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Cláudia Soares; Oscar Afonso

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THE NON-OBSERVED ECONOMY IN PORTUGAL: THE MONETARY MODEL AND THE MIMIC MODEL

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>> ÍNDICE

>> ABSTRACT

This paper offers estimations for the Portuguese path of the Non-Observed Economy (NOE), in the period 1970-2013, through two seminal approaches: monetary method and the Multiple Indicators Multiple Causes (MIMIC) model. It is observed that the tax burden and social benefits are its main causes. Then, to get a more in-depth understanding of the phenomenon, it provides a study of the Granger causality between the NOE and the official Gross Domestic Product (GDP), emphasising the implications of the NOE on the Portuguese economy. Evidence has been found for the existence of bidirectional causality between the NOE and the GDP, suggesting that the formal economy affects the NOE, and conversely that the NOE affects the economic growth.

***Keywords**: Non-observed economy, MIMIC model, Monetary method, Economic growth, Portugal.*

***JEL** classification numbers: O17, C39, H10, H26*

>> 1. INTRODUCTION

In all countries of the world there is a part of the economy, the Non-Observed Economy (NOE), whose activities are not reflected in national accounts and have numerous and important effects. In particular, the NOE reduces government revenue and distorts official indicators, thus influencing public sector decisions, inducing changes in incentives and remuneration factors. As a result, academic and political interest in the NOE has greatly increased (e.g., Tanzi, 1982 and 1999; Schneider and Enste, 2000; Schneider, 2000 and 2005).

Although it is impossible to select the best general definition of NOE, it is considered that estimates should include the productive activities which cannot be directly observed for economic reasons (e.g., Schneider and Enste, 2000; Giles and Tedds, 2002; Dell'Anno, 2003). For example, activities performed with the express intention of avoiding taxes, social contributions which benefit employees or are intended to avoid observing legal requirements concerning minimum wages, working hours, health and safety regulations, thus excluding, for example, illegal activities, domestic labour and intra-family transfers.

In general, the NOE includes (OECD, 2002): (i) the Illegal Economy, which includes activities forbidden by law (e.g., production and distribution of illegal drugs), or activities that are illegal when they are carried out by unauthorized Individuals; (i) the Underground Economy, which, by definition, avoids the payment of taxes and of social security contributions, some legal standards and some administrative procedures; (iii) the Informal Economy, which is composed by units engaged in the production of goods or services in order to generate employment and incomes to the involved individuals, and these units typically operate at a low level of organization, with little or no division between labour and capital, and on a small scale (labour relations, when they exist, are based on casual employment or personal and social relations and not on formal contracts).

Bearing in mind the above definition, Schneider (2002), for example, noted that in 2001/2002 the average weight of the NOE as a percentage of official Gross Domestic Product (GDP) was 16.7% in 21 countries from the Organization for Economic Cooperation and Development (OECD) and 38.0% in 22 developing countries. Schneider and Klinglmair (2004) observed that in 1999/2000 the average size of the NOE as a percentage of official GDP was 41% in developing countries, 38% in transition countries and 18% in OECD countries. Hence, it is usually considered that the NOE value, as a percentage

of official GDP, fluctuates between 15% in the most developed countries and 70% in some developing countries (e.g., Frey and Schneider, 2000). In any case, it is a significant value.

In particular, according to Schneider (2012), Portugal, although belonging to the Old Continent, presented for 2012 an extension of the NOE around 19.4% of official GDP, well above the European average and in contrast with the economies that more contribute to economic growth in the eurozone, such as Germany and France with 13.3% and 10.8%, respectively. Despite the significant share of NOE in Portugal, there are few studies devoted exclusively to Portugal – the exception are Dell'Anno (2007) and Afonso and Gonçalves (2009, 2011). Addition information regarding the Portuguese case are likely to be obtained through various studies which address multiple countries, such as Schneider and Enste (2000), Feld and Schneider (2010) and Schneider (2012).

Concerning the estimation methodology, it can be used direct and/or indirect methods. The formers require contacts with or observations of economic agents to gather direct information about undeclared income and can be based on auditing of tax returns and surveys. In turn, indirect methods try to find the traces of the NOE in the official statistics, usually by using macroeconomic data, and following one of six approaches: the discrepancy between national expenditure and income statistics; the discrepancy between the official and real labour force statistics; the transaction approach; the physical input (e.g. electricity) method; the monetary model; and the multiple indicators and multiple causes (MIMIC) method.

By looking exclusively upon economic issues, we estimate the size of the NOE in Portugal through both the monetary model (e.g., Ahumada *et al*., 2009) and the MIMIC method (e.g., Frey and Weck-Hanneman, 1984). The monetary method establishes relations between the official GDP and monetary variables, assumes that developments in monetary variables that are not explained by the models are explained by the NOE, and covers the three perspectives: transaction method, cash/deposit ratio method and cash demand method. In line with Tanzi (1980, 1983), Breusch (2005b) and Ahumada *et al.* (2007, 2009), among others, we use the cash demand method. In turn, the MIMIC model is a member of the Linear Structural Relationships Interdependent (LISREL) family (e.g., Jöreskog and Sörbom, 1993) and, by understanding the dimension of the NOE economy as a "latent variable", and applies structural equation modelling. By estimating the same phenomenon through different methodologies, we are particularly interested in improve our knowledge of the economic causes of the NOE and its development in Portugal.

Moreover, the literature on the subject tends to ignore the assessment of the effects of the NOE on the official GDP; for example, through the Granger causality. Here, it should be stressed the study of Schneider (2005), which have assessed the importance of NOE for the official economic growth by considering an exponential regression model whose specification also includes other variables that are usually assumed to be relevant in stimulating economic growth. Therefore, to improve the existing knowledge, it is also analysed the Granger causality, putting emphasis on the relationship between the mentioned variables.

The current paper is organised as follows. In Section 2 the cash demand method and the MIMIC method are generically presented. In Section 3 the theoretical background for the choice of variables and the specification of the models discussed. In Section 4 the data is presented and estimations results are analysed. In section 5 is analysis of the Granger causality is performed. Finally, the main conclusions are presented in Section 6.

>> 2. THE CASH DEMAND METHOD AND THE MIMIC METHOD

Here, we start by presenting the intuition for our monetary method, which, apart from being an alternative methodology, is crucial when applying the MIMIC model. Indeed, the latter requires an estimative for a base year and, generally, this estimative is obtained from one approach of the monetary method.

2.1. The cash demand method

This method, initially proposed by Tanzi (1980, 1982), assumes that money demand is partly used to perform transactions that economic agents wish to keep hidden from official records (Ahumada et al., 2009). Tanzi (1980, 1982) assumes that money demand is strongly affected by changes in regulations or in the level of taxes. The author considers that the demand for cash as a proportion of total money, *C*/*M*2, is a function of the weighted average rate of taxes, *TW*, the share of wages and salaries in total personal income, *WS*/*Y*, the interest on fixed term deposits, *R*, and per capita real income, *Y*/*N*:
$ln(C/M2)_t = \beta_0 + \beta_1 ln(1+TW)_t + \beta_2 ln(WS/Y)_t + \beta_3 lnR_t + \beta_4 ln(Y/N)_t + u_t$,
where: β_1, β_2, β_4>0, and β_3<0. By assuming that the velocity of money is equal both in the NOE and in the formal economy, from the results of the regression we can estimate the NOE: we estimate the NOE by comparing the cash demand when the regulation and taxes are at their lowest level with the cash demand at the current high levels of regulation and taxes. Although widely used, this method is criticized, for example, due to the fact that not all transactions in the NOE are paid in cash and the speed of money circulation is not the same in the two economies.

The proposed monetary method considers several general factors that cause variations in money demand, such as the interest rate or the inflation rate, and identifies sources that indicate the existence of the NOE since there may still be demand not explained by "official" factors. This additional demand is usually identified as evidence of income not reflected in national accounts: we have used Error Correction Model (ECM) to capture the magnitude of the NOE (e.g., Bajada, 1999) and, in particular, we follow Ahumada et al. (2004, 2007, 2009). That is, we consider that the total (observed) money level in economy, C_T, includes the used in the official economy, C_R, and in the NOE, C_H. Thus, the latter level can be measured by the difference between observed and estimated levels, assuming that C_R and C_H have the same functional form and equal parameters. Moreover, in order to evaluate the robus-

tness of this approach, we have also obtained an estimate of the NOE using the monetary approach proposed by Breusch (2005b).

