

Portugal's Rising Unobserved Economy Share in a Single-country Study*

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Abstract

We estimate that the Unobserved Economy (UnEc) share in Portuguese GDP rose to a maximum of 34.37% in 2022. The results suggest that cutting the tax burden and improving the efficacy of social benefits could reduce UnEc and foster inclusive growth. The rising UnEc share MIMIC estimates found in our single-country study, with variables suited to Portugal, contrast with the downward trend (from 22.2% in 2003 to 16.5% in 2021) in the MIMIC multi-country study by Schneider (2021), who uses different variables – mostly reflecting the economic structure of advanced economies – and does not report if and how country heterogeneity is dealt with. Compared to other recent single-country estimates for the European Union periphery, Schneider (2021) also underreports the UnEc share of (at least) Greece, Poland and Lithuania. Thus, we recommend that authorities prefer UnEc single-country estimates in their analysis and policy design and be aware of mentioned issues in multi-country results.

Keywords: unobserved economy, MIMIC model, economic growth, Portugal, European periphery

JEL Classification: O17, C39, H10, H26

1. Introduction

The Unobserved Economy (UnEc) encompasses a range of situations and activities representing a heterogeneous universe (Castells and Portes, 1989). This study follows the broad OECD (2002) definition of UnEc, covering aspects like hidden, illegal, and informal activities, self-consumption, and unaccounted production due to statistical problems. Notwithstanding its definition, the causes, consequences, and triggering agents have changed over time. It is certain that UnEc reduces public revenues and distorts official indicators, affecting government decisions.

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Understandably, there is a growing academic and policy interest in UnEc (e.g., Tanzi, 1983 and 1999; Schneider and Enste, 2000; Schneider, 2021).

In regard to the estimation methodology, indirect methods – using macroeconomic data to find the traces of UnEc in official statistics – such as the monetary method and in particular the MIMIC method (Multiple indicators, Multiple Causes) are the most used.

The main research question of this paper regards the recent trajectory of the UnEc share in Portugal's GDP. Following the MIMIC base specification of Soares and Afonso (2019) – excluding the monetary model also used in that article due to its unstable results –, which is the only single-country article focused on Portugal with UnEc share estimates for the 2010 decade (1970–2015), this work updates the series to the 1995–2022 period.

These results are analyzed with a new perspective for UnEc reduction in Portugal from the record share estimated in 2022, by looking at the identified causes of the rising trend and additional data shown in the discussion, which also support the interpretation of results.

By using specific determinants suited to Portugal, it is expected to be a more precise measure and evolution of the UnEc share compared to multi-country MIMIC studies, in particular Schneider (2021), who presents contrasting results between 2003 and 2021, with much lower estimates and a declining trajectory. A different set of variables – several of which are not significant in Soares and Afonso (2019) – and possible shortcomings in dealing with country heterogeneity may explain the conflicting results. Schneider (2021) also appears to underestimate the UnEc shares of at least Greece, Poland and Lithuania (which are also in the periphery of the European Union), considering recent single-country MIMIC estimates for these three countries. The issues raised here extend to other panel studies of Schneider, who has been providing references in the UnEc field for years.

In summary, this article provides a twofold contribution to the literature:

- (i) It presents the most recent Portuguese UnEc share MIMIC estimates in a single-country study – the main aim of the paper – as available results mostly come from multi-country studies, and analyses the causes for the discovered upward trend, generating policy recommendations.
- (ii) It critically compares the estimates with the conflicting results coming from the recent multi-country study of Schneider (2021) and presents possible explanations of apparent underestimation of the UnEc share of Portugal compared to this single-country study, but also in the cases of Greece, Poland and Lithuania as shown by related single-country estimates.

The following section presents a literature review regarding the UnEc definition, the existing estimation methods, and previous studies. Next, Section 3 shows the model setup (variables, measurement, and MIMC specification) and the main results. It is followed by Section 4, where we show UnEc shares of Schneider (2021) for Portugal and other European Union peripheral economies, and compare them to the results of this study, and to available single-country estimates for Greece, Poland and Lithuania. Then, a critical discussion of the UnEc results for Portugal is provided in Section 5, with our proposals to cut its size being in Section 6. The paper ends with the concluding remarks in Section 7.

2. Definition of UnEc, Estimation Methods and Previous Studies

2.1 Definition of UnEc

The general definition of the UnEc is not universal. A commonly used definition includes economic activities not recorded in the official GDP. Smith (1994), for example, defines it as market-based production of goods and services, legal or illegal, that escapes detection in official GDP estimates. Although it is impossible to select the best definition, estimates should include productive activities not observed due to economic reasons (e.g., Schneider and Enste, 2000; Giles and Tedds, 2002; Dell'Anno, 2003), such as activities undertaken with the explicit intention of avoiding taxes, social contributions or legal requirements concerning minimum wages, working hours, and health and safety regulations. Dell'Anno (2003), for example, proposes one of the broadest definitions, considering that it includes activities (and income derived from them) conducted to avoid government regulation or taxation.

This study follows the even broader OECD (2002) definition, which includes: (i) the black or hidden (underreported or underground) economy; (ii) the illegal economy; (iii) the informal economy that is not black or illegal; (iv) the household economy for own final use (self-consumption) that is not black, illegal or informal; and (v) other productive activities carried out but not accounted for due to statistical issues.

In this perspective, the UnEc definition followed here includes virtually everything not captured by the basic data sources used for compiling national accounts. Some of the included phenomena mentioned in the previous paragraph are not inherently negative, so they must be distinguished.

The illegal economy (ii) and the hidden economy (i) are particularly serious – fraud, tax evasion, money laundering, conflicts of interest, insider trading, deregulation, and the weakening of the state – and must be fought energetically and effectively.

The informal economy (iii) and self-consumption (iv) act mostly as a social cushion for mitigating population suffering, especially in times of recession, and in countries with fewer resources for social protection. The challenge here is to develop and grow the economy to obtain more resources and allocate them efficiently to social protection (with adequate supervision), so that the population does not have to resort to the informal economy and self-consumption to meet basic needs, thereby reducing these two phenomena to a socially balanced dimension, as they will always exist. Finally, statistical shortcomings (v) stems from difficulties in collecting and processing information, requiring a better allocation of resources for the development of statistical systems.

The analysis of results and policy proposals will focus mostly on how to reduce the undesired phenomena considering the identified causes of UnEc.

2.2 Estimation methods

Using scientific methodologies, it is possible to estimate the UnEc, usually as a proportion of official GDP, in three possible ways: (i) direct; (ii) indirect; (iii) mixed.

Direct methods require contacts with or observations of economic agents to collect direct information on undeclared income, and can be based on audits of tax returns and surveys.

In turn, indirect methods try to find the traces of UnEc in official statistics, through the use of macroeconomic data and models, following one of the six approaches: (i) the discrepancy between national expenditure and income statistics; (ii) the divergence between official and actual labor statistics; (iii) the transactions approach; (iv) the physical inputs method (e.g., electricity); (v) the monetary model; and (vi) the MIMIC method (Multiple Indicators, Multiple Causes).

Due to the lower costs and the availability of macroeconomic information, indirect measures, which require the usage of econometric techniques and models, gained predominance. They have the advantage of capturing the effects of more components of the UnEc. However, the information is always incomplete and prevents a full quantification, so the UnEc share tends to be underestimated, namely by the tax administration, which is mainly focused on the transaction accounting omissions for tax reasons.

The Monetary model, and in particular the MIMIC model, has emerged as the most widely used indirect approach (e.g., Schneider and Enste 2000; Johnson et al., 1998). Each method has its strengths and weaknesses, and it is almost certain that biases always prevail in UnEc estimates – e.g., different variables/data – making the comparison more difficult. Therefore,

there is no exact measure of the size of the UnEc, and estimates tend to differ, but usually not the trajectory. However, while the monetary and MIMIC models have been subject to criticism, they remain the best option (e.g., Schneider and Enste, 2000; Schneider, 2005, Buehn and Schneider, 2012).

In the MIMIC econometric model, the UnEc is a latent variable whose evolution (more concretely, the rate of change of the UnEc share in official GDP) is inferred from data regarding the 'causes' and 'indicators' (consequences), chosen according to the theory. Then, the UnEc/GDP series is obtained using the estimated evolution applied to a starting value exogenous to the model (estimated by another model in the same study or taken from another study). As mentioned in, for instance, Soares and Afonso (2019), the MIMIC model is coming from the Linear Structural Relationships Interdependent (LISREL) family, and it applies a Structural Equation Model (SEM) by considering the UnEc dimension as a 'latent variable'.

In the monetary model, money demanded beyond the official reasons – with various determinants – is used in transactions that are intended to be kept hidden, allowing to estimate the output undeclared by individuals.

As previously mentioned, this study is based on Soares and Afonso (2019), who combine the monetary and MIMIC models to estimate the UnEc share in official GDP from 1970 to 2015. Estimates for 1970–1995 from that paper are presented here for discussion, whereas the trajectory for 1995–2022, the focus of the present study, is an update and extension using that article's MIMIC base model specification – the one that reveals the best combination of theoretically relevant variables and quality results – and the most recent data.

The monetary model is not considered here because:

- (i) It tends to underestimate the UnEc;
- (ii) The MIMIC model is the most used in recent studies, allowing for higher comparability;
- (iii) The UnEc estimates obtained with the monetary model coefficients from the same article revealed high instability and sensitivity to the historically unusual combination of inflation and interest rates close to zero or even negative from 2012 to 2021, followed by a strong increase in 2022 – therefore, the results of the monetary model are not shown here, but are reported as a reason for using only the MIMC model;
- (iv) As shown in Section 3, the followed MIMIC specification includes money circulation (outside banks) per capita as an indicator, so part of the monetary model logic is already reflected in the estimated MIMIC coefficients used here. Therefore, the results are expected to capture, at least partially, all phenomena included in the OECD (2002) definition, namely activities that justify spending and money circulation unaccounted for in official GDP.

2.3 Comparison with previous studies

Regarding international studies, Schneider (2002), for example, estimated that in 2001–2002, the average size of UnEc share in official GDP was 16.7% in 21 OECD countries, and 38% in 22 developing countries. Schneider and Klinglmair (2004) found that in 1999 and 2000, the average UnEc share was 41% in developing countries, 38% in transition countries and 18% in OECD countries.

