Report identifying methodologies and tools to improve the non-risk management procedures

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List of Acronyms

Abbreviation	Description
ADA	Analytics discovery area
ADW	Agency Data Warehouse
AEP	Analytics execution platform
ARIES	Aim /Research/ Intervention/ Evaluation/ Share approach
BASIC Toolkit	OECD's Behaviour, Analysis, Strategies, Intervention, and Change Toolkit
BI	Behavioral insights
CDA	Currency demand approach
CIP	Compliance improvement plan
CRM	Compliance risk management
DG REFORM	Directorate-General for Structural Reform Support
EY	Ernst & Young
EC	European Commission
EU	European Union
ETL	Extract transform load
FTA	OECD's Forum on Tax Administration
IMF	International Monetary Fund
ISBPMD	Information Systems and Business Process Modelling Directorate
MIMIC	The Multiple Indicators Multiple Causes model
NRA	National Revenue Agency
NISD	Network and Information Security Directorate
OECD	Organisation for Economic Co-operation and Development
PIA	Privacy impact assessment
RfS	Request of Service
Risk Management Programme	Programme for compliance with tax and social security legislation and risk reduction
TDM	Team development machines

1. Public information – TLP-WHITE

1.   Introduction

EY has been engaged by the European Commission to prepare a report for the National Revenue Agency ("NRA") to identify methodologies and tools to improve non-risk management procedures/assessments and gaps in existing processes.

1.1   Scope of the report

This report:

► Identifies the major external factors influencing tax compliance behaviour.

► Highlights methods and tools (known as "non-risk management procedures / assessments") which analyse and create knowledge about the external conditions identified as influencing tax compliance behaviour.

1.2   Definition of tax compliance behaviour and related concepts

This paper defines tax compliance behaviour as that which meets the legal obligations imposed by the tax system. The commentary therefore focuses on non-compliance through evasion, where the taxpayer pays less tax than they are obligated to, including by hiding income or information from the tax authorities, rather than through a legal arrangement of a taxpayer's affairs that is intended to reduce their tax liability. This distinction is not always clear-cut and is not consistently applied across the academic literature. Activity required to manage the risk that avoidance activities may cross into illegality is not the primary focus of this paper.

In the context of tax compliance and further analyses, it is also useful to introduce related concepts of tax gap and shadow economy.

Tax gap is the difference between taxes that theoretically should be collected (based on the scale of economic activity and binding regulations) and the actually collected taxes. Its key components include VAT gap, PIT gap and CIT gap. Sources of the tax gap and related tax non-compliance include shadow economy, tax frauds, tax evasion and other (see Figure 1).

Figure 1: Tax gap and its sources
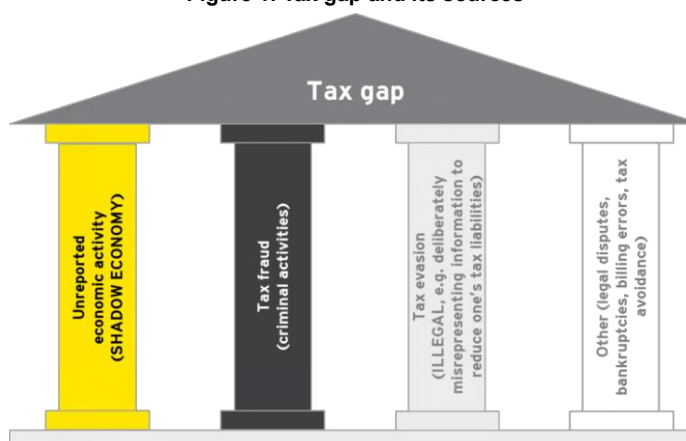
Source: EY.

Shadow (non-observed) economy is unreported value added (≈GDP) of registered and unregistered entities, which is responsible for a large part of the total tax gap. It includes[1]:

► Hidden and underground activities where the transactions themselves are not against the law, but are unreported to avoid official scrutiny (e.g., an unreported part of companies' revenues to avoid taxation).

► Activities described as 'informal', typically where no records are kept (e.g., some street vendors, etc.).

► Illegal activities where the parties are willing partners in an economic transaction (e.g., drug selling).

► Household production of goods for own consumption (not sold on the market) is sometimes treated as the non-monetary shadow economy.[2]

Cash shadow economy is unregistered economic activity generated by cash payments. It was analyzed in the series of EY research by EY (see e.g., EY (2019)[3]). Cash allows the seller not to report the transaction. With only a few exceptions, if an electronic payment was used instead of cash, it would be difficult to hide a transaction. Cash shadow economy can be broken down into the 'passive shadow economy' and the 'committed shadow economy'. In the 'passive shadow economy' consumer pays with cash (e.g., due to personal preference or lack of other payment infrastructure) and seller uses this opportunity to benefit from not reporting the transaction (consumer is often unaware of it). In such case cash is the cause of the shadow economy and policies that limit cash payments or increase their registration may help. In the 'committed shadow economy' the seller offers the consumer a lower price (without tax) or an opportunity to buy an illegal product/service if payment is made in cash. In such case cash is just the consequence of their joint willingness to act in the shadow economy and to tackle this problem controls, incentives, education and tax morale improvements may be needed (they are also important for the passive shadow economy).

1.3 Approach to the literature analysis

This paper sets out a concise articulation of the literature, providing the basis for the evaluation of tools. It starts by considering the deterrence approach to predicting taxpayers' behaviour and then extends this by adding social and psychological factors.

1.3.1 Deterrence model

The paper starts by applying a framework for considering whether, and by how much, a taxpayer will choose to evade taxes – the deterrence model[4]. In this model, a risk-averse taxpayer considers tax as a cost and decides whether, and how much, to evade taxes in a similar way as they would approach any risky financial decision or gamble. As set out in Section 2, the outcome under this model is a function of factors including:

► Understated tax liability

► Probability of enforcement action

► Probability of detection

[1] European Commission (2013), European System of Accounts. ESA 2010.
[2] OECD (2002), Measuring the Non-Observed Economy. A Handbook.
[3] EY (2019), Reducing the Shadow Economy in Albania Through Electronic Payments.
[4] Allingham, M.; Sandmo, A. (1972) Income Tax Evasion: A Theoretical Analysis

- ► The utility cost of bearing risk and

- ► The expected value of punishment.

In applying this model, it is taxpayers' perception of detection that is important, rather than the reality. Perception can be affected both by actual changes in enforcement action (for example, by better use of third-party data) and by communication from tax authorities.

1.3.2 Extended model

Following the development of the deterrence model, researchers realised that taxpayer compliance behaviour is also influenced by social and psychological factors and, as a result, extended their studies to cover these factors. Building from the deterrence model, the paper therefore identifies additional factors that affect taxpayer compliance. The deterrence model is used by the paper as a starting point only, since that model assumes that taxpayers are influenced by penalties no differently than any other costs and there is no intrinsic "tax morale", or intent to meet tax obligations. Some social scientists[5] have questioned this central assumption that illegality is not by itself a factor, and that there is no intrinsic willingness to pay. They suggest that, in thinking about tax evasion, it is necessary to abandon the expected utility maximization model and incorporate a range of social and psychological considerations. This underpins much of the recent focus on behavioural approaches to tax and is an emerging theme within the literature.

Fischer model

The literature regarding the external conditions that might influence tax compliance behaviour is extensive but scattered. The literature identifies important factors as influencing tax compliance behaviour, including:

- ► Demographic variables, such as age, gender, and education

- ► Non-compliance opportunities, segmented by income level, income source and occupation

- ► Attitudes and perceptions regarding fairness and trust in the tax administration, and the approach taken by peers

- ► The tax system structure, such as its complexity, and

- ► The probability and consequences of detection inherent in the enforcement approach adopted, i.e., the procedures for ensuring compliance and the penalties for not remitting tax due.

These factors, broadly, are set out in the Fischer model of tax compliance[6] determinants upon which this paper draws.

Beyond Fischer

Fischer's paper was written before the global financial crisis of 2008, and the large government deficits that followed. This has led to further research and work, particularly focusing on income and wealth inequality. There has also been greater scrutiny of high-net worth individuals and corporations. Empirical research has also expanded. More recent developments seek to expand the model's emphasis on

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[5] For example, Luttmer, Erzo F.P., and Monica Singhal. (2014). *Tax Morale.*
[6] Fischer CM, Wartick M, Mark M (1992). Detection Probability and Taxpayer Compliance: A Review of the Literature. J. Acc. Lit. 11: 1-46

culture variables, such as social norms and ethical values, seeing these as significant factors in setting attitudes and perceptions regarding tax compliance.

1.4 Approach taken by tax administrations in identifying and evaluating tools

With the rapid increase in studies, no model appears to have achieved universal support or to have successfully linked all relevant factors. However, the literature to date has resulted in a relatively consistent set of factors that are considered to affect the behaviour of taxpayers, as noted in 1.3.2.

Over the past decade, tax administrations have increasingly recognised that behavioural insights (as identified in the literature) can generate important tools for meeting their missions. The OECD's Forum on Tax Administration ("FTA")[7] notes that, in a 2020 survey of its members, 73% of respondents agreed that behavioural insights were part of their administration's current strategy[8]. Approximately one third of FTA members are using behavioural insights. In a growing number of tax administrations, behavioural scientists are investigating how best to enact change by targeting general taxpayer behaviours, as well as by tailoring interventions for individuals and specific taxpayer segments. Electronic data capture is allowing tax administrations to better analyse behaviour and understand trends, segmented by different taxpayer groups. This is allowing tax administrations to customise taxpayer services and enforcement. Initiatives taken to influence taxpayer compliance frequently include media campaigns, direct contact, tax education, mandating digital systems, cooperative compliance, changes regarding taxpayer awards and sanctions, changes to anti-abuse rules and the creation of behavioral insights teams[9].

A key observation is that what works in one economy may not work in another. Local customs, institutional preferences, and the timing of the intervention, may impact on responses. As a result, a "test, learn, adapt" approach (involving testing the concept in a controlled and limited trial, a statistical evaluation of results, and identifying the successful elements) is recommended as good practice[10,11].

1.5 Relating non-risk management procedures and assessments to Bulgaria

When drawing on the approaches taken by tax administrations to identifying and testing non-risk management procedures and assessments, the paper considers for each potential procedure:

► The external condition/factor addressed

► The nature of the method/tool addressing factor

► The means by which the method/tool is intended to function

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[7] The FTA brings together Commissioners from 53 advanced and emerging tax administrations from across the globe, including all OECD and G20 members. Its vision is to create a forum through which Commissioners can identify, discuss and influence relevant global trends and develop new ideas to increase the fairness, efficiency and effectiveness of tax administration,

[8] Behavioural Insights for Better Tax Administration: A Brief Guide (oecd.org)

[9] 2018 International Survey on Revenue Administration.

[10] Asian Development Bank, A Comparative Analysis of Tax Administration in Asia and the Pacific: 2020 Edition (adb.org)

[11] Trials frequently depend on having a relevant comparison group to allow for a clear measure of intervention effectiveness. The randomised controlled trial, using random assignment to create two or more groups drawn from one larger population, is a frequently used approach.

► Which taxpayer segment the tool is most suitable for

► Likely response to the tool's application

1.6 Organization of this paper

Given the above, this paper is organized as follows:

► This introduction to the subject and the paper.

► A critical review of the existing literature, concluding on a set of factors that are considered likely to effect changes in taxpayer behaviour.

► Identification, for each of the factors, the measurement applicable to those factors, how those measurements could be obtained, and the tools and approaches to use in obtaining and evaluating those measurements.

► Examples of the tools that are currently used in practice, including specific information in relation to selected jurisdictions.

2.   Review of existing literature

As noted in Section 1, the academic literature in relation to the motivation for tax compliance can be separated into two strands – the development of the deterrence model and the extension to include social and psychological factors.

2.1   The development of the deterrence model

The classic economic deterrence models used to predict taxpayer compliance draw from Becker's (1968) Theory of Crime, so are based on theories of criminal behaviour and law enforcement. The theory of tax compliance has been developed substantially since the 1970s, with the work of Allingham and Sandmo in 1972[12] providing a theoretical model of tax evasion. This approach has been labelled the "deterrence" paradigm, as it treats tax as a cost and assumes that taxpayers inherently wish to pay no tax but are "deterred" from doing so solely by the risk of audit, detection, and penalty. The model's stylised taxpayer is essentially identical to a gambler who chooses how much to wager based on the odds and pay-outs of the noncompliance bet.

Economic deterrence models define individuals as rational, weighing the expected utility against expected costs (Allingham and Sandmo, 1972[13]; Milliron and Toy, 1988[14]). The individual's ultimate compliance decision is made taking a straightforward analysis of the costs and benefits (Devos, 2005)[15]. Therefore, the traditional focus has been on direct factors, such as the probability of audit and severity of penalties imposed (Devos, 2005)[16]. Taxpayers will weigh the benefits of noncompliance, including the probability of detection and punishment, against the choice to correctly report income (Alm, 2012)[17]. Under this paradigm, the aim of every taxpayer is to maximise the expected utility of each choice after processing any contingent costs like legal penalties (Slemrod, 2007)[18].

These earlier models led to the conclusion that the level of income reported to the government will increase as the level of enforcement activities resulting in punishment increases (Allingham and Sandmo, 1972)[19]. This approach concludes taxpayers comply only because of the economic consequences of detection and punishment, and hence a taxpayer will report all income received to avoid these consequences. (Alm, 2012)[20].

[12] Allingham, M. and Sandmo, A. (1972). "Income Tax Evasion: A Theoretical Analysis." Journal of Public Economics 1
[13] Ibid
[14] Milliron and Toy (1988), Uncertain Tax Policies, Individual Behaviour and Welfare, American Economic Review 78(1):237-45
[15] Devos, K (2005), The Attitudes of Tertiary Students on Tax Evasion and the Penalties for Tax Evasion – A Pilot Study and Demographic Analysis, eJournal of Tax Research (2005) vol. 3, no.2, pp.222-273
[16] Ibid
[17] Alm, J. (2012), Measuring, Explaining, and Controlling Tax Evasion: Lessons from Theory, Experiments and Filed Studies. Tulane Economics Working Paper Series Working Paper 1213.
[18] Slemrod, J. (2007), Cheating Ourselves: The Economics of Tax Evasion, Journal of Economic Perspectives – Volume 21, Number 1 – Winter 2007 – Pages 25-48
[19] Allingham, M. and Sandmo, A. (1972). "Income Tax Evasion: A Theoretical Analysis." Journal of Public Economics 1
[20] Alm, J. (2012), Measuring, Explaining, and Controlling Tax Evasion: Lessons from Theory, Experiments and Filed Studies. Tulane Economics Working Paper Series Working Paper 1213.