2.2. The MIMIC method

The MIMIC model is a member of the Linear Structural Relationships Interdependent (LISREL) family and is divided in two equation: a measurement equation, which relates the latent (unobserved) variables to the manifest (observable) indicators; a structural equation, which specifies the relationship between the unobservable variables and their causes. We have one unobserved variable, the size of the NOE, *S*, which is affected by an exogenous set of causes, C_1, C_2, ..., C_n, subject to a disturbance u, $S_t = \beta_1 C_{1t} + \beta_2 C_{2t} + ... + \beta_n C_{nt} + u$. There is also a set of indicators, I_1, I_2, ..., I_m, of the NOE's size that capture the NOE's effects on variables. The unobserved NOE, by determining the endogenous set of indicators, is subject to a random disturbance/measurement error, ε_1, ε_2, ..., ε_m: $I_{it} = \lambda_t S_t + \varepsilon$, i=1, ..., m. Structural disturbances u and measurement errors ε are normally distributed, mutually independent, and an expected value of zero is admitted in all variables. The interaction between the causes C_{it} (i = 1, 2, ..., n), the size of the NOE, S_t, and the indicators I_{jt} (j = 1, 2, ..., m).

By introducing the vectors $\mathbf{C} = (C_1, C_2, ..., C_n)'$ of observable exogenous causes, $\boldsymbol{\beta} = (\beta_1, \beta_2, ..., \beta_n)'$ of parameters of the structural model, $\mathbf{I} = (I_1, I_2, ..., I_m)'$ of observable endogenous indicators, $\boldsymbol{\lambda} = (\lambda_1, \lambda_2, ..., \lambda_m)'$ of parameters of the measurement model, $\boldsymbol{\varepsilon} = (\varepsilon_1, \varepsilon_2, ..., \varepsilon_m)'$ of measurement errors, $\boldsymbol{\theta} = (\theta_1, \theta_2, ..., \theta_m)'$ of standard errors of ε, we can rewrite: $S = \beta' C + u$ and $I = \lambda . S + \varepsilon$, where: $E(u\varepsilon') = 0$, $E(u^2) = \sigma^2$, $E(\varepsilon\varepsilon') = \Theta^2$ and Θ is the diagonal matrix mxm. The model can be solved in the reduced form, as a function of the observed variables, $I = \lambda\ (\ \beta' C + u) + \varepsilon = \Pi' C + v$, where the coefficient matrix of the model in the reduced form is given by $\Pi = \beta\, \lambda'$ and the disturbance vector by $v = \lambda\, u + \varepsilon$, where its covariance matrix is $\Omega = E(vv') = \sigma^2 \beta\beta' + \Theta^2$.

>> 3. VARIABLES CAUSE AND CONSEQUENCE

There is a vast literature on the possible causes and indicators of the NOE. For a more comprehensive view on the causes and indicators of the NOE the works of Schneider and Enste (2000), Schneider (2005) and Buehn e Schneider (2012), among others, are references. Although there is no consensus nor about the causes (for both monetary and MIMIC method) neither about the indicators (for the MIMIC method) of the NOE, we need to justify the variables since the results depend on how correctly, precisely and comprehensively they are. The used variables (in Table 1) as causes and indicators of the NOE were therefore determined by taking into account the literature. Thus, all of them are linked, in one way or another, to the NOE theory and we believe that are correct to evaluating the NOE. One can distinguish between four types of causes:

a. *Tax burden* – according to literature (e.g., Frey and Weck-Hanneman, 1983; Loayza, 1996; Tanzi, 1999 and Schneider, 2000 and 2006; Schneider and Enste, 2000, Schneider, 2011b), the fiscal burden is the most important determinant of tax evasion. The tax burden has been also disaggregated into three different partial proxies, to test if all the components have the same effects on the NOE: (a) direct taxes and social contributions as a percentage of GDP; (b) indirect taxes as a percentage of GDP; and (c) subsidies and social benefits as a percentage of the disposable income. The idea is that an increase in (a) and (b) incentives the NOE, and thus a positive sign for the parameter associated to this variable is expected. With regard to (c), they may have different effects on the NOE. Subsidies encourage economic agents to remain in the official economy, but they introduce distortions into competition and may encourage the NOE. Social benefits represent a higher economic cost in operate into the ENR, but the economic agent may have some incentive to remain irregular to have access to the social benefits. Hence, we expect a negative or any ambiguity in the coefficient of this variable.
b. *Regulation burden* – the greater the regulation burden on the economy, the greater the incentive to opt for the NOE (Aigner et al., 1988; Schneider e Enste, 2000; Friedman *et al.*, 2000). However, since the State is only supplied by legal activities, a State that has a very high consumption level in GDP will certainly lead the agents to decide to maintain activity in the formal economy in order to do business with the State. To represent the regulation burden we use the government expenditure measured by the weight of government consumption on GDP, and the expected sign for this variable is ambiguous.

c. *Required standard of living* – the aim of a better standard of living should imply an increase in the NOE since to reach the necessary disposable income people may also need an unofficial job. A high number of small businesses, a large proportion of independent professionals and self-employed with respect to the total work-force are expected to emerge and, as a result, a higher level of the NOE. To measure this variable we use, as a proxy, the private consumption as a percentage of GDP. Hence, the expected sign of this variable is positive. In turn, we also consider the disposable income as a variable. In this case, due to the same arguments the expected sign is obviously negative.
d. *Specific causes of the monetary model* – within this set of variables, we have the interest rate and the inflation rate. The former variable adversely affects the detention of money since represents an opportunity cost. The latter variable has a positive effect on the demanded money level (e.g., Gadea and Serrano-Sanz, 2002) since accelerates the existing level of transactions in the economy, representing also an opportunity cost of holding money.

Due to the lack of available information and the unfeasibility of correctly estimating a monetary method and an overly-complex structural equation model with regard to the sample size, we have not included other potential causes such us public employment upon the labour force, unemployment rate, unemployment insurance, self-employment, governments spending on combating tax evasion, electricity consumption, indices of corruption, labour market flexibility, size of government, legal system and property rights, labour force share with wages set by centralized collective bargaining, labour market regulations and regulation. Unfortunately, the time series have an insufficient sample size, missing values and inadequate frequency that prevent a correct application of our methodologies.

The unexpected development of the indicator variables for the MIMIC method may reflect that "real economic activity" differs from the "legal" or official activity. Thus, although the NOE is treated as a latent variable, which by definition is not directly observable, we consider our estimations reflect its development and relative size. Bearing namely in mind Schneider e Enste (2000), Bajada e Schneider (2005), Schneider (2005), Dell'Anno (2007, 2008) e Schneider *et al.* (2010), we assume that a change in the size of the NOE can be reflected in the following two indicators:

a. *Currency in circulation outside of banks* – this indicator, the basis of the monetary approach to the estimation the size of the NOE (and therefore additional comments are not required), is based on the assumption that irregular transactions use only cash, instead of checks or credit cards, in order to circumvent auditing controls. If this hypothesis is accepted, it is then

possible to estimate the NOE economy by comparing the actual demand for cash with the demand that could be expected if the NOE did not exist. Thus, the expected sign is positive.

b. *Real gross domestic product* (*variable of scale*) – when using the MIMIC model is necessary to fix a scale variable to estimate the rest of the parameters as a function of this scale variable. Following the authors who have estimated the NOE through MIMIC models, the value of the fix parameter is arbitrary, but by using a positive (or negative) unit value it is easier to establish the relative magnitude of the other indicator variables.[1] The choice of the 'sign' of coefficient of scale (λ_{11}) is based on theoretical and empirical arguments. In the literature there is no agreement about the effects of the NOE upon economic growth.[2] If the "sign" of the coefficient of scale (λ) is changed, all the structural parameters change signs (keeping the same absolute values and standard errors). The scientific methodology employed is a "reductio ad absurdum". For instance, if a value (+1) is assigned to λ_{11} ($Y_1 = \lambda_{11}\eta + \varepsilon_1$: equation of the measurement model), then consequently the estimated structural coefficients show a positive or negative sign. At this point the researcher can verify if these estimated signs agree with economic theories and empirical evidence regarding the NOE and its causes: if structural coefficients have economic significance then the signs of the reference indicators could be considered to be appropriate. If, however, they entirely contradict well-known theories and empirical studies then the hypothesis that supports the "minus" sign for the relation between the NOE and the reference indicator should be accepted. The hypothesis that supports the "+" sign for the relation between the NOE and growth rate of official GDP is accepted as more reasonable for our analysis, meaning that the formal economy and the NOE are perfectly complementary. Moreover, analysing this variable in the light of the monetary method, this is also decisive in measuring the NOE, since disposable income (derived from real GDP, added the contributions and social benefits granted by the State and net of taxes and contributions levied by the State) is in fact a reference variable in all studies that use the monetary method. Thus, it is expected the presence of a positive

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1 The coefficient λ of the measurement equation associated with the official GDP growth is thus set at a non-zero value. "For instance if the estimate of one of the other elements of λ is 3, then the corresponding indicator variable is 3 times as important as the variable that is the basis for normalisation." Giles and Tedds (2002, p. 109).