In these earlier studies, the value of UnEc shares generally fluctuated between 15% in most developed countries and a very high value of 70% in some developing countries (e.g., Frey and Schneider, 2000).

More recent studies – highlighted below to frame the Portuguese case – point to lower UnEc share estimates in general, but still with very high values for less developed countries despite a general downward trend along the years.

The available estimates of the UnEc in Portugal mostly come from international studies of multiple countries. For example, according to Schneider (2013), Portugal had in 2012 the UnEc share of 19.4%, a high value for European country. These earlier studies pointed to an increase in the previous decade. Schneider and Enste (2000), for example, reported values for Portugal of 16.8% in 1990, 15.6% in 1990 and 1993, 22.1% in 1994 and 1995, and 22.8% in 1996 and 1997. Feld and Schneider (2010) and Johnson et al. (1998) also reported estimates for Portugal.

A more recent international study, by Medina and Schneider (2018), applying the MIMIC method to 158 countries, estimates the average UnEc share in 2010–2015 ranged from 38.8% in lower-income economies to 14.97% in advanced economies – including 15.28% in the OECD (population-weighted values). Portugal recorded a value of 19.82%, above the OECD, but very underestimated compared to the value reported here for that period (shown in Section 3).

The recent MIMIC results from Schneider (2021) allow to estimate (using additional population data from the World Bank) the population-weighted average of UnEc share in GDP in 2021 at around 13% for a set of 36 OECD countries – those of the EU-27 (of which only five do not belong to the OECD¹) plus nine other OECD countries (mostly advanced economies²). In comparison, Portugal exhibits an estimate of 16.5% in 2021 – higher than the weighted average of 13%, and just slightly above the unweighted average of 16.1% in the 36 estimated countries – a figure that seems very underestimated compared to the one here shown for that year (32.62% as reported in Section 3), using determinants adjusted to Portugal's reality.

1 Bulgaria, Croatia, Malta, Romania, and Cyprus.

2 Of which four European (United Kingdom, Norway, Switzerland, and Turkey), and five non-European (United States, Canada, Japan, Australia, and New Zealand).

Despite the significant UnEc presence in Portugal, there are few single-country studies dedicated exclusively to the Portuguese case. The exceptions are Dell'Anno (2007), Afonso and Gonçalves (2011) – with conflicting trends (negative and positive, respectively) in 1977–2004 and 1970–2008 – and Soares and Afonso (2019), the only study with values for the recent decade (1970–2015), from where the present work departs. The first table presented in Soares and Afonso (2019) provides a comprehensive picture of UnEc estimates for Portugal in previous studies, highlighting the type of study (single-country or multi-country), estimation method, time horizon and trend.

That study by Soares and Afonso (2019) uses an average of results with the MIMIC and Monetary models, while the other mentioned studies focused on Portugal mostly use the MIMIC model.

Regarding the comparison with multi-country international studies, it should be noted that the UnEc estimates emerge from determinants that are statistically significant for that large set of economies, but many of those determinants may be irrelevant in single-country studies like the one presented here, which can be expected to produce more precise estimates by using variables that better suit Portugal's reality. On the other hand, such international studies have the advantage of showing that more advanced countries tend to have lower UnEc, and can thus serve as a benchmark for best practices.

The comparative analysis of results shown in Section 3 and 4 suggests a significant underestimation of Portugal's UnEc in the multi-country MMIC studies of Medina and Schneider (2018, 2021), and especially Schneider (2021), who presents more updated results. The underreport compared to recent single-country MIMIC results also appears to affect at least three other EU peripheral countries (Greece, Poland, and Lithuania) as shown in Section 4.

3. Size and Trajectory of UnEc in Portugal

3.1 Explanatory variables, measurement, and MIMIC specification

The statistics presented here regarding the size and trajectory of the UnEc from 1995 to 2022 are derived from the base 5-1-2 MIMIC specification – five causes, one latent variable (UnEc), and two indicators (consequences) as shown in Figure 1 – of Soares and Afonso (2019), chosen for the quality of the results and theoretical justification of the variables.³

3 Although the coefficients associated with Indirect taxes (% of GDP), *IT*, and Government consumption (% of GDP), *PC*, are not significant (significance level of 10%), their inclusion is theoretically justified and improves the significance of the other inserted variables and the overall estimation as justified in Soares and Afonso (2019), and reaffirmed here. For a deeper argumentation regarding the variables, please consult Soares and Afonso (2019).

The five cause variables (C_i ; $i = 1, 2, 3, 4, 5$) in the specification – placed on the left side of Figure 1 in association with the structural equation of the model – are explained below with regard to reasoning, measurement (for technical details, see Appendix) and expected sign, considering four axes:

1. Tax burden (% of GDP): high values encourage the use of UnEc to avoid paying taxes, so it is expected to have a positive sign regarding each of the analyzed components (cause variables):
 - Direct taxes and social security contributions as % of GDP ($DTSSC$, C_1): they penalize the budget of households and businesses, providing a strong incentive to participate in UnEc.
 - Indirect taxes as % of GDP (IT , C_2): a high taxation of transactions in goods and services creates an incentive not to declare them officially, especially in some sectors, which are recognized by the tax authorities, but the tax benefits for the taxpayer to verify invoices (foreseen in the Portuguese tax system) are very small.
2. Subsidies to households and firms and social benefits as % of disposable income (SSB , C_3): they induce two opposite effects, but the first one, with a negative sign, is dominant:
 - Increased cost of being in UnEc due to the risk of losing support (even if monitoring by the Portuguese authorities is not very tight), in addition to the reduced need to participate in UnEc due to the increased benefit, and subsistence/activity minimums related to it. This dominant effect in the results is theoretically countered, at least in part, by the effect below.
 - Households and firms have an incentive to remain irregular to access support, especially if the taxation of low entrance levels of official salary/ revenues (barrier to entry into the official economy for households/ individual businesses) is high enough to make the net-tax entrance earnings smaller than the support, which cannot be officially accumulated up to a certain threshold of official income.

That is why support should not be too generous in relation to the net-tax income, otherwise it stimulates a subsidy-dependent class of households and small entrepreneurs, accustomed to low quality of living and low activity, and mostly outside the official economy.
3. Regulatory burden (% of GDP): the higher the burden, the higher the incentive to participate in UnEc:
 - Public consumption as % of GDP (PC , C_4): variable used as a measure of the regulation burden on the economy, although it also incorporates an effect of contrary (negative) sign – which appears in the results presented below – since the state supplier firms have an incentive to stay in the official economy.

4. Standard of living: to reach the highest possible standard of living, and to be able to survive and function in society, there is an incentive for people (workers and entrepreneurs) to participate in UnEc as a complement or even alternative to official income.
 - Disposable income per capita (DI, C_5): it is the average standard of living – present and future consumption (savings) – to be achieved by each person in order to be on a par with others, including those of ‘higher status’, and to function in this consumerist society. This generates an incentive to participate in UnEc (leading to a greater share of independent workers and self-employed) as a faster way to achieve this goal, across income classes.

The two indicator variables ($I_j; j = 1, 2$) used in the MIMIC specification are also part of the estimation process (measurement equation is in right side of Figure 1).

1. Money circulation per capita (MC, I_1), measured by aggregate M1 outside banks per capita:
 - This indicator assumes, following the monetary model logic, that irregular transactions use cash (banknotes and coins) instead of registered means of payment (e.g., checks and bank cards) not to leave traces of participation in UnEc. Thus, the higher UnEc and its share is, the greater the currency in circulation needed for these irregular transactions. The velocity of money circulation is assumed constant as in Soares and Afonso (2019).
2. GDP per capita (GDP_{pc}, I_2): theoretically, an increase in UnEc also contributes to the official GDP by generating official transactions (either sham, as in the case of the official front business of ‘money laundering’, or unavoidable, such as cash spent on pens and paper associated with an unregistered tutoring activity, for example).
 - The coefficient of GDP per capita is set to 1 to conduct the estimation of the other parameters, resulting in the normalization of all parameters to represent percentage impacts of the UnEc share in official GDP, also considering that the variables are inserted in the specification in logarithmic form.

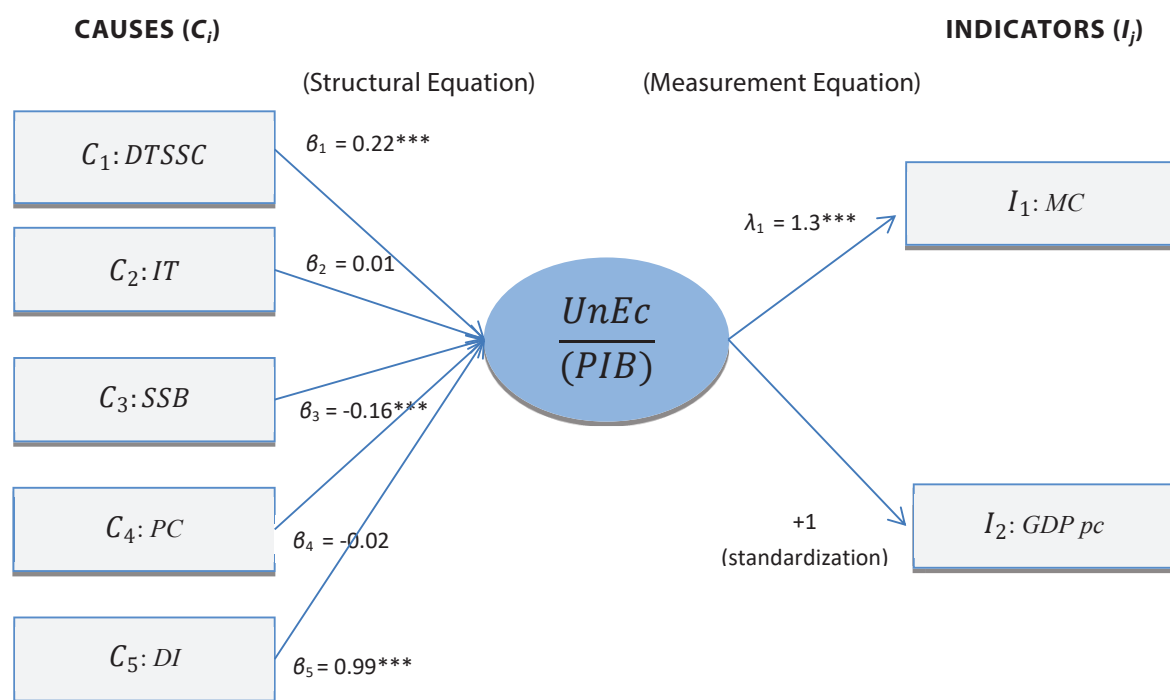
The data used to calculate the UnEc share, related technical details, and sources are shown in Appendix. In particular, Table A2 shows all the data that were used in this paper, aside from the MIMIC base-model coefficients from Afonso and Sores (2019), where all the details regarding the estimation and conducted tests can be consulted.