2.1.1 Non-compliance based on amount of tax evaded: the Allingham-Sandmo model

The Allingham-Sandmo model takes the taxpayer's income as given and considers the taxpayer at the point of filing an income tax return. How much income should be reported and how much evaded? It assumes that the revenue authority has no knowledge of the taxpayer's income ahead of this reporting decision. Consequently, it is only applicable to income which can be evaded without certain detection. It then works on the basis that the taxpayer applies their subjective probability of detection to maximise their expected utility, with most taxpayers assumed to be risk averse. The probability function reflects the taxpayer's beliefs about the probability of detection, which is likely to vary from the actual probability.

The implications of the Allingham-Sandmo model are that a higher penalty rate or a higher probability of detection will always discourage tax evasion (and encourage compliance). On the assumption that taxpayers become more willing to engage in risky activities as income / net worth increases, the Allingham-Sandmo model would support a segmented approach to tax compliance.

More formally, Slemrod (2018)[21] notes that the basic version of the model, for the case of a proportional income tax, can be written as follows:

$$Max_e\left[(1 - p(e,a)) \times U(y(1-t) + te) + p(e,a)U(y(1-t) - fte)\right]$$

Where:

► e is understated tax liability and is chosen to maximise the outcome

► p is the probability that evasion is penalized

► a represents enforcement intensity

► U(.) is a von Neumann-Morgenstern utility function

► y is exogenous true income

► t is a linear tax rate, and

► f is the proportional penalty assessed on detected evasion.

This formal expression, highlighting the centrality of the utility function to the deterrence model, is helpful when analysing its impact.

2.2 Assumptions and weaknesses of the deterrence model

The Allingham-Sandmo model is based on strong assumptions, which were explored and to some degree relaxed in the subsequent literature. Problems have been identified with the standard expected utility approach to tax compliance as some of its main predictions are not strongly supported by the evidence[22].

In particular, the early literature assumes that a taxpayer will not comply with their obligations if they perceive non-compliance to deliver a financial advantage. For this to hold true, if the penalty rate is four times the standard tax due, then the modelled probability of detection would need to be 25% or more.

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[21] Slemrod, J (2018) Tax compliance and enforcement, National Bureau of Economic Research Working Paper 24799
[22] Alm J (2019), What motivates tax compliance?, Tulane Economics Working Paper Series Working Paper 1903.

Empirical estimates suggest that this greatly overstates the actual probability (Frey and Feld, 2002)[23]. While empirical studies indicate that the perceived probability of detection is higher than the actual probability[24], the consensus in the literature is that this explanation is insufficient. Allingham and Sandmo (1972)[25] considered that the social stigma attached to being caught evading taxes leads to a more restrictive condition for tax evasion to be optimal. A "disutility" of tax evasion can be built into its utility function. The negative value attached to evasion acts as an additional penalty – a "conscience tax" – to deter evasion.

In reality, many taxpayers meet their obligations in full on a voluntary basis, regardless of the probability of detection. Adapting the Allingham-Sandmo model to take account of this "conscience tax" approach suggests that the effectiveness of using penalty taxation as deterrence to tax evasion (and means of improving compliance) reduces. An increase in the penalty rate may still lead to less evasion, but it also reduces the intrinsic incentive to behave honestly. The difference between empirical findings and the predicted outcome from the deterrence paradigm has, therefore, led to the calls for the development of an extension to the approach[26].

2.2.1 What if the tax administration possesses information regarding the taxpayer?

For an increasing range of income sources, the tax administration will have information regarding the taxpayer's income. For income sources, subject to third-party reporting and/or withholding, such as income from employment or dividends/bank interest, the deterrence model needs to be adapted. In a full reporting model, where the tax authority has the ability to fully reconcile filings to taxpayers, tax evasion would need to involve multiple parties. This will limit the capability of a taxpayer to avoid detection and limit the applicability of the paradigm. In such cases, the deterrence model can be expanded.

2.2.2 Is compliance driven entirely by financial considerations?

The model also assumes that compliance is driven entirely by financial considerations, especially those generated by the level of enforcement. A rational economic analysis of the evasion gamble suggests that most rational individuals should underreport income not subject to third-party information or should over-claim deductions not subject to independent verification. This assumption is not borne out by experience in practice[27]. However, even in the least compliant countries, evasion seldom rises to levels predicted by a purely economic analysis. In fact there are often substantial numbers of individuals in most countries who apparently pay all (or most) of their taxes all (or most) of the time, regardless of the financial incentives they face from the enforcement regime (Alm 2019)[28].

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[23] Frey, Bruno and Lars P. Feld (2002), "Deterrence and morale in taxation: An empirical analysis," CESifo Working Paper, No. 760.
[24] Andreoni, James, Brian Erard and Jonathan Feinstein (1998), "Tax compliance," Journal of Economic Literature 36, 818-860.
[25] Allingham, M. and Sandmo, A. (1972). "Income Tax Evasion: A Theoretical Analysis." Journal of Public Economics 1
[26] Phillips (2011).
[27] Alm (ibid) highlights that this observation has been made by Graetz and Wilde (1985), Elffers (1991), Andreoni, Erard, and Feinstein (1998), Torgler (2006), and Kirchler (2007), among many others. For a somewhat contrary view, see Slemrod (2007).
[28] Alm J (2019), What motivates tax compliance? Tulane Economics Working Paper Series Working Paper 1903.

2.2.3   Does the taxpayer possess perfect knowledge?

The deterrence model relies on the assumption that taxpayers possess knowledge of penalty computations and audit rates (Devos, 2005)[29]. In reality, taxpayers are unlikely to know the exact probabilities of being detected or the amount of penalties to be imposed (Tanzi and Shome, 1993)[30]. Additionally, taxpayers are assumed to have a complete understanding of the relevant aspects of tax regulations, keep adequate books and records, and successfully complete the required tax forms (Smith and Kinsey, 1987[31]; King and Sheffrin, 2002[32]). These assumptions lead to an unproven theoretical model (McKerchar et al., 2013)[33].

2.2.4   What if the taxpayer is not an individual?

Much of the tax evasion literature considers the decisions of a single individual. The literature has therefore been criticised on the basis that it should consider a range of taxpayers, with different income and evasion opportunities. Marrelli (1984)[34] extended the Allingham-Sandmo model to the case of a risk-averse firm in the case of a duopoly. He established comparative results similar in nature to those of the Allingham-Sandmo model where the firm could act as evading indirect tax when acting as a tax collector for government.

Corporate tax evasion by firms has been examined by Chen and Chu (2005)[35] and Crocker and Slemrod (2006)[36]. They highlight that the Allingham-Sandmo model is likely to be inadequate in this context, as their view is that the separation of ownership and control is important for understanding corporate tax evasion. They therefore model tax evasion in the context of the contractual relationship between the shareholders and management. They form the conclusion that the effect of policies to control evasion may depend on who is penalised – the owners of the corporation or management.

2.2.5   Does tax evasion have a social context?

The Allingham-Sandmo model's use of an endogenous probability of detection assumes that the probability of detection increases with the amount evaded. The taxpayer will form their views on the probability of detection in part from their own observations and experience. If the taxpayer forms the view that non-compliance is widespread, their own non-compliance may increase. Other taxpayers may observe this change in behaviour and in turn increase their degree of non-compliance. Hence this kind of social process could involve multiple market equilibria, either with high or low evasion, with only small differences in the tax and penalty incentives[37].

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[29] Devos, K (2005), The Attitudes of Tertiary Students on Tax Evasion and the Penalties for Tax Evasion – A Pilot Study and Demographic Analysis, eJournal of Tax Research (2005) vol. 3, no.2, pp.222-273
[30] Tanzi, V. and Shome, P. (1993), A Primer on Tax Evasion, IMF Staff Papers: Volume 40 No.4
[31] Smith, K.W. and Kinsey, K.A. (1987), Understanding Taxpaying Behavior: A Conceptual Framework with Implications for Research, Law & Society Review, Vol.21, No.4, pp. 639-663
[32] King, S.K and Sheffrin, S.M (2002), Tax Evasion and Equity Theory: An Experimental Investigation. International Tax and Public Finance, 9(4), 505–521
[33] McKerchar et al. (2013), Indicators of tax morale: an exploratory study, eJournal of Tax Research (2013) vol. 11, no. 1, pp. 5-22
[34] Marrelli, Massimo (1984), "On indirect tax evasion," Journal of Public Economics 25, 181-196.
[35] Chen, K-P and Chu, C.Y. (2005), Internal control versus external manipulation: a model of corporate income tax evasion, RAND Journal of Economics, Vol. 36, No. 1, Spring 2005, pp. 151-164
[36] Crocker, K.J. and Slemrod, J. (2006), The Economics of Earnings Manipulation and Managerial Compensation, Michigan Ross School of Business, Working Paper 2006-5.
[37] Sandmo, A, (2004), The theory of tax evasion: A retrospective view.

2.3   Extensions to the deterrence model

As a result of the above concerns and others, work has been done to extend the deterrence model by adding additional factors to make the model more realistic. As noted by Alm (2019)[38], factors considered under this approach include:

► Employer withholding (Kleven et al., 2012[39]; Alm, Clark, and Leibel, 2016[40])

► The individual's labour supply decision (Pencavel, 1979[41]; Cowell, 1981[42])

► The choice of sector in which to work or the type of job to pursue (Cowell, 1985[43]; Pestieau and Possen, 1991[44])

► Multiple individual strategies for reporting (e.g., simultaneous tax avoidance and tax evasion decisions) (Cross and Shaw, 1982[45]; Alm, 1988[46]a; Martinez-Vazquez and Rider, 2005[47])

► Alternative penalty, tax, and tax withholding functions (Pencavel, 1979[48]; Yaniv, 1988[49]), complexity and the associated uncertainty about the relevant fiscal parameters (Alm, 1988b[50]; Beck and Jung, 1989a[51]; Scotchmer and Slemrod, 1989[52]; Cronshaw and Alm, 1995[53]; Snow and Warren, 2005[54]; Alm, 2014a[55])

► The use of paid preparers to assist in tax calculations (Klepper and Nagin, 1989b[56]; Scotchmer, 1989[57]; Reinganum and Wilde, 1991[58]; Erard, 1993[59])

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[38] Alm J (2019), What motivates tax compliance? Tulane Economics Working Paper Series Working Paper 1903

[39] Kleven

[40] Alm, J. Clark, J. and Leibel, K. (2016), Enforcement, Socioeconomic Diversity, and Tax Filing Compliance in the United States, Southern Economic Journal 2016, 82(3), pp. 725-747

[41] Pencavel, J. (1979), A note on income tax evasion, labor supply and non-linear tax schedules, Journal of Public Economics, Volume 12, Issue 1, August 1979, Pages 115-124.

[42] Cowell, F.A. (1981), Taxation and Labour Supply with Risky Activites, Economica, New Series, Vol.48, No. 192 (Nov, 1981), pp. 365-379.

[43] Cowell, F.A. (1985), The Economic Analysis of Tax Evasion, Bulletin of Economic Research 37:3, 1985, 0307-3378

[44] Pestieau, P. and Possen, U. (1991), Tax evasion and occupational choice, Journal of Public Economics, Volume 45, Issue 1, June 1991, pp. 107-125

[45] Cross, R.B. and Shaw, G.K. (1981), The Evasion-Avoidance: A Suggested Approach, National Tax Journal, Vol.34, No.4, pp. 489-491

[46] Alm, J. (1988), Uncertain Tax Policies, Individual Behavior, and Welfare, The American Economic Review, Vol, 78, No. 1, pp. 237-245

[47] Martinez, J. and Rider, M. (2005), Multiple Modes of Tax Evasion: Theory and Evidence, National Tax Journal Vol. 58 No. 1, pp. 51-76

[48] Pencavel, J. (1979), A note on income tax evasion, labor supply and non-linear tax schedules, Journal of Public Economics, Volume 12, Issue 1, August 1979, Pages 115-124.

[49] Yaniv, G. (1988), Withholding and non-withheld tax evasion, Journal of Public Economics, Volume 35, Issue 2, pp. 183-204

[50] Alm, J. (1988) Compliance Costs and the Tax Avoidance-Tax Evasion Decision, The American Economic Review, Vol. 78, Issue 1, pp. 237-245

[51] Beck, P.J. and Jung, W.O. (1989), Taxpayers' Reporting Decisions and Auditing under Information Asymmetry, The Accounting Review, Vol. 64, No.3, pp. 468-487.

[52] Scotchmer, S. and Slemrod, J. (1989), Randomness in tax enforcement, Journal of Public Economics, Volume 38, Issue 1, pp. 17-32

[53] Cronshaw, M. and Alm, J. (1995), Tax Compliance With Two-sided Uncertainty, Public Finance Quarterly, Vol.23, No. 2, pp. 139-166

[54] Snow, A. and Warren, R.S. (2007), Ambiguity About Audit Probability, Tax Compliance, and Taxpayer Welfare, Economic Enquiry, Volume 43, Issue 4, pp. 865-871

[55] Alm, J. (2014), Does an uncertain tax system encourage "aggressive tax planning"? Economic Analysis and Policy, Volume 44, Issue 1, pp. 30-38

[56] Klepper, S. and Nagin, D. (1989), The role of tax preparers in tax compliance, Policy Sciences, Vo.22, No.2, pp. 167 - 194

[57] Scotchmer, S., Who profits from taxpayer confusion? Economics Letters, Volume 29, Issue 1, pp. 49-55

[58] Reinganum, J. and Wilde, L. (1991), Equilibrium Enforcement and Compliance in the Presence of Tax Practitioners, Journal of Law, Economics & Organization, Vol. 7, No. 1, pp. 163-181

[59] Erard, B. (1993), Taxation with representation: An analysis of the role of tax practitioners in tax compliance, Journal of Public Economics, Volume 52, Issue 2, pp. 163-197

- ► The receipt of government services financed by tax payments (Cowell and Gordon, 1988[60])

- ► Positive (individual) rewards for honesty (e.g., eligibility for a lottery if found to be compliant) (Falkinger and Walther, 1991[61])

- ► Endogenous audit selection rules that utilise information from tax returns to strategically determine whom to audit (Landsberger and Meilijson, 1982[62]; Rickard, Russell, and Howroyd, 1982[63]; Greenberg, 1984[64]; Reinganum and Wilde, 1986[65]; Graetz, Reinganum, and Wilde, 1986[66]; Beck and Jung, 1989b[67]; Kuchumova, 2017[68]).

