primo si sofferma sulla relazione tra sommerso e tassazione. Il secondo, più recente, ha sottolineato l'importanza delle istituzioni economiche nel determinare il livello di economia in nero. La dicotomia discende, tra l'altro, dal fatto che l'approccio istituzionale è rivolto soprattutto ai paesi meno sviluppati, dove il potere di tassare è inversamente collegato al livello di corruzione presente nei poteri pubblici. Infatti, un suo interessante risultato empirico è che, analizzando anche i paesi più poveri, economia sommersa e aliquote fiscali mostrano una correlazione negativa. Il contrario di quanto teorizzato dal filone di ricerca nato quasi quarant'anni fa dai lavori microeconomici di Allingham e Sandmo. Inoltre, non avendo la possibilità di tassare, un paese non può finanziare istituzioni buone ed efficienti, il che, secondo i teorici "istituzionali", lo inchioda in un equilibrio cattivo.

Il nostro lavoro propone di allargare anche ai paesi appartenenti all'OCSE l'analisi istituzionale. Il motivo è capire quali sono, in paesi dotati di istituzioni relativamente poco corrotte e sufficientemente efficienti, le relazioni che possono instaurarsi tra alcune istituzioni economiche (le regolamentazioni dei mercati, la bontà dell'apparato burocratico, la tassazione, ecc) e l'economia sommersa. Un modello teorico e i risultati empirici sembrano convergere verso le seguenti indicazioni:

- anche le Pubbliche Amministrazioni più oneste possono avere una quota significativa di economia sommersa;
- nei paesi maggiormente industrializzati l'economia nascosta aumenta con la tassazione;
- l'efficienza delle Pubbliche Amministrazioni potrebbe essere correlata positivamente con il sommerso;
- tra i paesi maggiormente industrializzati, sono quelli maggiormente orientati verso il mercato (cioè quelli maggiormente capitalistici) a mostrare il minore livello (comunque non zero) di economia sotterranea.

Parole chiave: economia sommersa, equilibri multipli, tassazione, rule of law.

Classificazione JEL: H26, K42, O17.

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1 INTRODUCTION

The shadow economy¹ (SE) has several impacts on the economic system, some positive, some negative. Despite improvements and efforts (OECD, 2002), national accounts are still biased by the underground activities and this can mislead the policymakers. The SE affects the design of the national tax systems and triggers links between legal and illegal activities, it may impose constraints to the public revenues generation and, therefore, limit the provision of the public goods/services. On the positive side, the SE allows bypassing excessive regulations, provides an alternative social safety net, and may be the necessary first-step for training the new taxpayers. The SE is persistent and widespread in time and in space. According to the Schneider and Enste's survey (2000), during the last decades the underground sector was nearly three-quarters of the officially recorded GDP in Nigeria and Thailand, but it amounted to a noteworthy 15 percent in the OECD countries as well.

The mainstream literature on SE may be roughly divided into two clusters. The first associates the presence of SE mainly with taxation (Allingham and Sandmo, AS, 1972 and followers). An alternative, more recent, view underlines the importance of institutional failures such as excessive regulations, inefficiency of the bureaucracy and corruption (Johnson *et al.*, 1997; Friedman *et al.*, 2000, Rosser *et al.* 2003). The former points out that, *ceteris paribus*, the bigger the tax burden, the greater the hidden income in order to increase the disposable income. The latter points out that, just like another kind of tax, regulations are costly to be satisfied and can stimulate the 'quit option' (*i.e.* the decision to go underground). The efficiency of the public sector is then connected with the SE because a more efficient bureaucracy increases the expected value of the penalty and this lowers, other things being equal, the optimal level of SE. Furthermore, because of the bad government, a reduced quality and quantity of public services may discourage individuals from using these services and make them less willing to pay for them. It is important to observe that the above mentioned variables are strictly interrelated and that only some combinations of their values are possible. In fact, the recent literature

¹ The unobserved sector of the economy has nor a commonly accepted definition, neither a commonly used name. A plethora of terms suggestive of different situations (underground, subterranean, moonlight, hidden, irregular, shadow, black, informal, etc.) have been used to call it. We will indifferently use here some of them. Regarding to the definition, a good benchmark is worked out in 1993 by the System of National Accounts (SNA): the underground economy is the value-added activities that the official statistics do not register although they should (see also OECD, 2002). This definition seems to be sufficiently close to the kind of underground activity here studied, although there is no need for them to be equal given the different targets between the present work and the SNA.

shows that economic systems can be locked in two very different stable equilibria, one good and one bad. In the former, a wide tax base and large public revenues are ruled by efficient and uncorrupt governments, which rises the costs to be underground (*i.e.* the expected penalty and the exclusion from public services). On the other hand, public institutions are honest and well functioning because sufficiently supported by large flows of public receipts. In the latter, the spiral works in the opposite direction, unavoidably leading to inefficient and corrupt institutions operating side-by-side to a large irregular sector. This “system-wide” standpoint suggests that *higher* tax burdens could be associated with *less* SE which, actually, is an interesting empirical result of the institutional approach.

In line with this recent strand of the literature and motivated i) by the multifaceted nature and ii) by the widespread and enduring presence of a non trivial share of SE even in developed countries, we propose a simple model supporting some testable implications. The main novelty of our theoretical setting lies in arguing that, once escaped from the bad equilibrium, different good equilibria are possible. Unlike AS (and followers) and the institutional literature, this paper points out the effects of government’s choices on the private sector, with this latter reacting only to some extent. In fact, the AS tradition focuses especially on the private sector analysis. On the other hand, the institutional literature deals with private agents’ choices and their effects on the public sector, with the government modeled as a passive player. Possibly, this is so because this strand of the research is particularly interested in studying underdeveloped/transitional countries, likely lying in the bad equilibrium. However, it leaves unexplored important questions on uncorrupt governments’ choices, which may well actively prefer to be, *e.g.*, revenue-maximizing or tax-burden-minimizing. We want to fill this gap because, as for the SE equilibrium, government’s preferences are clearly not neutral. In addition, as for the revenue-maximizing case, we claim that important feedbacks between the variables emerge – good/large institutions need large revenues and may incur in over-regulation; on the other hand, public expenditures may suffer from decreasing productivity in hampering the SE, calling for ever growing tax receipts.

Our model raises important testable implications, when the experiments deal with relatively uncorrupt governments – i) even honest bureaucracies may chronically show a significant share of SE, ii) *higher* tax rates can be associated with *more* SE, iii) due to its necessary tax-funding, the efficiency of the public sector could be positively related to SE, iv) capitalistic (*i.e.* with a small public sector) countries should show the minimum, although strictly positive, SE optimal ratio. The first two items are in contrast to what claimed by the

institutional literature. In particular, the second implies that some situations may cause the AS tradition switching over the new approach. The third suggests the presence of non linear relationships between the variables involved. The latter logically follows from the others. Available data for OECD countries over fifteen years are somewhat coherent with our intuitions.