Figure 1 presents the estimated coefficients of the base MIMIC specification in Soares and Afonso (2019), which are used here to update and extend the UnEc estimation in 1996–2022. The causal parameters, labeled as $\beta_i, i = 1, 2, 3, 4, 5$ (structural equation on the left side of Figure 1), represent the percentage impact on the UnEc share in official GDP arising

from a 1% change in the associated cause. Thus, for example, if *DTSSC* (direct taxes and social security contributions) increases by 1%, the UnEc share is estimated to increase by 0.22%, which is the estimate of the coefficient β_1 in Figure 1.

In the measurement equation (right side of Figure 1), the coefficient estimate $\lambda_1 = 1.3$ means that a 1% increase in the UnEc share has a 1.3% impact on *MC*, the monetary circulation per capita outside banks, which is significant at 1%. This clearly shows that irregular transactions have a relevant impact in money circulation outside banks. This variable *MC* influences the estimation, but its coefficient is not used in the UnEc variation calculations, as they only require the cause coefficients, which also allow to estimate the cause contributions in each period.

Figure 1: MIMIC 5-1-2 model and estimated coefficients used in UnEc calculations



Notes: *** Statistically significant coefficients (1% significance level)

Source: Adaptation of Figure 1 from Soares and Afonso (2019), including the estimated parameters of the base MIMIC specification 4 in Table 3 of the same article

3.2 Main results

3.2.1 UnEc trajectory and value

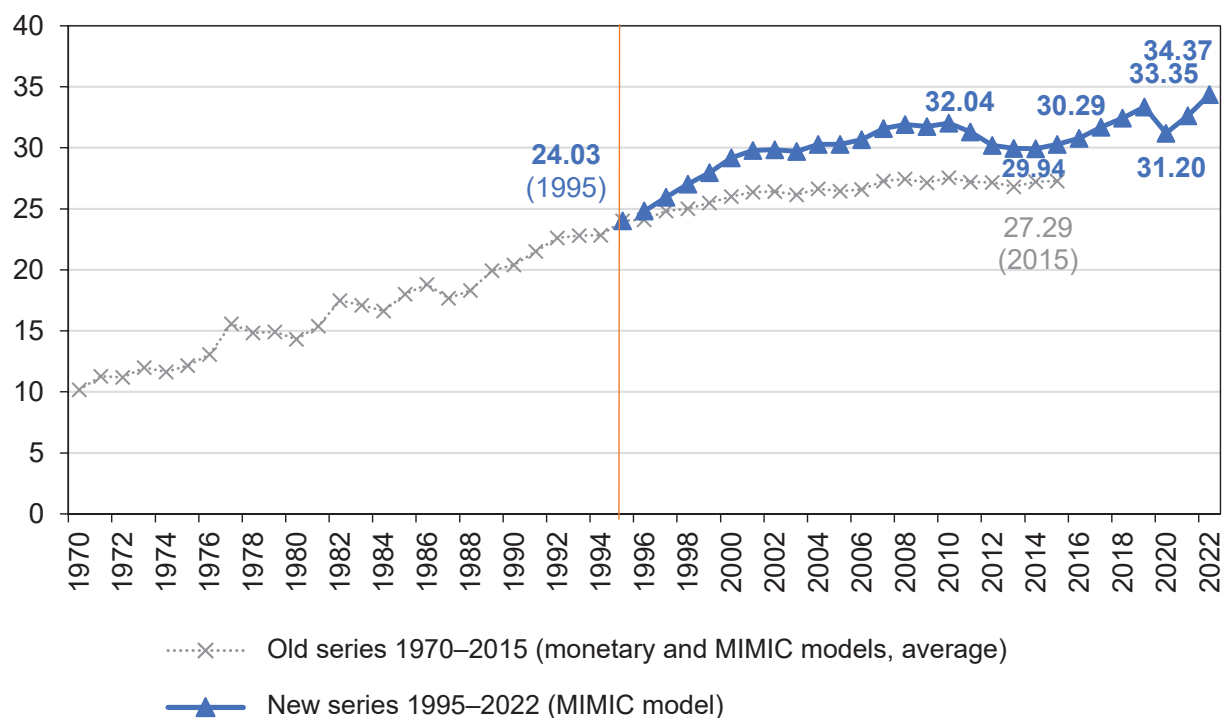
The UnEc share in official GDP and value (at constant 2016 prices) are shown, respectively, in Tables 1 and 2, and in Figures 2 and 3.

Table 1: UnEc share (% GDP), old series (1970–1995) and new series (1996–2022)

	UnEc (% GDP), old series 1970–1995		UnEc (%GDP), new series 1996–2022
	(Monetary and MIMIC models, average)		(MIMIC model 5-1-2)
		1996	24,80
1970	10.17	1997	25.96
1971	11.27	1998	27.03
1972	11.19	1999	27.97
1973	11.99	2000	29.19
1974	11.63	2001	29.79
1975	12.17	2002	29.84
1976	13.07	2003	29.72
1977	15.59	2004	30.28
1978	14.83	2005	30.28
1979	14.93	2006	30.67
1980	14.32	2007	31.59
1981	15.40	2008	31.92
1982	17.48	2009	31.75
1983	17.11	2010	32.04
1984	16.63	2011	31.31
1985	18.00	2012	30.21
1986	18.82	2013	29.97
1987	17.67	2014	29.94
1988	18.31	2015	30.29
1989	19.93	2016	30.78
1990	20.42	2017	31.69
1991	21.51	2018	32.44
1992	22.62	2019	33.35
1993	22.80	2020	31.20
1994	22.85	2021	32.62
1995	24.03 *	2022	34.37

Notes: * Starting value for the calculation of the new series, since the MMIC method only estimates relative changes in the UnEc/GDP.

Source: values from 1970–1995 (old series) are from Soares and Afonso (2019); for the period 1996–2016 (new series), authors' calculations using the MIMIC base specification of Soares and Afonso (2019), and data from the Portuguese National Statistics Institute

Figure 2: UnEc share (% GDP)

Sources: same as in Table 1.

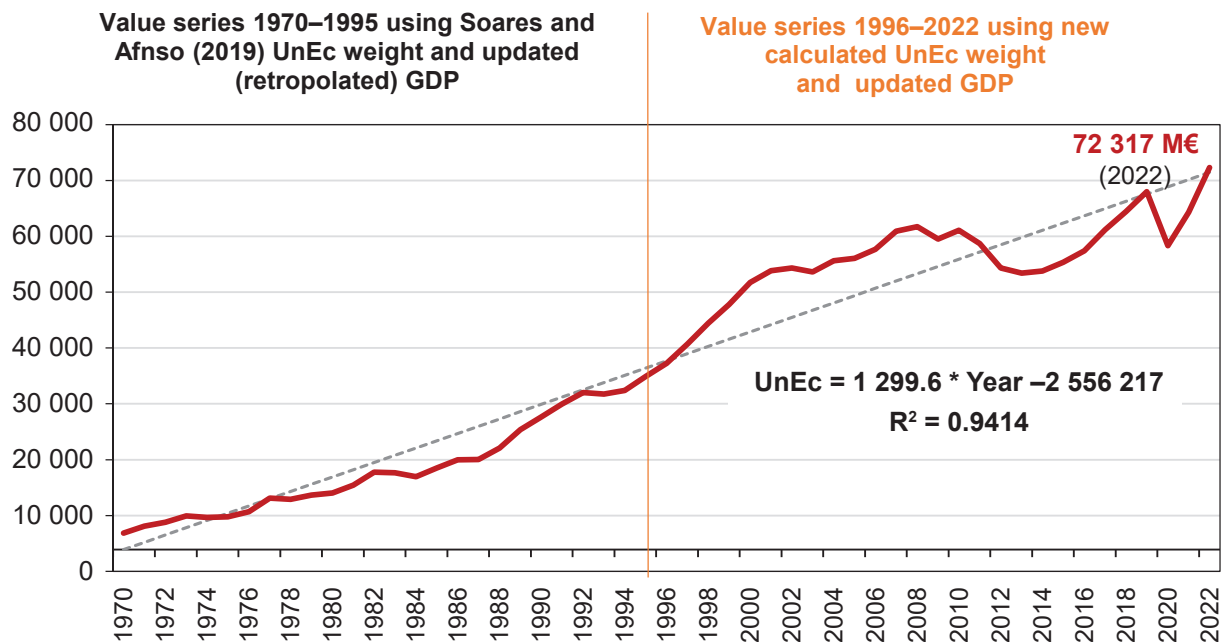
Table 1 and Figure 2 show that the UnEc share in official GDP reached an estimated maximum of 34.37% in 2022 in the new calculated series, after 32.62% in 2021 – almost double the value of 16.5% in Schneider (2021) – and 24.03% in 1995 (starting value from Soares and Afonso, 2019). In 2010–2015 average share 30.63%, much above the corresponding 19.82% estimate for Portugal in the multi-country study by Medina and Schneider (2018), suggesting an underestimation compared to the results shown here, which are more adapted to Portugal's specifics.

The upward trend also characterizes the period 1970–1995 as shown in the 'old' series (left side of Table 1 and Figure 2), which is taken from Soares and Afonso (2019) to enrich the analysis. This leads to a series break in 1996 (indicated with the column division in Table 1, and the vertical line and disconnection of series in figure 2). Figure 2 also shows that the UnEc share estimate for 2015 in the new series, 30.29%, exceeds the 27.29% value of the old series, also influenced by the monetary model, which, as previously mentioned, tends to underestimate the UnEc share.