These extensions considerably complicate the theoretical analyses. Alm (2019)[69] considers that no single theory has been able to incorporate more than a few of these factors in a meaningful way, although allowing for withholding tax appears to move the model closer to observed reality. As the extensions continue to leave enforcement as the main factor that motivates compliance, they do not address the underlying mismatch between traditional economic theory and the wider range of factors driving taxpayer behaviour.

2.4   The extended model

The deterrence model falls within a standard neoclassical economic model of human behaviour: individuals are rational, they have unlimited willpower, and they are purely self-interested. Many researchers now posit that taxpayers' compliance behaviour is also influenced by social and psychological factors and as a result, have undertaken studies to cover these factors.

Jackson and Milliron (1986)[70] carried out a comprehensive review of the tax compliance literature and identified 14 key factors studied by researchers on tax compliance to that date, as noted below.

2.4.1   The Fischer model

These 14 factors are categorised by Fischer and associates (Fischer et al., 1992)[71] into four groups in the Fischer Model:

- ► Demographic (e.g., age, gender, and education)

[60] Cowell, F.A. and Gordon, J.P.F, Unwillingness to pay: Tax evasion and public good provision, Journal of Public Economics, Vol. 36, pp. 305-321
[61] Falkinger, J. and Walther, H. (1991), Rewards versus Penalties: on a New Policy against Tax Evasion, Public Finance Quarterly, Volume 19, Issue 1, pp. 67-79
[62] Landsberger, M and Meilijson, I. (1982), Journal of Public Economics, Vol. 19, Issue 3, pp. 333-352
[63] Rickard, J., Russell, A and Howroyd, T. (1982), A Tax Evasion Model with Allowance for Retroactive Penalties, Economic Record, Vol. 58, Issue 4
[64] Greenberg, J. (1984), Avoiding tax avoidance: A (repeated) game-theoretic approach, Journal of Economic Theory, Vol. 32, Issue 1, pp. 1-13
[65] Reinganum, J. and Wilde, L. (1986), Equilibrium Verification and Reporting Polices in a Model of tax Compliance, International Economic review, Vol. 27, No. 3, pp. 739-760
[66] Graetz, M., Reinganum, J. and Wilde, L. (1986), The Tax Compliance Game: Toward an Interactive Theory of Law Enforcement, Journal of Law, Economics and Organization, Vol, 2, No. 1
[67] Beck, P.J. and Jung, W.O (1989), The Role of Tax Practitioners in Tax Reporting: A Signalling Game, University of Illinois, College of Commerce and Business Administration, Faculty Working Paper No. 89-1578.
[68] Kuchumova, Y. (2017), The Optimal Deterrence of Tax Evasion: The Trade-off Between Information Reporting and Audits, Journal of Public Economics, Volume 145, pp. 162 -180
[69] Alm J (2019), What motivates tax compliance? Tulane Economics Working Paper Series Working Paper 1903
[70] Jackson BR, Milliron VC (1986). Tax Compliance Research: Findings, Problems, and Prospects, J. Account. Lit. 5: 125-165
[71] Fischer CM, Wartick M, Mark M (1992). Detection Probability and Taxpayer Compliance: A Review of the Literature. J. Acc. Lit. 11: 1-46

► Non-compliance opportunity (e.g., income level, income source and occupation),

► Attitudes and perceptions (e.g., fairness of the tax system and peer influence)

► Tax system/structure (e.g., complexity of the tax system, probability of detection and penalties and tax rates).

The Fischer model of tax compliance sought to incorporate economic, sociological and psychological factors holistically. It expands on the Allingham-Sandmo model by providing a framework for understanding the influence of those socio-economic and psychological components on taxpayers' compliance decisions[72].

Subsequent papers have sought to further expand the Fischer model. Notably, Chau and Leung (2009)[73] consider culture to be a powerful environmental factor that affects tax compliance and suggest a partial refinement to this model by incorporating a cultural factor into the model.

Alabede et al (2011)[74] proposed adding three additional factors to the Fischer Model – public governance quality, perceived tax service quality and treatment of taxpayers by the tax authority, and ethnic diversity. He also highlighted risk appetite and the financial condition of taxpayers as secondary influences of taxpayer behaviour.

2.4.2 Greater use of behavioural economics

Behavioural economics, applying psychological insights into human behaviour to explain economic decision-making, can be seen as a catch-all categorisation of all other factors that involve "more than amoral cost-benefit calculation" (Slemrod, 2007)[75].

Many field experiments have delivered encouraging results, leading to the creation of "nudge" units. In relation to tax compliance, these have either:

► Included deterrence messages aimed at addressing perceived weaknesses in the Allingham-Sandmo model, such as the taxpayer's perception of information held by the tax authority, the probability of detection and social context in which evasion occurs.

► Targeted non-pecuniary and intrinsic motivations, by stressing the benefits from taxation, fairness and social norms, morality, broadly classified as "tax morale" (Luttmer & Singhal, 2014)[76], or "moral suasion" (Mascagni, 2018)[77]; Torgler, 2004)[78].

The results from these studies have been mixed, suggesting the importance of linking messages to their specific environment, taxpayer perceptions and type of tax.

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[72] Chau, G and Leung, P (2009), A critical review of Fischer tax compliance model: A research synthesis, Journal of Accounting and Taxation Vol.1 (2), pp. 034-040, July, 2009

[73] Ibid

[74] Alabede, J.O et al (2011), Determinants of Tax Compliance: A Proposed Model for Nigeria

[75] Slemrod, Joel (2007). "Cheating Ourselves: The Economics of Tax Evasion." Journal of Economic Perspectives, 21(1): 25-48.

[76] Luttmer, E. F. P., & Singhal, M. (2014). Tax morale. Journal of Economic Perspectives, 28(4), 149-168. https://doi.org/10.1257/jep.28.4.149

[77] Mascagni, G. (2018). From the lab to the field: A review of tax experiments. Journal of Economic Surveys, 32(2), 273-301. https://doi.org/10.1111/joes.12201

[78] Torgler, B. (2004b). Moral suasion: An alternative tax policy strategy? Evidence from a controlled field experiment in Switzerland. Economics of Governance 5(3), 235-253. https://doi.org/10.1007/s10101-004-0077-7

Jamieson et al (2020)[79] find that deterrence messages that change the perceived probability of audit or make the penalties for non-compliance more noticeable worked in several field experiments, although there were some exceptions. They also note that messages highlighting the tax behaviour of others (i.e., social norms) and omission/commission messages that increase the moral costs of non-compliance have worked towards increasing compliance for income taxes.

2.4.3 Empirical research reinforces the extended model

Recently, researchers have started working alongside tax authorities to test different insights drawn from behavioural science (Pomeranz & Vila-Belda, 2018)[80]. In part because of concerns with naturally occurring field data, researchers have increasingly employed controlled field experiments (or randomised controlled trials, ("RCTs")). In a typical controlled field experiment, a treatment sample of individuals receives a message (e.g., a letter or an electronic notification) telling them some policy-relevant information (e.g., "your tax return will be closely examined", "most people pay their taxes", "paying taxes helps others", or "taxes provide for public services"). A control sample of individuals receives a neutral message. The impact of the policy innovation is then examined by a simple comparison of the treatment group compliance with the control group compliance. To date, most controlled field experiments have used this "message" approach, although other approaches are starting to be employed[81].

These studies in general show that the following aspects all lead to different outcomes:

► the tax system in the country studied

► the tax type

► the underlying characteristics and perceptions of taxpayers

► social and cultural attitudes, and

► the baseline behaviours of taxpayers.

Individuals are in part motivated by narrowly defined, and individually based, financial considerations (e.g., audits, penalties). They are also motivated by non-financial considerations (e.g., sympathy, empathy, guilt, shame, morality). Further, there is some evidence that they are motivated by social considerations (e.g., social norms, public goods, voting, neighbour behaviour). There is also evidence that individuals are motivated by information and by the ways in which they process this information. The literature also suggests that individuals with different levels and sources of income, and firms, act differently, but must be considered a collection of different segments[82].

2.4.4 Economic shocks and tax compliance

A significant negative economic shock, such as the 2008 global financial and economic crisis or the more recent COVID-19 pandemic, increases compliance risks for tax authorities at a time when government requires greater resources for taxpayer support. Theoretical and empirical studies suggest that an economic downturn tends

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[79] Jamison, JC; Mazar, N; Sen, I (2020), Applying behavioral insights to tax compliance: Experimental evidence from Latvia, Journal of Tax Administration, https://ore.exeter.ac.uk/repository/handle/10871/121984

[80] Pomeranz, D. D, & Vila-Belda, J. (2019). Taking state-capacity research to the field: Insights from collaborations with tax authorities (CEPR Discussion Paper 13688). London, England: CEPR Centre for Economic Policy Research.

[81] Hallsworth (2014) provides a critical discussion of controlled field experiments,

[82] In researching this paper, no substantial body of behavioural experiments addressing the impact of whether the taxpayer is an individual, small firm or multinational on tax compliance was found.

to worsen taxpayer compliance in important aspects[83]. Compliance risks include tax arrears, loss-reporting businesses, tax withholding, and the cash economy. However, the possibility of changes in taxpayer compliance as a result of economic shocks have received relatively little attention.

The basic models of income tax compliance suggest compliance might in some respects improve as incomes fall during a recession, both because individuals may become less willing to take the risk involved in cheating on their taxes[84] and due to the progressive nature of the tax code[85].

Reverse considerations include:

► When credit is tight or unavailable, credit-constrained taxpayers may be tempted to use tax evasion as an alternative source of finance.

► Taxpayers who face severe economic stress—such as bankruptcy—may perceive the downside risks of tax evasion (penalties) to be minimal compared with the potential upside gains (avoiding bankruptcy).

► If an economic crisis changes the mix of economic actively to hard-to-tax sectors[86], compliance is likely to decline.

Empirical evidence regarding the impact of recession on taxpayer compliance has until now been limited, with increasing interest following the global financial crisis and, more recently, COVID-19. Such evidence as does exist supports the prediction that compliance will worsen in a downturn. For example:

► Plumley (1996)[87] found that taxpayers' filing and reporting compliance are negatively correlated with unemployment.

► Credit constraints can reduce taxpayer compliance (Cai and Liu, 2009)[88].

► VAT compliance tends to worsen as the (negative) output gap grows[89]

Research is now starting to be produced on the impact of the COVID-19 pandemic on tax compliance behaviour. For example, Mascagni and Santoro[90] have found that the pandemic shifted perceptions around equity and trust in tax systems, as well as attitudes to conditional and unconditional tax compliance. They found improvements in taxpayers' perceptions about the fairness of the tax system, and a shift from unconditional compliance to a conditional version that links more closely with public

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[83] Brondolo, J (2009), Collecting Taxes During an Economic Crisis: Challenges and Policy Options (IMF Staff Position Note, SPN/09/17).
[84] The Allingham-Sandmo model suggests that a fall in income should lead to reduced evasion if, as is often assumed, relative risk aversion increases with decreases in income.
[85] Slemrod, Joel, 2001, "A General Model of the Behavioral Response to Taxation," International Tax and Public Finance, Vol. 8, pp. 119–28.
[86] Schneider, Friedrich, 2009, "Influence of the global economic crisis on the underground economy in Germany: a (renewed increase)," discussion paper, Institute of Economics, Johannes Kepler University of Linz, Linz, Austria, March 2009. predicted that the global financial crisis would increase the shadow economy in 21 Organisation for Economic Development and Cooperation (OECD) countries by an average of 0.5 percent of GDP during 2009 after a decline each year since 2001
[87] Plumley, Alan H., 1996, "The Determinants of Individual Income Tax Compliance: Estimating the Impacts of Tax Policy, Enforcement, and IRS Responsiveness" (Washington: Internal Revenue Service).
[88] Cai, Hongbin, and Qiao Liu, 2009, "Competition and Corporate Tax Avoidance: Evidence from Chinese Industrial Firms," The Economic Journal, April 2009 (London).
[89] IMF Fiscal Affairs Department (2012).
[90] Mascagni G and F Santoro (2021), Tracking COVID-19's impact on tax in Africa: Formal an informal tax burdens, tax compliance, and the reach of tax relief (IDS)

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service delivery. These findings suggest possible directions for tools to measure and influence compliance behaviour in the case of an economic shock.

2.4.5 Impact of messaging to taxpayer

2.4.5.1 Deterrence messages

Studies suggest that successful deterrence messages can include:

► Interventions that impact on perceptions of audit probability, with messages that increase the perception of audit appearing effective

► Messages highlighting the costs of detection on the taxpayer, as research has shown that individuals may underestimate and/or be inattentive to financial penalties (Karlan et al., 2016)[91]; Stango & Zinman, 2011)[92].

2.4.5.2 Non-deterrence messages

Studies suggest that successful non-deterrence message can include:

► Utilising a set of messages that highlight the benefits of compliance (i.e., how taxes are used and how this benefits society), with taxpayers motivated to pay for the services provided by government. Overall, utilising these types of messages has produced mixed results.

► Perceptions of, or attitudes towards, the effectiveness of government itself can influence compliance. For example, Frey and Torgler (2007)[93] showed that perceptions of tax evasion, along with institutional measures (such as voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rules of law, and control of corruption) are correlated with tax morale.

► Social norms. Previous studies have shown that people are "conditional cooperators" in the laboratory, increasing their contributions in public goods games if others are also contributing, but withdrawing otherwise (Charness & Rabin, 2002[94]; Fehr & Falk, 2002[95]). Several studies have shown that these preferences also hold true in the domain of tax compliance, in that any individual taxpayer will be less inclined to pay her taxes if she believes that others are not cooperating—that is, if she believes that others are not paying their fair share of taxes (Bazart & Bonein, 2014[96]; Frey & Torgler, 2007[97]).

► Personal norms, through an appeal to the individual's personal sense of duty. For example, recent experiments have shown that letters that frame non-compliance as an intentional and deliberate choice typically do well in increasing compliance.

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[91] Karlan, D., McConnell, M., Mullainathan, S., & Zinman, J. (2016). Getting to the top of mind: How reminders increase saving. Management Science, 62(12), 3393-3411. https://doi.org/10.1287/mnsc.2015.2296

[92] Stango, V., & Zinman, J. (2011). Fuzzy math, disclosure regulation, and market outcomes: Evidence from truth-in-lending reform. The Review of Financial Studies, 24(2), 506-534. https://doi.org/10.1093/rfs/hhq089

[93] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159

[94] Charness, G. and Rabin, M. (2002), Understanding Social Preferences with Simple Tests, Quarterly Journal of Economics, Vol. 117, Issue 3, pp. 817-869

[95] Fehr, E. and Falk, A. (2002), Psychological foundations of incentives, European Economic Review, Vol. 46, Issues 4-5, pp. 687-724

[96] Bazart, C. and Bonein, A. (2014), Reciprocal relationships in tax compliance decisions, Journal of Economic Psychology, Vol. 40, pp. 83-102

[97] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159

2.5 Current state of literature

While the literature on behavioural approaches to tax compliance is voluminous, much remains unknown[98]. Arguably, a theoretical analysis of tax compliance behaviour shows that:

Enforcement is one of several factors that matter for tax compliance.