The paper is organized as follows. Sections II and III describe, respectively, the theoretical model and the data. Sections IV to VI explain and perform empirical tools and analyses. Concluding remarks and an appendix close the paper.

2 A SIMPLE THEORETICAL MODEL

The present model sketches out authority's and taxpayers' behavior, focusing on the relationship between SE, rule of law, labor market regulations and taxation. This model is different in several aspects and encompasses the existing ones in allowing multiple², actually infinite, equilibria that include the dichotomic situation described by Johnson *et al.* (1997) and by Friedman *et al.* (2000). Before proceeding, some word about corruption is necessary. If corruption is above a certain threshold, it becomes a special cause of underground economy, in the sense of eclipsing the weight of any other parameter of the taxpayers' maximand. In other words, once pushed underground because of the widespread corruption, agents do not worry about taxation or regulations paying, and feeling, bribes as a 'catch-all tax'. Empirical results by Johnson *et al.* (1997) support this view. Only a relatively high expected penalty could dampen the decision to go underground, but corruption undermines the legal system both directly and indirectly via lower government resources³. Also, as argued by Wei, corruption tax more than taxes because (Wei, 1997, p. 4): "corruption, unlike tax, is not transparent, not preannounced, and carries a much poorer enforcement of an agreement between a briber and a bribed. In other words, corruption embeds arbitrariness and creates uncertainty". Finally, corruption and intrusive regulations go hand in hand (De

² Other differences between this model and its predecessors will be mentioned throughout the paper.

³ Empirical studies report a negative correlation between the number of public officials involved in corruption and the level of the public wages (Tanzi, 1998). It can be read as a switch between tax receipts and bribes.

Soto, 1989; Djankov *et al.*, 2002) because, on the one side, pervasive regulations create room for bribing while, on the other side, a highly corrupt bureaucracy can generate intrusive and discretionary regulations as a means of realizing economic rents. Against this backdrop, the following analysis especially deals with relatively uncorrupt systems, where the effect of other determinants of subterranean activities could play some role. As for the main causes of the SE we maintain what suggested by the literature. In other words, we model the relationships between SE, taxation (t =tax rate, T =revenues), rule of law (r) and regulations (e) in relatively uncorrupt countries. We address it with a threefold analysis – i) how individuals affect and are affected by the variables; ii) how the variables affect each other; iii) how governments affect and are affected by the variables.

In our model, like in the Allingham-Sandmo framework, once decided to operate taxpayers must decide the amount of income to under-report⁴. This option depends on the relative expected costs (C) and revenues (R). The former is a positive function of the penalty times the probability to be caught (r), and of the share of hidden income (y). The assumption that all taxpayers operate regularly with some share of hidden income has the consequence that all taxpayers have access to publicly provided goods/services⁵. This situation is common in developed countries and explains why publicly provided goods are not in the cost function. On the other hand, some public good is not excludible; while some other is means-tested and should rather be in the revenues function. Finally, the presence of a share of completely underground taxpayers does not affect model's predictions. In the present model there is only one type of government outlay that can modify the optimal portion of hidden activity chosen by taxpayers (y^*) - by financing the rule of law, governments may increase the expected penalty and, *ceteris paribus*, may shrink y^* . Actually, some types of regulations⁶ could reduce y , but, unlike r , we assume that they

⁴ The hypothesis that tax rates are associated more with the tax evasion than with the labor supply is developed in the so called New Tax Responsiveness approach (Goolsbee, 1999).

⁵ This is different from existing models. In Johnson *et al.* (1997), the option faced by taxpayers is to be either totally regular, or totally irregular. In Friedman *et al.* (2000), firms can conceal a portion of their production diverting some of it in a lower productivity (underground) market. Some government resources, spent to enhance firms' productivity in regular markets, are in the entrepreneurs' maximand.

⁶ Some kind of regulation (*e.g.*, on the healthy and on the safety of the workers), can improve labour productivity. As in Friedman *et al.* (2000), in this model over-regulation does not generate public resources. However, unlike them, in this model over-regulation does not coincide with corruption. This is so because in our case over-regulation may be due to too big, but uncorrupt, bureaucracies.

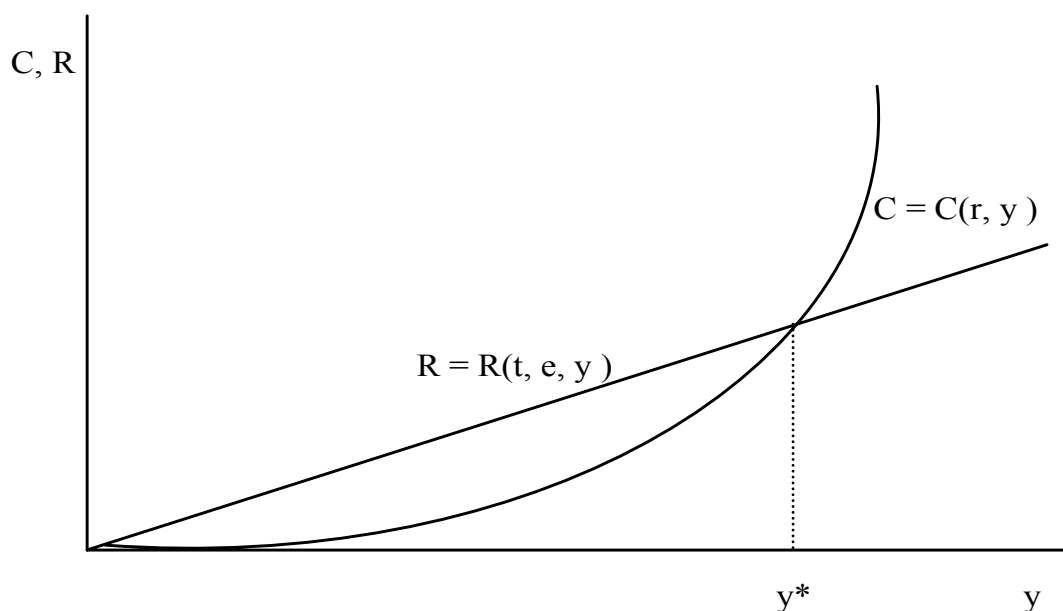
can be implemented for free. The costs of producing underground are supposed to be quadratic in y , increasing at increasing rates. This is so because, given r , diverting a growing amount of income could be easier and easier to be detected. Moreover, as argued by Cross and Shaw (1982), expenditures to learn about evasion activities are more and more costly for the taxpayer. So, y is not only easier and easier to be detected, but it is harder and harder to be concealed. The revenues depend on the tax rate (t), on excessive regulations (e), and on the share of SE. The tax rate measures the gain of hiding one unit of income so the total revenue from tax evasion is $t \cdot y$. As for e , the logic is that respecting regulations is costly and only declared income must conform to regulations. Otherwise stated, in the present setting e is just another sort of (linear) tax rate in disguise. The payoffs of being underground are assumed linearly increasing in the share of undeclared income, and the cost curve should cut the revenues line from below. More formally (using a widespread notation),