Table 2: UnEc in Mil € (2016 prices), old series (1970–1995) and new series (1996–2022)

	UnEc (M€ in 2016 prices), based on old series UnEc/GDP 1970-1995		UnEc (M€ in 2016 prices), based on the new UnEc/GDP series 1996-2022
	(Monetary and MIMIC models, average)		(Model MIMIC 5-1-2)
		1996	37 251
1970	6 850	1997	40 715
1971	8 069	1998	44 420
1972	8 789	1999	47 772
1973	9 946	2000	51 755
1974	9 655	2001	53 837
1975	9 770	2002	54 357
1976	10 669	2003	53 620
1977	13 109	2004	55 609
1978	12 892	2005	56 046
1979	13 676	2006	57 698
1980	14 012	2007	60 907
1981	15 443	2008	61 741
1982	17 753	2009	59 501
1983	17 673	2010	61 088
1984	16 958	2011	58 688
1985	18 523	2012	54 318
1986	19 965	2013	53 393
1987	20 021	2014	53 768
1988	22 071	2015	55 363
1989	25 398	2016	57 406
1990	27 626	2017	61 175
1991	29 947	2018	64 410
1992	32 035	2019	67 987
1993	31 750	2020	58 325
1994	32 390	2021	64 339
1995	34 874	2022	72 317

Source: same sources indicated in Table 1 regarding the UnEc/GDP series (old and new); GDP data needed to calculate UnEc value at constant 2016 prices are from Portuguese National Statistics Institute (GDP at 2016 prices from 1995 to 2022) and Bank of Portugal (GDP change in volume from 1971 to 1995 – long series – used for retropolation)

Figure 3: UnEc in million euros (2016 prices), Mil €

Source: same as in Table 2

Applying the 34.37% share of UnEc in GDP in 2022, the value of UnEc in 2022 at 2016 prices is estimated to have reached a maximum of 72,317 million euros (Mil €) (Table 2 and Figure 3). Figure 3 also illustrates the upward trend of UnEc in real terms (i.e., excluding the price effect, since UnEc is expressed in Mil € at 2016 prices) between 1970 and 2022, confirmed by the regression line with positive slope and a coefficient of determination (R^2) of 94%.

The 2022 UnEc value at current prices is estimated to be 82,232 Mil € (see Table 3) – by applying the GDP deflator to the value at 2016 prices.

Table 3: UnEc at 2016 prices and at current prices (Mil €)

Year	UnEc at 2016 prices (M€)	UnEc at the year's prices (M€)
2021	64 339	70 055
2022	72 317	82 232

Source: Portuguese National Statistics Institute (GDP deflator data), and authors' own calculations based on results from previous tables

3.2.2 Evolution of UnEc/GDP share and its components since 2010

Table 4 and figure 4 show a reduction in the (logarithmic) annual average growth rate of the UnEc/GDP share from 3.8% in the second half of the 1990s (1995–1999) to 1.3% in the first decade of this millennium (1999–2009), and 0.5% in the second one (2009–2019), but with a resurgence in the period 2019–2022, to 1.0%. The average UnEc/GDP growth rate was 1.3% in 1995–2022 – this is the same as an annual change in UnEc that is 1.3 p.p. above the change in GDP, since calculations are in a logarithmic scale (see Figure 5, and the related yearly values in Figure 6).

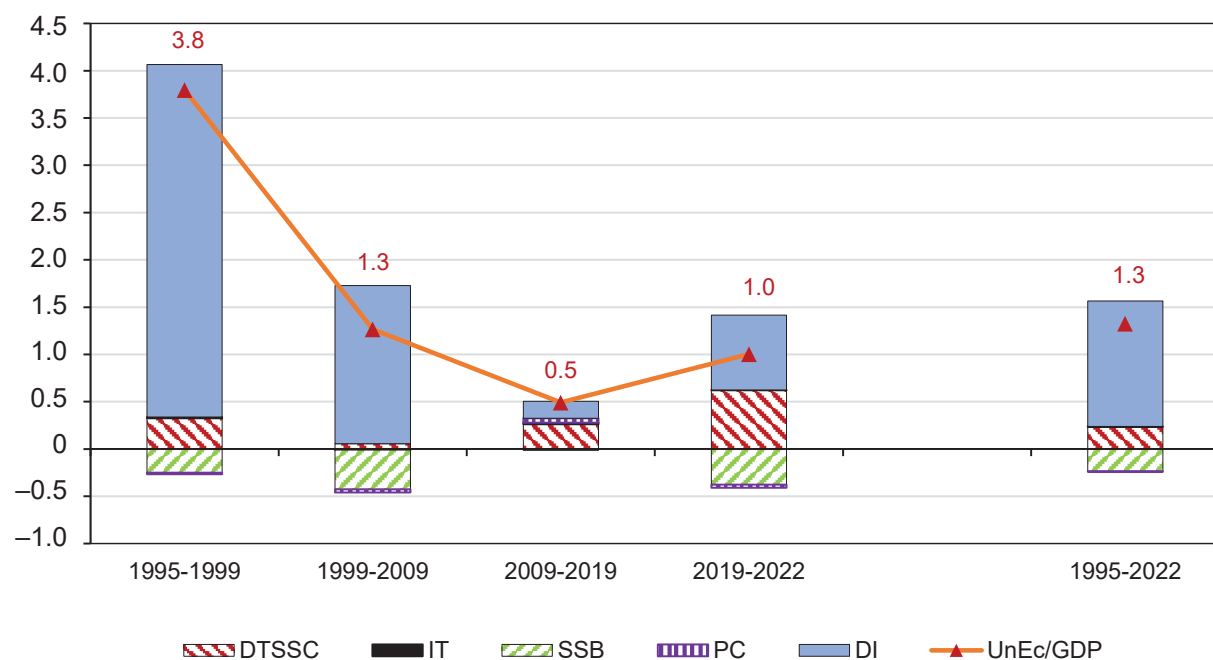
Table 4: Annual average growth (% , logarithmic change) of UnEc share in official GDP and quantified contributions of causes (percentage points), by periods

	<i>DTSSC</i>	<i>IT</i>	<i>SSB</i>	<i>PC</i>	<i>DI</i>	UnEc/GDP
1995–1999	0.32	0.01	–0.25	–0.02	3.73	3.8
1999–2009	0.06	–0.01	–0.42	–0.03	1.67	1.3
2009–2019	0.26	0.02	–0.01	0.05	0.18	0.5
2019–2022	0.62	0.00	–0.38	–0.03	0.79	1.0
1995–2022	0.23	0.01	–0.24	0.00	1.33	1.3

Notes: the sum of contributions equals the average growth of UnEc/GDP share in each period, but they do not sum across periods – as they are annual average changes – unless they are multiplied by the number of years to obtain the respective cumulative (logarithmic) change

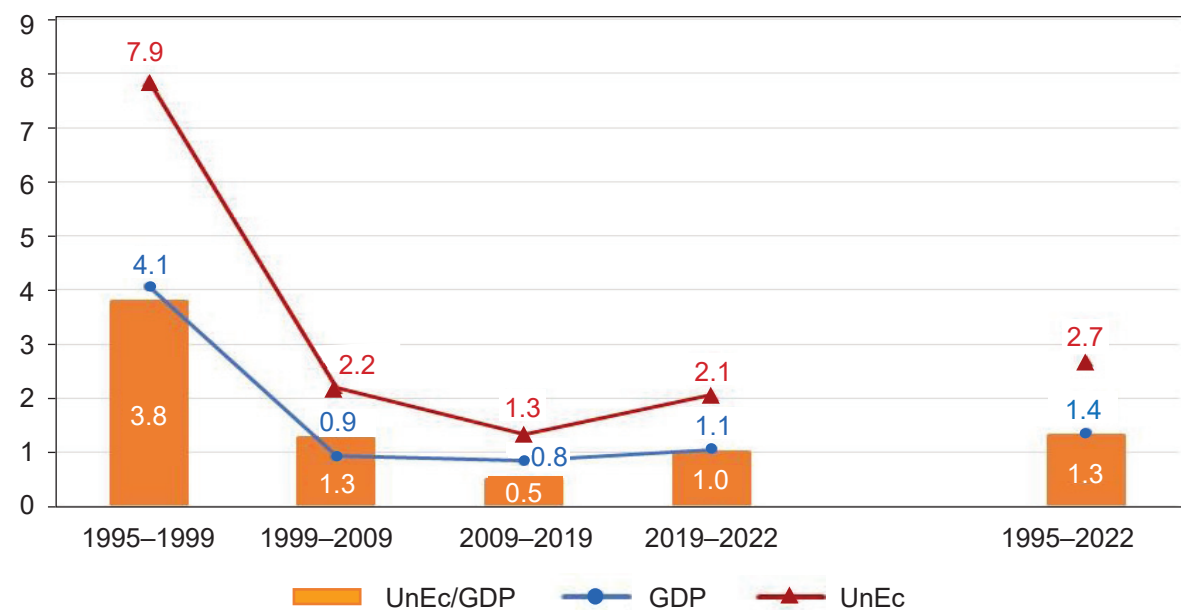
Source: authors' own calculations

Figure 4: Annual average growth (% , logarithmic change) of UnEc/GDP share and contributions of causes (percentage points), by periods



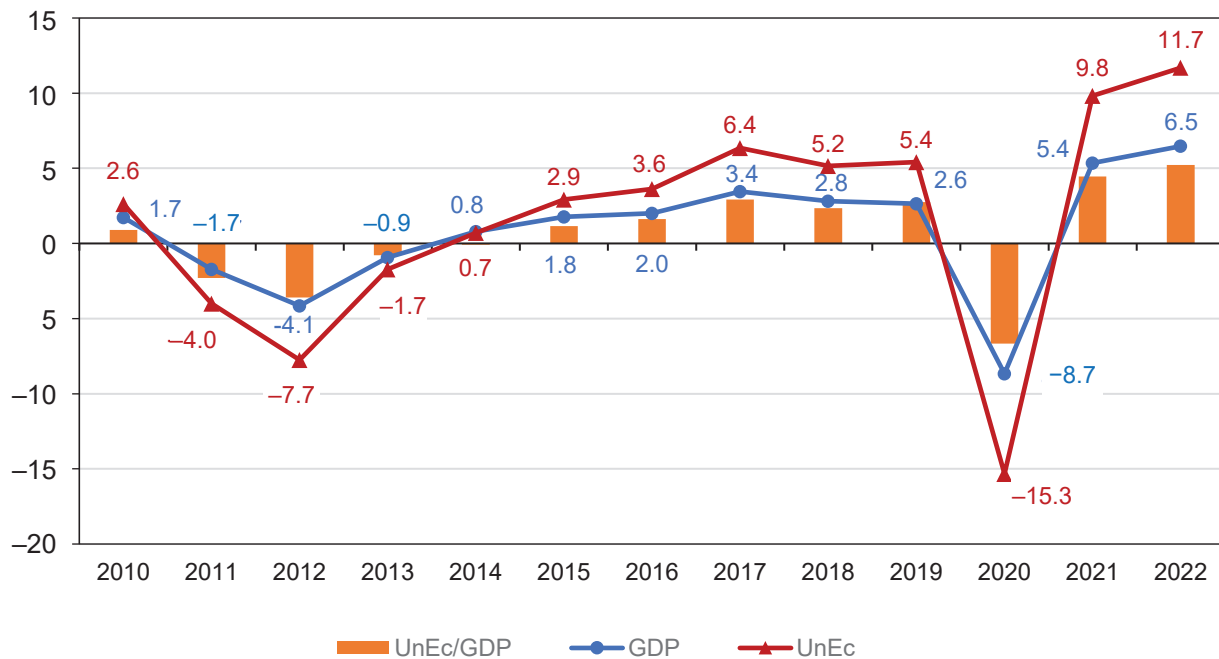
Source: authors' own calculations

Figure 5: Annual average growth (% , logarithmic change) of UnEc, GDP and UnEc share in GDP, by periods