The existence and use of third-party information and withholding tax systems improves tax compliance.

An individual does not always behave as assumed under the traditional economic approach. Instead, the individual:

- May be unable to make all calculations required under expected utility theory
- May misjudge the true costs of an action, and
- May be affected by the framing of a decision.

The individual can be influenced by group considerations.

These points indicate the importance of messaging. The precise combination of tax type, target population, social and cultural norms, timing, framing of the message, and delivery channel can influence both the magnitude and direction of response[99]. While studies give some indication of what might work where, they are not conclusive. Nevertheless, deterrence messages have increased compliance in several different field experiments. Messages highlighting social norms and messages regarding omission/commission messages are seen as showing promise.

2.6 Summary: Factors impacting on non-risk management procedures and assessments

Figure 2 below summarises the factors noted as potentially impacting on non-risk compliance. They are considered in more detail in section 3, which also comments on ways in which they could be tracked.

Figure 2: Factors impacting on non-risk management procedures and assessments

NRA able to respond/track

Demographics
- Age
- Gender
- Education
- Marriage/partnership status
- Ethnic diversity
- Financial condition of taxpayers
- Level of economic development

Attitudes and perceptions
- Fairness of tax system
- Peer influence
- Social norms
- Ethics/conscience/tax morals
- Public governance (service) quality
- Perceived tax service quality
- Religiosity/sense of community
- Trust in government
- Other cultural factors

Factor

NRA potentially able to influence

Non-compliance opportunities
- Tax at risk
- Third party reporting
- Sector/occupation
- Corporate form

Tax system and structure
- Complexity of tax system
- Probability of detection
- Penalties
- Tax rate
- Corruption

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[98] Jamison, JC; Mazar, N; Sen, I (2020).
[99] Ibid.

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3. Identifying key factors, methods and approaches from academic literature

Section 2 identified four main categories of factor which are relevant to non-risk management procedures and assessments – tax systems and structures, non-compliance opportunities, demographics, and attitudes and perceptions. Building on this, section **Error! Reference source not found.** provides a framework for considering the detailed factors. In doing so, it identifies those factors that have a direct impact on the likelihood of non-compliance and those that have an indirect impact the likelihood of non-compliance. Given the nature of the factors, there is considerable interaction between them and it is necessary to consider the impact of the external factors on a single taxpayer in an holistic manner.

This section further notes:

▶ Why each factor should be considered for measurement

▶ The main channels of interaction between the factors

▶ The potential for significant changes to the factor in the short-term, and

▶ The likely direction of impact of the factor on tax compliance

3.1 Direct factors impacting on tax compliance

3.1.1 Tax system/structure

Figure 2 summarises the direct factors relating to tax compliance, the potential for significant change to those factors in a short timeframe and the likely strength and direction of compliance response to change. It highlights those factors where change is more closely related to the NRA's core functions.

Figure 3 – Direct factors influencing compliance

Direct factors impacting on tax compliance
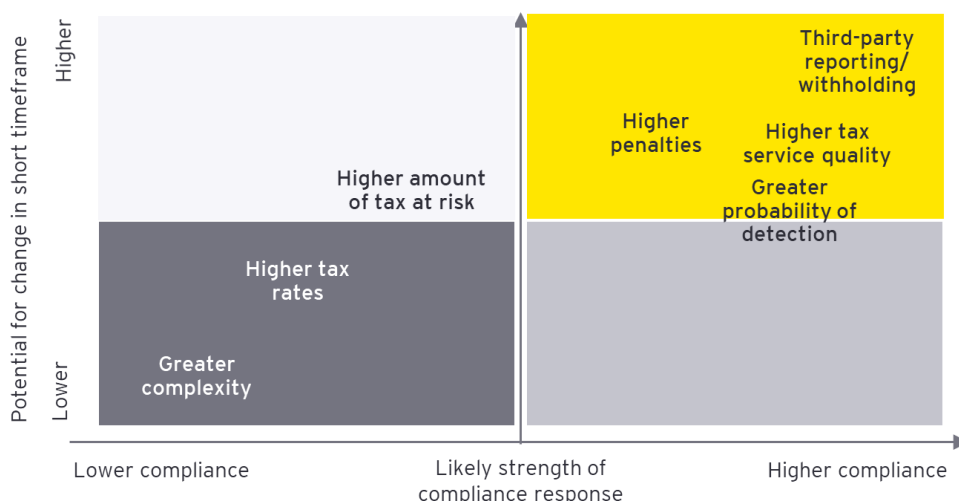
Source: EY analysis of economic literature

3.1.2 Greater complexity

The association between complexity and tax evasion has been found to be positive and significant. Picciotto (2007)[100] highlighted the substantial potential for "improving tax compliance, in particular by reducing complexity, improving clarity, and the use of broad principles."

There are two main ways in which complexity influences tax compliance behaviour:

► confusing tax law with excessive detail, and

► numerous complicated calculations in determining tax liability (Chau and Leung, 2009)[101].

This relationship has been long established, with Jackson and Milliron (1986)[102] recognising an increase in tax non-compliance due to increasingly complex tax laws. More recently, Richardson (2006)[103] finds complexity to be the most important determinant of tax evasion across 45 developed and developing countries. Also Dybka et al. (2022)[104], using the currency demand econometric approach (see chapter 3.7.1) and model averaging techniques, identified the number of hours needed for tax payments as an important determinant of the shadow economy. Therefore, where a country's tax system is highly complex, tax compliance will lower (G. Richardson, 2006)[105]. Two other cross-national studies confirm this (Alm and McClelland, 2012[106]; Bame-Aldred et al., 2013[107]). Whilst not all studies show such a strong negative relationship (e.g., Fauvelle-Aymar, 1999[108]; Slemrod, 2002[109]; Kim, 2008[110]), the balance of material suggests that it is an important negative factor.

It would be feasible for the NRA to seek to reduce tax complexity (by first measuring it and then targeting specific complex areas), and this could be expected to improve compliance. In general, excess complexity can be identified as where "tax law is more complex than is needed to achieve the policy aim"[111].

As a general approach, reductions in complexity in a tax measure can be achieved through:

► Ensuring the proposed tax measure meets the policy aims

► Considering the focus of the measure

► Maintaining the measure properly as circumstances change

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[100] Picciotto, S. (2007), Game playing, tax law and the regulatory state, Law & Policy, Vol. 29, Issue 3, pp. 11-30
[101] Chau, G. and Leung, P. (2009), A critical review of Fischer tax compliance model: A research synthesis, Journal of accounting and taxation, Vol. 1, Issue 2m pp. 34-40
[102] Jackson, B., Milliron, V. (1986), Tax preparers: Government agents or client advocates?, Journal of Accountancy: New York, Vol. 167, Issue 5
[103] Richardson, G. (2006), Determinants of tax evasion: A cross-country investigation, Journal of international Accounting, Auditing and Taxation, Vol. 15, Issue 2, pp. 150-169
[104] Dybka, P., Olesiński, B., Rozkrut, M. and Torój, A. (2022), Measuring the model uncertainty of shadow economy estimates, International Tax and Public Finance, https://doi.org/10.1007/s10797-022-09737-x
[105] Ibid
[106] Alm, J. and McClellan, C. (2012), Tax Morale and Tax Compliance from the Firm's Perspective, Kyklos International Review for Social Sciences, Vol. 65, Issue 1, pp. 1-7
[107] Bame-Aldred, C.W. et. Al (2013), National culture and firm-level tax evasion, Journal of Business Research, Vol. 66, Issue 3, pp. 390-396
[108] Fauvelle-Aymar, C. (2007), The Political and Tax Capacity of Government in Developing Countries, Kyklos International Review for Social Sciences, Vol. 52, Issue 3, pp. 391-413
[109] Slemrod, J. and Yitzhaki, S. (2002), Tax avoidance, evasion and administration, Handbook of Public Economics, Vol. 3, pp. 1423-1470
[110] Kim, S (2008), Does political intention affect tax evasion? Journal of Policy Modeling, Vol. 30, Issue 3, pp. 401-415
[111] Sanger, Chris, Tax complexity – a definition.

Issues relating to the measurement of the impact of complexity of a tax system on taxpayers include:

► The complexity of a particular measure may vary over time. The transition to a new system might appear complex initially but this complexity may decrease as taxpayers adapt to the new arrangements. Where the goal of reducing complexity is to increase compliance, the focus should be on the enduring rather than transitional costs of complexity.

► When considering changes that will impact on the complexity of the tax system, only incremental costs associated with the change should be included. Even with no taxes, companies would still have to keep records of income and expenses to calculate their profits and individuals would engage in financial planning.

► Simplifying the tax system by eliminating a programme is possible, but may lead to additional complexity elsewhere, e.g., replacing a research and development ("R&D") tax credit with a non-tax R&D grant incentive. Tax compliance improvements could therefore be at the cost of increased complexity elsewhere.

Complexity in tax legislation can be measured in several ways, including:

► The length of tax legislation and regulation, tracking changes over time and relative to comparable jurisdictions.

► The quantity of numerical thresholds and de minimis limits.

► Surveys of taxpayer perception.

► Creating stylised taxpayer examples and looking at the impact of the tax system on the taxpayer as a whole, such as in the (now discontinued) World Bank Ease of Doing Business series.

Indices of taxpayer complexity can also be developed, through consultation with tax professionals. There is a relationship between tax professionals' perceptions of tax complexity, measured through the indices, and some of their tax noncompliant behaviours, in particular the unintentional ones[112].

As an example of measuring complexity, the UK's Office of Tax Simplification has developed a complexity index, a spreadsheet tool for analysing and measuring the relative complexity of the UK tax system[113]. The spreadsheet divides the UK tax system into 107 discrete areas. It then assigns to each area values for ten different complexity factors, six for "intrinsic complexity" and four for "impact of complexity". Combining these factors using roughly equal weightings creates two numbers between 1 and 10 for the relative complexity of the tax area: one for intrinsic complexity and one for impact of complexity. 10 is the most complex, 1 the simplest. The spreadsheet can then be sorted by these numbers in descending order to find the most complex areas of the UK tax system.

Greater complexity can be associated with negative perceptions of the quality of service provided by the tax administration, and greater scope for tax agents to improve compliance levels.

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[112] Borrego, Lopes and. Ferreira (2016), Tax complexity indices and their relation with tax non-compliance: Empirical evidence from the Portuguese tax professionals
[113] Office of Tax Simplification complexity index - GOV.UK (www.gov.uk)

3.1.3   Perceived probability of detection

Theory suggests that, if taxpayers believe the audit risk to be high, tax compliance increases whereas, if there is no risk of audit, tax evasion increases (Davis et al, 2003[114]; Kim, 2005[115]; Schauer and Bajor, 2007[116]). Thereby, increased audit risk is predicted to reduce noncompliance.

In practice, empirical studies on perceived probability of detection show a smaller impact than predicted by theory. Bame-Aldred et al. (2013)[117] found positive and significant results that indicate that increased audit risk increases tax compliance behaviour. In a large-scale experiment in Uruguay, Bérgolo et al. (2017)[118] found that providing firms with detailed information about past audit statistics, and average audit probability and penalties, together with a letter stating that evasion increases chances of audit, increased compliance. Taxpayers in receipt of letters performed marginally better. However, they not only found that higher audit probabilities (or penalties) do not lead to higher payments, but that firms' beliefs of audit probabilities drop after receiving the treatment letters. The authors hypothesise that, even though firms respond to the threat of audit, it is not through the rational mechanisms laid out in Allingham and Sandmo (1972)[119]. In addition, a cross-national study by Alm and McClelland (2012)[120] found no significance. These studies do not negate the theory but suggest that it is only a part-explanation for recorded behaviour.

Taxpayers are also likely to change behaviour in the period following audit. Advani, Elming and Shaw (2017)[121] show that audits raise reported tax liabilities for at least five years after audit, with the magnitude of the impact declining over time. They decomposed their findings by income source, showing that the magnitude of the initial impact is lower for income components which are third party reported, and the impact declines more quickly for components that are more volatile.

A higher probability of detection can be associated with greater use of third-party data and other modern risk assessment techniques. It links to other direct factors influencing tax compliance, such as higher penalties, higher tax rates and the amount of tax at risk, as set out in section 2.

3.1.4   Penalties

The relationship between tax compliance and the severity of sanctions is another important factor affecting the taxpayer's tax compliance decision (Chau and Leung, 2009[122]). The majority of available literature in tax compliance research reports a significant positive relationship between penalties and tax compliance behaviour

[114] Davis, J.S et al, (2003), Social behaviours, enforcement and tax compliance dynamics, The Accounting Review, Vol. 78, Issue 1, pp. 39-69

[115] Kim, J. (2005), Tax reform issues in Korea, Journal of Asian Economics, Vol. 16, Issue 6, pp. 973-992

[116] Shauer, P.C and Bajor, L. (2007), The impact of detection risk on tax compliance: An alternative view, Academy of Accounting and Financial Studies Journal, Vol. 11, Issue 2

[117] Bame-Aldred, C.W. et. Al (2013), National culture and firm-level tax evasion, Journal of Business Research, Vol. 66, Issue 3, pp. 390-396

[118] Bérgolo, M.L. et al. (2017), Tax audits as scarecrows: Evidence from a large-scale field experiment, National Bureau of Economic Research, Working Paper 23631

[119] Allingham, M. and Sandmo, A. (1972). "Income Tax Evasion: A Theoretical Analysis." Journal of Public Economics 1

[120] Alm, J. and McClellan, C. (2012), Tax Morale and Tax Compliance from the Firm's Perspective, Kyklos International Review for Social Sciences, Vol. 65, Issue 1, pp. 1-7

[121] Advani A, Elming W and J Shaw (2017), The dynamic effects of tax audits (IFS Working Paper W17/24)

[122] Chau, G. and Leung, P. (2009), A critical review of Fischer tax compliance model: A research synthesis, Journal of accounting and taxation, Vol. 1, Issue 2m pp. 34-40

(Jackson and Milliron, 1986[123]; Carnes and Englebrecht, 1995[124]; Maciejovsky et al., 2012[125]; and Richardson and Sawyer, 2001[126]), with others identifying no material relationship (Kirchler, 2007[127]; Torgler, 2007[128]).