$$C = C(r, y) \text{ with } C(0) = 0; C_r > 0; C_y > 0; C_{yy} > 0$$

$$R = R(t, e, y) \text{ with } R(0) = 0; R_t > 0; R_y > 0; R_e > 0$$

$$\text{F.O.C. } y^* \quad C = R.$$

Fig. 1 Taxpayers' equilibrium



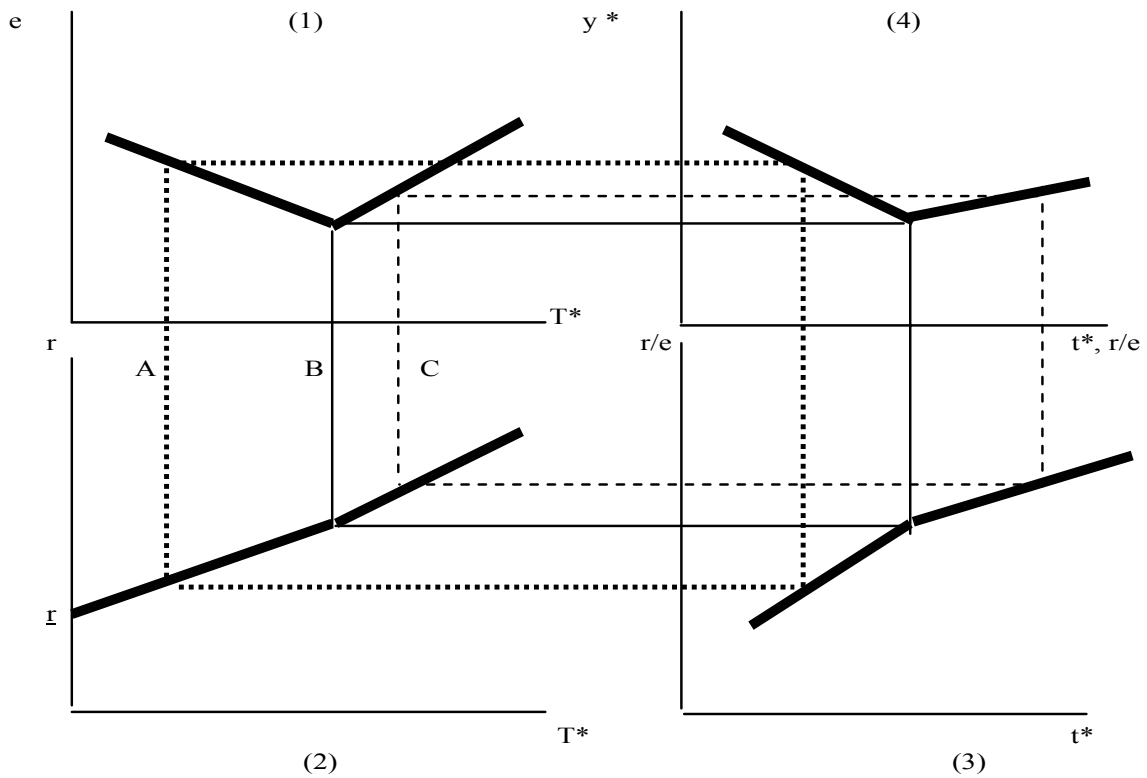
Note: Share of undeclared income (y^*) according to the exogenous arguments of the Costs (r =rule of law), and of the Revenues (e =regulations, t =tax rate) functions.

We assume that taxpayers take (e, r, t) as given. That is, they choose the optimal share of SE just to equate their relative marginal costs and revenues,

but not in order to modify (e, r, t) . Alike, taxpayers are supposed to be indifferent in paying the same amount of different combinations of taxes, expected penalties and license fees. Following an (exogenous) increase in the level of the tax rate, the revenue function becomes steeper and meets the cost function for a higher y^* .

Private sector's decisions are not the end of the story because of the complex links between all the involved variables. The following Figure 2 aims at helping the discussion, showing model-consistent (possible) combinations of the variables. It is important to note that it is a simultaneous qualitative (*i.e.* no metric) static representation of our conjectures.

Fig. 2 Potential Equilibria in the Shadow Economy



Legend: r =rule of law, e =regulations, t^* =Laffer-optimal tax rate, T^* =Laffer-optimal government receipts, y^* =equilibrium share of undeclared income.

In Figure 2 we highlight three kinds of equilibria⁷ (A, B, C) according to different but equally self-consistent values of the variables. While the position “A” may be thought of as being close to the bad equilibrium⁸ mentioned in the

⁷ We use a star (*) to indicate optimal values of the variables. T and t are ‘Laffer optimal’ (see the explanation in the main text).

⁸ A-equilibria must be seen as the situations with the highest share of SE. That is, in panel 4 of figure 2, there are not triplets (e, r, t) such that a C-equilibrium is above an A-equilibrium.

two-equilibria literature, situations such as B and C can not be addressed within that framework. In fact, working with a linear “ $y;T$ ” relationship, it argues that $y=0$ ($T=\max$) and $T=0$ ($y=1$) are the only two conceivable stable equilibria – a marginal move from an intermediate equilibrium will definitively attract the system in the bad or in the good equilibrium. We think that this view is too extreme and that other stable positions can be rationalized, when focusing on developed countries. To this end, we point out the presence of some peculiarities in the proposed relationships. As for the “ $e;T^*$ ” function (see Figure 2 – upper-left panel), we suppose the presence of a threshold level inverting the negative slope. The intuition behind is that above a certain value, government activity becomes so intrusive (from the ‘cradle to the grave’) that, despite its efficiency (see Figure 2 - lower-left panel), the *Bureau* just can not avoid over-regulating. For instance, public goods and services might be offered at prices lower than the market ones, leading to an excess of demand that needs to be regulated. In addition, the government’s size (in terms of T) may trigger over-regulations simply to justify its own presence. We then point out the presence of a threshold value for r (\underline{r}) and a positive connection between the institutional setting (r/e), the government revenues (T) and the tax rate (t). As for the former, in line with the bad-equilibrium story, we argue that at or below (\underline{r}) the government is just too much inefficient for collecting revenues by taxation. As for the latter, an explanation can be offered via an analysis *à la* Laffer. Let⁹ $T=t(1-y)$, and t^* =tax rate maximizing T ($T_{max} \equiv T^*$). Basically, for any given level of r/e , $t=t^*$ (and, accordingly, $T=T^*$) when the tax rate elasticity of y is one in absolute value. For $t < t^*$, a one percent increase in t improves T because y increases by less than one percent. The opposite applies when $t > t^*$. We can see the “ $r/e; t^*$ ” function as the higher envelope of the optimal points¹⁰ of the different Laffer curves created by growing values of the ratio r/e . The idea behind is that poor institutions reach the $(t^*; T^*)$ optimal point at very low levels of these variables, and their Laffer curve is very low. For $r/e \rightarrow 0$, $t^* \rightarrow 0$ and $T^*=0$, like in the $r \leq \underline{r}$ case (see Figure 2 – lower-left panel). If a country could

⁹ $(1-y)$ is the share of regular product (y_r) under the hypothesis that, once decided to operate, taxpayers just choose how much income to hide: $y+y_r=1$. Note that t does not impact on the level of total GDP, but only on y and y_r .