Notes: the (logarithmic) average change in the UnEc/GDP share corresponds to the difference between the average changes in UnEc and GDP

Source: authors' own calculations

Figure 6: Annual growth (% , logarithmic variation) of UnEc, GDP and UnEc/GDP share in the years 2010 to 2022

Notes: the annual (logarithmic) change in the UnEc/GDP share corresponds to the difference between the annual change in UnEc and GDP

Source: authors' own calculations

Therefore, in all the mentioned sub-periods, the UnEc share showed an upward trajectory (positive growth rates), confirming the general trend in the whole period.

As for the causes, the most recent period (2019–2022), marked by the Covid-2019 pandemic and the war in Ukraine, brought back the phenomenon of inflation, creating a strong increase in tax revenues and the tax burden that the government chose not to return to taxpayers. This made *DTSSC* (direct taxes and social security contributions as percentage of GDP) the second most important cause of the UnEc/GDP increase in that period, representing 0.62 p.p. (percentage points) of the annual average growth of 1% (62%) as shown in Table 4.

The first cause of the annual average increase of 1% in UnEc/GDP in 2019–2022 was *DI*, the disposable income per capita (contribution of 0.79 p.p., or 79%), stimulated by the realization of postponed expenditure and the recovery of tourism related to the end of the pandemic, with Portugal benefiting from the image of a safe destination, far from war, since 2022. This evolution counteracted the previous strong fall of *DI* in 2020 – reflecting the sharp drop in tourism associated with the Covid-19 pandemic – which led to a significant decline in the UnEc/GDP in that crisis year (Table 5 and Figure 7) together with the rise of subsidies and social benefits, *SSB* (Table 5

and Figure 7 show a strong negative contribution in 2020), with emphasis on the government simplified-layoff measure (which subsidized companies with less activity in that period, thus helping to preserve employment). The crisis, together with income protection due to the layoff measure – accessed only by companies with regularized tax and social contribution situations, also contributing to the explanation of the reduction in the parallel economy – led to large precautionary savings later spent by the population.

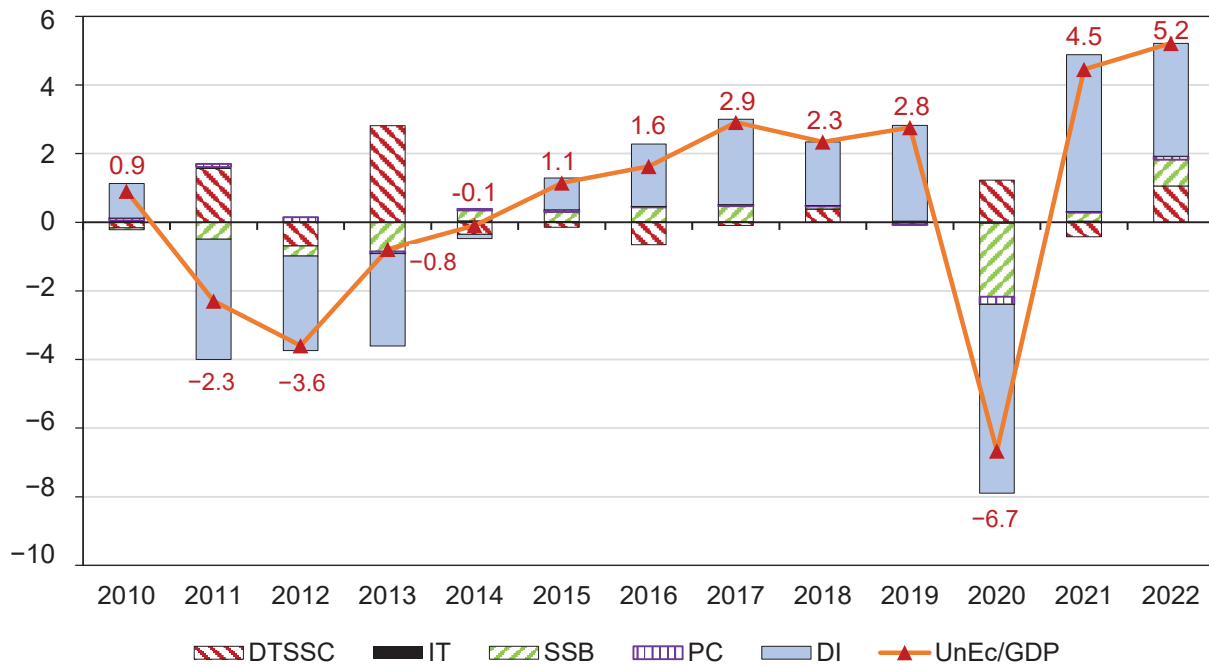
Table 5: Annual growth (% , logarithmic change) of UnEc/GDP share and quantified contributions of causes (percentage points), years 2010 to 2022
Table 5: Annual growth (% , logarithmic change) of UnEc/GDP weight and quantified contributions of causes (percentage points), years 2010 to 2022

	<i>DTSSC</i>	<i>IT</i>	<i>SSB</i>	<i>PC</i>	<i>DI</i>	UnEc/GDP
2010	−0.17	0.05	−0.05	0.07	1.00	0.9
2011	1.57	0.04	−0.49	0.09	−3.50	−2.3
2012	−0.69	0.00	−0.29	0.14	−2.76	−3.6
2013	2.82	−0.01	−0.85	−0.06	−2.69	−0.8
2014	−0.35	0.04	0.30	0.05	−0.13	−0.1
2015	−0.15	0.02	0.28	0.06	0.93	1.1
2016	−0.66	0.01	0.42	0.03	1.82	1.6
2017	−0.09	0.01	0.46	0.05	2.49	2.9
2018	0.38	0.01	0.07	0.02	1.86	2.3
2019	−0.06	−0.01	0.03	0.00	2.79	2.8
2020	1.23	−0.03	−2.14	−0.22	−5.50	−6.7
2021	−0.42	0.04	0.25	0.02	4.58	4.5
2022	1.06	0.00	0.76	0.10	3.30	5.2

Notes: the contributions sum the annual change in of UnEc/GDP share in each year; the sign of *SSB* and *PC* contributions is symmetrical to that of their respective evolution, as both variables have negative coefficients (as shown in Figure 1)

Source: authors' own calculations

Figure 7: Annual growth (% , logarithmic change) of UnEc/GDP share and contributions of causes (percentage points), years 2010 to 2022



Notes: the contributions of *SSB* and *PC* have a symmetrical sign to that of their respective evolution because they have negative coefficients (see Figure 1)

Source: authors' own calculations

Going back to the 2010s – a decade marked by the implementation of harsh Economic and Financial Adjustment Program (imposed by the IMF, the European Commission and the ECB, which helped the Portuguese government to avoid bankruptcy), and the recovery that followed – the *DTSSC* variable was the main cause of the 0.5% annual average increase of UnEc/GDP in that period (contribution of 0.26 p.p., or 52%, shown in Table 4), mostly reflecting the ‘huge increase’ in the income tax applied to families, which was chosen to rebalance public accounts and has not been fully reversed until the present day. It was followed by *DI* (0.18 p.p., or 36%), which was strongly penalized by the implementation of that Program (Table 5 and Figure 7 show significant annual decreases of *DI* in the years 2011 to 2014) but grew in the whole 2009–2019 period due to the subsequent strong economic recovery, between 2014 and 2019.

In the periods 1999–2009 and 1995–1999, the *DI* variable made the main contribution to UnEc/GDP growth. It is not surprising, therefore, that *DI* is also the main cause in the overall period of analysis 1995–2022, explaining 100% of the annual average UnEc/GDP growth of 1.3%, as the other variables' contributions cancel each other out (Table 4). Indeed, the 0.24 p.p. contribution of the tax burden in 1995–2022, mainly from *DTSSC* (0.23 p.p. or 18%, the second largest contribution; *IT* contribution was only 0.01 p.p.), compensated the negative

SSB contribution of the same magnitude (-0,24 p.p.) – reflecting the rise of the included supports (note that this cause negatively impacts *UnEc/GDP*) – since *PC* (Public Consumption) had a null contribution. Although *IT* and *PC* are theoretically relevant and improve the significance of other variables in the estimation, the coefficients are not statistically significant (at a 10% significance level), explaining why the associated contributions are relatively small.

Figure 5 also shows the separate evolution of the (logarithmic) annual average change in *UnEc*, *GDP* and *UnEc/GDP* in 1995–2022, and sub-periods. The annual average growth of *UnEc* decreased from 7.9% in 1995–1999 to 2.2% in the first decade of this millennium, and 1.3% in the second, but rose to 2.1% in 2019–2022, a period marked by a large annual oscillation due to the crises. In fact, as shown in Figure 6, *UnEc* exhibited annual variations of -15.3% in 2020, 9.8% in 2021, and 11.7% in 2022 (compared to -8.7%, 5.4%, and 6.5% in *GDP*, respectively), corresponding to annual variations of -6.7%, 4.4%, and 5.2% in the *UnEc/GDP* ratio, which were mainly explained by the contribution of *DI*, and, to a lesser extent, by those of *DTSSC* and *SSB* (Table 5 and Figure 7). Table 6 allows to verify the evolution of the variables between periods, complementing the analysis of contributions.