Two possible explanations have been observed for the mixed findings in these studies:

► One possible explanation is that, once penalties rise beyond a certain level, the downside of the penalties to be imposed becomes so severe that the taxpayer opts out of the compliance system entirely, instead preferring to take the risk of failing to comply altogether.

► Alternatively, a taxpayer may not have sufficient awareness of the level of penalties imposed. In this situation, it is the desire to avoid consequences that drive compliant behaviour by taxpayers, who will be aware that there are consequences for late payment of business tax,but lack specific knowledge of how they are applied.[129]

► Given that penalties themselves are not sufficient to ensure compliance in all cases, tax administrations have identified a range of related tools which have the potential to improve outcomes. These include:

► Reporting individuals with outstanding tax obligations to credit agencies

► Restricting overseas travel by debtors

► Requiring tax clearance for government contracts

► Withholding government payments to debtors and non-compliant taxpayers.

► Issuing director penalty notices where a company's obligations are not met. The effect of the notice is that, if not resolved, the company director they will become personally liable for the tax due.

► Imposing compulsory electronic charges, for example, by transactional skimming of payments through financial intermediaries. This would operate by the tax administration having the ability to require financial institutions to attach an additional charge on electronic transactions for taxpayers with outstanding tax debt.

The success of various penalty or related measures could be tracked through the proportion of taxpayers subject to penalty who comply fully in future, through data analytics and/or random subsequent reviews.

3.1.5 Tax rate

The deterrence theory postulates that, as tax rates increase, tax compliance decreases (Clotfelter, 1983)[130]. Studies either support this theory (Edlund and Aberg,

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[123] Jackson, B., Milliron, V. (1986), Tax preparers: Government agents or client advocates? Journal of Accountancy: New York, Vol. 167, Issue 5
[124] Carnes, G.A. and Englebrecht, T.D. (1995), An investigation of the effect of detection risk perceptions, penalty sanctions, and income visibility on tax compliance, The Journal of American Tax Association; Sarasota, Vol. 17, Issue 1
[125] Maciejovsky, B. (2012), Rationality versus emotions: The case of tax ethics and compliance, Journal of Business Ethics, Vol. 109, pp. 339-350
[126] Richardson, M. and Sawyer, A.J. (2001), A taxonomy of the tax compliance literature: further findings, problems and prospects, 16 Australia Tax Forum, pp. 137-284
[127] Kirchler, E. (2007), The economic psychology of tax behaviour, Cambridge University Press
[128] Torgler, B. (2007), Tax compliance and tax morale: A theoretical and empirical analysis
[129] Canada Revenue Agency. (December 2009). Attitudes towards payment of debt and compliance. Final Report. Prepared by Sage Research for Canada Revenue Agency.
[130] Clotfelter, C.T. (1983), Tax evasion and tax rates: An analysis of individual returns, The review of economics and statistics, Vol. 65, No. 3, pp. 363-373

2002[131]; Wu and Teng, 2005[132]) or find no significant relationship (G. Richardson, 2006[133]; Torgler and Schneider, 2007[134]; Kim, 2008[135]; Bame-Aldred et al., 2013[136]; Kountouris and Remoundou, 2013)[137].

Harju et al. (2014)[138] studied the impact of exogenously varying the VAT rate and found that a higher tax rate led to lower compliance rates for hairdressers in Finland. There are two effects here, the increase in the amount at risk as tax rates rise and the visibility of the magnitude of the tax. As tax rates rise in a downturn to the economy, this may become one of the few areas where significant "savings" can be made.

High tax rates affect the amount of tax at risk, and, in conjunction with rules regarding penalties and the probability of detection, form a significant part of the tax compliance framework. Effective and headline tax rates by sector can be calculated from tax returns and related to the proportion of compliant taxpayers in that sector as shown through audit statistics.

3.1.6 Tax at risk

Tax at risk is closely related to tax rate, with the amount of tax at risk being a function on tax rate, taxable income and tax base. As a taxpayer's income rises, in a progressive tax system, the amount of tax at risk can increase substantially. The amount of tax at risk is more significant for higher income taxpayers. The theoretical model indicates that, as income rises, tax evasion should increase over most ranges (Andreoni et al., 1998)[139]. Vogel (1974)[140] finds that respondents who report an improvement in individual financial/income status during the past five years are more likely to commit tax evasion than those who report a deterioration of their financial/income status during the same period. Houston and Tran (2001)[141] also reveal the respondents in the lower income group tend to have a lower proportion of non-compliance by under-reporting income and by over-claiming expenses than their counterparts in the higher income group. By investigating participants in the 1997 Arkansas Tax penalty amnesty program, Ritsema et al. (2003)[142] also find that income level is positively related to the tax owed.

Tax at risk will therefore be impacted by changes to tax rates, and also by indirect factors such as economic shocks, income earning potential by taxpayers, for example

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[131] Edlund, J. and Aberg, R. (2002), Social norms and tax compliance, Swedish economic policy review, Vol. 9, pp. 201-228

[132] Wu, S.Y. and Teng, M.J. (2005), Determinants of tax compliance – a cross-country analysis, Public Finance Analysis, Vol. 61, No.3, pp. 393-417

[133] Richardson, G. (2006), Determinants of tax evasion: A cross-country investigation, Journal of international Accounting, Auditing and Taxation, Vol. 15, Issue 2, pp. 150-169

[134] Torgler, B. and Schneider, F. (2007), What Shapes Attitudes Toward Paying Taxes? Evidence from multicultural European Countries, Social Science Quarterly, Vol. 88, Issue 2, pp. 443-470

[135] Kim, S (2008), Does political intention affect tax evasion? Journal of Policy Modeling, Vol. 30, Issue 3, pp. 401-415

[136] Bame-Aldred, C.W. et. Al (2013), National culture and firm-level tax evasion, Journal of Business Research, Vol. 66, Issue 3, pp. 390-396

[137] Kountouris, Y., and Remoundou, K. (2013). Is there a cultural component in tax morale? Evidence from immigrants in Europe. Journal of Economic Behavior & Organization, Vol. 96, pp. 104–119

[138] Harju, J. et al. (2014), Do honest hairdressers get a haircut? Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association, Vol. 107, pp. 1-32

[139] Adreonio, J. et al. (1998), Tax compliance, Journal of economic literature, Vol. 36, No.2, pp. 818-860

[140] Vogel, J. (1974), Taxation and public opinion in Sweden: An interpretation of recent survey data, National Tax Journal, Volume 27, No. 4

[141] Houston, J. and Tran, A. (2001), A survey of tax evasion using the randomized response technique, Advances in taxation, Vol. 13,

[142] Ritsema, C.M. (2003), Economic and behavioural determinants of tax compliance: evidence from the 1997 Arkansas Tax Penalty Amnesty Program, 2003 IRS Research Conference

through education or change in occupation, and the general level of economic development within a country.

3.1.7 Third party reporting available

Use of third-party data strengthens the ability for the tax administration to target its tax compliance strategy, as well as requiring multiple parties to "collude"[143] to avoid immediate detection. Hence:

► Tax administrations are increasingly investing in building capacity for data matching, data analysis and transaction monitoring.

► At the same time, many administrations have considerably expanded the collection of third-party data from private sector institutions such as banks and credit card companies.

► Data are being collected from intermediaries regarding taxpayer transactions, for example, creating an obligation for online sales and service platforms to report transactions above a certain threshold.

► Given the increasing importance of the cryptocurrency market, countries are also moving towards introducing legal obligations requiring exchange platforms to report transactions above a certain threshold.

Factors to be measured include:

► The level of third-party reporting applied within a sector and the amounts which reconcile between third-party and taxpayer reporting.

► Whether tax administration can match reported amounts to taxpayer.

► Changes in compliance rates upon adoption of automatic reporting (e.g., digital platforms).

For example, Dybka et al. (2022)[144], using the currency demand econometric approach (see chapter 3.7.1) and model averaging techniques, show that a growth in the number of payment cards could significantly reduce the shadow economy (likely due to the increased difficulty of hiding transactions with more electronic payments).

3.1.8 Perceived tax service quality

Many studies note that tax service quality has a direct impact on the level of taxpayers' satisfaction, and on taxpayers' compliance behaviour. Chen, Huang and Wang (2011)[145] concluded that poor service quality has a significantly negative impact on non-compliance behaviour. In general, many developed countries are seeking to improve services to taxpayers, frequently treating them as "customers" or "clients" (Kirchler, 2007)[146]. Similarly for Nigeria, Alabede (2011)[147] tested tax service quality and noted that Nigerian taxpayers had a low perception about the quality of tax services offered by the tax authority.

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[143] For the purposes of this report, "collude" is used in the sense that non-compliance will only be successful if more than one party fails to meet their obligation, whether acting in concert or independently. For example, third party reporting will reduce non-compliance if either the reporting institution provides data to enable the tax administration to act against non-compliant taxpayers or the taxpayer considers that data will be provided and therefore complies.
[144] Dybka, P., Olesiński, B., Rozkrut, M. and Torój, A. (2022), Measuring the model uncertainty of shadow economy estimates, International Tax and Public Finance, https://doi.org/10.1007/s10797-022-09737-x
[145] Chen, Y. et al. (2011),Corporate tax avoidance and firm opacity. Unpublished working paper University of Missouri
[146] Kirchler, E. (2007), The economic psychology of tax behaviour, Cambridge University Press
[147] Alabede, J.O et al (2011), Determinants of Tax Compliance: A Proposed Model for Nigeria

Tax service quality perceptions can measure both customer requirements (what type of service would be required) and detailed questions regarding what has been delivered measured against those expectations. In general terms, taxpayers are likely to require an adequate service regarding:

▶ Whether calculations and transactions are correct

▶ Quality of information available across a range of channels

▶ Ease of finding answers to queries

▶ Ease of navigating processes

Tax service quality will typically be measured through taxpayer perceptions surveys. Such surveys can be qualitative in design, adopting a series of group discussions to capture a wide set of taxpayer experiences, and exploring views of what constitutes a quality service. Ideally surveys of this nature would be carried out by independent, professional surveyors and allow for detailed follow up questions. Many tax administrations, such as the UK (HMRC) and the US (the Internal Revenue Service), have significant experience with such surveys.

3.2 Indirect factors impacting on tax compliance

Indirect factors impacting on tax compliance can broadly be split between demographic variables and the attitudes and perceptions of taxpayers, in turn influenced by the demographic factors.

3.2.1 Demographics

The relationship between demographic variables and tax compliance has long been of interest to researchers[148]. Demographic variables vary throughout cross-national studies. Age, gender[149] and education are the most frequently addressed variables, but marital status, economic status (occupation), and social status (income level) are also included by several researchers.

Figure 4 summarises the main demographic factors relating to tax compliance, the potential for significant change to those factors in a short timeframe and the likely strength of compliance response to change.

Figure 4 - Demographic factors impacting on tax compliance

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[148] Tittle C (1980). Sanctions and Social Deviance: The Question of Deterrence New York: Praeger.
[149] The various studies referred to in general conflate gender with sex rather than using the term in the sense of a social construction relating to behaviours and attributes based on labels of masculinity and femininity.
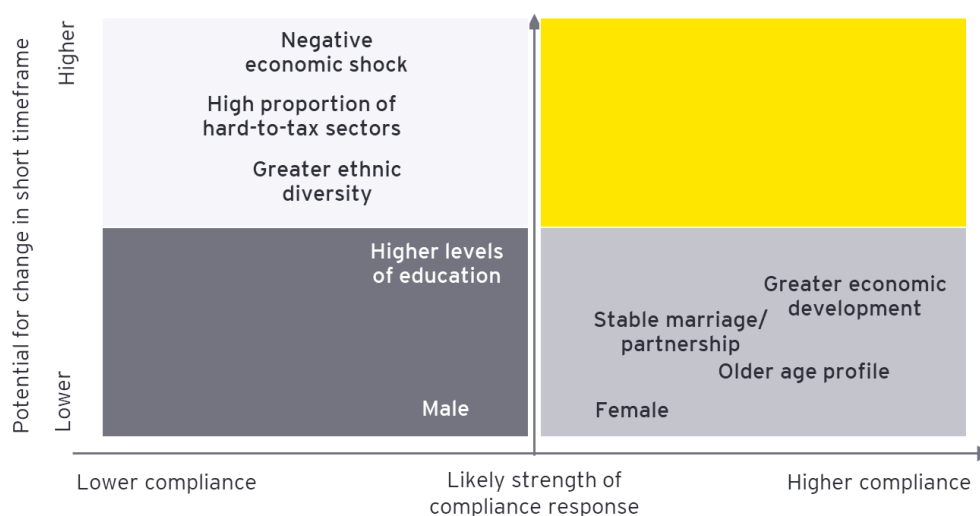
Source: EY analysis of economic literature

3.2.2 Age

The socialisation of older generations differs from younger generations: social values, attitudes toward the state and toward taxes may change from one age cohort to another. Research on different age cohorts shows that socialisation can take on dissimilar routes[150]. In one cohort, personal, social and societal norms might evolve which stimulate tax compliance. In other cohorts, norms might evolve to undermine tax honesty. Nevertheless, the majority of studies suggest that age is positively linked to increased compliance. The reasons for this have been found to include:

► Younger taxpayers are willing to take risks as they are less fearful of audits and penalties (Ritsema, 2003)[151].

► The need for public goods such as social security, health care etc. increases with age. Older citizens might place greater value on the benefits they derive from paying taxes and therefore be more compliant ((Kircher, 2007)[152].

► Some older taxpayers will be in a stronger financial situation than younger ones and therefore have fewer budget constraints to act as a barrier to tax compliance. It is easier for them to afford being tax compliant due to fewer budget constraints. Having built up a comfortable home, having raised children, and earning more income than younger generations, gives them financial freedom which young citizens may lack (Kircher, 2007)[153]. Age is correlated with greater financial resources that can be applied to tax compliance.

► Older taxpayers accumulate experience with their business, taxes and tax authorities (Nordblom & Žamac, 2012)[154].