2 Indeed, some authors estimate a positive relationship between the official and unofficial economy (e.g., Adam and Ginsburgh, 1985; Tedds, 1998; Giles, 1999b; Giles and Tedds, 2002; Chatterjee et al., 2003; Alanón and Gómez-Antonio, 2005), whereas others find an inverse relationship between these variables (e.g., Frey and Weck-Hannemann, 1984; Loayza, 1996; Kaufmann and Kaliberda, 1996; Eilat and Zinnes, 2000; Ihrig and Moe, 2000, 2001, 2004; Schneider and Enste, 2000; Dell'Anno, 2003; Dell'Anno and Schneider, 2003).

sign of this variable since, the greater the disposable income held by economic agents in order to meet their needs, tend the greater the demand of money. This means that many activities go the NOE during economic recessions and periods of slow growth. Fixing this variable as the scale variable implies that the effects of the NOE are measured in terms official GDP.

Table 1. Description, measure, sources and description of the variables

Variable	Description	Measure	Source	Detail	Jarque-Bera p-value
*M*1	Narrow money	*Per capita*	Bank of Portugal	[(national contribution to the monetary aggregates of the Eurozone - M1, excluding currency)+ (monetary emition less the currency of the IFM)]/ total population	0.06
YD	Disposable Income	*Per capita*	-Bank of Portugal -OECD Statistical Compendium, ed. 02#2012	[(Gross domestic product, volume, market prices)- (Total direct taxes, value / Gross domestic product, deflator, market prices) - (Social security contribution received by general government, value / Gross domestic product, deflator, market prices) + (Subsidies, value /Gross domestic product, deflator, market prices) + (Social security benefits paid by general government, value / Gross domestic product, deflator, market prices)] / total population	0.16
DT	(direct taxes and social contributions) / PIB	%	-Bank of Portugal -OECD Statistical Compendium, ed. 02#2012	[[(Total direct taxes, value / Gross domestic product, deflator, market prices) + (Social security contribution received by general government, value / Gross domestic product, deflator, market prices)] / Gross domestic product, volume, market prices]*100	0.10
INDT	Indirect taxes / PIB	%	-Bank of Portugal -OECD Statistical Compendium, ed. 02#2012	[(indirect taxes / Gross domestic product, deflator, market prices) / Gross domestic product, volume, market prices] *100	0.05

Variable	Description	Measure	Source	Detail	Jarque-Bera p-value
WF	(subsidies + social benefits paid by the government) / Disposable income	%	-Bank of Portugal -OECD Statistical Compendium, ed. 02#2012	[[(Subsidies, value /Gross domestic product, deflator, market prices) + (Social security benefits paid by general government, value /Gross domestic product, deflator, market prices)] / Rendimento Disponível, volume]*100	0.01
GOVEXP	Government final consumption / PIB	%	-OECD Statistical Compendium, ed. 02#2012	(Government final consumption expenditure, volume / Gross domestic product, volume, market prices) *100	0.02
PCONS	Private final consumption	%	-OECD Statistical Compendium, ed. 02#2012	(Private final consumption expenditure, volume / Gross domestic product, volume, market prices) *100	0.00
R	Interest rate	%	-OECD Statistical Compendium, ed. 02#2012	Short-term interest rate	0.08
INF	Tax of inflation	%	-Bank of Portugal	ifference of the logarithm of the consumer price index	0.09

>> 4. DATA AND EMPIRICAL RESULTS

The focus in this Section is placed on data, delivering some additional considerations to that presented in Table 1, and on empirical results, assessing the similarity between the two different estimation methods of the NOE in order to conclude whether both allow capture similarly the reality under study.

4.1. Data

The sources of data and concrete specification of the variables are, as already stated, summarised in Table 1; that is, the variable values have annual periodicity and are in natural logarithm. The size of the ENR is shown only for the period 1970-2014 due to the temporal limitation imposed by the variable "net national income", which is used in one specification the monetary methodology.

We start the data treatment by testing its (non-)stationarity of the temporal series to avoid the existence of spurious relationships since non-stationary time series model leads to results without economic validity. We have applied the unit root statistical tests of Dickey and Fuller (1979, 1981) and Phillips and Perron (1988), denominated Augmented Dickey-Fuller (ADF) and Phillips Perron (PP). All variables have a unitary root and hence are integrated of order 1, I(1), thereby ensuring its stationarity from the first differences (Table2).

Table 2. Stationarity analysis

Variable	Level		First difference	
	ADF	PP	ADF	PP
	C&T	C&T		
YD	0.49	0.49	0.00*ct	0.00*ct
DT	0.90	0.99	0.00*ct	0.00*ct
INDT	0.31	0.34	0.00*c	0.00*c
WF	0.76	0.73	0.00*c	0.00*c
PCONS	0.05	0.17	0.00*n	0.00*n
GOVEXP	0.96	0.95	0.00*ct	0.00*ct
INF	0.11	0.16	0.00*n	0.00*n
R	0.75	0.80	0.00*ct	0.06***ct
M1	0.72	0.82	0.00*n	0.00*n

Notes: (1) H_0: the series has a unit root. H_1: the series is stationary. (2) * is the rejection of the null hypothesis for a significance level of 1%; ** For a significance level of 5% and *** for a 10% significance level. (3) The terms *ct*, *c* and *n* refers to the consideration of, respectively, a constant and a trend, a constant and none of the factors in the analysis of stationarity.

We proceed with the cointegration analysis, which is particularly relevant since the application of the monetary method follows Bajada (1999) and thus the adoption of an ECM,[3] whose specification is established in a single equation and the variables present a behaviour close to each other over time (Alogoskoufis and Smith, 1991). We have used the maximum likelihood procedure of Johansen (1988), which presents greater consistency when there is more than one vector of cointegration. In the cointegration analysis (Table 3), the eigenvalue statistics and the trace statistics for a significance level of 5% allow to reject the null hypothesis that assumes the absence of any vector cointegration (r=0) against the alternative hypothesis that there is at least one vector of cointegration (r>0). In fact, considering the null hypotheses against other alternative hypotheses, one can detect the presence of six cointegrating vectors, with no rejection of the hypothesis that the number of vectors be less than or equal to 6. Accordingly, it can be stressed the existence of a long-run relationship between the other variables, then continuing toward the estimation of the model. Since for some variables the coefficients turned out to be not significant, multiple specifications are considered.

Table 3. Cointegration analysis

Number of cointegration relationship	H0	H1	eigenvalue	Trcae statistics	Critical value (5%)	P-value
Any*	$r = 0$	$r > 0$	0,92	354,85	197,37	0,00
a maximum of one*	$r \leq 1$	$r > 1$	0,75	241,35	159,53	0,00
a maximum of two*	$r \leq 2$	$r > 2$	0,70	179,48	125,62	0,00
a maximum of three*	$r \leq 3$	$r > 3$	0,62	126,43	95,75	0,00
a maximum of four*	$r \leq 4$	$r > 4$	0,52	84,25	69,82	0,00
a maximum of five*	$r \leq 5$	$r > 5$	0,44	52,02	47,86	0,02
a maximum of six	$r \leq 6$	$r > 6$	0,33	26,44	29,80	0,12
a maximum of seven	$r \leq 7$	$r > 7$	0,18	8,70	15,49	0,39
a maximum of eight	$r \leq 8$	$r > 8$	0,00	0,08	3,84	0,78

Notes: (1) * is the rejection of the null hypothesis for a 5% significance level. (2) the level of cointegration r corresponds to the number of linearly independent cointegrating vectors

[3] The ECM has been proposed by Phillips (1957) and Sargan (1964), gained popularity with Hendry (1979) and improved by Engle and Granger (1987) for whom cointegration and ECM are inseparable since cointegration between two variables can be represented by the ECM.

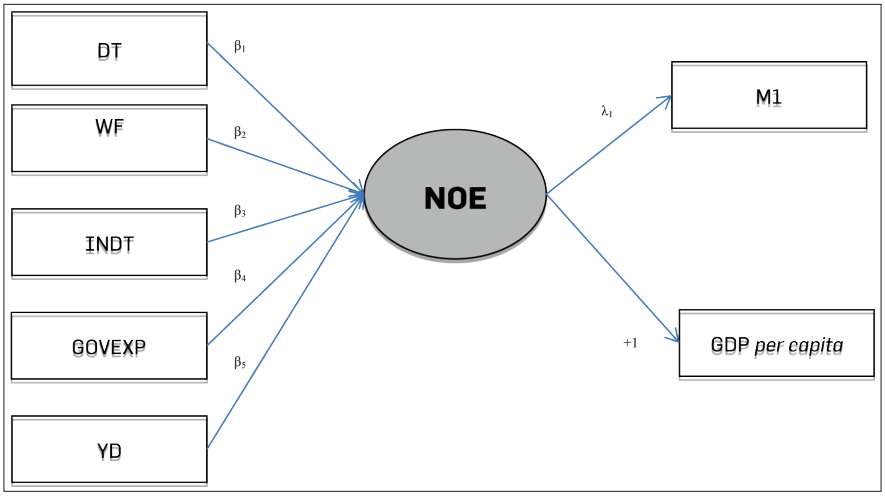
4.2. Empirical results

Table 4 presents the estimated results for the monetary method and the MIMIC model. Both approaches tried to capture the same reality; but, as already stated, the estimation procedures are distinct. Regarding the monetary method, different specifications have been estimated and the different short and long term effects obtained by the ECM suggests that there is a dynamic in some of the variables included in the models. The variables that justify much of the developments in money demand are direct taxes and social contributions to social security, social benefits paid by the State, the interest rate, the inflation rate, disposable income, private final consumption and annual dummy variables, which are mostly significant for a significance level of 1%.