¹⁰ Panels (1) and (2) are drawn such a way that above-threshold values of T^* are associated with values of e and r such that r/e keeps increasing, although at a lower rate (see Figure 2 - panel 3). One may think to a decreasing marginal ‘productivity’ of r in terms of T^* and, as mentioned, to an ever growing over-regulation activity stemming from a bigger and bigger bureaucracy. For very high values of T^* , r/e becomes constant and then, possibly, decreasing.

afford to have a higher r/e it can, for any given t^* , collect higher T^* just because of the lower y . But the new equilibrium will probably have higher r/e , T^* and t^* . This is because above the threshold value for T^* , greater T^* are associated with r/e ratios which increase lesser and lesser until stop growing¹¹. In turn, it means that somewhere the growth of T^* must be related to greater tax rates¹².

The closing model question is to understand how governments establish the rules-of-the-game, that is the values of (e, r, t) . In other words, why governments should choose to stay in (or close to) an 'A-equilibrium' and not, for instance, in (or close to) a 'B-equilibrium'? We do not explicitly set up authorities' behavior, assuming that the values of taxpayers' parameters are determined by the government depending on historical, cultural, ethnical, geographical, political factors (Diamond, 1997; La Porta *et al.*, 1999; Torsten *et al.*, 2001; Guiso *et al.*, 2003) here not modeled. Otherwise stated, while bureaucracies actively try to modify the triplet (e, r, t) , they do that amid slow-motion exogenous constraints. Even if these factors are outside the model, and quite because of this 'degree-of-freedom', we are strongly tempted to speculate about them. A country which, because of its history, culture, etc., has very fragile and unfair institutions may opt (or simply can not avoid) to impose more bribes than taxes using a widespread network of regulations (A-equilibrium). A consolidated social democracy is likely to put more weight to the public revenues-maximization target, setting some combinations of taxpayers' parameters such that it stays near the C-equilibrium. A similar reasoning will lead a 'pure capitalistic' country to implement *laissez-faire* policies to reduce as much as possible the presence of the state in the economic system. Even this *minimum* state needs a strictly positive amount of public revenues, which leads to a non-zero SE optimum ratio (see Fig. 1). On the other hand, despite their very different fiscal environments, tax revolts are much more likely in a capitalistic country (e.g. in 1978 in the US) than in a Scandinavian social democracy. In sum, it is easy to imagine this country in a B-type equilibrium¹³. Each point of the kinked curve drawn in Figure 2 – upper-right panel - is a potential equilibrium because it is made by feasible/optimal combinations of the taxpayers' parameters (see also Fig. 1). Given the different 'speed of behavior' featuring bureaucracies and agents (with the latter much more flexible) a country may be, for instance, in a 'transition point' between A and B or between

¹¹ Actually, panel 4 of Figure 2 should have a third axis in order to show the area in which the behaviour of r/e and t^* diverges.

¹² See Friedman *et al.* (2000) for a different way to reach a similar conclusion.

¹³ Djankov *et al.* (2002) show empirically that countries with more democratic and more limited governments have lighter regulations.

B and C, etc. What is important here is that government's options and taxpayers' reactions reduce the number of possible combinations of the variables leaving, anyway, the room for several equilibria.

Our model raises important testable implications, when the experiments deal with relatively uncorrupt economic systems – i) even honest bureaucracies may chronically suffer from a significant share of SE, ii) *higher* tax rates can be associated with *more* SE, iii) the efficiency of the public sector could be positively related to SE, iv) capitalistic (*i.e.* with a small public sector) countries should show *minima*, albeit strictly positive, SE ratios. The first two items are in contrast to the institutional literature. In particular, the second implies that some situations may cause the AS tradition switching over the new approach. The third suggests the presence of non linear relationships between the variables involved. The latter logically follows from the others.

3 THE DATA SET

The collected data set consists of almost three-yearly (1990, 1993, 1995, 1998, 2000, 2003) panel of twenty-one OECD countries. We limit the data set to twenty-one OECD countries owing to data limitations for Turkey, for recent OECD members (transition countries, Korea, Mexico) and for smaller countries (Luxembourg, Iceland). While the choice to focus on OECD countries reduces the degrees of freedom, it also should reduce the heterogeneity of the countries under observation (see section 6), on the one hand, and it should increase the reliability of the data set, on the other hand. Finally and most importantly, it is more likely that other causes of the SE can emerge if countries are relatively uncorrupt, as the most developed ones should be (Mauro, 1995).

The panel data includes nine variables: the Shadow Economy as percentage of declared GDP (SE); GDP per capita at constant 1990 prices in US Dollars (GDP cap); an index of the Rule of Law (RoL); an index of Labor market Regulation (Reg); an index of corruption (CPI); the total tax revenues as percentage of declared GDP (T1); the taxes on personal income as percentage of declared GDP (T2); the Income tax, in percentage of gross wage, for single persons without children (T3); the employee contributions, in percentage of gross wage, for single persons without children (T4).

While we relegate further details on data sources and transformations in appendix 1, it is worth noticing that, unlike mainstream literature, we compute

the SE ratio as percentage of declared GDP. The logic to refer to ‘corrected’ tax rates runs as follows. National account data are, in OECD countries, ‘exhaustive’ (OECD, 2002). This is so because incomes are relatively easy to hide, consumption is not. Otherwise stated, GDP figures are comprehensive of the non-observed sectors via demand-side adjustments. Accordingly, the ‘real’ fiscal pressure on regular agents must be computed only on their income. Clearly, to the extent a part of the hidden activity remains outside the official GDP and/or agents are not completely (dis)honest, this procedure generates an overestimation of fiscal pressure. But, it is worth repeating, this error is likely to be lower than that resulting from not-corrected data. In the following table 1 we have organized the collected dataset according to some of the suggestions emerged in section 2.

