Comparative fiscal illusion: A fiscal illusion index for the European Union

Dell'Anno, Roberto and Dollery, Brian

Department of Economics and Statistics; University of Salerno – Via Ponte Don Melillo, Fisciano (SA) 84131 – Italy, School of Business, Economics and Public Policy; University of New England - Armidale NSW 2351 - AUSTRALIA

9 November 2012

Comparative fiscal illusion: A fiscal illusion index for the European Union

Roberto Dell'Anno (corresponding author)

Department of Economics and Statistics

University of Salerno – Via Ponte Don Melillo, Fisciano (SA) 84131 – Italy

rdellanno@unisa.it

Brian Dollery

School of Business, Economics and Public Policy

University of New England - Armidale NSW 2351 - AUSTRALIA

bdollery@une.edu.au

Abstract: This paper provides an empirical analysis of fiscal illusion by estimating an index of fiscal illusion for 28 European countries over the period 1995–2008 employing a structural equation approach. Using MIMIC models, the paper investigates the main indicators of fiscal illusion and develops an index of fiscal illusion. It concludes that the chief deteninants for the deployment of fiscal illusion strategies are the share of self-employment on total employment, the educational level of citizens, and the size of tax burden. At the same time, policy makers attempt to 'conceal' the real tax burden by means of debt illusion, fiscal drag, wage withholding taxes, as well as taxes on labour.

JEL Classification: *H3, H8, 052.*

Keywords: *Fiscal illusion; Financial illusion; MIMIC model; European countries.*

1. Introduction

One of the many consequences of the protracted global financial crisis has been a stark realisation that there is a pressing need for greater accountability in public finance, especially in terms of public sector indebtedness (Tirole 2011). In particular, it is widely recognised that governments should offer transparent reports of revenue-raising and expenditure activities at the national level, as well as for the different levels of government in multi-tiered systems. In this context, the question of fiscal illusion can play a pivotal role since the real costs of public sector activity may not be apparent to citizens. Fiscal illusion refers to a systematic misperception of fiscal parameters and an associated pattern of over- and under-estimation of expenditure and taxation liabilities which is persistent, recurring and consistent through time and which gives rise to biases in budgetary decisions at all levels of government. Fiscal illusion can take many forms. For instance, tax illusion might arise from the use of debt to finance centrsal government budget deficits since taxpayers might be unaware of the full tax liabilities they will incurr in future.

A useful, albeit nascent, empirical approach to this problem resides in the estimation of indexes of fiscal illusion (see, for instance, Mourão 2008) or its converse in transparency indexes (see, for example, Alt and Lassen 2006). Well-constructed indexes of this kind allow for international comparisons of different countries. They are thus a useful tool for public policy makers since they provide a means of adjuding the relative importance of fiscal illusion in a given polity. This paper falls squarely into this embryonic empirical tradition.

A robustly constructed index of fiscal illusion has several distinct benefits. In the first place, the construction of an index of this kind requires careful empirical assessment of the different putative factors involved in fiscal illusion. An empirical excercise along these lines is valuable from a policy perspective because it serves as a method of discovering which factors are important and which are extraneous to fiscal illusion. Secondly, the process of carefully constructing an index obliges us to acquire numerical estimates of the relative importance of those factors that do influence fiscal illusion, a useful line inquiry in its own right. Thirdly, a comparative index of fiscal illusion may serve to alert the public and policy makers alike not only as to the acuteness of the problem, but also where a given country stands in relation to its trading partners. Transparency of this kind may, in itself, provoke a more effective policy response to disprelling or at least ameliorating fiscal illusion.

We employ a data drawn from sample of 28 European countries for a period fourteen years, extending from 1995 to 2008, in order to investigate structural incentives for deploying methods of obscuring the real costs of government, to develop several indicators of fiscal illusion, and then to construct an index of fiscal illusion for the sample of European countries. The empirical analysis employs Structural Equation Modelling (SEM) and the Multiple Indicators Multiple Causes (MIMIC) modelling techniques.

The paper is itself divided into three main parts. Section 2 provides a brief review of the empirical analysis of fiscal illusion. Section 3 discusses the data, models and results of the empirical estimations in three discrete components: sub-section 3.1 outlines the SEM and the MIMIC methodologies adopted in the estimation procedures, as well as the models used; sub-section 3.2 considers the problem of the most apposite explanatory variables and plausible *a priori* expectations; and sub-section 3.3 details the procedures followed for constructing the index of fiscal illusion. The paper ends in section 4 with some short concluding comments.

2. Approaches to Fiscal Illusion

In essence, the fiscal illusion hypothesis holds that, in real world democratic polities, the benefits and costs of governmental activity may be misconstrued by citizens, who will typically under-estimate the costs involved. Although the intellectual genesis of this proposition goes back at least as far as J. R. McCulloch (1845) in his *Treatise on the Practical Influence of Taxation and the Funding System,* Puviani (1903) has dominated the traditional approach to fiscal illusion, which has been developed further by other scholars, most notably Buchanan (1967) and Wagner (1976), writing in the same tradition.

For much of its history the empirical analysis of fiscal illusion has been largely directed at revenue-raising rather with public expenditure activities or public regulation. Wagner (1976) has identified five specific hypotheses traditionally investigated in the empirical analysis of fiscal illusion: (a) the revenue-complexity hypothesis, where the misperception of the tax/price stems from the fragmentation of the revenue system; (b) the revenue-elasticity hypothesis, where growth in revenue is associated with income elastic forms of taxation; (c) the flypaper effect, where lump-sum intergovernmental grants have a stimulatory effect on public expenditure; (d) the renter illusion hypothesis, where fiscal illusion is depends on the extent of property ownership in a given jurisdiction; and (e) the debt illusion hypothesis, where public awareness of the extent public expenditure depends more on current taxation than debt financing. These hypotheses essentially explore the mechanisms which can explain the existence of fiscal illusion. Dollery and Worthington (1996) have provided a detailed survey of empirical work on fiscal illusion.

In addition to this established corpus of work, a new embryonic strand of the empirical literature has drawn on the original insights developed by Puviani (1903), which centred on the notion that political elites may deliberately design a fiscal system so as to conceal the real burden it imposes and thus minimise resistance to such revenue-raising. In essence, this nascent approach seeks to identify the fiscal instruments which best facilitate 'obscuring' the real fiscal burden. Following on the work of Puviani (1903), Buchanan (1967) consideredvarious methods which can be deployed to enhance the opacity of the fiscal system degree of fiscal illusion, such as revenue-raising through a complex array of many taxes rather a few significant levies, and the exploitation of political events as 'scare tactics' to justify additional imposts. In an empirical application of this line of thought, these factors can be embodied in Herfindahl-type indexes, which can facilitate the study the fiscal illusion by examining its composite explanatory variables. The present paper falls squarely in this tradition.

In an analysis of the intellectual foundations for this approach, Mourão (2008) has observed that empirical analysis along these lines, which constructs fiscal illusion indexes, 'allows for research on the role of illusory practices by politicians to achieve their particular aims deceiving specific electorates'. In addition, it demonstrates that 'despite being an old idea, primarily suggested in 1903, fiscal illusion is a phenomenon that persists in democratic countries, conditioning their economies, mainly their fiscal aggregates'. Mourão (2008) has provided a helpful synopsis of the relevant literature. The resulting indexes of fiscal illusion can provide useful 'benchmarks' for evaluating the comparative performance of different democratic countries, discerning long-run trends, and uncovering good governance practices in minimising fiscal illusion. The present paper seeks to contribute to this embryonic empirical literature (Dell'Anno and Mourão 2012) by developing a fiscal illusion index.

3. Empirical Analysis

Section 3 outlines the empirical methodology, model specification and construction of the fiscal illusion index. With respect to the country sample, the (unbalanced) panel used for estimating MIMIC model consists of a cross-section of 28 countries (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom) over a 14 year period (1995-2008) using 10 variables for a total of 3778 observations. All variables, except the Free Press Index, are measured as percentage points. Definitions and data sources are provided in Appendix A.