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[150] Riley, M. & Foner, A., Warner, J. (1988). Sociology of age. In N.J. Smelser (Ed.), Handbook of sociology (S.243–290). Newbury Park: Sage

[151] Ritsema, C.M. (2003), Economic and behavioural determinants of tax compliance: evidence from the 1997 Arkansas Tax Penalty Amnesty Program, 2003 IRS Research Conference

[152] Kirchler, E. (2007), The economic psychology of tax behaviour, Cambridge University Press

[153] Kirchler, E. (2007), The economic psychology of tax behaviour, Cambridge University Press

[154] Nordblom, K, and Žamac, J., Endogenous Norm Formation Over the Life Cycle – The Case of Tax Moralw, Economic Analysis and Policy, Vol. 42, No. 2, pp. 152-170

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► Older taxpayers acquire knowledge regarding tax law which is associated with improved tax compliance (Eriksen & Fallan, 1996)[155].

The study of Cabral, Kotsogiannis and Myles (2019[156]) that used traces-of-true-income approach (see chapter 3.7.3 for the details on the approach) to calculate the level of income underreporting and corresponding personal income tax gap among self-employed in the UK found that people become more compliant with age. The authors estimated that the income is underreported by the self-employed in Great Britain by on average 37.5% among those under 35 years old, 18.2% among those between 35 and 45 years old and 13.6% among the group of 46-60 years old. However, in the study of Cabral, Gemmell and Alinaghi (2021[157]) who conducted similar analysis for New Zealand, no effect of age on the level of income underreporting by individuals was found. Thus, the effect of age on tax compliance likely differs between countries.

Chronological age is linked to other measures which have the potential to impact on tax compliance, including the distribution of economic productivity, health, functional capacities, or biological age. Each of these attributes may affect the ability of the population to comply with their tax obligations, although there is no significant literature on these points has been observed. Age can be a proxy for these factors.

3.2.3 Sex and Gender

Sex and gender are terms that are often used interchangeably but they are in fact two different concepts, even though for many people their sex and gender are the same[158]. The World Health Organization regional office for Europe describes sex as characteristics that are biologically defined, whereas gender is based on socially constructed features. Tax literature on the topic generally uses the terms interchangeably but the underlying studies appear to use sex rather than gender as the distinguishing factor.

In general, women are found to behave more morally than men do and be less likely to break the law (Betz, O'Connell, & Shepard, 1989[159]; White, 1999[160]). Based on that finding, the personal, social and societal norms of women should lead to higher levels of tax compliance than men's norms. An assumption that women engage more strongly in social cooperation is supported by results from ultimatum games in which women offer higher shares of their endowment to anonymous interaction partners than do men (Eckel & Grossman, 2001[161]). The hypothesis that women are more tax compliant than men bases also on findings that women tend to be generally less risk seeking in financial decisions (Barber & Odean, 2001[162]; Cronson & Gneezy, 2009[163]). In addition, two studies that used traces-of-true-income approach (see chapter 3.7.3),

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[155] Eriksen, K. and Fallan, L. (1996), Tax knowledge and attitudes towards taxation: A report on a quasi-experiment, Journal of Economic Psychology, Volume 17, Issue 3, pp. 387-402
[156] Cabral, A. C. G., Kotsogiannis, C., & Myles, G. (2019). Self-Employment Income Gap in Great Britain: How Much and Who?. *CESifo Economic Studies*, *65*(1), 84-107.
[157] Cabral, A. C. G., Gemmell, N., & Alinaghi, N. (2021). Are survey-based self-employment income underreporting estimates biased? New evidence from matched register and survey data. International Tax and Public Finance, 28(2), 284-322.
[158] UK Office of National Statistics (2019), What is the difference between sex and gender?
[159] Betz, M., O'Connell, L. and Shepard, J.M. (1989), Gender differences in proclivity for unethical behaviour, Journal of Business Ethics, Volume 8, pp. 321-324
[160] White Jr, R.D. (1999), Are women more ethical? Recent findings on the effects of gender upon moral development, Journal of public administration research and theory, Vol. 9, Issue 3, pp. 459-472
[161] Eckel, C.C and Grossman, P.J. (2001), Chivalry and solidarity in ultimatum games, Economic inquiry, Vol.39, Issue 2, pp. 171-188
[162] Barber, B.M and Odean, T. (2001), Boys will be boys: Gender, overconfidence and common stock investment, The quarterly journal of economics
[163] Cronson, R. and Gneezy, U (2009), Gender differences in preferences, Journal of Economic Literature, Vol. 47, No. 2, pp. 448-74

one based on the data from the UK (Cabral, Kotsogiannis and Myles, 2019[164]) and another from New Zealand (Cabral, Gemmell and Alinaghi, 2021[165]) concluded that self-employed men underreport significantly more of their personal income than self-employed women.

Torgler and Valev (2010)[166] investigated whether attitudes toward corruption and tax compliance behaviour vary with sex. As in previous cross-national literature, women have been found less likely to approve of tax evasion (Torgler, 2003[167]; 2005[168]; 2006[169]; Alm & Torgler, 2006[170]; Frey and Torgler, 2006[171]; Torgler and Schneider, 2007[172]; Torgler 2012[173]). In contrast, several studies find no significant effect of sex on tax compliance behaviour (Slemrod, 2002[174]; Torgler, 2004[175]; I. Lago-Penas and S. Lago-Penas, 2010[176]; Kountouris and Remoundou, 2013[177]; G.Richardson, 2006[178]; Cummings, et al., 2009[179]). Only one study shows mixed results (Ross and McGee, 2012[180]).

Based on time series data, the studies in general suggest that the difference remains in place over time.

3.2.4 Education

Education has an impact on tax compliance, but the direction of that impact varies across the literature surveyed, potentially due to the fact that the level of education impacts a number of more direct factors:

► Higher education is related to a better knowledge of tax law[181]. Therefore, more highly educated people understand the law and filing rules, while those with lesser

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[164] Cabral, A. C. G., Kotsogiannis, C., & Myles, G. (2019). Self-Employment Income Gap in Great Britain: How Much and Who?. *CESifo Economic Studies*, *65*(1), 84-107.

[165] Cabral, A. C. G., Gemmell, N., & Alinaghi, N. (2021). Are survey-based self-employment income underreporting estimates biased? New evidence from matched register and survey data. International Tax and Public Finance, 28(2), 284-322.

[166] Torgler, B. and Valev, N.T. (2010), Gender and public attitudes towards corruption and tax evasion, Contemporary Economic Policy, Vol. 28, Issue 4, pp. 554-568

[167] Torgler, B. (2003), Tax Morale, Rule-Governed Behaviour and Trust, Constitutional Political Economy, Vol. 14, pp. 119-140

[168] Torgler, B. (2005), Tax morale and direct democracy, European Journal of Political Economy, Vol. 21, issue 2, pp. 525-531

[169] Torgler, B. (2006), The importance of faith: Tax morale and religiosity, Journal of economic behaviour and organisation, Vol. 61, Issue 1, pp. 81-109

[170] Alm, J. and Torgler, B. (2006), Culture differences and tax morale in the United States and in Europe, Journal of Economic Psychology, Vol. 27, Issue 2, pp. 224-246

[171] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159

[172] Torgler, B. and Schneider, F. (2007), What Shapes Attitudes Toward Paying Taxes? Evidence from multicultural European Countries, Social Science Quarterly, Vol. 88, Issue 2, pp. 443-470

[173] Torgler, B. (2012), Attitudes towards paying taxes in the USA: An empirical analysis, The Ethics of Tax Evasion. In: McGee, R. The Ethics of Tax Evasion

[174] Slemrod, J. and Yitzhaki, S. (2002), Tax avoidance, evasion and administration, Handbook of Public Economics, Vol. 3, pp. 1423-1470

[175] Torgler, B. (2004), Tax morale in Asian countries, Journal of Asian Economics, Vol. 15, Issue 2, pp. 237-266

[176] Lago-Penas, I. and Lago-Penas, S. (2010), The determinants of tax morale in comparative perspective: Evidence from European Countries, European Journey of Political Economy, Vol. 26, Issue 4, pp. 441-453

[177] Kountouris, Y. and Remoundo, K. (2013), Is there a cultural component in tax morale? Evidence from immigrants in Europe, Journal of Economic Behaviour and Organsiation, Volume 96, pp. 104-119

[178] Richardson, G. (2006), Determinants of tax evasion: A cross-country investigation, Journal of international Accounting, Auditing and Taxation, Vol. 15, Issue 2, pp. 150-169

[179] Cummings, R.G, et al. (2009), Tax morale affects tax compliance: Evidence from surveys and an artificial field experiment, Journal of Economic Behaviour & Organisation, Volume 70, Issue 3, pp. 447-457

[180] Ross, A.M and McGee, R.W. (2012), Attitudes towards tax evasion: A demographic study of the Netherlands, Journal of International Business Research, Vol. 11, Issue 2, pp. 1-44

[181] Conversely, higher education is also associated with better access to information on schemes to avoid taxes. Therefore, higher education may be related to lower evasion but higher avoidance tendencies.

levels of education are associated with lower understanding and a greater propensity for error when filing tax returns.

► Low financial literacy in general and little knowledge on taxes limit understanding of one's duties and opportunities may breed distrust and consequently non-compliance. A low level of education may be related to low tax compliance (Bobek et al., 2007)[182]. However, it was also found that high tax complexity, and hence limited understanding of one's tax duties and high insecurity, fuel compliance (Kirchler, 2007)[183].

One interpretation of these results is that, in general, tax compliance takes a "U-shape", with compliance most concentrated at either end of the education spectrum. For example, Ross and McGee (2012)[184] find those with no formal education or the highest educated as most compliant. Across the six countries, those with little or no formal education were most opposed to tax evasion in Brazil, Russia and China, while the strongest opposition in India and the USA came from the most educated group. In Germany the two groups tying for strongest opposition were opposite ends of the education spectrum. The relationship between education and attitude toward tax evasion is therefore not uniform across countries and cultures. Several other cross-national studies find a significant and positive relationship between education and tax compliance behaviour indicating higher education does lead to more tax compliance (Torgler, 2006[185]; Kountouris and Remoundou, 2013[186]; G.Richardson, 2006[187], Torgler, 2012[188]). Conversely, many others find a negative and significant relationship (Torgler, 2003[189]; 2005[190]; 2006[191]; Alm & Torgler, 2006[192]; I. Lago-Penas and S. Lago-Penas, 2010[193]). Still more find little or no significant effect on tax compliance behaviour (Slemrod, 2002[194]; Torgler, 2005; Frey and Torgler, 2007[195]; Torgler and Schneider, 2007[196]; Cummings, et al., 2009[197]; Torgler and Valev, 2010[198]).

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[182] Bobek, D.D. et al. (2007), Social norms of tax compliance: Evidence from Australia, Singapore and the United States, Journal of Business Ethics, Vol. 74, pp.49-64

[183] Kirchler, E. (2007), The economic psychology of tax behaviour, Cambridge University Press

[184] Ross A and AR McGee (2012) Education Level and Ethical Attitude toward Tax Evasion: A Six-Country Study

[185] Torgler, B. (2006), The importance of faith: Tax morale and religiosity, Journal of economic behaviour and organisation, Vol. 61, Issue 1, pp. 81-109

[186] Kountouris, Y. and Remoundo, K. (2013), Is there a cultural component in tax morale? Evidence from immigrants in Europe, Journal of Economic Behaviour and Organisation, Volume 96, pp. 104-119

[187] Richardson, G. (2006), Determinants of tax evasion: A cross-country investigation, Journal of international Accounting, Auditing and Taxation, Vol. 15, Issue 2, pp. 150-169

[188] Torgler, B. (2012), Attitudes towards paying taxes in the USA: An empirical analysis, The Ethics of Tax Evasion. In: McGee, R. The Ethics of Tax Evasion

[189] Torgler, B. (2003), Tax Morale, Rule-Governed Behaviour and Trust, Constitutional Political Economy, Vol. 14, pp. 119-140

[190] Torgler, B. (2005), Tax morale and direct democracy, European Journal of Political Economy, Vol. 21, issue 2, pp. 525-531

[191] Torgler, B. (2006), The importance of faith: Tax morale and religiosity, Journal of economic behaviour and organisation, Vol. 61, Issue 1, pp. 81-109

[192] Alm, J. and Torgler, B. (2006), Culture differences and tax morale in the United States and in Europe, Journal of Economic Psychology, Vol. 27, Issue 2, pp. 224-246

[193] Lago-Penas, I. and Lago-Penas, S. (2010), The determinants of tax morale in comparative perspective: Evidence from European Countries, European Journey of Political Economy, Vol. 26, Issue 4, pp. 441-453

[194] Slemrod, J. and Yitzhaki, S. (2002), Tax avoidance, evasion and administration, Handbook of Public Economics, Vol. 3, pp. 1423-1470

[195] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159

[196] Torgler, B. and Schneider, F. (2007), What Shapes Attitudes Toward Paying Taxes? Evidence from multicultural European Countries, Social Science Quarterly, Vol. 88, Issue 2, pp. 443-470

[197] Cummings, R.G, et al. (2009), Tax morale affects tax compliance: Evidence from surveys and an artificial field experiment, Journal of Economic Behaviour & Organisation, Volume 70, Issue 3, pp. 447-457

[198] Torgler, B. and Valev, N.T. (2010), Gender and public attitudes towards corruption and tax evasion, Contemporary Economic Policy, Vol. 28, Issue 4, pp. 554-568

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Metrics used to monitor the educational structure of populations are well developed[199]. Setting aside measures that express the educational status of children currently in education, it can be argued that the most relevant series of measures are those which focus on educational attainment as a measure of the level of education across the population older than the population that is still in the educational system. Attainment is often further broken down by sex, age group, nationality, race, socioeconomic status, and also socioeconomic background of parents.

Possible metrics include:

► Mean years of schooling.

► Population by highest level of education – such as primary education, lower secondary education, bachelor or equivalent programmes.

► Measures regarding learning attainment – reading and language proficiency, mathematics and numeracy, scientific knowledge and understanding.

3.2.5 Ethnic diversity

While available studies are limited, there is some evidence that racial and national identities play a role in tax compliance, and that their effects depend on the population heterogeneity. Overall, ethnically fractionalized countries have poorer tax morale than homogeneous ones. This is consistent with findings that suggest detrimental impact of ethnic fractionalisation on public sector performance.[200]

Li suggests this is because people are more willing to pay taxes to finance a public sector that benefits their own group and are reluctant to bear the economic cost for other groups. Fractionalisation therefore erodes tax morale through reducing altruism and the sense of mutual obligation. Similarly, Alm, Clark and Leibel (2016)[201] find that non-filing rates rise in US counties with the highest levels of racial fragmentation. Counties with the highest racial fragmentation have a likelihood of non-filing ranging from 49% to 53% higher than the likelihood of non-filing in counties with the lowest racial fragmentation.

Ethnic diversity could be measured by region/county from national census data. This data could in turn be cross-referenced to tax returns by region/county to assess the extent to which diversity and compliance are correlated.