Table 1 Averages over years 1990-2003. OECD Countries

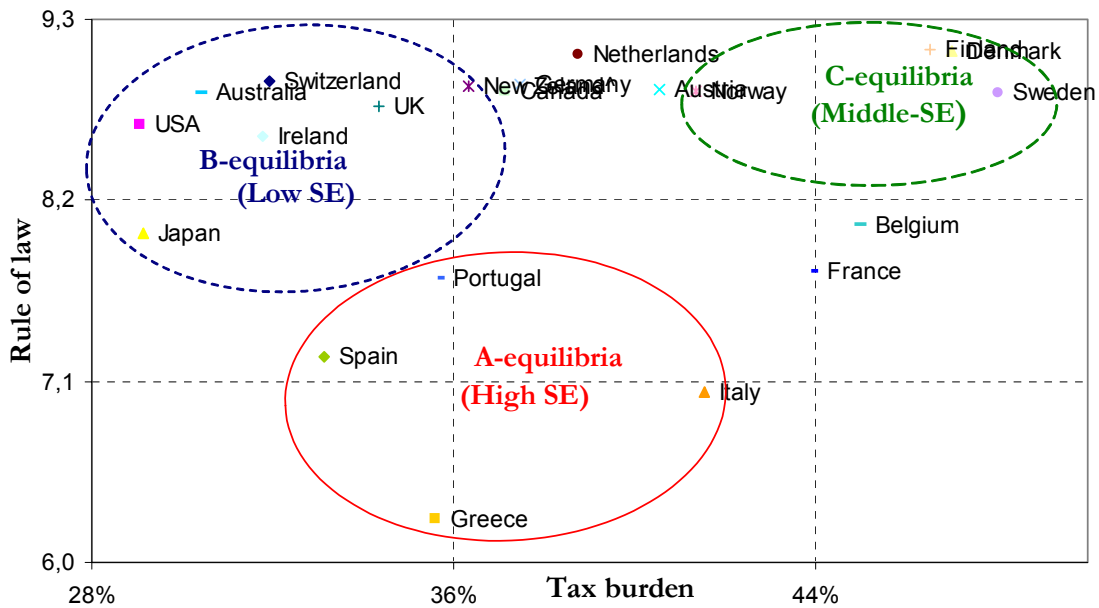
	Countries	SE	GDP cap	CPI	RoL	Reg	T1	T2	T3	T4
B	Switzerland	7.8	35115.2	8.80	8.9	6.4	31.9	10.7	10.2	28.2
B	USA	8.9	25488.7	7.67	8.7	7.2	29.1	10.9	17.9	7.8
B	Japan	10.1	26475.1	6.42	8.0	5.9	29.1	6.2	7.2	0.2
	Austria	10.5	23931.4	7.51	8.9	5.6	40.5	9.4	9.6	17.8
B	New Zealand	10.9	14335.5	9.33	8.9	7.7	36.3	14.5	21.4	9.4
	Netherlands	12.4	22245.6	8.56	9.1	6.3	38.7	9.1	8.4	6.2
B	UK	12.9	19687.5	8.56	8.8	7.1	34.3	10.4	16.9	0.0
	France	12.9	22650.4	7.42	7.8	5.8	43.9	6.7	12.0	6.5
B	Australia	13.2	21282.0	8.57	8.9	6.6	30.4	12.5	24.4	0.0
B	Ireland	13.7	19662.4	7.40	8.6	6.5	31.8	9.8	19.2	15.5
	Canada	14.6	22863.6	8.98	8.9	6.8	37.1	13.7	20.6	5.5
	Average B	11.1	23149.5	8.1	8.7	6.8	31.8	10.7	16.7	8.7
C	Denmark	14.8	29033.9	9.47	9.1	6.4	47.0	25.5	36.8	12.7
	Germany	15.9	23061.8	7.82	8.9	5.4	37.5	9.2	20.3	15.3
C	Norway	15.9	33214.5	8.85	8.9	6.0	41.3	11.1	21.9	8.8
C	Sweden	16.9	30354.8	9.14	8.8	5.9	48.0	18.8	27.7	2.8
C	Finland	17.0	28948.5	8.93	9.1	6.2	46.5	14.7	27.3	8.1
	Average C	16.2	30387.9	9.1	9.0	6.1	45.7	17.5	28.4	8.1
A	Portugal	18.1	8193.1	6.67	7.7	5.3	35.7	5.5	6.5	6.1
	Belgium	19.2	21926.8	6.70	8.0	5.8	45.0	14.0	27.0	13.5
A	Spain	20.5	15270.3	5.57	7.3	5.7	33.1	6.9	12.2	13.2
A	Greece	24.7	9086.1	5.27	6.3	4.7	35.6	4.5	2.1	19.9
A	Italy	24.9	21093.5	4.57	7.0	4.8	41.5	10.6	18.2	12.3
	Average A	22.1	13410.7	5.5	7.1	5.1	36.5	6.9	9.8	12.9
	Unweighted OECD	15.0	22567.2	7.7	8.4	6.1	37.8	11.2	17.5	10.0

Note: the first column (tentatively) indicates the type of equilibrium (see section 2). SE=Shadow Economy as percentage of declared GDP; GDP cap= real GDP per capita; CPI=index of corruption; RoL=index of the Rule of Law; Reg=index of Labor market Regulation; for CPI, RoL and Reg indexes vary from 1 to 10 (10=“better”); T1=total tax revenues as percentage of declared GDP; T2=taxes on personal income as percentage of declared GDP; T3=Income tax as percentage of gross wage, for single persons without children; T4=employee contributions, as percentage of gross wage, for single persons without children.

4 A PRELIMINARY CLUSTER ANALYSIS

Notwithstanding the obvious *caveats* surrounding the statistics referring to the SE and to variables such as Rule of Law, Regulation, etc., even from the simple observation of the data a number of stylized facts come out. They seem to be noteworthy and in line with the model's predictions.