Table 6: *UnEc/GDP* share and its causes in level, selected years, and period averages

	DTSSC (% GDP)	IT (% GDP)	SSB (% RD)	PC (% GDP)	DI (€ pc at 2016 prices)	UnEc/GDP (%)
1995	15.8	13.2	15.8	17.5	122 465	24.0
1999	16.8	13.9	16.8	18.0	142 367	28.0
2009	17.2	12.5	21.8	21.3	168 544	31.7
2019	19.4	15.0	22.0	17.0	171 659	33.4
2020	20.5	14.5	25.2	19.0	162 378	31.2
2021	20.1	15.1	24.8	18.8	170 060	32.6
2022	21.1	15.1	23.6	17.9	175 816	34.4
1995–1999	16.3	13.4	16.3	17.7	132 133	26.0
2000–2009	16.9	13.9	19.3	20.0	158 907	30.5
2010–2019	19.0	14.3	22.8	18.2	162 413	31.2
2020–2022	20.5	14.9	24.5	18.5	169 418	32.7
1995–2022	17.9	14.1	20.6	18.8	156 504	30.2

Notes: *DTSSC* and *IT* exclude taxes from EU institutions

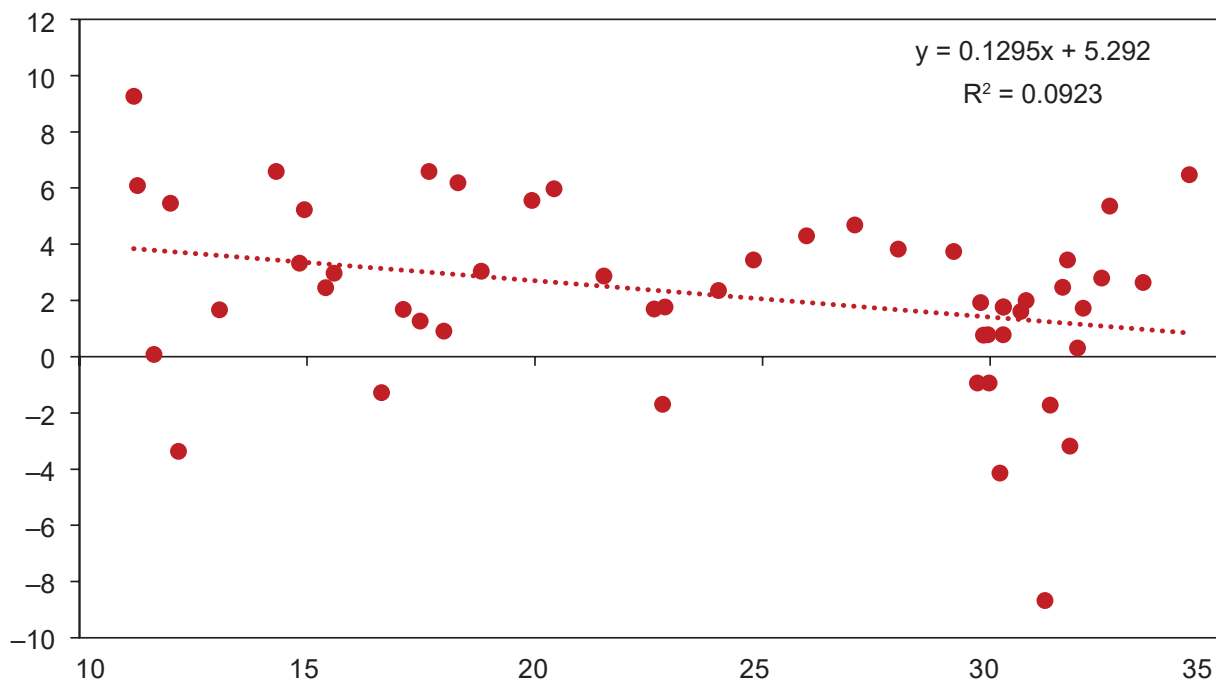
Source: Portuguese National Statistics Institute, and authors' own calculations

In Table 6, we highlight that *DTSSC* reached a maximum of 21.1% in 2022 – significantly above the 19.4% value in 2019, before the pandemic – that, when added to indirect taxes, *IT* (15.1% of GDP, also a maximum, but with a much smaller progression compared to 2019, when it was 15%), translates into a historical maximum tax burden of 36.2%, which rises to the ‘official’ value of 36.4% if taxes from EU institutions are added as well.

3.2.3 Negative correlation between UnEc/GDP share and GDP growth

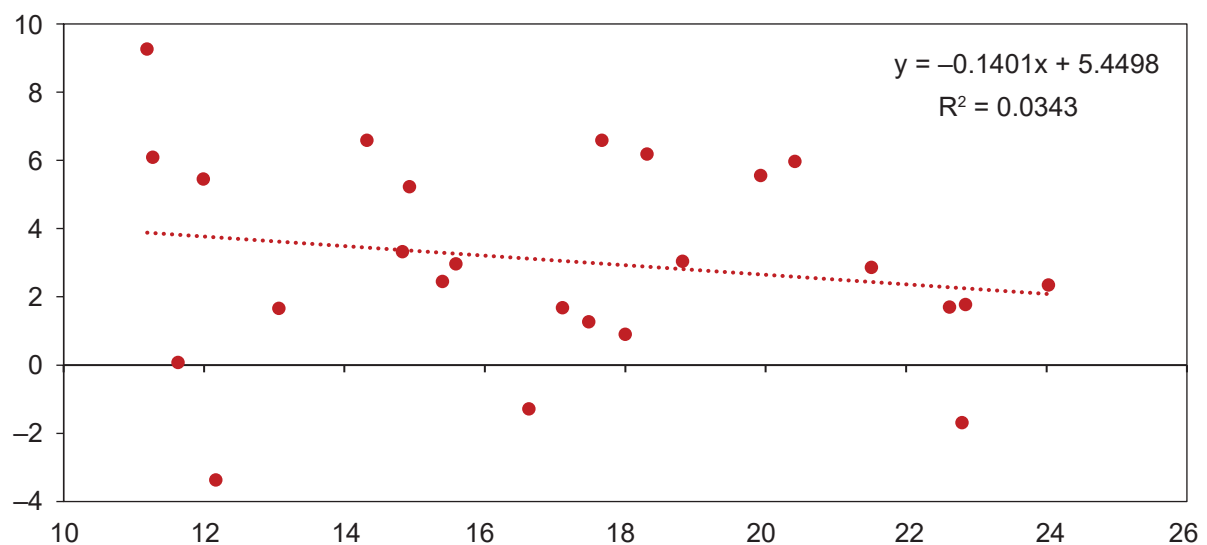
Figures 8, 9 and 10 confirm a negative correlation between the UnEc/GDP share and the GDP growth rate in the new calculated UnEc/GDP series 1996–2022, the previous series 1971–1995 from Soares and Afonso (2019), and in the whole period 1971–2022 (putting together the two series), even though the coefficients of determination (R^2) are very low. The impact is more negative in the 1996–2022 sub-period (coefficient of the regression line in Figure 10). However, as noted in Soares and Afonso (2019), the relationship between UnEc and GDP is bidirectional.

Figure 8: Correlation between the Portuguese annual real GDP growth rate (% , yy axis), and the UnEc/GDP share (% , xx axis) over the period 1971–2022



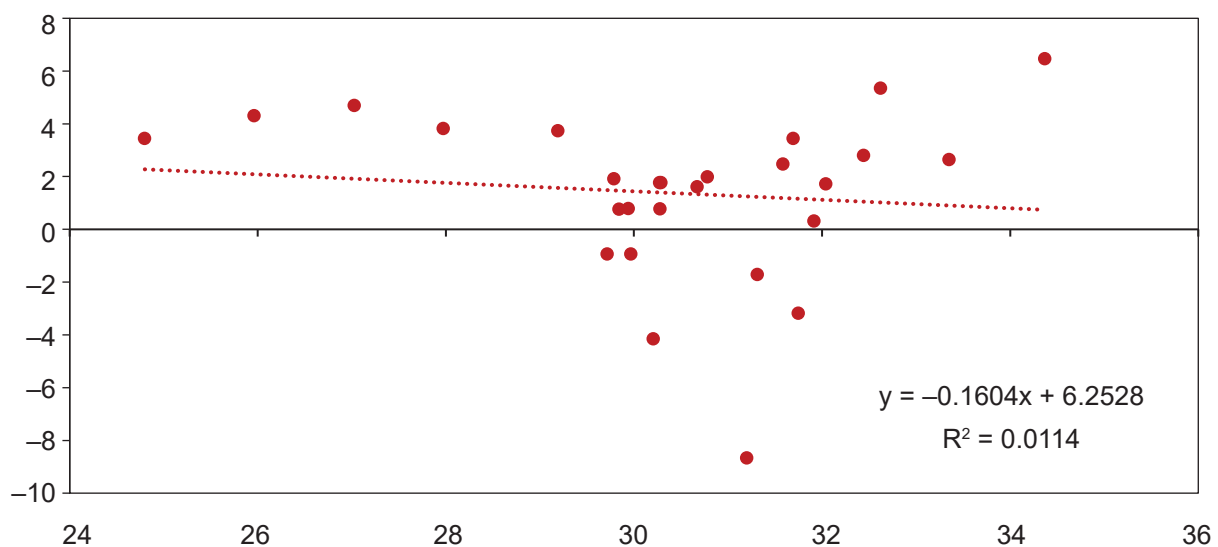
Source: authors' calculations

Figure 9: Correlation between the Portuguese annual real GDP growth rate (% , yy axis), and the UnEc/GDP share (% , xx axis) over the period 1971–1995



Source: authors' calculations

Figure 10: Correlation between the Portuguese annual real GDP growth rate (% , yy axis), and the UnEc share (% , xx axis) over the period 1996–2022



Source: authors' calculations

4. Panel results of Schneider (2021) for Portugal and other European peripheral economies compared to this study and to other single-country estimates

This section explains the case of possible underestimation of UnEc shares in the recent multi-country MIMIC study by Schneider (2021) – and in his panel studies in general – compared to this and two other single-country MIMIC studies regarding European peripheral countries.