The empirical analysis of fiscal illusion follows the Dell'Anno and Mourão (2012) approach. The main methodological contribution of this paper lies in the application of robust estimators to deal with the problem of non-normality (Jöreskog et al. 2000). A Robust Maximum Likelihhod empoirical approach is considered a superior strategy to include non-normality in moderate sample size work. The second contribution derives from the structure of dataset, which has a more wide-ranging time dimension than Dell'Anno and Mourão (2012). It thus allows us to estimate the dynamics of the fiscal illusion process in the European Union[1] instead of simple average scores for each country.

3.1 The SEM and the MIMIC approach

Structural Equation Models are based on statistical relationships among latent (i.e. unobservable) and manifest (i.e. observable) variables. The SEM approach is an extension of the general linear model that simultaneously estimates relationships between multiple independent, dependent and latent variables. In this sense, the SEM includes factor analysis and multivariate regression as special cases. It thus integrates two important aspects of economic analysis: (a) variable measurability and observability and (b) the causal relationship between them.

In this paper, a special case of the SEM is considered: the Multiple Indicators and Multiple Causes model. The MIMIC model derived its name from Jöreskog and Goldberger (1975). It was introduced into economic analysis by Weck-Hannemann (1983) and it has been applied to the analysis of shadow economies.[2]

---

[1] In the 1995, the European Union was enlarged to 15 member states.

[2] Following Weck (1983), other economists have used this approach in the statistical analysis of the shadow economy, including Frey and Weck–Hannemann (1984), Schneider (2005), Dell'Anno (2007), Dell'Anno et al. (2007) and Dell'Anno and Solomon (2008).

The measurement model defines the relations between a latent variable (fiscal illusion) and its indicators and a structural model which specifies the casual relationships between a latent variable and its causes. The measurement equation in matrix notation is given by:

$$\underset{(d\times 1)}{y} = \underset{(d\times 1)}{\lambda}\underset{(1\times 1)}{F} + \underset{(d\times 1)}{\varepsilon}\ , \tag{1}$$

where the latent variable (F) determines linearly, subject to disturbances $\varepsilon' = (\varepsilon_1, \varepsilon_2, ...\varepsilon_d)$, a set of d endogenous indicators $y' = (y_1, y_2, ..., y_d)'$. The covariance matrix of the measurement errors, ε, is given by the matrix[3] Θ_ε. Furthermore, λ is a $(d\times 1)$ column vector of regression coefficients that relate y to F.

Equation 2 is a structural equation, which shows that the unobserved variable F is determined linearly by the x set of exogenous causes $(x_1, x_2, ..., x_c)$. Because the structural equation model only partially explains the latent variable, the structural disturbance error term, ζ, represents the unexplained component. β is a $(1\times c)$ vector of structural coefficients describing the "causal" relationship between F and its causes. In matrix notation, it is written as:

$$\underset{(1\times 1)}{F} = \underset{(1\times c)}{\beta'}\underset{(c\times 1)}{x} + \underset{(1\times 1)}{\zeta}\ . \tag{2}$$

Without loss of generality, all of the variables are considered to carry zero expectations. $\left[E(F) = E(x) = E(y) = 0\right]$, and the variance of the structural disturbance term ζ is abbreviated by Ψ. The MIMIC model also assumes that (a) $E(\zeta) = E(\varepsilon) = 0$ error terms do not correlate with the causes $\left[E(x\zeta) = 0\right]$; (b) the error terms in the measurement model do

[3] In the standard MIMIC model (Jöreskog and Goldberger 1975), the measurement errors are assumed to be independent of each other, but this restriction could be relaxed (Stapleton 1978). In this analysis, several covariances between indicators are relaxed since they are empirically and theoretically plausible. Figure 1 shows some of these estimated covariances.

not correlate either with the causes $\left[E\left(x\varepsilon'\right)=0\right]$ or with the (c) latent variable $\left[E\left(F\varepsilon'\right)=0\right]$; and, finally, (d) measurement errors do not correlate with structural disturbances $\left[E\left(\varepsilon\zeta\right)=0\right]$.

From equations (1) and (2) and the use of the definitions the MIMIC model can be solved for the reduced form as a function of the observable variables x and y, as shown in equation 3:

$$y = \Pi' x + z\,, \tag{3}$$

where $\Pi = \lambda\beta'$ is a $c \times d$ reduced-form coefficients matrix and has rank one expressed in terms of c and d elements of structural and measurement coefficients; and $z = \lambda\zeta + \varepsilon$ is a reduced-form disturbance vector with $z \sim \left(0, \Omega\right)$, where the reduced form of the covariance matrix is given by

$$\underset{(d\times d)}{\Omega} = \underset{(d\times 1)}{\lambda}\,\underset{(1\times 1)}{\Psi}\,\underset{(1\times d)}{\lambda'} + \underset{(d\times d)}{\Theta_{\varepsilon}}\,. \tag{4}$$

Assuming multivariate normality, the maximum-likelihood estimates of the parameters are calculated by minimizing the discrepancy between the empirical covariance matrix, S, and the covariance matrix implied by the model Ω (Jöreskog 1967):

$$F_{ML} = \ln\left|\Omega\right| + tr\left(S\Omega^{-1}\right) - \ln\left|S\right| - \left(d + c\right), \tag{5}$$

where "|.|" indicates the determinant of a matrix, *tr* indicates the trace, *d* is the number of observed endogenous indicators (*y*), and *c* is the number of observed exogenous causes (*x*). The necessary condition for identification is that the number of structural parameters should be equal to the number of reduced-form parameters. An observation of the reduced-form parameters shows that unique solutions to the structural parameters λ and β cannot be obtained from the reduced-form model. This situation exists because altering the scale of F yields an infinite number of solutions to λ and β from the same reduced-form solution. This inability to obtain unique solutions to λ and β causes an identification problem, which can be resolved by fixing the scale of the unobserved variable. This is the sufficient condition for identification, which can be achieved by constraining one of the paths from the latent variable to one of its indicator (reference) variables, by assigning the value of 1.0 to this path. This procedure anchors the latent variable to the reference indicator.[4]

In this analysis, the coefficient of the measurement equation is selected following two criteria. From a statistical point of view, evaluating the measurement equations is preferable to selecting the regression with the highest R^2 among alternative MIMIC specifications. From an economic perspective, it is desirable to opt for the indicator of fiscal illusion with the most sound theoretical justification. According to both criteria, the best choice is to fix as reference variable with the (positive) coefficient of the equation that regresses the latent variable on the public debt as a percentage of GDP (λ_2=1). However, to check robustness of results to alterantive indicators we also use as reference variable the "Withholding taxes from wages" (λ_6=1).[5]

3.2 Observable structural causes and indicators of fiscal illusion

As we have seen, growing literature exists on the empirical analysis of strategies to distort taxpayers' perception of the tax burden (Dollery and Worthington 1996). Combining this literature with data availability, we specify the MIMIC model. The rationale behind the selection of the observed variable is a key issue for our empirical approach. As stated by Duncan (1975), the meaning of the latent variable, and hence the reliability of the estimates of the fiscal illusion index, depend on how comprehensively the causal and indicator variables correspond to the intended content of the latent variable. In particular, taking into account data availability, four main structural causes which enhance the efficacy of fiscal illusion, and five

[4] An alternative is to fix the variance of the unobserved variable F at unity.

[5] We find that estimated parameters are robust.

main categories of policies capable of distorting taxpayers' perceptions of their tax burdens, are chosen.

With respect to possible "causes", they are hypothesized to make it easier for a policy maker to exploit, with a greater efficacy, fiscal illusion mechanisms. In particular, the structural model includes the relationships between fiscal illusion (F) and the following variables: self-employment (x_1); political pressures and controls on media content (x_2); tertiary school enrolment (x_3) and the tax burden (x_4). We now consider each of these in turn:

X_1 Self-employment: The first cause is argued to be the ratio between self-employed workers and the total employed population. Following Fasiani (1941), the higher the ratio, the more visible the tax burden because more "active" tax compliance is required for these workers than for employees *ceteris paribus*. This result occurs because, for the self-employed, the system of withholding income tax allows for discretionary behaviour. A further reason to support a positive sign for this coefficient is related to the shadow economy. Self-employed persons are involved in tax evasion and underground economic activities more than employees (see, for instance, Dell'Anno et al., 2007). Thus, in countries with a higher share of self-employment, government has greater incentives to create misperceptions of the tax burden in order to reduce tax evasion and/or to bring those economic activities back into the official economy (i.e. by reducing the costs of operating officially).