Fig. 3: A, B, C - equilibria in OECD countries

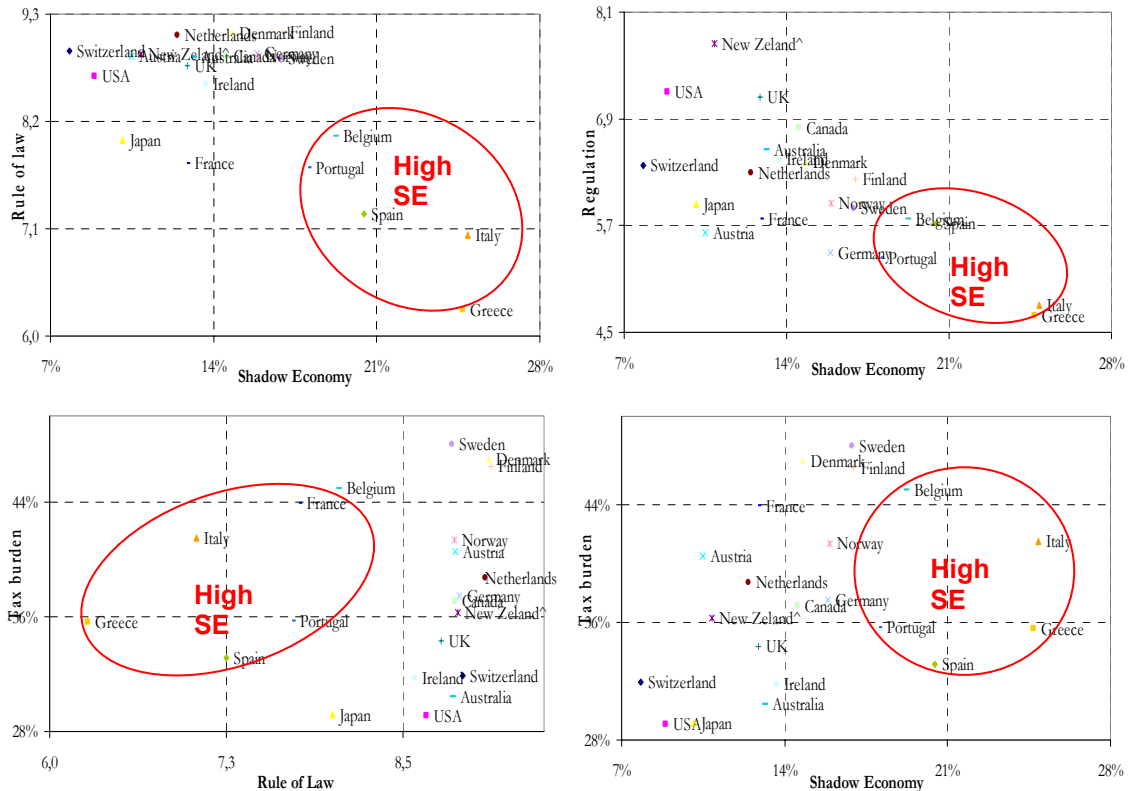


Note: The values of Rule of Law (Rol) and Tax Burden (T1) are drawn from table 1.

Data tell that SE ratios are large in Italy, Greece, Spain, Belgium, and Portugal. It holds both for different estimates of the SE and over the period 1990-2003. It is hard to think about an exclusively tax-induced SE in these countries because, as Figure 4 clearly shows (lower-right panel), they share a significantly lower tax burden than that imposed in Scandinavian economic systems. Much more suspicious-looking seems to be the weakness of the legal system and the intrusive labor market regulations (upper-side panels). The view that institutional failures can be more important than taxes in promoting the shadow economy is already present in the literature (Johnson *et al.* 1998, 1999; Friedman *et al.* 2000; and, for an intra-country analysis, Bovi and Castellucci, 2001). Following what suggested by Friedman *et al.* (2000) it can be said that only governments with a relatively good level of rule of law and economic

freedom can sustain high tax rates¹⁴. Recalling model's prescriptions and noticing that the tax rate correction exacerbates fiscal ratios, it is important to observe that countries with the largest SE have not the highest tax burdens, but the worst bureaucracies. The English speaking countries (United States, United

Fig. 4 The relative position of high shadow economy (SE) in OECD countries



Kingdom, Ireland, Australia, New Zealand and Canada) are featured by the lowest values of both SE, taxation and regulation burden in the sample. Thus, one can be tempted to say that these countries share B-equilibria (see also figure 3).

Data for the remaining OECD countries show other possible combinations of the indicators suggesting that, summing up: i) the theoretical framework set up in section 2 seems to be congruent with the data set; ii) the nature of the SE changes across the most developed countries; iii) even among the most developed countries, none of them can avoid to live together with some strictly positive share of underground economy.

¹⁴ In passing, it is noteworthy that in the Southern part of Italy the tax wedge is smaller and the shadow economy is larger than in the rest of the country (Bovi and Castellucci, 2001).

5 THE PANEL DATA MODEL

The *prima facie* evidence of an association between the SE and its hypothesized causes suggests going on with a more rigorous econometric analysis. Panel analysis provides a powerful method to test empirically the theoretical hypotheses. It allows considering both the space and time dimension of the data. Alternative types of panel model specification can be suitable for our analysis. In contexts like this one, the usual question is the individual specific effects should be assumed to be fixed (Fixed effects model) or random (Random effects model). According to Baltagi (1995), the fixed effects model is the appropriate specification if the analysis is focusing on a specific set of N units and the inference is restricted to the behavior of this set of units. The Random effects model, on the other hand, is an appropriate specification if we are drawing N individuals randomly from a large population and want to draw inferences about the entire population. In light of these arguments, a fixed effects model is the proper specification in our case.

In the subset of Fixed effects models can have constant slopes but intercepts that differ according to the cross-sectional unit (country). In other words, there are significant differences among countries but no significant temporal effects. A more general fixed effects panel model allows the intercept to vary across country and over time. In equation 1, we formally describe a regression model with n-1 country dummies and t-1 time dummies:

$$y_{it} = \sum_{j=1}^N \alpha_j DC_{ij} + \sum_{j=1}^{T-1} \delta_j DT_{jt} + x'_{it} \beta + \varepsilon_{it} \quad (1)$$

with:

$$i = 1, 2, \dots, 21 ; t = '90, '93, '95, '98, '00, '03 ; DC_{ij} = \begin{cases} 1 & \text{if } i = j \\ 0 & \text{otherwise} \end{cases} \text{ and } DT_{jt} = \begin{cases} 1 & \text{if } j = t \\ 0 & \text{otherwise} \end{cases}$$

An important assumption in these models is the independence of the explanatory variables and the random error components. In this case the regressors are said to be 'exogenous' and are assumed to be determined outside the model. Failure of this assumption may lead to biased or inconsistent estimates. A usual technique for dealing with variables that are correlated with the error term (endogeneity) is to instrument them. Valid instruments must i) be uncorrelated with the error term and ii) explain part of the variability in the endogenous regressors. In our setting these requirements are quite demanding.

A potentially useful, and sometimes used, data set is that developed by La Porta *et al.* (1999). However, they suggest instruments such as type of religion, latitude, type of colonization, etc., whose variation in time does not allow constructing proper endogeneity tests. While this prevents addressing causality issues, the proposed experiments can offer some support to model's predictions. Moreover, it is worth noticing that the institutional indexes (CPI, Reg and RoL), are to some extent predetermined by construction (see Appendix 1), shrinking the simultaneity problem. As for the other variable, the tax burden, we try to get robust results taking advantage of three different measures. Then, unlike other works, we perform F-tests to select the best model as for the presence of time and/or space differences in our panel. All in all, it means that the empirical efforts we propose can realistically offer only some indicative correlations, which, however, is enough for consolidating our theoretical suggestions.

In our empirical models, all variables are taken in logarithmic transformation. y_{it} = [Shadow Economy as percentage of declared GDP] and x_{it} = [GDP per capita; Index of corruption; Index of the Rule of Law; Index of labor market Regulation; Total tax revenues as percentage of declared GDP; taxes on personal income as percentage of declared GDP; Income tax, in percentage of gross wage, for single persons without children; Employee contributions, in percentage of gross wage, for single persons without children].

6 THE ECONOMETRIC EVIDENCE

In this section, we empirically test some of the predictions of the theoretical framework set up in section II. First of all we have to verify if the selected OECD countries are relatively uncorrupt, that is if their SE shares are orthogonal to the corruption index. Table 2 lists the main results of the "corruption" experiment.