4.1 Detailed comparison and analysis of contrasting results for Portugal between this study and the recent panel study by Schneider (2021)

In Table 7, the upward trend of Portugal's UnEc share in GDP contrasts with the declining trajectory in 2003–2021 found in the recent multi-country study by Schneider (2021), which also uses the MIMIC model, but most likely has very different variables – the model and base coefficients come from another study, probably Medina and Schneider (2021), the most recent article that is cited there, comprising data for 158 countries in 1991–2015.

Table 7: UnEc share in GDP (%) from Schneider (2021) in a set of European Union peripheral economies in 2003, 2019, 2020 and 2021, and values for Portugal calculated in this paper

Year	2003	2019	2020	2021	2022
Schneider (2021)					
Portugal	22.2	15.38	17.01	16.50	
Greece	28.2	19.23	20.94	20.31	
Bulgaria	35.9	30.12	32.93	32.41	
Romania	33.6	26.90	29.33	28.89	
Croatia	32.3	26.43	29.56	29.01	
Hungary	25.0	23.22	25.96	25.01	
Slovakia	18.4	12.15	14.01	13.66	
Poland	27.7	20.65	22.45	22.02	
Latvia	30.4	19.84	20.91	20.22	
Values here calculated					
Portugal	29.72	33.35	31.20	32.62	34.37

Notes: for simplicity, the peripheral economies of the European Union were considered as those with GDP per capita in purchasing power parity below 80% of the European average (Eurostat data for 2022), which are also geographically peripheral. Countries are presented counterclockwise starting with Portugal

Source: authors' calculations based on Soares and Afonso (2019); Schneider (2021); Eurostat

The MIMIC variables that prove statistically significant in the panel study by Medina and Schneider (2021) for a subsample of advanced countries (closer to the ones estimated in Schneider, 2021), presented in Table 1.10 of that study, are GDP per capita (negative sign), size of government (negative sign), labor participation rate (negative sign), and GDP growth (positive sign). In some combinations that exclude the rule of law or the government size trade openness and rule of law become significant (both with negative sign). If GDP per capita is excluded as a cause and GDP growth as an indicator (robustness test shown in table 1.17 of Medina and Schneider, 2021), then the significant causes are trade openness (negative sign), the unemployment rate (positive sign), and the rule of law (negative sign), while the labor participation rate remains a significant indicator (negative sign).

Even if Schneider (2021) model is not based on Medina and Schneider (2021), the underlying variables are likely very similar, so the difference is striking compared to the significant variables of the base single-country study Soares and Afonso (2019) that are used here, which is better suited to Portugal's economic and social reality. For example, a variable also related to the government size used in Soares and Afonso (2019), public consumption as percentage of GDP, is not significant. Labor market variables (such as the unemployment rate) were also tested and found not significant in Soares and Afonso (2019). On the other hand, institutional quality indicators (such as the rule of law) are appropriate to compare countries, but are not well suited for a single country study, due to their low variability in time, which usually generates insignificant estimates.

Certainly, all the variables in Medina and Schneider (2021) – also considering the overall results of that study with developing countries (which appear in table 1.8), where most of the above-mentioned variables are significant at the same time – in particular GDP per capita, reflect the economic structure of the most advanced countries, where the shadow economy has a lower presence, meaning that they may not be suited for a less advanced peripheral economy like Portugal, and, in general, for countries that fall outside the average patterns estimated by Schneider (2021).

Therefore, the difference of statistically significant variables in Schneider (2021) compared to the base study of Soares and Afonso (2019) appears to explain the contrasting UnEc trajectory and values for Portugal compared to the ones estimated here, in addition to specific econometric treatments required in a multi-country SEM such as Schneider (2021), which does not explain if (and how) country heterogeneity is dealt with. The same applies to Medina and Schneider (2021), and in all of Schneider's prior panel studies in this area, to the best of our knowledge.

For example, the UnEc shares can vary between countries beyond the shown explanatory variables if the multi-country SEM includes fixed effects (country-specific dummies) – see, for

instance, Wooldridge (2010) – which are not reported in Schneider (2021) or his other studies. Moreover, the UnEc share can be underreported in a EU peripheral economy like Portugal in the component of money circulation unaccounted for in official GDP (indirectly assessed by the MIMIC model) if within-country variation is not separated from between-country variation, which is which is possible to do with specific econometric procedures, such as Multilevel SEM (e.g., Heck and Thomas, 2020).

To provide a clear example, the indirect MIMIC estimation of money circulation unaccounted for in the Portuguese official GDP should not be influenced by the same estimation for Germany (where overall economic conditions are different), and that may occur in Schneider (2021) depending on the econometric technique he used. This could also contribute to the discrepancy of UnEc share estimates between Schneider (2021) and single-country estimates, not only for Portugal as already shown above, but also for other European peripheral countries as highlighted below.

4.2 Results for Portugal and other European Union peripheral economies in Schneider (2021), and comparison with available recent single-country estimates

Considering as peripheral economies in the European Union (EU) those with less than 80% of the EU average standard of living (assessed by the average GDP per capita in purchasing power parity), which are also geographically peripheral, we can see that from the nine identified countries in Table 7, only Hungary did not show a marked decrease of the UnEc share in Schneider (2021) between 2003 and 2021 (basically stabilizing at 25% despite some oscillations).

The biggest decreases occurred in Latvia (from 30.4% in 2003 to 20.22% in 2022), Greece (from 28.2% to 20.31%), Poland (from 27.7% to 22.02%), and Portugal (from 22.2% to 16.5%).

From those nine countries, only Portugal and Greece diverged from the average EU standard of living in that period (data from Eurostat), because their GDP per capita in PPP grew much less than the average, reflecting the severe economic adjustment programs they were subjected in the context of the European sovereign debt crisis (especially Greece) in the 2010 decade. Despite the subsequent economic recovery, these events should cast some doubt over the capacity to decrease the UnEc share in Portugal and Greece after 2010, since the low standard of living increase also means a lower rise in tax revenues, and relatively less resources for social protection and fighting tax evasion and corruption, for example. All these things should hamper UnEc share reduction compared to other economies, especially the other peripheral ones in Table 7. The results calculated for Portugal in this paper with different explanatory

variables (repeated in Table 7 for the relevant years) show instead UnEc share increase in the same period (from 29.72 to 32.62%).

In the case of Greece, a recent MIMIC single-country study by Koufopoulou et al. (2021) estimates UnEc share to be 34.09% in 2021, much higher than the 20.31% value shown in Schneider (2021) and reported in Table 7. As for available recent single-country MIMIC estimates regarding the other peripheral economies, we found that Buszko (2022) provides a higher UnEc share estimate for Poland in 2019 than Schneider (2021) (23% vs. 20.65%), but in this case the difference is smaller. Buszko (2022) also provides a separate UnEc estimate for Lithuania in 2019 (24.1%) that is higher than the one shown in Schneider (21.92%). This country also belongs to the EU periphery but does not appear in Table 7 since its GDP per capita in PPP is higher than 80% of the EU average in 2022, so it is not considered a peripheral economy under these criteria.

We have provided evidence and probable causes – different variables and possible shortcomings in the econometric treatment of country heterogeneity – why Schneider (2021) under-reports UnEc shares compared to single-country estimates of at least four European peripheral countries (Portugal, Greece, Poland, and Lithuania).

4.3 UnEc share development during the pandemic compared to that in Schneider (2021)

In regard to the changes in 2020 – year marked by the Covid-19 pandemic – the results estimated for Portugal in this paper point to a UnEc share decrease in that year (with negative contributions from the disposable income, and subsidies and social benefits as explained above and shown in Table 5). That contrasts with the increase in that year found in Schneider (2021) both for Portugal and the other European peripheral economies (Table 7) likely reflecting the fall in GDP per capita, variable that has a negative impact in the associated Medina and Schneider (2021) study. In 2021, the trajectories reversed, with the UnEc shares of the peripheral economies (including in Portugal) falling in Schneider (2021), and increasing in the series calculated for Portugal in this paper. In 2022, the UnEc share for Portugal rose again and was already above the 2019 level (34.37% vs. 33.35%). In the case of Greece, Koufopoulou et al. (2021) estimates a decrease of the UnEc share for that country both in 2020 (from 34.66% to 34.37%) and 2021 (to 34.09%); in all those years these values are much above those (around 20%) presented in Schneider (2021).

5. Discussion of the Results

This section provides a critical interpretation of the main results in view of the Portuguese reality and recent history. The high share and value of the UnEc found here seem to explain the fact that, despite Portugal's relatively low standard of living in the European context⁴, associated to an even smaller relative labor productivity level⁵, and a high official risk of poverty and social exclusion⁶ – which reveals significant social inequalities⁷ – there is not much social protest compared to other moments in history where those indicators were better. In 2022, 47 thousand working hours were lost due to strikes in Portugal, after 33.4 thousands in 2021 (data from national independent entity Pordata), which is comparable to 53.4 and 108.1 thousands in 2002 and 2003, when the Portuguese standard of living was relatively higher, around 84% of the European average.

The high tax burden, which has reached successive maximums along the years (even before the Covid-19 pandemic) is a clear incentive to underreport income for those who can do it (especially independent workers – as employees are the most tightly monitored – or those with earnings outside of work).

Symptomatically, there exists a significant emigration flow, especially of the qualified and talented young generation, who can earn much more abroad (especially after taxes). According to the Portuguese Emigration Observatory, 30% of the Portuguese youth (between 15 and 39 years) lives outside the country, which is a cause of great concern.

The above discussion has a close adhesion to the significant UnEc share found in this single-country study and not with the declining and low UnEc share shown by the multi-country study of Schneider (2021), where results for other peripheral countries may also be questionable, especially those for Greece as mentioned in the previous section.

The analysis of the Portuguese UnEc increase causes in this study is consistent with the presented data.

4 The seventh lowest in the EU-27 in 2022, measured by GDP per capita in purchasing power parity at only 77.1% of the Union average, according to Eurostat.

5 Fourth lowest in 2022, at 66.6% of the EU average, considering labor productivity per hour worked in PPP (Eurostat).

6 Corresponding to 22.4% of the population in 2021, the eighth highest value in the EU-27, where the average was 21.7% (Eurostat).

7 Gini coefficient after social transfers of 33% in 2021, the fifth highest value in the EU, where the average was 30.1% (Eurostat).