H1: We expect the self-employment rate to be positively correlated with fiscal illusion because self-employed persons have both a greater awareness of tax burden and they may operate (or move into) in the unofficial "shadow" economy. Thus higher self-employment rates increase policy maker's incentives to distort the perception of the tax burden (β_1>0).

X_2 Political pressures and controls on media content: The second observed variable that may improve the efficacy of fiscal illusion strategies are political pressures and controls on media content, as estimated by Freedom House. This variable takes into account the possibility of citizens not getting distorted information about expenditure and tax revenue policies. It seems reasonable that, the greater the freedom of the media from political pressure (i.e. the lower the index score), the lower fiscal illusion.

H2: We expect the political pressures and controls on media content to be positively correlated to fiscal illusion because it becomes an easier task for a policy maker to distort the perception of the tax burden if the media do not provide individuals' with accurate information ($\beta_2>0$).

X_3 Tertiary school enrolment: The third potential cause of fiscal illusion takes into account the ability of a society to correctly evaluate beneficiaries of both tax reforms and public expenditure programs. In assuming that this ability can be inferred from the education level of citizens, we consider the percentage of people in the total population who have completed tertiary education.

H3: We expect the level of education to be negatively correlated to fiscal illusion because higher education reduces the effectiveness of the fiscal illusion policies. Thus, policy makers have less incentive to distort taxpayers' perceptions ($\beta_3<0$).

X_4 Tax burden: Finally, we include tax revenue as percentage of GDP as a proxy for the policy maker's need to reduce the perception of tax pressure. The relationship between taxation and fiscal illusion is not regarded as a unidirectional causal relationship as these variables are endogenously determined. On one hand, taxpayers paying higher taxes (usually) oppose further increases in taxation. Therefore policy makers have a greater inducement to hide the tax burden. On the other hand, greater fiscal illusion makes easier for politicians to increase the tax burden, and thus the causal relationship works in reverse.[6]

H4: We expect the tax burden to be positively correlated with fiscal illusion because a higher (effective) tax burden encourages a government to adopt tax policies aimed at increasing fiscal illusion and greater fiscal illusion decreases the electoral cost of larger tax revenues ($\beta_4>0$).

With respect to the measurement model, it includes some of the most common strategies to reduce citizens' perceptions of their tax burdens. From a statistical point of view, the number of indicators has a relevant role in assigning reliability to the SEM approach. It is well known that unacceptable solutions (i.e. negative variance estimates, also known as "Heywood cases") can occur frequently in SEM if a sufficient number of good indicators is not provided. To take into account this caveat, up to six alternative observable indicators of fiscal illusion are included in the model. In particular, the measurement model links the following six indicators to the unobservable variable: y_1 - inflation rate (fiscal drag); y_2 - public debt (Ricardian equivalence hypothesis); y_3 - ratio between indirect and direct tax revenues (Mill's hypothesis); y_4 - Herfindahl index of revenue (complexity of tax system); y_5 - Implicit tax rate on labour and y_6 - Withholding tax on labour income (i.e. size and visibility of withholding tax on wages and salary income, respectively). We briefly examine each of these in turn:

Y_1 Inflation rate: This indicator takes into account misperception of the tax burden due to monetary illusion. In this case, ruling elites may stimulate price inflation to devalue the claims of creditors of the state (and/or in a progressive tax system), with rising nominal earnings

[6] This evidence may suggest that tax revenue should be included in the model among both the causes and indicators of the latent variable. However, it cannot be done due to perfect collinearity. Thus we checked information loss as consequence of excluding tax revenue as potential indicator of fiscal illusion. Regressing the tax burden on the existing six indicators, we found that four of six indicators have statistically significant coefficients and explain about 20% of the tax revenue variance. In this sense, the exclusion of tax revenue from measurement model is partially accounted for by these variables.

resulting in higher real tax burdens (i.e. fiscal drag). To encompass this method of implementing fiscal illusion, we include the annual average rate of change of harmonized indices of consumer prices.

H5: We expect the inflation rate to be positively correlated to fiscal illusion because individuals do not (immediately) realise increased tax burdens due to increased prices (λ_1>0).

Y_2 Public Debt: A common strategy to create fiscal illusion is to use public debt. The argument here is that taxpayers are more likely to perceive the cost of public programs if they pay for them through current taxation than if tax liabilities are deferred through public-sector borrowing (Oates 1988).

H6: We expect public debt to be positively correlated with fiscal illusion because the Ricardian equivalence hypothesis does not hold (λ_2>0).

Y_3 Tax complexity: The third indicator of misperceptions of tax liabilities is the complexity of the tax system. Following Wagner (1976), we estimate the Herfindahl index of the revenue system (H). A normalized version of H-index is computed in order to range the scores from 0 to 100. In symbolic terms: $\left(H^* = \left[\left(H - \frac{1}{n}\right) \Big/ \left(1 - \frac{1}{n}\right)\right] * 100\right)$, where $H = \sum_{i=1}^{n} t_i^2$, t_i is the revenue share of tax *i* in the tax system, and *n* is the number of taxes.[7] For this proxy, a higher value means a less complex revenue system.

H7: We expect the Herfindahl index to be negatively correlated to fiscal illusion because, other things equal, the more complicated the revenue system, the more likely it is that the taxpayer will underestimate the tax burden (λ_3< 0).

---

[7] According to Oates (1988), the results from the various studies of the revenue-complexity hypothesis are mixed. For instance Clotfelter (1976) found no evidence that the Herfindahl index affects fiscal illusion. Moreover, Pommerehne and Schneider (1978); Dollery and Worthington (1999); Sausgruber and Tyran (2005); Mourão (2008), Dell'Anno and Mourão (2012) find evidence supporting this hypothesis.

Y_4 Share of indirect taxation: The third variable included as indicator of fiscal illusion is the "Mill hypothesis", according to which the fiscal extraction through indirect taxation is underestimated compared to direct taxation, because it is less visible to the taxpayers. The "Mill' hypothesis" (1848), stressed by Schmölders (1960) and Buchanan (1967), represents one of the most common forms by which the policy maker reduces the perceived sacrifice of the taxpayers.

H8: We expect the share of indirect taxation to be positively correlated with fiscal illusion because, the more tax revenue is concealed in market prices, the more likely it is that the taxpayer will underestimate the tax burden ($\lambda_4 > 0$).

The fifth category of indicators is related to withholding taxes on wages and salary income. Withholding taxes are a very common method of collecting income taxes. Each pay period an employer is required to withhold tax from each employee's gross salary and send it to the public exchequer. According to the literature (Enrick 1964; Wagstaff 1965; Berry and Lowery 1987), a revenue system heavily reliant on withholding taxes from wages leads taxpayers to underestimate their tax burdens. For Buchanan (1967), the withholding of income for tax payments is the first "modern" tool for generating (optimistic) illusions. Whilst withholding has the advantage of simplifying tax compliance, it does not allow the worker to fully perceive the percentage of their income withheld, thereby limiting their ability to determine their degree of participation in the funding of public goods and services.