All reported regressions are modeled including, thus controlling for, fixed countries and time effects (see equation 1). This is so because this kind of model is the "final winner" of a battery of pooling tests, comparing all the possible pairs of alternative models. We omit to report the dummies for the sake of brevity and replicate the econometric procedure for three models (called I, II, III, in the following tables) according to the three alternative kinds of tax burdens. The goodness-of-fit statistic is quite comforting and a general

evaluation of the estimated equations shows that all the estimated correlations are robust to variations in the covariates. Moreover, trials without GDP per capita as control variable give similar outcomes¹⁵. So, we are somewhat reassured that we are studying uncorrupt “above threshold” economies. However, and this is our point, relatively uncorrupt does not mean to be totally regular and, according to our model, these systems may well show associations with other SE-triggering variables. This is confirmed by table 2. In particular,

Table 2 Correlations between Shadow Economy and its causes in OECD countries

Dependent Variable: share of Shadow economy on declared GDP			
MODELS			
Regressors	I	II	III
GDP per capita	-0.08	0.15	0.19
Corruption	-0.03	0.09	0.18
Rule of Law	1.19**	1.48***	1.54**
Regulation	-0.28	-0.38	-0.35
T1	0.51**		
T2		0.43***	
T3			0.11*
T4			-0.10
Adjusted R ²	0.726	0.734	0.700
# Observ.	126	125	106
F-tests for Pooling	I	II	III
Fully pooled model Vs Fixed country effect	F-stat=5.00*** d.f. (20,100)	F-stat=6.87*** d.f. (20,99)	F-stat=5.54*** d.f. (18,81)
Fully pooled model Vs Fixed time effect	F-stat=7.93*** d.f. (5,115)	F-stat=14.46*** d.f. (5,114)	F-stat=10.31*** d.f. (5,94)
Fixed country effect Vs Fix. country & time eff.	F-stat=3.71*** d.f. (20,95)	F-stat=3.62*** d.f. (20,94)	F-stat=3.19*** d.f. (18,76)
Fixed time effect Vs Fix. country & time eff.	F-stat=3.73*** d.f.(5,95)	F-stat=3.97*** d.f.(5,94)	F-stat=3.30*** d.f.(5,76)
Fully pooled Vs Fix. country & time eff.	F-stat=5.30*** d.f.(25,95)	F-stat=7.11*** d.f.(25,94)	F-stat=5.67*** d.f.(23,76)

***Denotes significant at 1% level; ** Denotes significant at 5% level; * Denotes significant at 10% level. All variables are log-levels. There are three country and time effects models (I, II, III) according to the three different tax burdens (T1; T2; T3 and T4). Dummies not reported. Other details under table 1.

unlike what emphasized by the institutional literature, all the experiments point out that tax burdens are *positively* correlated with the SE. Also, the elasticity with respect to the rule of law is positive, suggesting that the uncorrupt OECD countries are, on average, on the increasing “developed-economy” part of Figure 2 (*i.e.* the less-elaborated part of the two-equilibria theory). Although with the expected sign, the index of labor market regulation is statistically not different from zero over the three model specifications.

¹⁵ They are available upon request.

The second group of econometric exercises we present (table 3) aims at comparing estimates obtained by considering, separately, countries characterized by the highest (A and C countries) and the lowest (B countries) level of SE in the sample¹⁶. The logic behind is that, due to the high tax burden of C-countries and to the bad institutional setting of A-countries, one should expect a greater sensitivity of SE to its causes in the former cluster.

Table 3 Shadow Economy and its causes in OECD countries. Sub-sample space analysis

Dependent Variable: share of Shadow economy on declared GDP						
MODELS						
Regressors	H-SE (I)	H-SE (II)	H-SE (III)	L-SE (I)	L-SE (II)	L-SE (III)
GDP per capita	-0.72	-0.22	-0.39	-0.06	0.10	0.35
Rule of Law	1.49**	2.07***	1.74*	-0.40	0.43	1.43
Regulation	0.21	-0.35	0.17	-0.40	-0.40	-0.40
T1	1.13**			0.39*		
T2		1.77***			0.24	
T3			0.22			0.29
T4			-0.14			-0.09
Adjusted R²	0.574	0.639	0.403	0.611	0.609	0.590
# Observ.	60	59	53	66	66	53

Results are obtained by considering two separate panels: H-SE are OECD countries with the highest level of SE as % of declared GDP (Italy, Greece, Spain, Belgium, Portugal, Finland, Sweden, Norway, Germany, Denmark); L-SE are OECD countries with the lowest level of SE as % of declared GDP (Switzerland, USA, Japan, Austria, New Zealand, Netherlands, United Kingdom, France, Australia, Ireland, Canada). F-tests suggest country and time effects for all the three models (dummies and F-tests not reported). Other details under tables 1 and 2.

The estimates collected in table 3 indicate that the fit of the regressions for sub-panels are broadly similar for five out of six models (but H-SE, III). As for the coefficient and in terms of figure 2, L-SE countries are close to the B-equilibrium. That is, they cluster around the “corners” of the panels, which may explain why they show (almost) no significant correlations. While not significant, it is worth noticing that the GDP per capita coefficients are greater in the H-SE experiments than in the L-SE ones. This is somewhat expected due to the lower homogeneity of the A+C group as compared to the B team. Furthermore, confirming our a priori, both the tax burden and the rule of law coefficients are large, positive and significant for high-SE countries. Otherwise stated, even

¹⁶ Referring only to A- or C-countries would dramatically reduce the degrees of freedom and, in turn, the reliability of the estimates.

among uncorrupt (good-equilibrium?) countries, data reveal different elasticities¹⁷ of tax and institutional variables with respect to the SE. Finally, results show the increase (decrease) in the magnitude of the taxation and RoL coefficients for High (Low) SE countries with respect to the pooled case (see table 2). All in all, these robust¹⁸ findings are coherent with the model's prescriptions.

7 CONCLUDING REMARKS

In this paper some considerations about the underground wealth of “uncorrupt” nations have been organized in a graphical analysis, with some attempt to test them. The proposed theoretical model suggests that there are critical thresholds that produce many different equilibrium states. Each of these states has a different optimal level of the SE ratio, which may be of any size, but zero. Thus, the model enriches the suggestions of previous works (Johnson et al., 1997; Friedman et al., 2000; Schneider, 2003), which argued for the existence of just two extreme stable equilibria, according to the level of the SE. We argued that if the corruption level is below threshold, countries move away from the bad (high SE) equilibrium but, unlike what suggested by the existing works, they may end up with different “good” equilibria. The kind of good equilibrium achieved depends on government choices which, in turn, depend on historical, cultural, etc. exogenous factors. Also, the fiscal and institutional environment where private agents operate is not explicitly designed to have a zero-SE ratio. Otherwise stated, the disparate attitude of policymakers towards taxation, efficiency/pervasiveness of the bureaucracy, etc., leads the private sector to hide a peculiar share of income. This optimal choice, in turn, impacts on the public side of the economic system. As a consequence, both the level and the nature of the equilibrium SE ratios may be different in relatively uncorrupt countries.

¹⁷ An empirical confirmation of this statement is provided by Scandinavian countries where, tax rate, size of public sector, are higher than Mediterranean countries (e.g. Italy, Greece, Spain) but their levels of (estimated) SE are lower (Dell'Anno and Schneider, 2003). Alike, due to its worse local institutional setting, in the Southern part of Italy the tax wedge is smaller and the shadow economy is larger than in the rest of the country (Bovi and Castellucci, 2001).