The base MIMIC model used was a 5-1-2 (five causes, one latent variable and two indicators), represented in Figure 1. Contrary to the monetary method, the MIMIC model does not allow direct measurement of the NOE. The final result is a NOE index, measured as a percentage of GDP and expressed in growth rate since the variables are in logarithmic differences. It also requires a calibration method after the incorporation of an exogenous estimate. We decided to adopt the method followed by Alañón and Gómez-Antonio (2005), starting from the estimation of the structural equation $\Delta \hat{S}_t = \hat{\beta}_1 \Delta C_{1t} + \hat{\beta}_2 \Delta C_{2t} + \hat{\beta}_3 \Delta C_{3t} + \hat{\beta}_4 \Delta C_{4t} + \hat{\beta}_5 \Delta C_{5t}$, where C1 represents the variable DT in Figure 1, and so on.

Starting with the MIMIC 5-1-2 model and iterating some non-significant variables, some alternative models have been estimated according to maxi-

Figure 1: MIMIC model 5-1-2



mum likelihood (Table 4); i.e., basing our decision on the significance of the variables and on the Chi-square test, which indicates the overall model fit, we use the MIMIC 4-1-3, MIMIC 5-1-3 and MIMIC 6-1-2. The estimates can be directly compared to assess the weight of the variables in the formation of NOE, since they are defined in the same unit (percentages). Then, to determine the size of the NOE an index is calculated using an existing estimation of the NOE for a base year. In the selection of exogenous estimate, we have decided to choose the growth rate for the period 1990-1991 previously calculated from the estimates obtained by the monetary method. This will allow you to scale the index by reference to this growth rate, then allowing the reflection of the NOE as a percentage of GDP

.

Since $\frac{\widehat{\eta}_t}{\eta_E} = \frac{\widehat{S}_t}{\widehat{S}_E}$, $\widehat{\eta}_t = \eta_E \times \frac{\widehat{S}_t}{\widehat{S}_E}$, t=1, 2, ..., 43; i.e. $\widehat{\eta}_t = \eta_{21} \times \frac{\widehat{S}_t}{\widehat{S}_{21}}$, t=1, 2, ..., 43,

onde η_{21} is the exogenous estimated growth rate observed for the period 1990-1991 associated with the selected calibration period; $\hat{S}_{21}$ is the index value for the reference year achieved by structural equation; and $\hat{S}_t$ is the value estimated from the structural equation and related to the reporting period 1970-2013. The previously mentioned expression allows us to capture the growth rates of the NOE as a percentage of GDP; thus, to capture the magnitude will be necessary to associate the size of the NOE to 1990 with achieved growth rates.

Table 4 – Monetary models (MM) MIMIC models and estimated parameters

Variable	Specification 1		Specification 2		Specification 3		Specification 4	
	MM	MIMIC	MM	MIMIC	MM	MIMIC	MM	MIMIC
Δ DT	0.06	0.17	0.05	0.22	0.06	0.21	0.08	0.22
	(1.70)***	(14.86)*	(2.51)**	(19.61)*	(1.75)***	(18.28)*	(1.91)***	(21.13)*
DT(-1)	0.15		0.08		0.15		0.13	
	(2.97)*		(2.31)**		(2.93)*		(1.78)***	
Δ INDT	-					0.01	-0.02	0.01
						(1.04)	(-1.14)	(0.57)
INDT(-1)	-				-0.02			
					(-0.89)			
Δ WF	-0.05	-0.16	-0.02	-0.16	-0.04	-0.16	-0.06	-0.16
	(-1.72)***	(-31.58)*	(-1.05)	(-28.08)*	(-1.75)***	(-31.07)*	(-1.99)***	(-33.65)*
WF(-1)	-0.01		0.02				0.04	
	(-1.20)		(1.85)***				(2.59)**	
Δ GOVEXP	-		0.05	-0.01	-		0.08	-0.02
			(0.68)	(-0.82)			(1.23)	(-1.09)
Δ PCONS	0.54		0.46		0.53		0.44	
	(2.45)**		(1.90)***		(2.47)**		(2.15)**	
Δ YD	4.77	1.01	4.67	0.99	4.68	0.98	4.62	0.99
	(16.20)*	(44.74)*	(12.02)*	(54.04)*	(16.40)*	(57.71)*	(11.87)*	(59.19)*

Variable	Specification 1		Specification 2		Specification 3		Specification 4	
	MM	MIMIC	MM	MIMIC	MM	MIMIC	MM	MIMIC
YD(-1)	-0.03		-0.04		-0.02		-0.02	
	(-0.90)		(-1.38)		(-0.93)		(-0.58)	
R(-1)	-3.65E-03		-4.15E-03		-3.90E-03		-3.51E-03	
	(-2.83)*		(-2.31)**		(-2.67)**		(-2.61)**	
INF	0.17		0.22		0.18		0.24	
	(3.13)*		(2.59)**		(2.98)*		(3.00)*	
Δ M1		1.65		1.04		1.15		1.3
		(3.05)*		(2.07)**		(2.13)**		(2.64)*
M1(-1)	-0.04		-0.30		-0.05		-0.06	
	(-2.35)**		(-1.57)		(-2.32)**		(-2.79)**	
D1974	0.28		0.11		0.26		0.10	
	(13.37)*		(7.04)*		(13.16)*		(3.64)*	
D1975	0.03		0.18		0.03			
	(1.64)		(6.16)*		(1.72)***			
D1976							0.11	
							(6.86)*	
D1986	-0.04				-0.04		0.00	
	(-2.48)**				(-2.56)**		(-0.24)	
D1974* Δ YD	-4.44				-4.36			
	(-22.35)*				(-20.98)			
D1974* Δ M1	1.16				1.16			
	(21.48)*				(20.82)*			
D1975* Δ YD			-4.34				-6.41	
			(-15.81)*				(-15.40)*	
D1975* Δ M1			1.18					
			(16.87)*					
D1976* Δ YD							2.76	
							(7.10)*	
D1976* Δ M1							1.12	
							(18.41)*	
D1985* Δ YD							-0.73	
							(-3.24)*	
D1985* Δ M1							-0.15	
							(-2.06)*	
D1986* Δ YD			-0.28					
			(-2.00)***					
D1986* Δ M1			-0.20					
			(-2.44)**					
D1996* Δ YD	-0.40				-0.36			
	(-2.47)**				(-2.60)**			
D1996* Δ M1	-0.16				-0.17			
	(-3.07)*				(-2.96)*			
Independent Term	-0.53		-0.38		-0.49		-0.54	
	(-5.54)*		(-6.29)*		(-5.99)*		(-4.23)*	

Notes: (1) t-statistic in parentheses, (2) Statistical significance: * prob <0.01, ** prob <0.05, *** prob <0.1 (3) Software used: EViews 8.0 and SPSS Amos, (4) estimates of the standard deviations calculated based on consistent estimator of the variance and covariance matrix of the OLS estimators of the regression coefficients in the presence of heteroscedasticity and / or auto-correlation (HAC).

Before proceeding to a more in-depth analysis of the causes of the NOE, common to the monetary method and the MIMIC model, it should be noted that the variables indicator of the MIMIC model, namely the amount of per capita real money (defined by the monetary aggregate *M*1) and real GDP per capita (GDP*pc*) show consistent results in all cases, and the variable *M*1 indicator clearly shows a significance level of less than 5% and a behaviour consistent with the economic theory. Given the specific estimation process of the MIMIC model, in order to obtain the absolute levels of the estimated parameters, and not only their relative magnitudes, we have followed the suggestion of Giles and Tedds (2002) with normalization of the GDPpc – see footnote 1. It is also important to highlight that this normalization, despite allowing a stagger of the latent variable, does not change the qualitative result (Stapleton, 1978).