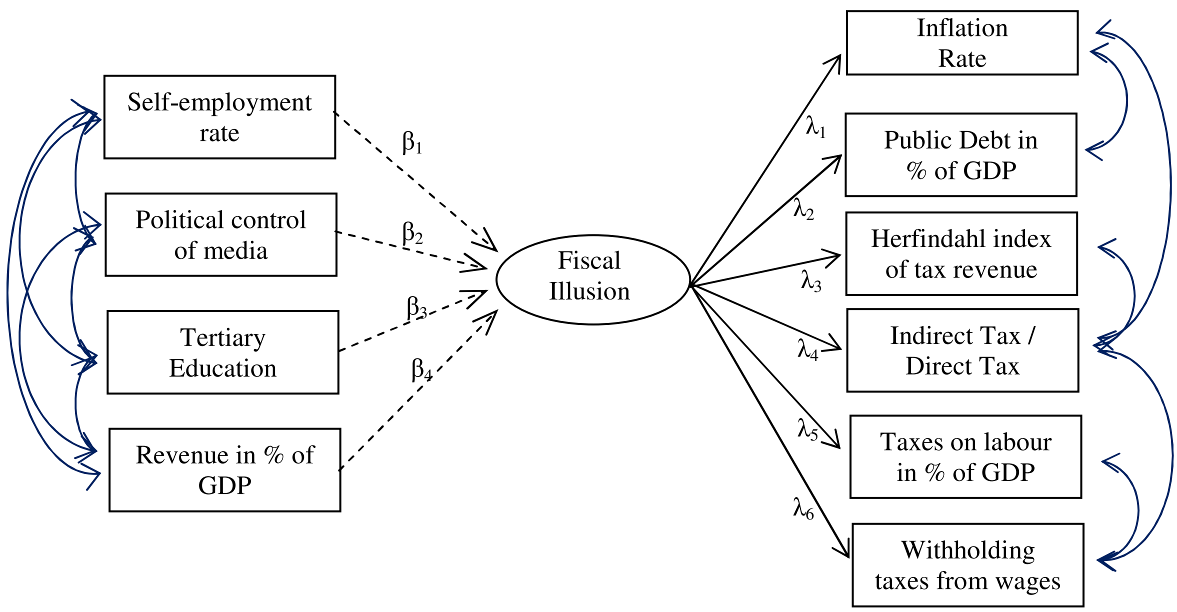
To take into account this phenomenon, two variables are included: the (implicit) tax rate on labour and the ratio between taxes on labour of which on employed paid by employers and taxes on labour of which on employed paid by employees.

Y_5 Tax rate on labour. H9: We expect the tax rate on labour to be positively correlated with fiscal illusion because the larger is the tax revenue collected from labour, greater is the relevance of the withholding system ($\lambda_5 > 0$).

Y_6 Withholding taxes from wages. H10: We expect withholding taxes from wages to be positively correlated with fiscal illusion becuause a higher value of the ratio means less visible taxation (λ_6>0).

Figure 1 shows the path diagram of the most inclusive MIMIC model specification. It includes four "Causes" - 1 latent variable – and six "Indicators" (hereinafter termed MIMIC 4-1-6)[8].

Figure 1: Path Diagram MIMIC 4-1-6



Once we have specified the model according to economic theory, the second step is to test the presence of unit roots in the data. Following Granger and Newbold (1974), it is well established that the non-stationarity of variables can lead to spurious regressions. As a result, we carried out unit root tests on variables to establish whether the variables were stationary or not. According to Levin and Lin (1993), testing for the unit root in panel framework is more powerful compared to performing a separate unit root test for each individual time series. We

[8] The arrows that link some indicators and some causes indicate that the MIMIC model estimates covariances among structural and measurement errors. The rationale for these covariances is theoretically based.

apply the Levin-Lin-Chu (LLC) test (Levin et al. 2002), the Fisher-ADF test and the Fisher-PP test (Maddala and Wu 1999; Choi 2001). Table 1 reports the results of panel unit root tests.

Table 1: Panel Unit Root Tests

	Variable	**Lag length** (test specification)	**Levin, Lin & Chu**§ t-statistic	**ADF–Fisher**° Chi-square	**PP–Fisher**° Chi-square
X_1	Self-employment rate	0 to 1 (trends + intercepts)	-6.96*** (0.000)	82.40** (0.012)	66.13 (0.167)
X_2	Political control of media	0 to 2 (intercepts)	-5.51*** (0.000)	114.00*** (0.000)	199.31*** (0.000)
X_3	Tertiary Education	0 to 1 (trends + intercept)	-6.61*** (0.000)	69.26 (0.110)	66.44 (0.160)
X_4	Revenue in % of GDP	0 to 2 (intercepts)	-4.54*** (0.000)	99.36*** (0.000)	71.82* (0.076)
Y_1	Inflation rate	0 to 1 (intercepts)	-8.65*** (0.000)	115.08*** (0.000)	130.80*** (0.000)
Y_2	Public Debt in % of GDP	0 to 1 (trends+ intercepts)	-3.785*** (0.000)	73.31* (0.060)	71.35* (0.081)
Y_3	Herfindahl index of tax revenue	0 to 2 (trends+intercepts)	-4.49*** (0.000)	99.94*** (0.000)	93.50*** (0.000)
Y_4	Ind Taxes/dir taxes	0 to 2 (intercepts)	-4.06*** (0.000)	78.36** (0.026)	58.58 (0.381)
Y_5	Taxes on labour in % of GDP	0 to 1 (trends+ intercepts)	-3.36*** (0.000)	60.67 (0.311)	75.41** (0.043)
Y_6	Withholding taxes from wages	0 to 1 (trends+ intercepts)	-6.33*** (0.000)	84.08*** (0.009)	83.33** (0.010)

§Null Hypothesis: Unit root (assumes common unit root process); °Null Hypothesis: Unit root (assumes individual unit root process). ****Denotes significant at 1% level;* ***Denotes significant at 5% level;* **Denotes significant at 10% level. P-values are in parenthesis. The lag length is based on Akaike information criterion. Newey-West automatic bandwidth selection and Bartlett kernel are applied.*

Based on the Levin-Lin-Chu (2002) tests, we conclude that these series do not have a common unit root. Looking at the presence of individual unit root, ADF and PP tests reveal that all variables, except the tertiary education and public debt, are stationary.

The final step to make SEM approach suitable to the panel structure of the data set is to transform observed variables as deviations from the mean values of the respective countries calculated over the sample period. This manipulation verifies the hypothesis that all of the variables have zero expectations. $\left[E(F)=E(x)=E(y)=0\right]$, since the variables have the same mean (zero) for each country. This method makes SEM amenable to analysing heterogeneity across cross-sectional units in the MIMIC model. This approach is motivated by the relevance of country fixed effects in our model.[9] According to this analysis, the deviations from the means of countries are estimated as follows:

$$x^*_{jit} = \left(x_{jit} - \overline{x}_{ji}\right); \; y^*_{jit} = \left(y_{jit} - \overline{y}_{ji}\right), \tag{6}$$

where j = 1, 2,…, 10 indicates the observed causes and indicators variables; i = 1, 2,…, 28 denotes the countries; and t = 1995, 2001,…, 2008 specifies the time period. Table 2 shows the estimates of alternative MIMIC specifications.

By testing multivariate normality, we find that this hypothesis does not hold in our models. Thus maximum likelihood (ML) estimates of standard errors and chi-squares may be incorrect. In these instances, it may be best to use weighted least squares (WLS). This method requires a very large sample so that the asymptotic covariance matrix of the sample can be estimated accurately. However if the sample size is not sufficiently large, the WLS estimator will perform less satisfactorily than ML (Muthén and Kaplan, 1985, 1992). According to Olsson et al. (2000), WLS provide estimates and fit indexes close to the those obtained for ML only for sample sizes larger than 1000. As our sample has less than 350 cases, we consider WLS estimates as a robustness check on ML only. Other approaches to non-multivariate normality have been proposed by Jöreskog et al. (2000). One approach is to normalize the variables before analysis through normal scores (NS-ML). Asecond approach is to use scaled chi-square and “robust” standard errors employing the method developed by Satorra and Bentler (1994), known as the Robust Maximum Likelihood estimator (RML). According to Hu et al. (1992) and Curran et al. (1996), RML is the best approach to dealing with nonnormality in small samples (i.e. lower than 500).

Table 2 shows parameters estimated for alternative MIMIC specifications and estimators.[10]

[9] To support this choice we apply the following stepwise approach: 1) Factor analysis is applied to estimate the scores of latent variable on the measurement model; 2) the factors used to explain the covariance structure of the observed data are unobserved, but we estimated them from the loadings and observable data. These factor score estimates are used as substitutes for the higher-dimensional observed data; 3) Estimated factor scores are used as dependent variables for three panel regressions in which the independent variables are the four “causes” of MIMIC model (structural equation). For each of these regressions we performed Redundant Fixed effects tests. According to Likelihood tests, the cross-country fixed effect are statistically significant. This implies that cross-unit fixed effects have to be included in the model specification.