¹⁸ Similar results, available on request, are obtained without controlling for per capita GDP or adding the index of corruption (statistically not significant in each and every experiment).

The empirical analysis of the underground economy must be led and valued, by definition, very carefully. The lack of valid instruments hampers intriguing normative discussions. For instance, as emphasized by the proposed theoretical model, the underground economy can reduce government resources and this can lead to a more inefficient bureaucracy. Thus, it is far from clear that the correlation is causal. While this means that the empirical results are not suitable for normative implications, the proposed exercises can realistically offer some indicative correlations. On the positive side, what pointed out in this paper contributes to the ongoing debate, corroborating previous empirical results and offering new insights. Then, we have controlled for the presence of significant differences across countries and over time. This is hardly found in literature. Last but not least, the empirical analysis of relatively uncorrupt economic systems (which should share the most reliable/comparable data) is congruent with our theoretical setting – i) even honest bureaucracies may chronically show a significant share of SE, ii) higher tax rates can be associated with more SE, iii) due to its necessary tax-funding, the efficiency of the public sector could be positively related to SE, iv) capitalistic (i.e. with a small public sector) countries should show the minimum, although strictly positive, SE optimal ratio.

APPENDIX 1: DATA SOURCES

The sources of the data are: Schneider (2005a, 2005b) for SE; United Nation Statistical on-line database for 'GDP per capita at constant 1990 prices in US Dollars'; the Transparency International on-line database¹⁹ for Corruption; Gwartney and Lawson (2005) for 'Rule of Law' and 'Labor market regulation'; the OECD Revenue Statistics (2005) for T1 and T2; OECD Taxing Wages (2006) for T3 and T4. Further, the data spans from 1990 to 2003, *i.e.* there are 48 observations for each country. However, due to the logarithmic transformations of the data and to 13 missing values (T2_{Finland,1993}; T3_{Australia,1990}; T3_{Australia,1993}; T3_{France,1990}; T4_{Australia,1990}; T4_{Australia,1993}; T4_{Australia,1995}; T4_{Denmark,1990}; T4_{Germany,1990}; T4_{Italy,1990}; T4_{Italy,1993}; T4_{Portugal,1990}; T4_{Portugal,1993}) the sample is reduced to 22 observations. Accordingly, the final unbalanced panel used for estimating equations (1) consisted of a cross-section of 21 countries over 6 time periods.

Data on the Shadow Economy for OECD countries are available from different sources and different methods²⁰. Considering that it is difficult to evaluate the SE estimates, because full scope information for these types of estimates is never available, any evaluation of reliability of SE estimates methodologies to estimate SE is incomplete. Needless to say, no method has imposed itself as being clearly superior to the others. Aware of these limitations, this work uses the estimates published by Schneider (2005a) for the years 1990, 1995, 2000 and Schneider (2005b) for the years 2002 and 2003. This article collects different sources and different methods (Currency demand approach in combination with Dynamic Multiple Indicators Multiple Causes approach). For a fuller treatment of these subjects we refer the reader to the cited paper and Schneider and Enste (2000). According to the treatment of T1 and T2, even the SE is calculated as percentage of declared GDP:

$$\frac{SE_{i,t}}{gdp_{i,t}^{decl}} = \frac{\alpha_{i,t}}{1 - \alpha_{i,t}}$$

where: $\alpha_{i,t}$ are the Schneider's estimates of SE as percentage of official GDP.

Data on 'GDP per capita' at constant 1990 prices in US Dollars are available form United Nation Statistical on-line database.

¹⁹ <http://www.icgg.org/corruption.index.html>

²⁰ This way to proceed is usual in literature. Widely cited works analyses the black economy aggregating several sources of data (e.g. Friedman *et al.*, 2000; Schneider and Enste, 2000).

The Corruption Perceptions Index (CPI) published by the Transparency International ranks several countries according to the extent of corruption from 1995. CPI relates to perceptions of the degree of corruption as seen by businesspeople, risk analysts and the general public and ranges between 10 (perfectly clean) and 0 (highly corrupt). Corruption Perceptions Index is annually published from 1995. The missing data in the years 1990 and 1993 are substituted respectively by the averages over the period '88-'92 and '92-'94.

Data on the 'Rule of Law' are available from the Fraser Institute, which elaborates an index running from 0 to 10 (lower numbers mean worse legal environment). In particular, we use as proxy of RoL the Area 2 of the Index of Economic Freedom, so called 'Legal Structure and Security of Property Rights' published by Gwartney and Lawson (2005) (data retrieved from www.freetheworld.com). The missing data in the years 1993 and 1998 are substituted respectively by the averages over the period '90-'95 and '95-'00. The key ingredients accounted by this index are: rule of law, security of property rights, an independent judiciary, and an impartial court system Gwartney and Lawson (2005, p. 7).

Data on 'Labor market Regulation' are also available from the Fraser Institute. This index running from 0 to 10 (lower numbers mean worse regulation). This index considers several kinds of restrictions that entry into labor market and interferes with the freedom to engage in voluntary exchange. The second (5B) considers labor-market regulations infringe upon the economic freedom of employees and employers (e.g. minimum wages, dismissal regulations, centralized wage setting, extensions of union contracts to non participating parties, unemployment benefits that undermine the incentive to accept employment, and conscription (Gwartney and Lawson 2005, p. 8). The missing data in the years 1993 and 1998 are substituted respectively by the averages over the period '90-'95 and '95-'00.

Data on total tax revenues and taxes on personal income are published by OECD (2005). T1 and T2 are derived by the original data according the following formula:

$$\frac{T1_{i,t}}{gdp_{i,t}^{decl}} = \frac{\beta_{i,t}}{1 - \alpha_{i,t}}$$

where: $\beta_{i,t}$ are the published data on OECD (2005) and $\alpha_{i,t}$ are the Schneider's estimates of SE.

The second set of tax burdens is extracted by Taxing Wages (OECD, 2006). The personal income taxes, in percentage of gross wage, for single persons without children are extracted by table D.2. This sample has missing

data in the year 1990. We use for 1990 the averages over the period 1989-1991.

Finally, the employee contributions, in percentage of gross wage, for single persons without children are calculated as difference between table D.3 and table D.2. There are missing data in the years 1990 and 1998. They are substituted respectively by the averages over the period '89-'91 and '97-'99.

The measurement of the tax burden is subject to controversy: '*all current measures reviewed have at least some important shortcomings.*' (OECD, 2000, p. 3). Just to mention, which is the tax rate pushing people underground? Is it the top or the average tax marginal rate? And what about tax reliefs, allowances, etc.? We use OECD data because OECD periodically computes statistics on tax burdens that, at least, allow reliable cross-country comparisons for several years. Some of these tax burdens are here used as alternative measures to improve the robustness of the findings.

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