In terms of forecasting the future impact on compliance, demographic projections regarding the change in make-up of both regional and national population could be measured. For example, should Bulgaria anticipate an uptick in inbound migration, that could increase ethnic diversity as well as affecting other factors (e.g., education level, knowledge of obligations, sense of community).

Collecting data on ethnic group, religion and national identity can be complex because of the subjective and multifaceted nature of the concepts. Membership to each of the concepts is something that is self-defined and subjectively meaningful to an individual. The concepts tend to evolve in the context of social and political attitudes or developments[202]. The UK's Office for National Statistics further recommends that a

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[199] The World Bank EdStats All Indicator Query holds over 4,000 internationally comparable indicators that describe education access, progression, completion, literacy, teachers, population, and expenditures.
[200] Li, Sherry Xin, Social Identities, Ethnic Diversity, and Tax Morale (June 18, 2009). Available at SSRN: https://ssrn.com/abstract=1422121 or http://dx.doi.org/10.2139/ssrn.1422121
[201] Enforcement, Socioeconomic Diversity, and Tax Filing Compliance in the United States Author(s): James Alm, Jeremy Clark and Kara Leibel, Source: Southern Economic Journal, January 2016, Vol. 82, No. 3 (January 2016), pp.725-747
[202] UK Office for National Statistics (2021), Ethnic group, national identity and religion

response to a question regarding ethnicity should be answered by the respondent directly, particularly if the respondent is an adult. Specific ethnic group and national identity questions could be developed through consultation and workshops with key stakeholders.

3.2.6 Shock to financial condition

A major economic shock is likely to hamper administrations' ability to collect taxes and may affect taxpayer compliance. Analysis of the impact of the financial crisis[203] found that taxpayer compliance tends to decline during an economic downturn but recovers quickly thereafter. This indicates a cash-based compliance effect rather than a more persistent change in taxpayer behaviour.

3.2.7 Marriage and partnership

Eleven cross-national studies found examined the effect of marital status on tax compliance behaviour. Nine studies (Torgler, 2002/2003[204]; 2003[205]; 2005[206]; 2006[207]; Alm and Torgler, 2006[208]; Frey and Torgler, 2007[209]; Torgler and Valev, 2010[210]; Torgler, 2012[211]; Kountouris and Remoundou, 2013[212]) confirm married taxpayers are more compliant than others, especially singles. Only two (Torgler, 2004[213]; Torgler and Schneider, 2007[214]) of the eleven studies were found not significant. while This affirms married taxpayers are more compliant than singles in cross-national, country-level tax compliance studies. While this finding may be in part due to the differing treatment of marriage for tax purposes, it could potentially also spill over into other forms of partnership. Depending on the nature of a country tax system, non-compliance by married couples could also require an element of collusion, making compliance more likely.

3.2.8 Level of economic development

The level of economic development can have a major impact on tax evasion across countries (Bird, 1992[215]; Quirk, 1997[216]; de Soto, 2000[217]; Alm and Martinez- Vasquez, 2003[218]). Countries in early stages of economic development are especially prone to

[203] IMF, 2015, Current Challenges in Revenue Mobilization - Improving Tax Compliance, Policy Paper.
[204] Torgler, B. (2002), Speaking to theorists and searching for facts: Tax morale and tax compliance in experiments, Journal of Economic Surveys, Volume 16, Issue 5, pp. 657-683
[205] Torgler, B. (2003), Tax Morale, Rule-Governed Behaviour and Trust, Constitutional Political Economy, Vol. 14, pp. 119-140
[206] Torgler, B. (2005), Tax morale and direct democracy, European Journal of Political Economy, Vol. 21, issue 2, pp. 525-531
[207] Torgler, B. (2006), The importance of faith: Tax morale and religiosity, Journal of economic behaviour and organisation, Vol. 61, Issue 1, pp. 81-109
[208] Alm, J. and Torgler, B. (2006), Culture differences and tax morale in the United States and in Europe, Journal of Economic Psychology, Vol. 27, Issue 2, pp. 224-246
[209] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159
[210] Torgler, B. and Valev, N.T. (2010), Gender and public attitudes towards corruption and tax evasion, Contemporary Economic Policy, Vol. 28, Issue 4, pp. 554-568
[211] Torgler, B. (2012), Attitudes towards paying taxes in the USA: An empirical analysis, The Ethics of Tax Evasion. In: McGee, R. The Ethics of Tax Evasion
[212] Kountouris, Y. and Remoundo, K. (2013), Is there a cultural component in tax morale? Evidence from immigrants in Europe, Journal of Economic Behaviour and Organsiation, Volume 96, pp. 104-119
[213] Torgler, B. (2004), Tax morale in Asian countries, Journal of Asian Economics, Vol. 15, Issue 2, pp. 237-266
[214] Torgler, B. and Schneider, F. (2007), What Shapes Attitudes Toward Paying Taxes? Evidence from multicultural European Countries, Social Science Quarterly, Vol. 88, Issue 2, pp. 443-470
[215] Bird, R.M. (1992), Improving tax administration in developing countries, International Monetary Fund
[216] Quirk, P.J. (1997), Money Laundering: Muddying the Macroeconomy, IMF Finance Development, Vol. 34, Issue 1
[217] De Soto, H., Integrating the poor into official legal system can unleash their economic potential, IMF Survey: Volume 29, Issue 21
[218] Alm, J. and Martinez-Vazquez (2003), Institutions, paradigms and tax evasion in developing and transition countries, Edwards Elgar Publishing Limited

tax evasion (Quirk, 99 1997[219]). Lower levels of economic development are predicted to be negatively related to tax compliance. Edlund and Aberg[220] (2002), Tsakumis et al. (2007)[221], and G. Richardson (2008)[222] support this prediction. While not fully explored in the literature, this finding would appear to link to factors such as a lower level of trust in government services, perceptions of tax administration services, perceived levels of corruption and occupational mix.

3.2.9 Sector/occupation

Taxpayers in less regulated industries, such as agriculture and self-employment, are less strictly monitored, resulting in a greater opportunity for non-compliance. Opportunities can arise from factors that are related to the sector, such as:

▶ The use of cash as a non-traceable medium

▶ The lack of third-party reporting

▶ Erratic payment patterns

Traces-of-true-income approach (see chapter 3.7.3) to measuring the level of income underreporting among individuals was often used to estimate the level of non-compliance among self-employed when compared to benchmark group of other employees for whom full compliance was assumed (see e.g. Pissarides and Weber, 1989[223]; Cabral, Kotsogiannis and Myles, 2019[224]; Cabral, Gemmell and Alinaghi, 2021[225]). From these studies, a robust conclusion emerges that self-employed are more likely to underestimate their income than employees. Some authors decided to test the traces-of-true-income specification under the assumption that private-sector employees do underreport their income and full compliance can only be assumed for public-sector employees (the assumption about full compliance of some individuals is required for performing this kind of analysis). For example, the study by Paulus (2015[226]) based on the data for Estonia yielded strong evidence for underreporting behavior among employees working in the private sector. However, the level of underreporting among private-sector employees (23%) turned out to be about two times lower than among self-employed (56%). Ekici and Besim (2014[227]) followed similar approach in the case of North Cyprus and estimated the level of under-reporting in the range of 10.7-13.7% for privately employed compared to 19.8-20.5% for self-employed.

Particular sectors also exhibit clusters of other factors. Peer influence and social norms within the sector will also adversely impact on compliance.

[219] Quirk, P.J. (1997), Money Laundering: Muddying the Macroeconomy, IMF Finance Development, Vol. 34, Issue 1

[220] Edlund, J. and Aberg, R (2002), Social norms and tax compliance, Swedish economic policy review, Vol. 9, pp. 201-228

[221] Tsakumis, G.T. et al. (2007), The relation between national cultural dimensions and tax evasion, Journal of International Accounting, Auditing and Taxation, Vol. 16, Issue 2, pp. 131-147

[222] Richardson, G. (2008), The relationship between culture and tax evasion across countries: Additional evidence and extensions, Journal of International Accounting, Auditing and Taxation, Vol. 17, Issue 2, pp. 67-78

[223] Pissarides, C. A., & Weber, G. (1989). An expenditure-based estimate of Britain's black economy. Journal of public economics, 39(1), 17-32.

[224] Cabral, A. C. G., Kotsogiannis, C., & Myles, G. (2019). Self-Employment Income Gap in Great Britain: How Much and Who?. *CESifo Economic Studies*, 65(1), 84-107.

[225] Cabral, A. C. G., Gemmell, N., & Alinaghi, N. (2021). Are survey-based self-employment income underreporting estimates biased? New evidence from matched register and survey data. International Tax and Public Finance, 28(2), 284-322.

[226] Paulus, A. (2015). Income underreporting based on income expenditure gaps: Survey vs tax records (No. 2015-15). ISER Working Paper Series.

[227] Ekici, T., & Besim, M. (2016). A measure of the shadow economy in a small economy: Evidence from household-level expenditure patterns. Review of Income and Wealth, 62(1), 145-160.

3.2.10 Business form

Some structures may be less open to tax evasion than others due to the separation of ownership and management, and the need for formal reporting and review. For example, the use of a limited liability corporate, with the additional reporting and the potential for review of the entities' affairs rather than that of the owners, can mean that third parties are involved in the business, reducing the ability for non-compliance without collusion.

The use of different business forms[228] can be tracked by taxpayer class and compliance compared to populations from other sources.

3.3 Attitudes and perceptions

Figure 5 summarises the main attitudes and perceptions relating to tax compliance, the potential for significant change to those factors in a short timeframe and the likely strength of compliance response to change.

Figure 5 - Attitudes and perceptions impacting on tax compliance
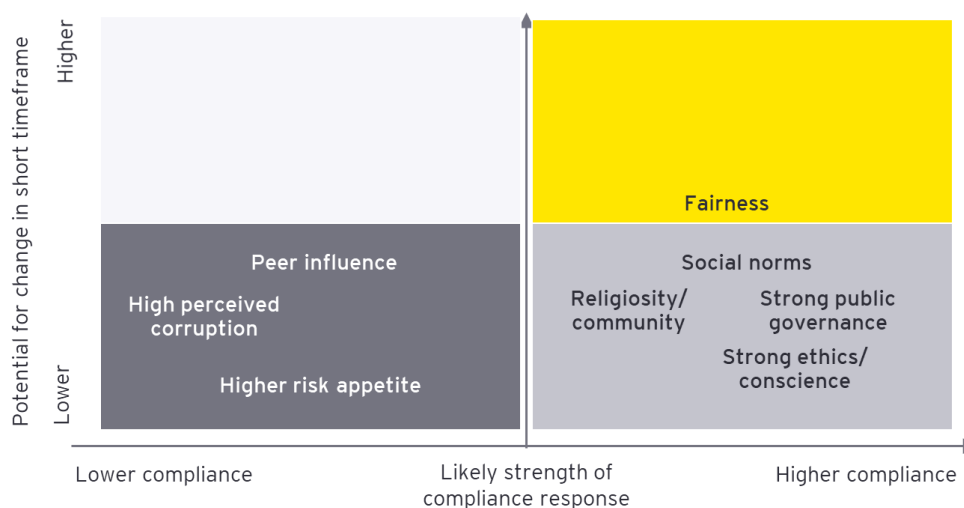
Source: EY analysis of economic literature

3.3.1 Fairness of tax system

When a government is perceived as fair and trustworthy, that is associated with lower tax evasion or higher tax compliance. Fairness and trust are the most examined variables in cross-national studies, which in general find fairness and trust to be positively and significantly correlated with tax compliance behaviour (Fauvelle-Aymar, 1999[229]; Slemrod, 2002[230]; Torgler, 2003[231]; 2004[232]; Riahi-Belkaoui, 2004[233]; Torgler,

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[228] While commentaries on the Fischer Model generally include business form within factors relating to non-compliance opportunities, this report classes "business form" as an indirect factor and commentary included in the demographics subsecton.
[229] Fauvelle-Aymar, C. (1999), The Political and Tax Capacity of Government in Developing Countries, Kyklos, Vol. 52, Issue 3, pp. 391-413
[230] Slemrod, J. and Yitzhaki, S. (2002), Tax avoidance, evasion and administration, Handbook of Public Economics, Vol. 3, pp. 1423-1470
[231] Torgler, B. (2003), Tax Morale, Rule-Governed Behaviour and Trust, Constitutional Political Economy, Vol. 14, pp. 119-140
[232] Torgler, B. (2004), Tax morale in Asian countries, Journal of Asian Economics, Vol. 15, Issue 2, pp. 237-266
[233] Riahi-Belkaoui, A. (2004), Relationship between tax compliance internationally and selected determinants of tax morale, Journal of International Accounting, Auditing and Taxation, Vol. 13, Issue 2, 2004, pp. 135-143

2005[234]; Wu and Teng, 2005[235]; Alm and Torgler, 2006[236]; G. Richardson, 2006[237]; Torgler, 2006[238]; Frey and Torgler, 2007[239]; Torgler and Schneider, 2007[240]; Kim, 2008[241]; G. Richardson 2008[242]; I. Lago-Penas and S. Lago-Penas, 2010[243]; Torgler and Valev, 2010[244]; Alm and McClellan, 2012[245]; Torgler, 2012[246]; Alon and Hageman, 2013[247]).

3.3.2 Peer influence

A range of country-specific studies conclude that respondents who believe their peers evade taxes are more likely not to comply themselves (Grasmick and Scott, 1982[248]; Spicer and Becker, 1980[249]). Peers are defined as the taxpayers' friends, family members, and colleagues (Jackson and Milliron, 1986)[250]. Later cross-national studies confirmed these results (Frey and Torgler, 2007[251]; Torgler, 2012[252]; Alon and Hageman, 2013[253]), with one study observed (Torgler and Valev 2010)[254] finding no significant results.