[10] We estimated several MIMIC specifications to check the robustness of the index with different sets of observed variables. The estimates proved robust. Omitted outputs will be provided by authors upon request.

Table 2: MIMIC models and parameter estimates

	4-1-6a				4-1-6b				4-1-5				3-1-5			
Causes	**ML**	**RML**	**NS-ML**	**WLS**	**ML**	**RML**	**NS-ML**	**DWLS[1]**	**ML**	**RML**	**NS-ML**	**WLS**	**ML**	**RML**	**NS-ML**	**WLS**
Self-employment Rate	0.82*	1.00*	1.00*	0.48	1.15*	0.79*	0.79*	0.55	0.94*	1.00*	1.00*	0.65	1.07*	1.02*	1.02*	0.60*
	(4.48)	(4.58)	(5.24)	(1.36)	(4.44)	(2.60)	(4.22)	(1.73)	(4.75)	(4.64)	(5.44)	(1.90)	(5.07)	(4.75)	(5.52)	(2.13)
Political contr. of media	0.24*	-0.03	-0.03	-0.13	0.33*	0.02	0.02	0.05	0.18	0.04	0.04	-0.14	--	--	--	--
	(2.56)	(-0.24)	(-0.20)	(-0.85)	(2.55)	(-0.25)	(-0.20)	(0.36)	(1.77)	(0.34)	(0.28)	(-1.18)				
Tertiary Education	-0.21*	-0.30*	-0.30*	-0.38*	-0.30*	-0.24*	-0.24*	-0.24*	-0.27*	-0.27*	-0.27*	-0.36*	-0.33*	-0.27*	-0.27*	-0.29*
	(-2.98)	(-2.85)	(-3.65)	(-3.81)	(-2.97)	(-2.56)	(-3.24)	(-2.27)	(-3.47)	(-2.65)	(-3.45)	(-4.14)	(-3.92)	(-2.66)	(-3.47)	(-3.45)
Revenue in % of GDP	0.54*	0.72*	0.72*	1.28*	0.76*	0.57*	0.57*	0.56	0.63*	0.71*	0.71*	0.97*	0.69*	0.72*	0.72*	0.85*
	(5.49)	(5.24)	(5.74)	(3.45)	(5.41)	(3.33)	(4.47)	(1.77)	(5.97)	(5.07)	(5.88)	(4.50)	(6.27)	(5.18)	(5.98)	(5.05)
Indicators																
Inflation rate	0.98*	0.30*	0.30*	-0.02	0.69*	0.38*	0.38*	0.21*	0.76*	0.33*	0.33*	0.65	0.66*	0.33*	0.33*	0.07
	(5.35)	(2.34)	(4.42)	(-0.53)	(5.97)	(2.29)	(3.95)	(2.35)	(5.11)	(2.44)	(4.55)	(1.90)	(4.94)	(2.43)	(4.54)	(1.52)
Public Debt in % of GDP	1.00	1.00	1.00	1.00	0.71*	1.26*	1.26*	1.15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
					(5.85)	(3.57)	(5.18)	(1.78)								
Herfindahl index of tax revenue	0.07*	-0.01	-0.01	0.00	0.05*	-0.02	-0.02	-0.03	--	--	--	--	--	--	--	--
	(3.84)	(-0.86)	(-0.91)	(0.03)	(5.85)	(-0.82)	(-0.90)	(-1.18)								
Indirect Taxes/ direct taxes	-1.15*	-0.72*	-0.72*	-0.90*	-0.82*	-0.90	-0.90*	-0.66	-0.82*	-0.60	-0.60*	-0.14	-0.71*	-0.60	-0.60*	-0.65*
	(-3.78)	(-2.33)	(-3.09)	(-3.32)	(-3.53)	(-1.90)	(-2.67)	(-1.34)	(-3.05)	(-1.85)	(-2.37)	(-1.18)	(-2.91)	(-1.84)	(-2.37)	(-2.20)
Taxes on labour in % of GDP	0.22*	0.19*	0.19*	0.16*	0.16*	0.24*	0.24*	0.31*	0.20*	0.21*	0.21*	0.36*	0.18*	0.20*	0.20*	0.22*
	(6.59)	(5.01)	(7.21)	(6.07)	(7.50)	(3.47)	(5.60)	(2.51)	(7.00)	(4.98)	(7.03)	(4.14)	(7.00)	(4.97)	(7.04)	(6.14)
Withholding taxes from wages	1.41*	0.79*	0.79*	-0.57*	1.00	1.00	1.00	1.00	1.17*	0.86*	0.86*	0.97*	0.93*	0.85*	0.85*	0.13
	(5.85)	(3.57)	(5.18)	(-3.15)					(5.63)	(3.58)	(5.17)	(4.50)	(5.24)	(3.55)	(5.15)	(0.60)
Statistics																
χ^2	275.03	127.40	203.11	138.60	275.03	127.40	203.11	128.21	155.12	68.39	113.52	51.63	131.44	91.34	91.34	33.18
Degree freedom	24	24	24	24	24	24	24	24	17	17	17	17	13	13	13	13
χ^2(*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
RMSEA	0.164	0.105	0.138	0.111	0.164	0.105	0.138	0.105	0.144	0.088	0.121	0.072	0.153	0.124	0.124	0.063
R^2 (Struct. eq.)	0.34	0.35	0.35	0.35	0.34	0.35	0.35	0.29	0.37	0.39	0.39	0.33	0.38	0.39	0.39	0.30

Notes: t-Statistics are given in parentheses. * Means |t-statistic|>1.96.
The degrees of freedom are determined using the expression 0.5(d+c)(d+c+1)–t, where "d" is the number of indicators, "c" is the number of causes, and "t" is the number of free parameters.
[1] We report Diagonally Weighted Least Squares (DWLS), as WLS does not converge to proper solutions.

χ^2 is a classic goodness-of-fit measure to determine overall model fit. A small χ^2 is a sign of a good model fit. However, the χ^2 test is widely recognized to be problematic (Jöreskog 1969). It is sensitive to sample size, and it becomes more and more difficult to retain the null hypothesis as the number of cases increases. The χ^2 test may also be invalid when multinormal distributional assumptions are violated, as in this analysis, leading to the rejection of good models or the retention of bad models. Due to these drawbacks of the χ^2 test, many alternative fit statistics have been developed, one of the most widely used statistics being the *Root Mean Square Error of Approximation* (RMSEA) proposed by Steiger and Lind (1980). RMSEA incorporates a penalty function for poor model parsimony and thus becomes sensitive to the number of parameters estimated and relatively insensitive to sample size (Brown 2006). A rule of thumb is that RMSEA ≤ 0.05 indicates a close approximate fit, values between 0.05 and 0.08 suggest a reasonable error of approximation, and RMSEA > 0.10 suggests poor fit (Browne and Cudeck 1993).

According to earlier results, the indexes of overall goodness of fit reveal a relatively poor fit with exception of 4-1-5 RML and 3-1-5-WLS. This result is explained by the fact that the variability of the indicators is not exclusively caused by the latent variable (fiscal illusion). The empirical evidence is provided by low values of the R^2 for measurement equations ($R^2<0.40$). Supplementary exogenous variables certainly affect to the latent variable in addition to the influence of fiscal illusion[11]. Accordingly, the goodness of fit statistics MIMIC 4-1-5 RML is deemed the preferable specification. It has the best goodness of fit in term of R^2 for the structural equation (0.39) and lowest RMSEA (0.088).

[11] In regression analysis, the omission of relevant variables can lead to biased coefficient estimates. To take into account this issue, the correlations between errors of the different equations of the measurement and variables of the structural model are included in the model estimation. It implies we specify a non-diagonal covariance matrix of the measurement errors Θ_{ε} and structural disturbances Ψ.

Estimated structural and measurement coefficients of this model have the expected signs, with exclusion of Herfindhal index of the complexity of tax system[12] and the ratio between indirect and direct revenue[13] that are statistically insignificant.