Regarding the causes of the NOE, the variable *DT* is statistically significant is all ECT and MIMIC adjustments, with an estimated coefficient sign validated by the theory. Hence, the *DT* is crucial in propelling the NOE, and indeed the greater the tax burden, the greater the tendency for economic agents engage in the NOE (Alm, 1996; Schneider 2005, 2006). In MIMIC model, the estimated coefficient is positive and the variable is statistically significant for a significance level always below 1%. In case of the adjustment 2, for example, an increase of 1% in the *DT* variable induces an estimated increase of the NOE around 0.22%.

Other relevant results that should be emphasized is related with ECM through which we conclude that the demanded money is balanced between the short and long-run, but for some specifications the effect is more evident in the long run. For example, in the specification 2, an increase of 1% in *DT*, increase the demand by 0.05% and 0.08% in the short and in the long-run, respectively. Thus, the estimated effect of *DT* on *M*1, distributed from multiple future time periods is 0.27%, which is the estimated the long-run elasticity of the variable.[4]

One plausible factor for the smaller short run effect on *M*1 comes from the expectation of the economic agents that the high tax burden does not remain in the long run. However, in face of successive increases in direct taxes and/or in social contributions, agents are more resistance to pay taxes. Additionally, a tendency to increase labour supply in the NOE emerges, accompanied by a higher propensity to purchase goods and services in

[4] The long-run multiplier has been calculated according the method proposed by Boef and Keele (2006, p.17), $\hat{k}_{ECM} = \frac{\hat{\beta}}{\hat{\alpha}} \hat{k}_{ECM} = \frac{\hat{\beta}}{\hat{\alpha}}$, where $\hat{\beta}$ $\hat{\beta}$ is the estimated coefficient associated with the explanatory variable, and $\hat{\alpha}\hat{\alpha}$ is the estimated coefficient of the dependent variable lagged by one period.

the NOE. This may take place due to the fall in tax deductions, reflected in a higher tax burden on personal and firms income, namely if accompanied by a persistent pattern of increase in indirect taxes.

Another important variable to explain the NOE are the social benefits paid by the State. Overall, this variable is significant, although with divergent effects in the short and in the long run. In the short run, an increase of social benefits leads to a decrease in money demand to carrying out operations under the NOE, given the associated costs. According Bajada (1999), this reduction in the incentive to deviate to the NOE is related to the existing trade-off between work and leisure.

By remaining in the formal economy, the economic agent can continue to reap the benefits, a reality that cease to happen if s/he choose to stay in the NOE. This effect is mirrored in the ECM and MIMIC specifications. For the latter with significance level smaller than 1%: ceteris paribus, it is estimated a reduction of 0.16% of the NOE in face of an increase of 1% of social benefits paid by the State. It is also possible, especially in the long-run, an increase in the NOE – e.g., specification 2 where the total effect of social benefits on the long-run money demand is 0.07%, which is the estimated long-run elasticity of the variable. According Dell'Anno (2007), the social benefits introduce distortions to domestic competition and also to the international competitiveness of the economy, since they alter the tax burden to be paid by firms and may encourage them to participate in the NOE, as these benefits can be based on questionable and discriminatory justice pillars and not according to market efficiency targets.

The variables that also influence the amount of money in circulation such as interest rate, inflation rate, disposable income and final private consumption proved to be statistically significant. The interest rate is a mostly significant factor to constraining money demand in the long run. According to the econometric results, ceteris paribus a 1% of increase in interest rate induces a decrease of the money demand -0.003% in the long run.

The inflation rate appears to have a positive effect on the money demand. According Gadea and Serrano-Sanz (2002), the inflation rate can have a positive effect on the money demand, accelerating the level of transactions in the economy, especially in periods whose overall price level is significant, representing in fact an opportunity cost in holding money. In turn, concerning *PCONS* the econometric results suggest a convergence with the economic theory: a greater PCONS induces a greater amount of money demand.

The effect of *YD* on money demand is essentially a short-run effect. It is expected that an increase leads to an increase in money demand and thus in the NOE, which is also confirmed by the associated coefficient in the MIMIC

model. This means that, for example, in the specification 2, an increase of 1% in *YD* leads, ceteris paribus, to an increase of 0.99% of the NOE. In the long run, an increase of 1% in *YD* leads, ceteris paribus, to an estimated reduction of 0.04% of the money demand (specification 2). The *GOVEXP* and *INDT* variables are not statistically significant and thus considering that they are crucial in explaining the observed path of the quantity of money will not be the subject of further study.

Regarding the analysis of the quality of adjustments, one of the crucial tests is the Engles's Arch test (Autoregressive Conditional Heteroskedasticity). This focuses on ascertaining the presence of autocorrelation in the variance of the perturbation terms (Engle, 1982). Thus, the null hypothesis is based on the assumption of non-existence of any Arch effects, with the possible assertion that the models do not have these effects, given that the *p*-value for all of them is superior to 0.05. Finally, through the Ramsey RESET test developed by Ramsey (1969) is possible to check that the models are specified correctly, founded by *p*-value clearly greater than 0.05. Therefore, one can conclude for the reasonableness of the estimation of the NOE through the specified models.

As regards the quality adjustment of specifications selected in the MIMIC model, it is evident the presence of a good quality adjustment from the results of key indicators and from the tests for evaluating the quality of structural equation (e.g., Boomsma, 2000; Schermelleh-Engel *et al.*, 2003; Kline, 2005; Hooper *et al.*, 2008), namely Chi-square (χ^2), the Root Mean square Error of Approximation (RMSEA), the Comparative Fit Index (CFI) and the Standardized Root Mean square Residual (SRMR).

We also perform other tests often reported as significant in econometric studies (e.g., McDonald and Ho, 2002); in particular, the incremental index Normed Fit Index (NFI) and Non-Normed Fit Index (NNFI) and, finally, the Parsimonious Normed Fit Index (PNFI). The χ^2 test with a *p*-value greater than 0.05, shows the non-rejection of the null hypothesis that the model is correctly specified, noting up such a scenario in all specifications (see Table 5).

Table 5. Ajustment tests

Variable	Specification 1		Specification 2		Specification 3		Specification 4	
	MM	MIMIC	MM	MIMIC	MM	MIMIC	MM	MIMIC
R^2	0.99		0.99		0.99		0.99	
LM Statistic (1)	0.03		0.01		0.03		0.02	
Arch (1)	0.34		0.31		0.24		0.11	

Variable	Specification 1		Specification 2		Specification 3		Specification 4	
	MM	MIMIC	MM	MIMIC	MM	MIMIC	MM	MIMIC
Ramsey (2)	0.64		0.57		0.68		0.11	
χ^2		2.53 (0.77)		4.48 (0.88)		5.27 (0.81)		7.69 (0.94)
df		5		9		9		15
RMSEA		0.00 (0.80)		0.00 (0.90)		0.00 (0.84)		0.00 (0.95)
CFI		1.00		1.00		1.00		1.00
NFI		0.98		0.97		0.97		0.96
NNFI		1.04		1.05		1.05		1.07
SRMR		0.08		0.09		0.10		0.10
PNFI		0.49		0.58		0.58		0.68

Notes: (1) p-value for the test shown in parentheses. (2) levels associated with RMSEA test in parentheses corresponds to their respective pclose.

As for the RMSEA, it has been recognized as one of the most appropriate indicators of the quality of the adjustment. It is expected that the RMSEA presents values below 0.06, thus capturing a good fit of the adjustment (Hu and Bentler, 1999). In fact, this indicator is 0 in all cases and thus substantially less than 0.06, which indicates a good quality of the adjustment. In what concerns the SRMR, reference values of a good adjustment lie between 0.08 (Hu and Bentler, 1999) and 0.10 (Schermelleh-Engel et al., 2003). In fact, this happens on all models specified and thus by this indicator, the quality of the adjustment is good.

Additionally, placing focus on the set of incremental tests, the NFI, the NNFI,[5] and the CFI (e.g., Hooper et al., 2008), it is expected these tests present values above 0.95, verifying a match between the empirical results and theoretical assumption. In particular, the CFI is 1 in all specifications, which demonstrates a good quality of the adjustments. Finally, it is also important to perform the PNFI test, which is a modification of the NFI (e.g., James et al., 1982). There are no reference values for this test, but is common to state that as greater the magnitude of the test the most parsimonious model is.

[5] According Byrne (1998), given that the NNFI is not sstandardised, it may have values greater than 1, which may cause difficulties as regards the interpretation.