The second main cause of Portugal's UnEc share rise between 1995 to 2022, and in the most recent period – from 2019 to 2022 – but which is the most obvious and immediate to be tackled, is the strong increase of the tax burden (reaching a maximum of 36.4% in 2022), mainly direct taxes and social security contributions (*DTSSC*), but also, to a lesser extent, indirect taxes (*IT*).

The main identified cause of the UnEc share rise from 1996 to 2022 and in 2019–2022 is the growth in disposable income per capita, a proxy for the average standard of living needed to function in the consumerist society and match those of higher 'status' – this generates an incentive to participate in the UnEc as a faster means to reach this goal. This result clearly implies that the official economy is not competitive compared to the UnEc, but also to other countries – especially inside the EU, the main trade partner of Portugal, which requires that the government takes comprehensive measures to make the official economy more attractive and competitive in general, so that workers and entrepreneurs do not have to recur to the UnEc or emigrate/relocate to have a decent income.

In contrast, the increase in subsidies (to households and firms) and social benefits (*SSB*) had a negative impact on the UnEc share between 1995 and 2022, mainly because they reduce the need for households and firms to participate in the UnEc and increase the risk of losing support. The negative effect of *SSB* on UnEc counteracted the positive contribution of the tax burden.

Apparently, it seems that the tax burden helped to finance a welfare state capable of preventing a greater need to resort to UnEc, which would be interesting, but unfortunately the results should be much better in a broad perspective. Indeed, the UnEc share rose much in that period in our results, the tax burden increase was not enough to finance the welfare state – as public debt increased from 63.3% to 113.9% of GDP between 1995 and 2022 – and, as mentioned above, Portugal continues to compare very poorly in crucial indicators such as living standards, labor productivity, risk of poverty, and inequality, all of which are related to the UnEc share.

Therefore, the excessive tax burden has not been sufficient to finance an inefficient welfare state, implying a double impact on the UnEc share – the positive effect of the tax burden and a smaller than expected negative effect of *SSB*, financed by both taxes and extra debt. This means there is space to lower the tax burden and increase the competitiveness of the official economy. Other measures can also promote a UnEc share decrease in Portugal as proposed in the next section.

6. Proposals for UnEc Share Decrease

Based on the results and discussion, we propose several measures to reduce the UnEc in Portugal:

- A significant reduction in the tax burden, particularly direct taxes (on workers and companies) and social security contributions, but also, to a lesser extent, indirect taxes. Such a proposal may have a positive impact on economic growth (e.g., Alinaghi and Reed, 2021) over time and open fiscal margin for other proposals below, namely increased capital accumulation and social support.
- As for subsidies and social benefits – influencing the decisions of dependent and independent workers, as well as small entrepreneurs – we suggest a reform to improve their efficacy:
 - Increase the levels of support, but ensuring that they are lower than the (small) income entry levels in the official economy (for dependent and independent workers, and small entrepreneurs) net of taxes, which means the taxation on these entry levels should be reduced in the first place;
 - Allow the possibility of accumulating support up to a certain official income threshold above the levels of entry into the official economy;
 - Increase the monitoring of support using the means available to the tax authority (with emphasis on information cross-checking, such as consumption and external wealth signs), so that they can reduce more effectively the share of UnEc;
 - Make support conditional, whenever possible, on the empowerment of beneficiaries regarding their skillset ('hard' and 'soft' skills) – via practical training and useful intervention in the community – to avoid “subsidy-dependence” and conservation of low living standards / activity.
- Transparency and efficiency in the management of public resources, including digitalization and the reduction of excessive bureaucracy.
- Swifter and more effective justice, especially regarding the fight against corruption and tax evasion. In particular, the implementation of the laws against illicit enrichment crime – as in France – strongly punishing the agents from the public or private sector who acquires assets significantly above the declared official income.
- Government promotion of capital accumulation (public and private) – human capital (education and health), and physical and immaterial capital (investment and innovations) – and other aspects that raise the productivity of workers and companies.
- Promote the development of the civil society and the political class with regard to ethics and the negative effects and implications of UnEc, as it also emerges due to cultural reasons.

7. Conclusions

In this single-country study, the results show that the share and value of the unobserved economy in Portugal have increased steadily since 1970, considering the series 1970–1995 from Soares and Afonso (2019), and the new 1996–2022 series calculated in this article with help of their MIMIC base specification, which uses dedicated variables suited to the Portuguese reality.

The upward trend contrasts with the declining trajectory in 2003–2021 found in the recent multi-country study by Schneider (2021), which also uses the MIMIC model, but most likely has very different variables – reflecting the economic structure of the more advanced economies – which apparently explain the distinct results, although there may also be econometric issues in that study regarding the treatment of country heterogeneity. Due to the difference in trajectories, the UnEc share in 2021 calculated here is almost double the value estimated by Schneider (2021).

Results for other European Union peripheral countries in Schneider (2021) compared to available recent MIMIC single-country estimates suggest that the UnEc share may also be underestimated in Greece (by a large margin), Poland and Lithuania at least, and more generally in countries that fall outside the average patterns estimated by Schneider (2021).

If, due to the raised issues, Schneider's multi-country studies underestimate UnEc shares in a significant number of countries, there is a risk that authorities in those countries may disregard still possibly relevant UnEc (underlying) problems, especially if the differences are large as it happens with Portugal and Greece.

The detailed results of the UnEc share in Portugal – regarding the main causes of the rising trend and additional data provided in the discussion – also allow us to present proposals for its reduction, which include, as the most important measures, a tax burden reduction, a better role of subsidies and social benefits, fighting the illicit enrichment crime, and more civic education on ethics.

To sum up, this study provides the most recent UnEc MIMIC estimates for Portugal in a single-country study, which appear realistic considering the included variables and additional data provided in the discussion. It also contributes to the literature by analyzing possible shortcomings of the multi-country studies by Schneider (2021 and others), which underreport UnEc values for at least four European Union peripheral countries (Portugal, Greece, Poland and Lithuania) compared to available recent single-country estimates.

Based on our conclusions, we recommend that authorities favor single-country UnEc estimates in their analysis and policy design and be aware of likely issues in multi-country studies. We hope this paper inspires similar studies in other countries to allow better informed UnEc related policies. In any case, the estimates of the UnEc should always be treated with much caution because it is inherently difficult to estimate.

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Appendix

Data regarding variables in 1995–2022

Table A1: Description and measurement details of the variables used in UnEc estimation

Variable	Description	Measure	Detail
<i>DI</i>	Disposable Income	Per capita	$\frac{[(\text{Gross domestic product, volume, market prices}) - (\text{Total direct taxes, value} / \text{Gross domestic product, deflator, market prices}) - (\text{Effective social security contributions received by general government, value} / \text{Gross domestic product, deflator, market prices}) + (\text{Subsidies, value} / \text{Gross domestic product, deflator, market prices}) + (\text{Social security benefits paid by general government, value} / \text{Gross domestic product, deflator, market prices})]}{\text{total population}}$
<i>DTSSC</i>	(Direct taxes and social security contributions) / PIB	%	$\frac{\{[(\text{Total direct taxes, value} / \text{Gross domestic product, deflator, market prices}) + (\text{Effective social security contributions received by the general government, value} / \text{Gross domestic product, deflator, market prices})]\}}{\text{Gross domestic product, volume, market prices}} * 100$
<i>IT</i>	Indirect taxes / PIB	%	$\frac{[(\text{Indirect taxes} / \text{Gross domestic product, deflator, market prices})]}{\text{Gross domestic product, volume, market prices}} * 100$
<i>SSB</i>	(Subsidies + social benefits paid by the government) / Disposable income	%	$\frac{\{[(\text{Subsidies, value} / \text{Gross domestic product, deflator, market prices}) + (\text{Social security benefits paid by general government, value} / \text{Gross domestic product, deflator, market prices})]\}}{\text{Disposable income, volume}} * 100$
<i>PC</i>	Government final consumption / PIB	%	$(\text{Government final consumption expenditure, volume} / \text{Gross domestic product, volume, market prices}) * 100$

Source: adapted from table A1 of Soares and Afonso (2019). The data source for all variable components is the Portuguese National Statistics Institute

Table A2. Data used in the UnEc share in GDP calculations (1995-2022 series)

	<i>DTSSC</i> (% PIB)	<i>IT</i> (% PIB)	<i>SSB</i> (% DI)	<i>PC</i> (% PIB)	<i>DI</i> (2016 € per capita)
1995	15.8	13.2	15.8	17.5	12 215
1996	16.3	13.4	16.4	17.7	12 602
1997	16.5	13.1	16.1	17.6	13 119
1998	16.2	13.6	16.5	17.8	13 759
1999	16.8	13.9	16.8	18.0	14 199
2000	17.3	13.4	17.1	18.9	14 761
2001	17.2	13.4	17.4	19.2	15 159
2002	17.1	13.9	17.9	19.6	15 264
2003	16.1	13.9	19.1	20.1	15 564
2004	16.3	13.8	19.3	20.4	15 868
2005	16.3	14.6	20.0	21.0	15 961
2006	16.5	14.8	20.1	20.3	16 127
2007	17.3	14.4	20.0	19.6	16 408
2008	17.7	14.0	20.4	19.8	16 569
2009	17.2	12.5	21.8	21.3	16 810
2010	17.1	13.2	21.9	20.6	16 982
2011	18.3	13.8	22.6	19.7	16 391
2012	17.8	13.8	23.0	18.3	15 941
2013	20.2	13.7	24.3	18.8	15 513
2014	19.9	14.2	23.8	18.4	15 492
2015	19.7	14.6	23.4	17.9	15 639
2016	19.1	14.7	22.8	17.6	15 930
2017	19.1	14.9	22.2	17.2	16 336
2018	19.4	15.1	22.1	17.0	16 645
2019	19.4	15.0	22.0	17.0	17 121
2020	20.5	14.5	25.2	19.0	16 195
2021	20.1	15.1	24.8	18.8	16 962
2022	21.1	15.1	23.6	17.9	17 536

Notes: *DTSSC* and *IT* exclude taxes from EU institutions (of relatively insignificant value), explaining why their sum in 2021 (35.2% of GDP) and 2022 (36.2%) is slightly lower than the tax burden figures presented in table 4 (35.3% and 36.4%, respectively)

Sources: Portuguese National Statistics Institute and author's calculations