3.3 Index of Fiscal Illusion

In this sub-section, we consider the procedure for constructing the index of fiscal illusion. As a first step, the structural equation is applied to estimate the index of fiscal illusion, where β_j are structural coefficients reported in Table 2.

$$F_{it} \approx \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} \tag{7}$$

The next step is to normalize the index to have a range [0, 10]. This is obtained by subtracting the minimum value and dividing by the range of the index values across the countries. In symbolic form, the following equation is applied:

$$F_{it}^{*} = 10 * \frac{F_{it} - \min\limits_{\forall i, \forall t}(F_{it})}{\max\limits_{\forall i, \forall t}(F_{it}) - \min\limits_{\forall i, \forall t}(F_{it})}. \tag{8}$$

To verify the robustness of the index to the different MIMIC specifications in Table 3, correlations between the scores of the indexes of fiscal illusion are reported.

---

[12] Data on the revenue from each tax is not available. Therefore, as is usual in the literature on the Herfindahl index of tax revenue, we use diverse types of taxation instead of the number of different taxes. This procedure makes Herfindahl index far from being a perfect measure of tax complexity, since it does not account for the effective sources of tax complexity, but measures complexity through the proportions of revenue collected by diverse types of taxation (e.g. direct, excise, capital). It implies that two countries (A and B) with the same level of tax revenue, but different levels of tax complexity, have the same values of the Herfindahl index. It occurs, for instance, if country A collected tax through a single direct tax (or excise), while country B levies several direct taxes (or excises). It can explain the 'gap' between theory and empirical evidence.

[13] With the exception of MIMIC 4-1-6a RML.

Table 3: Correlations among scores of Fiscal illusion index

	4-1-6a ML	4-1-6a RML	4-1-6b ML	4-1-6b RML	4-1-5 ML	4-1-5 RML	3-1-5 ML	3-1-5 RML	$\sum r_{xy}$
4-1-6a ML	1								**7.9546**
4-1-6a RML	0.9884	1							**7.9707**
4-1-6b ML	1.0000	0.9892	1						**7.9589**
4-1-6b RML	0.9907	0.9998	0.9915	1					**7.9719**
4-1-5 ML	0.9982	0.9951	0.9986	0.9966	1				**7.9799**
4-1-5 RML	0.9938	0.9987	0.9942	0.9990	0.9974	1			**7.9812**
3-1-5 ML	0.9912	0.9983	0.9920	0.9987	0.9972	0.9973	1		**7.9705**
3-1-5 RML	0.9924	0.9988	0.9929	0.9988	0.9964	0.9999	0.9969	1	**7.9740**

The anaysis of the matrix of correlations indicates that the index calculated by coefficients estimated with MIMIC 4-1-5 RML has the highest correlation with the other indexes of fiscal illusion. This means that this model is also the best choice to summarize the indexes estimated by alternative model specifications.

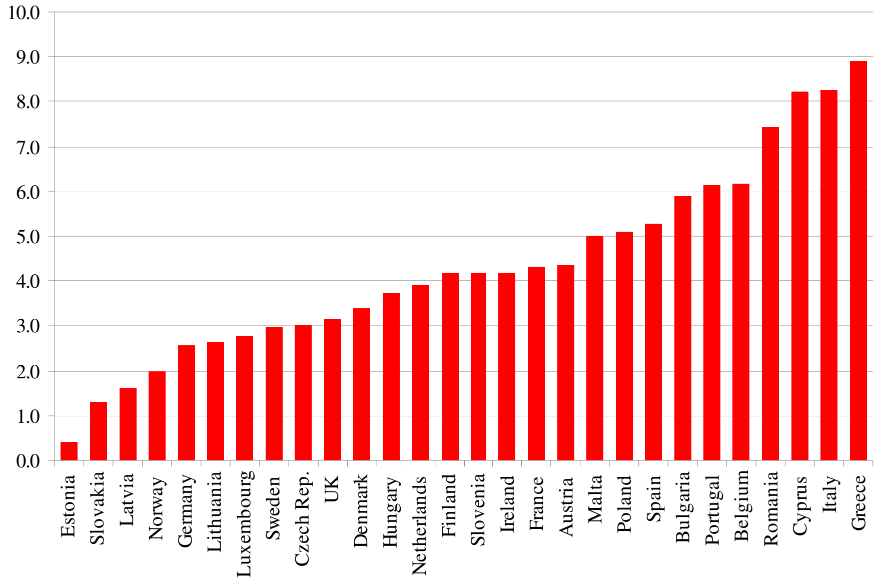
Table 4 reports the dynamic of the normalized indices of fiscal illusion $\left(F_{it}^{*}\right)$ of the 28 countries in the sample.

Table 4: Estimates of the index of Fiscal Illusion (MIMIC 4-1-5)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
Austria	4.50	4.70	4.72	4.66	4.53	4.29	4.53	4.30	4.25	4.23	4.08	3.97	3.98	3.97	**4.34**
Belgium	6.54	6.59	6.59	6.66	6.60	6.38	6.26	6.17	6.04	5.96	5.80	5.65	5.49	5.48	**6.16**
Bulgaria						6.24	6.03	5.78	6.07	6.18	6.11	5.70	5.57	5.34	**5.89**
Cyprus					7.83	8.25	8.33	8.15	8.71	8.75	9.09	8.86	9.69	4.52	**8.22**
Czech Republic				2.51	2.81	2.86	2.89	2.99	3.28	3.45	3.18	3.07	3.10	2.89	**3.00**
Denmark	3.92	3.93	3.92	3.77	3.12	3.38	3.06	2.97	3.21	3.24	3.48	3.22	3.26	2.95	**3.39**
Estonia				1.11	0.82	0.58	0.23	0.25	0.32	0.39	0.00	0.06	0.41	0.16	**0.39**
Finland	5.12	5.33	5.04	4.50	4.22	4.24	4.20	4.04	3.86	3.70	3.69	3.65	3.47	3.46	**4.18**
France	4.69	4.88	4.73	4.66	4.71	4.43	4.24	4.05	3.99	4.04	4.06	4.05	3.88	3.76	**4.30**
Germany	2.49	2.86	2.69		2.85	2.79	2.45	2.45	2.47	2.43	2.54	2.58	2.52	2.44	**2.58**
Greece						10.00	9.55	9.28	8.86	8.47	8.58	8.50	8.50	8.50	**8.92**
Hungary			4.96	4.46	4.26	5.08	4.07	3.78	3.42	3.19	2.95	2.70	2.90	2.88	**3.72**
Ireland	5.68	5.44	5.27		4.46	4.19	3.69	3.79	3.70	3.87	3.68	3.70	3.63	3.33	**4.19**
Italy	8.32	8.85	9.09	8.65	8.54	8.33	8.42	8.17	8.13	7.97	7.68	7.82	7.85	7.65	**8.25**
Latvia				3.28	2.76	2.11	2.15	1.51	1.29	1.20	0.91	1.12	0.90	0.47	**1.61**
Lithuania				3.70	3.54	3.22	3.06	3.04	2.97	2.63	2.24	2.04	1.57	1.10	**2.65**
Luxembourg	3.78	3.75	3.96		2.87	2.90	3.02	2.87	2.79	2.41	2.25	1.85	1.77	1.67	**2.76**
Malta						4.57	4.85	5.02	4.98	5.04	5.15	5.06	5.17	5.18	**5.00**
Netherlands		4.74	4.51	4.39	4.30	4.11	3.79	3.63	3.51	3.47	3.52	3.66	3.51	3.54	**3.90**
Norway		2.32	2.14	1.99	1.91	1.86	1.86	1.86	1.72	1.83	1.76	2.29	2.20	1.87	**1.97**
Poland			6.37	5.85	5.70	5.31	5.35	5.41	5.04	4.72	4.63	4.44	4.35	4.14	**5.11**
Portugal	6.08	6.24	6.22	6.39	6.30	6.31	6.30	6.28	6.28	5.90	5.91	5.86	5.88	5.75	**6.12**
Romania					9.69	9.62	9.36	7.14	7.62	6.19	6.56	6.12	6.11	5.81	**7.42**
Slovakia				1.65	1.52	1.28	1.13	1.09	1.27	1.47	1.51	1.11	1.12	1.17	**1.30**
Slovenia		4.83	4.81	4.71	4.58	4.25	4.18	4.17	4.06	3.98	3.93	3.78	3.63	3.50	**4.19**
Spain	6.22	6.08	5.77	5.63	5.54	5.35	5.17	5.13	4.98	4.95	4.92	4.88	4.88	4.24	**5.27**
Sweden	3.35	3.36	3.61	3.63	3.60	3.55	2.93	2.55	2.48	2.54	2.60	2.77	2.62	2.36	**3.00**
United Kingdom	3.89	3.83	3.68		3.22	3.14	3.10	2.84	2.75	2.79	2.84	2.96	2.89	3.13	**3.16**
Average	**4.97**	**4.86**	**4.89**	**4.33**	**4.41**	**4.59**	**4.44**	**4.24**	**4.22**	**4.11**	**4.06**	**3.98**	**3.96**	**3.62**	

Figure 2 shows the ranking of countries according to the annual averages of the index over the period 1995-2008.