Figure 2. The path of the NOE, as a % of the GDP

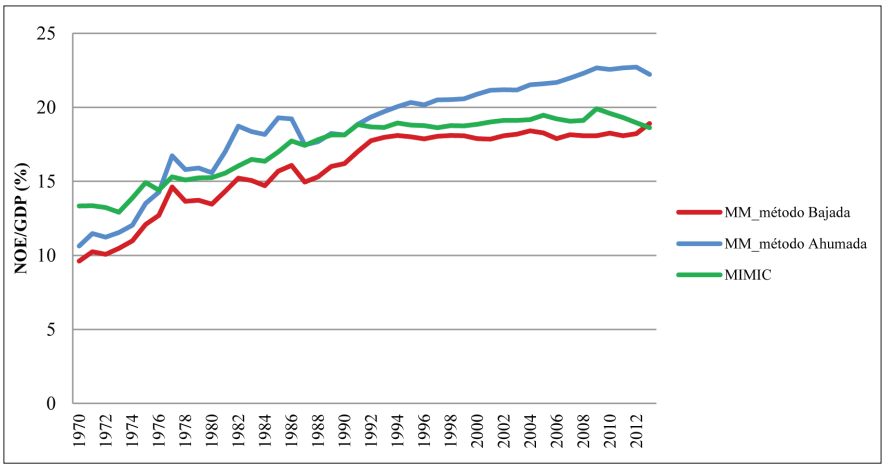


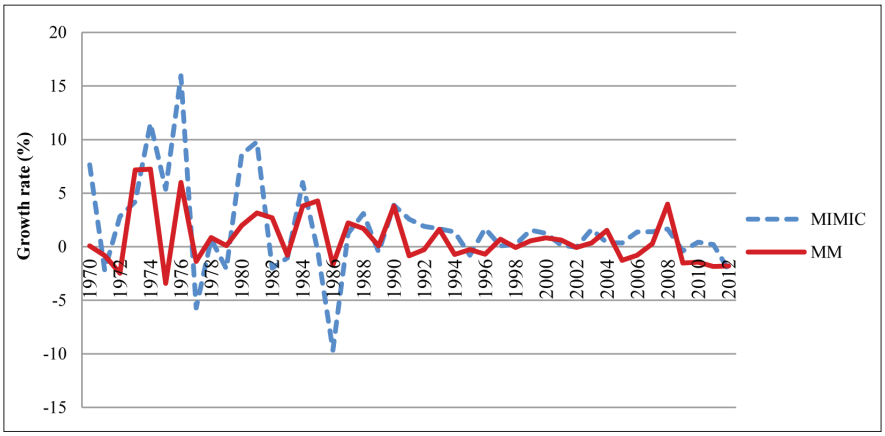
Figure 2 is merely representative of the magnitude of the NOE in Portugal (estimated from the specification 2), in the time period 1970-2013. It can present higher or lower size than the one in Figure 1 – see Table 6. From a careful analysis of the series obtained from the four specifications, the NOE presents an upward trend over time, varying between 6% and 13% in 1970 and between 20 and 25% in 2013. This expansion is especially notorious for the time horizon 1970-1991. Indeed, according to estimated data, the NOE grew by about 10 percentage points from 1970 to 1991, then verifying a slowdown of its growth rate. Additionally, it is visible a slightly stronger growth in economic recessions, such as in 2008 in which the magnitude of the NOE assumes values between 19% and 26%. In recent years a smaller growth or even a slowing of the NOE is visible, emphasizing the positive relationship with the economic output in line with the economic theory (e.g., Adam and Ginsburgh, 1985; Asea, 1996; Giles e Tedds, 2002).

Table 6. the path of the NOE as a percentage of the GDP, 1970-2013

Ano	Specification 1			Specification 2			Specification 3			Specification 4		
	Bajada	Ahumada	MIMIC	Bajada	Ahumada	MIMIC	Bajada	Ahumada	MIMIC	Bajada	Ahumada	MIMIC
1970	11.46	15,77	15.66	9.61	10.63	13.34	7.58	10.76	13.77	5.83	9.12	14.75
1971	12.38	17.14	15.67	10.25	11.48	13.35	8.20	11.71	13.78	7.02	11.06	14.76
1972	11.94	16.52	15.46	10.07	11.23	13.24	7.99	11.40	13.68	6.55	10.31	14.53
1973	12.41	16.88	14.81	10.48	11.55	12.92	8.42	11.80	13.40	7.14	10.98	13.88
1974	11.78	15.87	16.72	10.99	12.05	13.88	8.13	11.27	14.23	7.50	11.38	15.77
1975	12.36	17.05	18.69	12.08	13.52	14.92	8.84	12.58	15.11	9.03	14.16	17.93

Ano	Specification 1			Specification 2			Specification 3			Specification 4		
	Bajada	Ahumada	MIMIC	Bajada	Ahumada	MIMIC	Bajada	Ahumada	MIMIC	Bajada	Ahumada	MIMIC
1976	13.42	18.60	17.67	12.71	14.26	14.42	9.91	14.19	14.70	9.57	15.11	16.85
1977	15.15	21.1	19.41	14.63	16.73	15.31	11.21	16.13	15.45	14.00	22.27	18.74
1978	14.55	20.69	19.11	13.66	15.8	15.1	10.72	15.78	15.28	11.98	19.62	18.28
1979	14.07	20.04	19.38	13.73	15.91	15.23	10.42	15.37	15.39	12.29	20.16	18.56
1980	13.25	18.97	19.42	13.46	15.59	15.25	9.93	14.72	15.41	10.98	18.15	18.62
1981	13.62	20.03	19.99	14.31	16.99	15.55	10.26	15.67	15.66	12.84	22.03	19.29
1982	15.2	23.13	21.00	15.22	18.73	16.05	11.51	18.26	16.07	15.34	27.63	20.42
1983	15.23	23.01	21.93	15.06	18.36	16.49	11.50	18.08	16.44	14.50	25.84	21.45
1984	14.68	22.61	21.73	14.72	18.18	16.36	11.09	17.82	16.34	13.73	25.13	21.14
1985	15.59	23.66	23.12	15.70	19.3	16.99	11.85	18.73	16.86	16.35	29.31	22.63
1986	16.96	24.74	24.83	16.08	19.23	17.73	12.80	19.37	17.49	17.31	29.38	24.44
1987	16.25	23.24	24.16	14.96	17.46	17.43	12.02	17.81	17.24	14.59	24.08	23.69
1988	16.51	23.28	24.95	15.31	17.68	17.82	12.26	17.88	17.56	15.06	24.35	24.66
1989	18.15	25.08	25.56	16.01	18.24	18.13	13.48	19.22	17.8	16.67	26.22	25.42
1990	18.87	25.56	25.56	16.21	18.14	18.14	14.12	19.70	17.8	16.64	25.45	25.45
1991	19.61	26.19	27.14	17.00	18.86	18.85	14.81	20.34	18.37	18.22	27.31	27.25
1992	21.27	27.80	26.62	17.75	19.35	18.69	16.25	21.81	18.23	19.55	28.45	26.84
1993	21.48	28.24	26.59	17.99	19.72	18.64	16.44	22.19	18.2	20.27	29.72	26.7
1994	20.99	27.91	27.37	18.09	20.05	18.95	16.20	22.14	18.45	20.48	30.52	27.51
1995	21.31	28.94	26.94	18.02	20.33	18.81	16.34	22.88	18.34	20.86	32.04	27.16
1996	21.28	28.98	26.77	17.87	20.17	18.76	16.30	22.88	18.29	20.08	30.95	27.02
1997	21.75	29.84	26.42	18.05	20.52	18.63	16.64	23.56	18.18	20.79	32.39	26.68
1998	21.75	29.74	26.76	18.10	20.53	18.76	16.69	23.52	18.29	20.66	32.02	27.02
1999	21.69	29.81	26.69	18.08	20.57	18.75	16.59	23.52	18.28	20.65	32.24	26.99
2000	21.34	30.32	26.87	17.88	20.89	18.85	16.3	23.97	18.36	20.43	33.41	27.25
2001	21.34	30.82	27.29	17.85	21.15	19.01	16.38	24.52	18.49	20.33	34.01	27.67
2002	21.53	30.66	27.56	18.08	21.19	19.13	16.57	24.43	18.59	20.65	33.89	27.99
2003	21.48	30.37	27.56	18.19	21.18	19.11	16.54	24.19	18.58	20.72	33.66	27.96
2004	21.56	30.58	27.76	18.41	21.52	19.18	16.58	24.34	18.64	21.70	35.42	28.14
2005	21.07	30.33	28.47	18.27	21.60	19.47	16.28	24.28	18.88	21.08	35.11	28.94
2006	20.71	30.81	27.82	17.89	21.68	19.23	15.91	24.59	18.68	20.43	35.62	28.27
2007	21.14	31.39	27.38	18.15	21.98	19.07	16.24	25.06	18.55	21.18	36.84	27.85
2008	21.03	31.9	27.47	18.09	22.29	19.13	16.21	25.6	18.58	21.04	37.71	27.98
2009	20.44	31.62	29.43	18.08	22.66	19.9	15.84	25.57	19.21	21.13	38.94	30.04
2010	20.94	31.88	28.70	18.25	22.57	19.60	16.45	26.09	18.97	21.30	38.37	29.23
2011	20.58	31.94	27.90	18.07	22.67	19.32	16.1	26.08	18.74	20.94	38.74	28.45
2012	20.97	32.21	27.14	18.23	22.71	18.96	16.39	26.25	18.46	21.40	39.02	27.50
2013	21.52	30.73	26.38	18.91	22.23	18.63	16.92	25.02	18.19	22.65	37.32	26.61

Figure 3. The path of the NOE as a % of the GDP



As mentioned above, the adoption of different specifications generate different estimates for the NOE. Results show that the Bajada (1999) method produces an inferior dimension of the NOE when compared with the Ahumada method and the MIMIC model. As Figure 3 shows, the NOE obtained through the monetary method, regardless the methodology, and through the MIMIC model is generally convergent. Hence, both models provide reciprocal robustness.