Figure 2: Ranking of European Country (1995-2008)

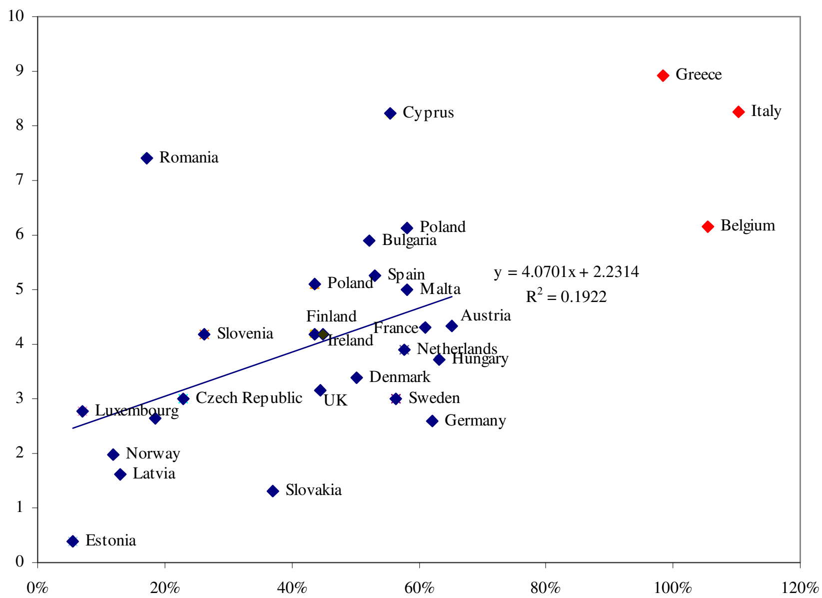


From this analysis, we find evidence that Southern European policy makers usually exploit fiscal illusion stratagems to distort taxpayers' perceptions of their tax burdens more than policy makers in other areas of Europe. In particular, Greece, Italy and Cyprus show the highest values among the 28 members of European Union.

According to this ranking, those countries with the highest public indebtedness also have the highest levels of fiscal illusion. Thus, since we suspected that our index may simply be a proxy of the ratio of public debt on GDP, we estimated the correlation that exists between our index and this variable. Figure 3 shows a scatter plot of the countries' averages and the output of a bivariate regression without the outliers: Greece, Italy and Belgium. Considering that R^2=0.19,[14] we conclude that the estimated index of fiscal illusion, although positively correlated with national indebtedness, measures something else.

[14] Including outliers, R^2=0.41.

Figure 3. Fiscal Illusion Vs Public Debt as % of GDP (Averages 1995-2008)



From this analysis, we also think that it is reasonable to deduce that our that our index does capture *bona fide* fiscal illusion rather than ‘creative accounting’ or some form of fiscal transparency. In any even, Beroth and Wolff (2008) and others have noted that these concepts cannot be defined with any degree of precision.

4. Conclusion

This paper has sought to extend the embryonic empirical literature on the estimation of fiscal illusion indexes by extending the work of Dell’Anno and Mourão (2012). The results of this statistical exercise are not only interesting in themselves, but may also shed some light on the fiscal crisis in the Eurozone. In this regard, it can be argued that the insights which flow from the theory of fiscal illusion are not only helpful in understanding how serious levels of national indebtedness have arisen in most of the most heavily indebted European countries, as a consequence *inter alia* of public misperceptions surrounding the burden and benefits from public expenditure, but these insights can also assist in normative policy prescription. For instance, the fiscal illusion index developed in this paper may explain the observed pattern of indebtedness across the contemporary Eurozone. It would seem that those European countries most characterised by excessive public debt and income elastic forms of taxation rank highly in terms of our fiscal illusion index. In particular, the those countries with the highest levels of fiscal illusion in the index, such as Greece and Italy, appear to have suffered more than other Eurozone nations as a consequence of the current financial crisis in terms of incapacity of their respective governments to stabilize their public budgets.

At a more general level, in addition to fiscal illusion arising from tax illusion, Richard Wagner (2001) has stressed the importance of fiscal illusion in terms of its broader relationship to the pervasive spread of complex regulation in modern developed economies as a form of taxation and the costs associated with this regulation. From a public policy perspective, efficient 'tax-prices' should reflect the 'real costs' of governmental activity in order for citizens to make rational judgements on the efficacy of public programs, including regulatory programs. To the extent that fiscal illusion surrounds public taxation, public expenditure and public regulation, this condition is not met. It follows that fiscal illusion indexes and other measures of fiscal illusion can inform public policy making by determining the extent to which fiscal illusion clouds public perceptions.

Furthermore, the MIMIC model utilised in our paper underlines the complexity of the relationships of both the causes and the indicators, which seem to affect fiscal illusion. In a more general sense, this highlights the need for systematic statistical approaches, such as MIMIC modelling techniques, to be used in investigating the nature of latent phenomena.

References

Alt J, Lassen D (2006) Fiscal Transparency, Political Parties, and Debt In OECD Countries, *European Economic Review*, 50(6): 1403-1439.

Beroth, K, Wolff, GB (2008) Fool the Markets? Creative Accounting, Fiscal Transparency and Sovereign Ris Premia, *Scottish Journal of Political Economy*, 55(4), 465-487.

Berry WD, Lowery D (1987) Understanding U.S. Government Growth: An Empirical Analysis of the Post-War Era. New York: Praeger.

Brown TA (2006) Confirmatory Factor Analysis for Applied Research. New York: Guilford Press.

Browne M, Cudeck R (1993) Alternative ways of assessing model fit. In: *Testing Structural Equation Models*. Bollen KA, Long JS eds, 136–162. Beverly Hills, CA: Sage

Buchana JM (1967) *The fiscal illusion. Public finance in democratic process: fiscal institutions and individual choice*, Chapel Hill (USA) University of North Carolina press.

Choi I (2001) Unit Root Tests for Panel Data, *Journal of International Money and Finance*, 20: 249–272

Clotfelter C (1976) Public Spending for Higher Education: An Empirical Test of Two Hypotheses. Public Finance 31(2): 177-95.

Curran P J, West S G, Finch J F (1996) The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods*, 1: 16-29.

Dell'Anno R (2007) Shadow Economy in Portugal: an analysis with the MIMIC approach. *Journal of Applied Economics* 10(2): 253-277.

Dell'Anno R, Gòmez de Antonio M, Alanon Pardo A. (2007) Shadow Economy in three different Mediterranean Countries: France, Spain and Greece. A MIMIC Approach. *Empirical Economics*, 33(1): 51-84

Dell'Anno R, Mourão P (2012) Fiscal Illusion around the World. An analysis using the Structural Equation Approach. *Public Finance Review,* 40(2): 270-299.

Dell'Anno R, Solomon O. (2008). Shadow economy and the unemployment rate in the USA is there a structural relationship? - An empirical analysis with structural equation model. *Applied Economics* 40(19): 2537-2555.

Dollery, B. E. and Worthington, A. C.(1996) The empirical analysis of fiscal illusion. *Journal of Economic Surveys*, 10(3), 261–298, 1996.