The analysis of the NOE over time is undoubtedly a powerful tool for research, allowing us to measure the magnitude of income that is not in national accounts and to identify the factors which influence the size.

Table 7. Contributions to the path of the NOE

	DT	*INDT*	*WF*	*GOVEXP*	*YD*	*PIB*	*NOE*
1970-1976	4.87%	2,65%	16.05%	3.01%	4.86%	4.79%	4.48%
1977-1983	3.17%	2.59%	4.80%	2.91%	2.42%	3.11%	2.12%
1984-1990	1.04%	-0.28%	-4.42%	1.03%	3.20%	4.06%	2.93%
1991-1997	2.69%	0.90%	2.45%	0.37%	1.95%	2.34%	2.35%
1998-2004	0.60%	1.08%	2.76%	0.93%	2.05%	2.31%	-0.05%
2005-2013	0.28%	-0.21%	2.63%	-0.06%	0.04%	-0.45%	0.22%

Notes: (1) Variables are presented in average annual growth rates. (2) Calculations by the authors.

Table 6 stands out immediately a group of timelines that stand out for their particular evolution and its influence on the NOE: 1970-1976, 1977-1979, 1986-1992, and finally, in 2008 -2013. In the period 1970-1976, seve-

ral factors may have been responsible for the relevant growth rate of the NOE. Portugal had just emerged from the (effects of the) revolution of April 1974, and thus was observed economic and political instability. In particular, a product contraction, a reduction in the stock of capital and in savings of emigrants, a deficit of the trade balance and a high public spending have emerged. Moreover, given the increased tax burden, there was a shortfall in tax collection.

Concerning the period extending up to the mid-80s, the magnitude of the NOE has a lower growth trend. In this period, it is introduced the first Official Plan Accounting (POC) in 1977 that aimed to implement an official model of accounting regulations. In addition, a set of economic measures, related with tax evasion, have been implemented in order to meet the required criteria to be a member of the European Economic Community in June 1985.

In turn, after June 1985 a degradation of the tax system emerged, with regard to the promotion of equity, efficiency and simplicity. As a result, we have introduced dummy variables for 1985 and 1986. In this period, it should be also stressed the adaptation of the new POC in 1989 in line with the rules made by the EEC directives, and the tax reforms with new taxes on expenditures (the VAT), on individual income (the IRS) and on firms income (the IRC). The increase in taxes has induced an increase in the tax burden, accompanied by the creation of the single social tax in 1986, with a new growth of the NOE.

At present, there is a slight slowdown in growth of the NOE. However, the economic and financial crisis of 2008 has increased the NOE, mainly due to the destabilization of the financial system, the bankruptcy of some financial institutions and the marked deterioration of public accounts, which have provoked a sharp increase in taxes and reduction of deductions and tax benefits.

>> 5. ANALYSIS OF GRANGER CAUSALITY

Studies on the causality between the NOE and the official economy are scarce. The study of causality is a powerful analysis tool when, for example, it comes to analyse the effects that the NOE have on economic growth. As a result, our aim is also to establish whether the empirical reality converges with the theoretical assumption that the NOE and the GDP have a causal relationship; i.e., if you can identify a statistical relationship of cause and effect between the variables.

To this end, we analyse the Granger (1969) causality in which a stationary time series *X* causes another stationary time series *Y* if the inclusion of lagged values of *X* to the lagged values of *Y*, allows a better and statistically significant prediction of *Y*. Thus, if *X* causes *Y*, then changes in *Y* should be preceded by changes in *X*; formally, $X_t = \sum a_i Y_{t-i} + \sum b_i X_{t-i} + \mu_{1t}$ and $Y_t = \sum a_i Y_{t-i} + \sum b_i X_{t-i} + \mu_{2t}$ and , where the errors μμ are normally distributed and mutually independent. The econometric analysis to assess the cause-effect relationship between real GDP and NOE has as a fundamental starting point the Vector Auto Regressive (VAR) – e.g., Sims (1980). The VAR is a time series model that uses past time series patterns to establish predictions, assuming that a variable can be explained by their lagged values and by lagged values of another variable. Thus, as pretreatment data, empirical analysis starts with the stationarity of the series.

Table 8. Stationary analysis (NOE and GDP)

Variable	Level		First difference	
	ADF	PP	ADF	PP
	C&T	C&T	C&T	C&T
NOE	0.97	0.98	0.02**	0.00*
GDP	1.00	1.00	0.01*	0.01*

Notes: (1) H0: the series has a unit root. H1: the series is stationary. (2) * is the rejection of the null hypothesis for a significance level of 1%; ** For a significance level of 5% and *** for a 10% significance level.

Table 8 shows that variables are integrated of order one, I(1), and therefore the first differences will be considered. This process is not consensual since it leads to loss of long-run information (Breusch, 2005a), resulting that the Granger causality analysis accommodates short-run relationships between variables. Hence, we proceeded to the study of cointegration in order to understand the long-run relationship between the variables. By using the Vector Error Correction Model (VEC) proposed by Engle and Gran-

ger (1987), it is possible to establish causal relationships between two variables that have a common long-run trend. From the maximum likelihood method proposed by Johansen (1988) is visible the presence of a long-run relationship between real GDP and the NOE (Table 9).

Tabela 9 – Cointegração (ENR e PIB)

Number of cointegration relatioships	H_0	H_1	eigenvalue	Trace statistics	Critical value (5%)	P-value
Any*	r = 0	r > 0	0.58	26.42	25.87	0.04
Maximum of one	r 1	r > 1	0.11	3.24	12.52	0.85

Note: (1) * is the rejection of the null hypothesis for a 5% significance level.

To select the optimum number of lags in the model, we have followed David Hendry to reach the optimum Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). In a context where these three criteria have divergent results, the possibility of adopting a model with three or five lags is possible, opting for the use of five lags model since it presents statistically significant results and a better adjustment. The results obtained by the VECM are of utmost importance since they allow us to capture the dynamic relationship between the NOE and the economic growth.

Table 10. VECM

Variable	D(NOE)	D(GDP)
Cointegration equation	.-1.02 (-2.63)	-0,61 (-4.11)
D(ENR(-1))	-0.00 (-0.00)	0.32 (1.83)
D(ENR(-2))	-0.55 (-1.43)	0.03 (0.19)
D(ENR(-3))	-0.24 (-0.61)	0.08 (0.49)
D(ENR(-4))	-0.17 (-0.59)	-0.19 (-1.67)
D(ENR(-5))	-0.24 (-0.88)	0.03 (0.33)

Variable	D(NOE)	D(GDP)
D(PIB(-1))	0.21 (0.40)	0.11 (0.51)
D(PIB(-2))	1.12 (2.47)	0.18 (1.02)
D(PIB(-3))	1.22 (2.51)	0.17 (0.91)
D(PIB(-4))	0.98 (1.72)	0.50 (2.30)
D(PIB(-5))	0.64 (0.98)	0.16 (0.63)
Independent term	-0.002 (-0.28)	-0.002 (-0.70)
R^2	0.80	0.80
LM test	0.47	
Cholesky (Lutkepohl)	0,76	

Table 11. Granger causality

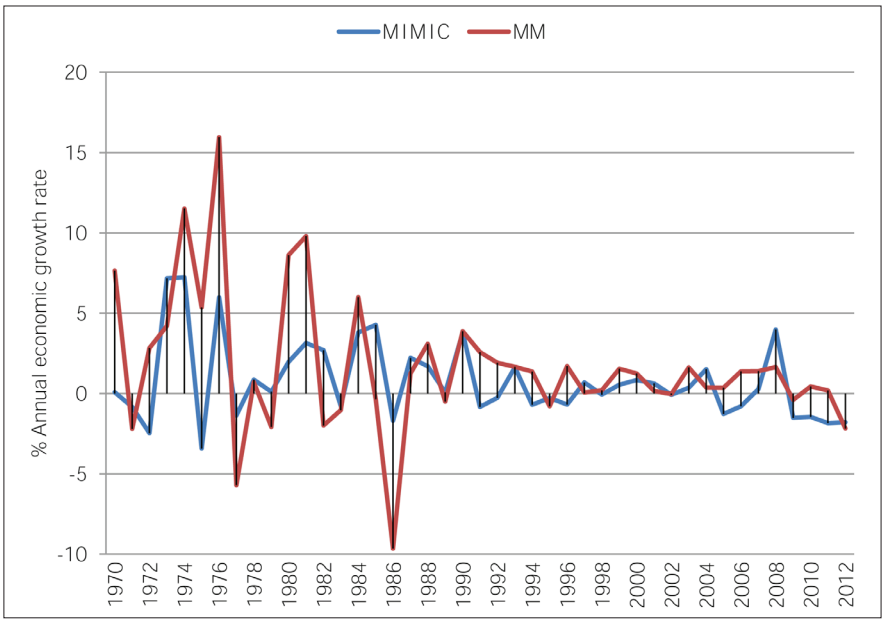
D(ENR)	→	D(PIB)	χ^2 15.78 0.00*
D(PIB)	→	D(ENR)	χ^2 11.87 0.04*

Note: * represents the rejection of the null hypothesis for a 5% significance level.