Dollery BE, Worthington A (1999) Tax complexity and fiscal illusion: An empirical evaluation of the Heyndels and Smolders approach. *Public Finance/Finances Publiques*, 51(4): 522-533.

Duncan OD (1975) *Introduction to Structural Equation Models*. New York: Academic Press.

Enrick N (1964) A Further Study of Income Tax Consciousness. *National Tax Journal*, 17: 169-73.

Fasiani M (1941) *Principii di scienza felle finanze*, vol. I. Torino: Giappichelli Editore.

Frey B, Weck-Hannemann H (1984) The hidden economy as an "unobservable" variable. *European Economic Review* 26: 33–53

Granger CWJ, Newbold P (1974) Spurious regressions in econometrics. *Journal of Econometrics* 2: 111–120.

Hu L, Bentler PM, Kano Y (1988) Can test statistics in covariance structure analysis be trusted?. *Psychological Bulletin* 112: 351-362.

Jöreskog KG (1967) Some contributions to maximum likelihood factor analysis. *Psychometrika*, 32(4): 443-482

Jöreskog KG (1969) A general approach to confirmatory maximum likelihood factor analysis. Psychometrika, 34: 183–202.

Jöreskog KG, Sörbom D, du Toit S, du Toit M (2000) LISREL 8: New Statistical Features. Chicago: Scientific Software International.

Jöreskog KG, Goldberger A (1975) Estimation of a model with multiple indicators and multiple causes of a single latent variable, *Journal of the American Statistical Association,* 70: 631-639.

Levin A, Lin CF (1993) Unit root test in panel data: new results. Department of Economics Discussion paper University of California at San Diego, Discussion paper, 93- 56.

Levin A, Lin CF, Chu C (2002) Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics*, 108: 1-24.

Maddala GS, Wu S (1999) A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test, *Oxford Bulletin of Economics and Statistics*, 61: 631-652.

McCulloch JR (1975) *A Treatise on the Practical lnfluence of Taxation and the Funding System.* Original edition 1845, reprint D. P. O'Brien (ed.), Edinburgh: Scottish Academic Press.

Mill JS (1848) Principles of Political Economy. Consulted Edition: Mill, John Stuart .1994. Oxford: Oxford University Press.

Mourão P (2008) Towards a Puviani's Fiscal Illusion Index. *Hacienda Publica Espanola* 187(4): 49-86.

Muthén B, Kaplan D (1985) A comparison of methodologies for the factor analysis of non-normal Likert variables. *British Journal of Mathematical and Statistical Psychology*, 38: 171-189.

Muthén B, Kaplan D (1992) A comparison of some methodologies for the factor analysis of non-normal Likert variables: A note on the size of the model. *British Journal of Mathematical and Statistical Psychology*, 45: 19-30.

Oates WE (1988) On the Nature and Measurement of Fiscal Illusion: A Survey. In *Taxation and Fiscal Federalism: Essays in Honour of Russell Mathews*, G. Brennan et al., eds., 65-82, Sydney: Australian National University Press.

Olsson U H, Foss T, Troye S V, Howell R D (2000) The Performance of ML, GLS, and WLS Estimation in Structural Equation Modeling under Conditions of Misspecification and Nonnormality. *Structural Equation Modeling* 7(4): 557-595.

Pommerehne W, Schneider F (1978) Fiscal Illusion, Political Institutions, and Local Public Spending. *Kyklos* 31: 381-408.

Satorra A, Bentler P M (1994) Correctios to test statistics and standard errors in covariance structure analysis, in Latent variable Analysis in Developmental Research, 285-305 (A. van Eye and C. C. Clogg, eds.), SAGE Publications, Inc., Thousand Oaks, CA.

Sausgruber R, Tyran J (2005) Testing the Mill hypothesis of fiscal illusion. *Public Choice*, 122(1): 39-68.

Schmölders G (1960) *Das Irrationale in der öffentlichen Finanzwirtschaft*. Reinbeck: Rowohlt.

Schneider F, (2005) Shadow economies around the world: What do we really know. *European Journal of Political Economy*, 21: 598-642.

Stapleton D (1978) Analyzing political participation data with a MIMIC Model. *Sociological Methodology*, 15: 52-74.

Steiger JH, Lind JC (1980) Statistically-based tests for the number of common factors. Paper presented at the annual Spring Meeting of the Psychometric Society in Iowa City. May 30, 1980.

Tirole J (2011) Illiquidity and all its friends. *Journal of Economic Literature.* 49(2): 287-325.

Wagner R (1976) Revenue structure, fiscal illusion and budgetary choice. *Public Choice* 25: 45-61.

Wagner R (2001) From the politics of illusion to the high cost of regulation. *Public Interest* 3 (8): June.

Wagstaff V (1965) Income tax consciousness under withholding. *Southern Economic Journal*. 32: 73-80.

Weck-Hannemann H (1983) Schattenwirtschaft: Eine Möglichkeit zur Einschränkung der öffentlichen Verwaltung? Eine ökonomische Analyse. Finanzwissenschaftliche Schriften, vol. 22. Lang: Bern/Frankfurt.

Appendix 1: Sources of data

	Name	Source	Max	Min	Mean	Obs
X_1	Self-employment rate	Self-employed in % of total employment. (lfsi_grt_a-Employment growth and activity branches - Annual averages) - EUROSTAT	45.7	5.3	15.9	378
X_2	Political pressures and controls on media	Sub-index B of the overall index of Freedom of the Press. Freedom House. To have homogenous data, from 1994 to 2001 the index is equal to sub-indexes B + D (http://www.freedomhouse.org/template.cfm?page=274)	33.0	0.0	7.9	392
X_3	Tertiary school enrolment	Persons with upper secondary or tertiary education attainment by age and sex (%) on 25 years and over (edat_lfse_08) - EUROSTAT	86.1	14.6	61.2	350
X_4	Tax Revenue in % of GDP	Total receipts from taxes and social contributions (including imputed social contributions) after deduction of amounts assessed but unlikely to be collected. (gov_a_tax_ag-Main national accounts tax aggregates) - EUROSTAT	69.5	25.6	38.0	389
Y_1	Inflation rate	Annual average rate of change of Harmonized indices of Consumer Prices (HICP) - EUROSTAT	154.9	-1.1	4.6	335
Y_2	Public Debt	General Government consolidated gross debt in % of GDP. (gov_dd_edpt1-Government deficit/surplus, debt and associated data – EUROSTAT)	130.4	3.8	48.4	383
Y_3	Normalised Herfindahl Index of Revenue	$H_j = \sum_{i=1}^{12} \left(\frac{R_{ji}}{\sum_{i=1}^{12} R_{ji}} \right)^2$; $H_j^* = 100 * \frac{H_j - 1/12}{1 - 1/12}$ Tax revenues (R_{ji}) refer to: Value added type taxes (VAT)/tot.rev.(TR); Import duties/TR; Taxes on imports excluding VAT and import duties/TR; Taxes on products, except VAT and import taxes/ TR; Other taxes on production/TR; Taxes on income/TR; Other current taxes/TR; Capital taxes/TR; Employers' actual social contributions/TR; Employees' social contributions/TR; Social contributions by self- and non-employed persons/TR; Imputed social contributions/TR. (gov_a_tax_ag-Main national accounts tax aggregates) - EUROSTAT.	34.8	7.6	13.6	389
Y_4	Ratio between indirect and direct taxes revenues	Taxes on production and imports in % of GDP/ Current taxes on income, wealth, etc. in % of GDP (gov_a_tax_ag-Main national accounts tax aggregates) -EUROSTAT	352.7	50.2	126.8	389
Y_5	Taxation on labour	Ratio of taxes and social security contributions on employed labour income to total compensation of employees (Implicit tax rate on labour) [tsiem070 – EUROSTAT]	47.8	17.8	35.2	381
Y_6	Withholding taxes from wages	Taxes on labour, of which on employed paid by employers [tax_lab_empr]/Taxes on labour, of which on employed paid by employees [tax_lab_empe] ([gov_a_tax_str] – EUROSTAT)	240.7	2.1	89.2	392