Regarding the robustness of the results, there are no autocorrelation of the errors terms since the LM test presents a *p*-value higher than 0.05, and through the Cholesky (Lutkepohl) test they present a normal distribution since the *p*-value is higher than 0.05.

From a careful analysis of the results presented in Tables 10 and 11, there is a bidirectional causal relationship between the real GDP and the NOE. This means that the coefficients associated with the real GDP lagged 5 periods are different from zero in the equation where the NOE emerges as explained variable. The same is true in the case of the NOE lagged by 5 periods present in the real GDP equation as a variable to explain. Also from Table 10, the GDP with 2-4 lags are statistically significant in the equation of the NOE as explained variable, and all coefficients of the GDP lagged *n* periods are positive, suggesting that a change observed in the formal

Figure 4. Growth rate of the NOE and of the GDP



economy affects in a similar way (in terms of signal) the NOE, such as in Giles (1997a), Tedds and Giles (2002) and Giles et al. (2002), among others (Figure 4). Thus, the decision of an expansionary fiscal policy to stimulate the (formal) economy, should safeguard the simultaneous stimulation of the NOE economy. Empirical evidence found in Giles and Caragata (2001) and Giles and Tedds (2002) show that the adoption of an expansionary fiscal policy from the reduction in the tax burden, keeping all other things being equal, allows a reduction in the ratio NOE/GDP, by reducing the NOE and increasing the GDP.

However, according to Eilat and Zinnes (2000) and Schneider (2012), the State may not have an incentive to avoid the NOE since some (informal) activities create an additional added value and a relevant level of poor population improves the level of life as a result of the additional income earned within the NOE. That is, the informal economy emerges as the attenuation factor of poverty and social exclusion – that is, regular exercise of activities within the Informal Economy generates positive impacts in economic, social and psychological levels.

Additionally, the VECM suggests that changes in the NOE affect the formal economy in a similar way, indicating that an increase in the NOE can have a positive effect on the economic growth (Asea, 1996). In the scenario whose explained variable is the GDP, the NOE seems to have a beneficial effect. Indeed, the lagged NOE variable is statistically significant and has a

positive coefficient. In fact, according to the short-run results, ceteris paribus, a 1% of increase in the NOE induces an increase of 0.32% in the GDP.

According to Frey and Schneider (2000) the NOE enables the development of an economic scenario where the dynamism, entrepreneurship and higher economic efficiency are evident. In the same line, Schneider (2007) finds that about two-thirds of the NOE profits are reinvested in the formal economy. Enste (2003) states that the NOE affect positively the economic development when responds to the increased demand of certain urban goods and small-scale services (Enste, 2003), contributing to the creation of markets, financial resources and enhanced competitiveness between the institutions. Moreover, bearing in mind the price difference, the shifting in the demand towards the NOE provides a higher disposable income to the agents. If this higher income is directed to savings leads to an increase of capital stock. In turn, if used for consumption, represents an increased demand in the formal economy.

Still according to the results presented in Table 10, the beneficial effects of the NOE on GDP are not verified in the long run, since it is estimated that, ceteris paribus, an increase of 1% in the NOE decreases the GDP in 0 20%. However, it is important to note that the impacts on the GDP are not precise since, as Schneider and Enste (2000) conclude, the exact quantification of the effects still remains ambiguous, theoretically and empirically.

>> 6. SOME CONCLUDING REMARKS AND POLICY RECOMMENDATIONS

The NOE is an increasing phenomenon, whose characteristics and determinants still require further investigation. In general, it is consensual that the NOE contributes to worse redistribution of income, penalises the social protection, affects negatively the allocation of resources, punishes competition and impoverishes the quality of public services. However, it contributes for survival of individuals and families during adverse scenarios (in same cases seems to be the only strategy) and some "informal" activities may serve as a starting point for an eventual transition to a formal economy. The NOE can be a response to problems in employment (it may is a response to insecurity, underemployment, low wages and discrimination by age, by health and by gender). It can be a response to (problems in) unemployment: (i) long-term and very long term of unemployment, (ii) the limits of social protection, and (iii) the obstacles to the reintegration in the labor market. Thus, the reduction of the NOE requires, on the one hand, jobs with quality, more stability, social protection and the possibility of professional development and, on the other hand, response to the unemployment, through rehabilitation of individuals and/or their reintegration into the labour market.

We have assumed as fundamental premises the measure of the NOE in the Portuguese economy based on different methodologies as well as the study of causality between the NOE and the formal economy in order to draw conclusions on the effects of the NOE on economic growth. Concerning the measure of the NOE, our calculations include two different econometric models, the monetary method and the MIMIC model. It is estimated that the NOE has an upward trend over the past decades, varying between 6% and 13% in 1970 and between 20% and 25% in 2013. Given the unobservable nature of the NOE, the estimates should be analysed with caution and rather than specific values, it should be stressed the growing trend. A better understanding of this phenomenon has been an objective of the competent authorities, given the associated effects.

The results allow us to make a set of conclusions. Firstly, in terms of statistical significance, the main causes are the direct taxes and contributions to social security. Secondly, the evidence seem to indicate that the NOE obtained by monetary method, according to various methodologies, and by MIMIC model does not present a sharp dichotomy. Thirdly, the Granger causality between the NOE and the GDP suggests that: (i) given the posi-

tive (negative) short-run (long-run) coefficients associated with the lagged NOE variable in the GDP equation there is a positive (negative) effects in the short-run (long run): ceteris paribus, an increase of 1% of the NOE increases (decrease) the GDP in 0.32% (0.20%); (ii) the VECM model point out the presence of positive coefficients associated with lagged GDP variables when the NOE is the explained variable and a bidirectional causality between the NOE and the GDP. This seems to suggest that, when it is introduced dynamism in the official economy, through fiscal policies, the NOE is also encouraged, verifying that both vary in the same direction, although the weight concerning the NOE is ambiguous.

It seems plausible to assume that rather than give credibility to the tax system and limit the NOE with the introduction of strong regulative measures to combat fraud and tax evasion, competent authorities should: (i) reformulate labour laws; (ii) simplify the tax system; (iii) reformulate of the social security system; (iv) educate the population; (v) adopt of a set of measures to enable the transfer of "informal" activities into the formal economy.

While the Portuguese NOE has been studied with greater intensity in recent years, there is no a plan to combat the phenomenon. Moreover, multiple domains are still not explored, which requires, for example, microeconomic analysis (e.g., a model to determine the probability of default and the entrance into the NOE taking into account the factors that characterize individuals and business models), an analyse on the eventual symmetry between the NOE and economic cycles (as a complement to the study of causality analysis), as well as a regional and sectoral analysis, such as the one performed by Tafenou et al. (2010), in order to identify the areas that need further attention by the authorities.

As a policy recommendation, we suggest the following measures: transparency in the management of public resources; education of the civil society about the perverse effects of the NOE; fast and effective justice; strong penalty of the illicit enrichment, punishing the agent who purchase goods in clear disagreement with the declared income; combating corporate fraud (i.e., the existence of shadow firms, the accounting manipulations, the fraudulent reports and the use of inside information); combating abuse of double taxation agreements; encourage increased use of electronic means in market transactions; combating money laundering (through better supervision of the financial system, better regulation of the sector and appropriate legislation). In short, the action of the tax inspection is crucial to combat the NOE, leading the fight against fraud and tax evasion and tax inequities, taking into account the observation of the tax realities, the observation of compliance with tax obligations and the prevention of tax offenses. The tax

administration should intensify massive and automatic controls through the information systems of various areas of tax management; invest in tax inspection "on the ground", particularly in more complex fraud and tax evasion.

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