3.3.3 Social norms/ethics/conscience

Research has now extended beyond peer influence to address social norms, defined by Bobek (2007[255]) as the taxpayers' own personal moral beliefs (personal norms) along with the beliefs of those close to them (subjective norms). Both personal norms and subjective norms are found to be significant and to have a positive impact on tax

[234] Torgler, B. (2005), Tax morale and direct democracy, European Journal of Political Economy, Vol. 21, issue 2, pp. 525-531

[235] Wu, S.Y. and Teng, M.J. (2005), Determinants of tax compliance – a cross-country analysis, Public Finance Analysis, Vol. 61, No.3, pp. 393-417

[236] Alm, J. and Torgler, B. (2006), Culture differences and tax morale in the United States and in Europe, Journal of Economic Psychology, Vol. 27, Issue 2, pp. 224-246

[237] Richardson, G. (2006), Determinants of tax evasion: A cross-country investigation, Journal of international Accounting, Auditing and Taxation, Vol. 15, Issue 2, pp. 150-169

[238] Torgler, B. (2006), The importance of faith: Tax morale and religiosity, Journal of economic behaviour and organisation, Vol. 61, Issue 1, pp. 81-109

[239] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159

[240] Torgler, B. and Schneider, F. (2007), What Shapes Attitudes Toward Paying Taxes? Evidence from multicultural European Countries, Social Science Quarterly, Vol. 88, Issue 2, pp. 443-470

[241] Kim, S (2008), Does political intention affect tax evasion? Journal of Policy Modeling, Vol. 30, Issue 3, pp. 401-415

[242] Richardson, G. (2008), The relationship between culture and tax evasion across countries: Additional evidence and extensions, Journal of International Accounting, Auditing and Taxation, Vol. 17, Issue 2, pp. 67-78

[243] Lago-Penas, I. and Lago-Penas, S. (2010), The determinants of tax morale in comparative perspective: Evidence from European Countries, European Journey of Political Economy, Vol. 26, Issue 4, pp. 441-453

[244] Torgler, B. and Valev, N.T. (2010), Gender and public attitudes towards corruption and tax evasion, Contemporary Economic Policy, Vol. 28, Issue 4, pp. 554-568

[245] Alm, J. and McClellan, C. (2012), Tax Morale and Tax Compliance from the Firm's Perspective, Kyklos International Review for Social Sciences, Vol. 65, Issue 1, pp. 1-7

[246] Torgler, B. (2012), Attitudes towards paying taxes in the USA: An empirical analysis, The Ethics of Tax Evasion. In: McGee, R. The Ethics of Tax Evasion

[247] Alon, A. and Hageman, A.L. (2013), The impact of corruption on firm tax compliance in transition economies: Whom do you trust?, Journal of Business Ethics, Vol. 16, pp. 479–494

[248] Grasmick, H,G. and Scott, W.J (1982)Tax evasion and mechanisms of social control: A comparison with grand and petty theft, Journal of Economic Psychology, Vol 2, pp. 213-230

[249] Spicer, M.W. and Becker, L.A. (1980), National Tax Journal, Vol. 33

[250] Jackson, B., Milliron, V. (1986), Tax preparers: Government agents or client advocates? Journal of Accountancy: New York, Vol. 167, Issue 5

[251] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159

[252] Torgler, B. (2012), Attitudes towards paying taxes in the USA: An empirical analysis, The Ethics of Tax Evasion. In: McGee, R. The Ethics of Tax Evasion

[253] Alon, A. and Hageman, A.L. (2013), The impact of corruption on firm tax compliance in transition economies: Whom do you trust?, Journal of Business Ethics, Vol. 16, pp. 479–494

[254] Torgler, B. and Valev, N.T. (2010), Gender and public attitudes towards corruption and tax evasion, Contemporary Economic Policy, Vol. 28, Issue 4, pp. 554-568

[255] Bobek, D.D. et al. (2007), Social norms of tax compliance: Evidence from Australia, Singapore and the United States, Journal of Business Ethics, Vol. 74, pp.49-64

compliance decision process. In fact, ethical values influenced by social norms may prohibit taxpayers from engaging in tax evasion (Blanthorne and Kaplan, 2008)[256]. There is much evidence that individuals are influenced by the ethical dimensions of their decisions; that is, "individuals are not always the outcome-oriented, egoistic, and selfish consumers envisioned by our standard theory but are affected in predictable ways by the processes by which outcomes are determined and also by notions of fairness, altruism, reciprocity, trust, social norms, and, more broadly, ethics."[257] While it is difficult to distinguish ethics as a factor in itself, some data may be drawn from taxpayer perceptions surveys. For example, Dybka et al. (2022)[258], using the currency demand econometric approach (see chapter 3.7.1) and model averaging techniques, identified a survey-based indicator of ethical behaviour of firms as an important driver of the shadow economy.

3.3.4   Public governance (service) quality

Governance consists of the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them[259].

Cross-national studies show, tax compliance behaviour has been found to be related to good governance and defined by a fair tax system (Frey and Torgler 2007[260]; Torgler and Schneider, 2007[261]; I. Lago-Penas and S. Lago-Penas, 2010[262]). This encompasses a non-corrupt government providing valued goods and services from collected tax payments (Cummings et al., 2009)[263]. Dybka et al. (2022)[264], among various analysed governance and institutional indicators, found the World Bank's rule of law index as particularly important for the shadow economy estimates based on the currency demand approach.

3.3.5   Corruption

The perception of corruption within government is negatively related to tax compliance behaviour. Studies showing this include (Wu and Teng, 2005[265]; Torgler, 2006[266]; Frey

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[256] Blanthorne, C and Kaplan, S. (2008), An egocentric model of the relations among the opportunity to underreport, social norms, ethical beliefs, and underreporting behavior, Accounting, Organizations and Society Vol. 33, Issues 7–8, pp. 684-703
[257] Alm J and B Torgier (2011), Do Ethics Matter? Tax Compliance and Morality
[258] Dybka, P. et al.(2022), op. cit.
[259] http://info.worldbank.org/governance/wgi/
[260] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159
[261] Torgler, B. and Schneider, F. (2007), What Shapes Attitudes Toward Paying Taxes? Evidence from multicultural European Countries, Social Science Quarterly, Vol. 88, Issue 2, pp. 443-470
[262] Lago-Penas, I. and Lago-Penas, S. (2010), The determinants of tax morale in comparative perspective: Evidence from European Countries, European Journey of Political Economy, Vol. 26, Issue 4, pp. 441-453
[263] Cummings, R.G, et al. (2009), Tax morale affects tax compliance: Evidence from surveys and an artificial field experiment, Journal of Economic Behaviour & Organisation, Volume 70, Issue 3, pp. 447-457
[264] Dybka, P., Olesiński, B., Rozkrut, M. and Torój, A. (2022), Measuring the model uncertainty of shadow economy estimates, International Tax and Public Finance, https://doi.org/10.1007/s10797-022-09737-x
[265] Wu, S.Y. and Teng, M.J. (2005), Determinants of tax compliance – a cross-country analysis, Public Finance Analysis, Vol. 61, No.3, pp. 393-417
[266] Torgler, B. (2006), The importance of faith: Tax morale and religiosity, Journal of economic behaviour and organisation, Vol. 61, Issue 1, pp. 81-109

and Torgler, 2007[267]; Alm and McClellan, 2012[268]; Alon and Hageman, 2013[269]). This suggests the need to include perception of corruption measures as a factor in analysing tax compliance behaviour at the country level.

3.3.6 Risk appetite

The extent to which a taxpayer is risk averse links to their approach to tax compliance, with a higher risk appetite correlated with non-compliance. There is support in the literature for the view that a greater risk appetite tends to be associated with higher income levels and occupations with a lower level of compliance. A lower risk appetite is more likely in older age cohorts. Segmenting taxpayers is significant when assessing risk appetite.

3.3.7 Religiosity/Sense of community

Religion generally requires adherence to a code of conduct. Religiosity is found to be a positive and significant factor supporting tax compliance in a range of cross-national studies reviewed (Torgler, 2005[270]; 2006[271]; Alm and Torgler 2006[272]; Frey and Torgler, 2007[273]; Torgler and Schneider, 2007[274]; G. Richardson, 2008[275]; I. Lago-Penas and S. Lago-Penas, 2010[276]; Torgler, 2012[277]; Kountouris and Remoundou, 2013[278]). This empirical evidence confirms greater church attendance results in higher tax compliance in cross-national country level studies. A natural extension to this approach would be to seek to measure a sense of community in some form, in addition to tracking the prevalence of organised religion within the community.

Measuring religiosity can be done through survey, with studies tracking measures such as religious affiliation, frequency of religious service attendance, frequency of prayer, perceived importance of religiosity, and belief. Community engagement is more difficult to measure, as it depends on a range of factors including geography, socioeconomic development and subjective self-reporting.

3.3.8 Trust in government

Trust in government and therefore the willingness to comply with tax laws is affected by the way citizens are treated when interacting with government institutions in the

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[267] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159

[268] Alm, J. and McClellan, C. (2012), Tax Morale and Tax Compliance from the Firm's Perspective, Kyklos International Review for Social Sciences, Vol. 65, Issue 1, pp. 1-7

[269] Alon, A. and Hageman, A.L. (2013), The impact of corruption on firm tax compliance in transition economies: Whom do you trust?, Journal of Business Ethics, Vol. 16, pp. 479–494

[270] Torgler, B. (2005), Tax morale and direct democracy, European Journal of Political Economy, Vol. 21, issue 2, pp. 525-531

[271] Torgler, B. (2006), The importance of faith: Tax morale and religiosity, Journal of economic behaviour and organisation, Vol. 61, Issue 1, pp. 81-109

[272] Alm, J. and Torgler, B. (2006), Culture differences and tax morale in the United States and in Europe, Journal of Economic Psychology, Vol. 27, Issue 2, pp. 224-246

[273] Frey, B. and Torgler, B. (2007), Tax morale and conditional co-operation, Journal of Comparative Economics, Vol. 35, pp. 136-159

[274] Torgler, B. and Schneider, F. (2007), What Shapes Attitudes Toward Paying Taxes? Evidence from multicultural European Countries, Social Science Quarterly, Vol. 88, Issue 2, pp. 443-470

[275] Richardson, G. (2008), The relationship between culture and tax evasion across countries: Additional evidence and extensions, Journal of International Accounting, Auditing and Taxation, Vol. 17, Issue 2, pp. 67-78

[276] Lago-Penas, I. and Lago-Penas, S. (2010), The determinants of tax morale in comparative perspective: Evidence from European Countries, European Journey of Political Economy, Vol. 26, Issue 4, pp. 441-453

[277] Torgler, B. (2012), Attitudes towards paying taxes in the USA: An empirical analysis, The Ethics of Tax Evasion. In: McGee, R. The Ethics of Tax Evasion

[278] Kountouris, Y. and Remoundo, K. (2013), Is there a cultural component in tax morale? Evidence from immigrants in Europe, Journal of Economic Behaviour and Organsiation, Volume 96, pp. 104-119

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regular delivery of public goods and services (Koumpais et al., 2020)[279]. This is a natural extension to a standard recommendation in the tax compliance literature that building a relationship of trust and cooperation between taxpayers and tax authorities is necessary to elicit voluntary tax compliance (e.g., Braithwaite, 2003[280]; Alm and Martinez-Vazquez, 2007)[281]. Koumpais et al.'s results further suggest the need to expand that finding to all the output organisations of government, rather than solely tax authorities.

Trust in government could be measured through responses to a perceptions survey, comparable to the Edelman Trust Barometer[282].

3.3.9 Other cultural factors

Culture is now generally considered by researchers to have a powerful effect on taxpayer compliance. The cultural framework most widely used in the literature is that of Hofstede (1980)[283], who identified four societal values; individualism, power distance, uncertainty avoidance and masculinity. Chan et al. (2000)[284] suggests that the cultural dimension most affecting tax compliance is the balance between collectivism (such as in China) and individualism (as in the United States). This cultural framework could be applied to the situation in Bulgaria.

3.4 Summary of factors likely to affect changes in taxpayer behaviour

Actively considering the risk factors associated with non-compliance could allow the NRA to:

► Achieve more equitable treatment between taxpayer segments

► Focus the burden of audit towards non-compliant taxpayers

► Make the best use of the available human, financial and technical resources

► Increase the level of voluntary compliance of taxpayers

► Adjust available resources to the levels of risks

► Weigh the possibilities that a compliant taxpayer could become non-compliant.

3.4.1 Direct and indirect factors distinguished

In this regard, it is misleading to represent a complex system by a single representative agent, who behaves in some average or typical way. Instead, compliance is driven by a range of behaviours and understanding of any system requires understanding of how different taxpayer segments are likely to behave. Figure consolidates the direct

[279] Koumpias A, Leonardo G and J Martinez-Vazquez (2020), Trust in Government Institutions and Tax Morale, International Center for Public Policy, Working Paper 20-01
[280] Braithwaite, V. (2003), Dancing with tax authorities: Motivational postures and non-compliant actions, Included in: Taxing Democracy, Ashgate Publishing Limited
[281] Alm, J. and Martinez-Vazquez (2003), Institutions, paradigms and tax evasion in developing and transition countries, Edwards Elgar Publishing Limited
[282] The Edelman Trust Barometer is an annual global survey of more than 36,000 respondents in 28 countries. It covers a range of societal indicators of trust among business, media, government and NGOs. While Bulgaria is not among the countries covered, a similar approach could be developed as a part of any taxpayer perceptions survey, with results tracked over time and related to international norms.
[283] Hofstede, G. (1980), Culture and organizations, Vol. 10, Issues 4, pp. 15-41
[284] Chan, K. H., and Lan Mo, P. L. (2000). Tax holidays and tax noncompliance: An empirical study of corporate tax audits in China's developing economy. The Accounting Review, Vol. 75(4), pp. 469-484.

and indirect factors impacting on tax compliance, indicating the direction of the compliance response and the major linkages between different factors.

The indirect factors mentioned are broadly captured under the umbrella term "tax morale". This relationship between different factors is brought together in the concept of tax morale, which has been defined as the existence of an intrinsic motivation to pay taxes (Feld and Frey, 2002)[285.]

The OECD summarises the most relevant intrinsic factors as:

► More educated individuals have more positive attitudes towards paying taxes.

► Women have higher tax morale than men.

► Older people are less likely to justify cheating on taxes than younger people.

► Those who are citizens of the country they live in have higher tax morale than non-citizens.

► Individuals who claim a faith or religious identity have more positive attitudes towards paying taxes.

Good government policies and performance are also likely to have a significant impact on tax morale:

► Individuals who believe they are living in a meritocratic society have significantly higher tax morale.

► Those who trust their national government display higher tax morale than those who do not.

► People who identify fiscal redistribution to be essential (i.e., governments should tax the rich to enable support for the poor) show higher tax morale.

► Those who perceive democracy to be the best system of government for their country tend to think that cheating on taxes is unjustifiable.

Tax morale is therefore derived from other factors, and tracking tax morale can complement, not replace, other efforts to improve compliance[286].

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[285] Feld, L. P., and Frey, B. S. (2002). Trust breeds trust: How taxpayers are treated. Economics of governance, Vol. 3, Issue 2, pp. 87-99
[286] OECD, Tax Morale: What Drives People and Businesses to Pay Tax?
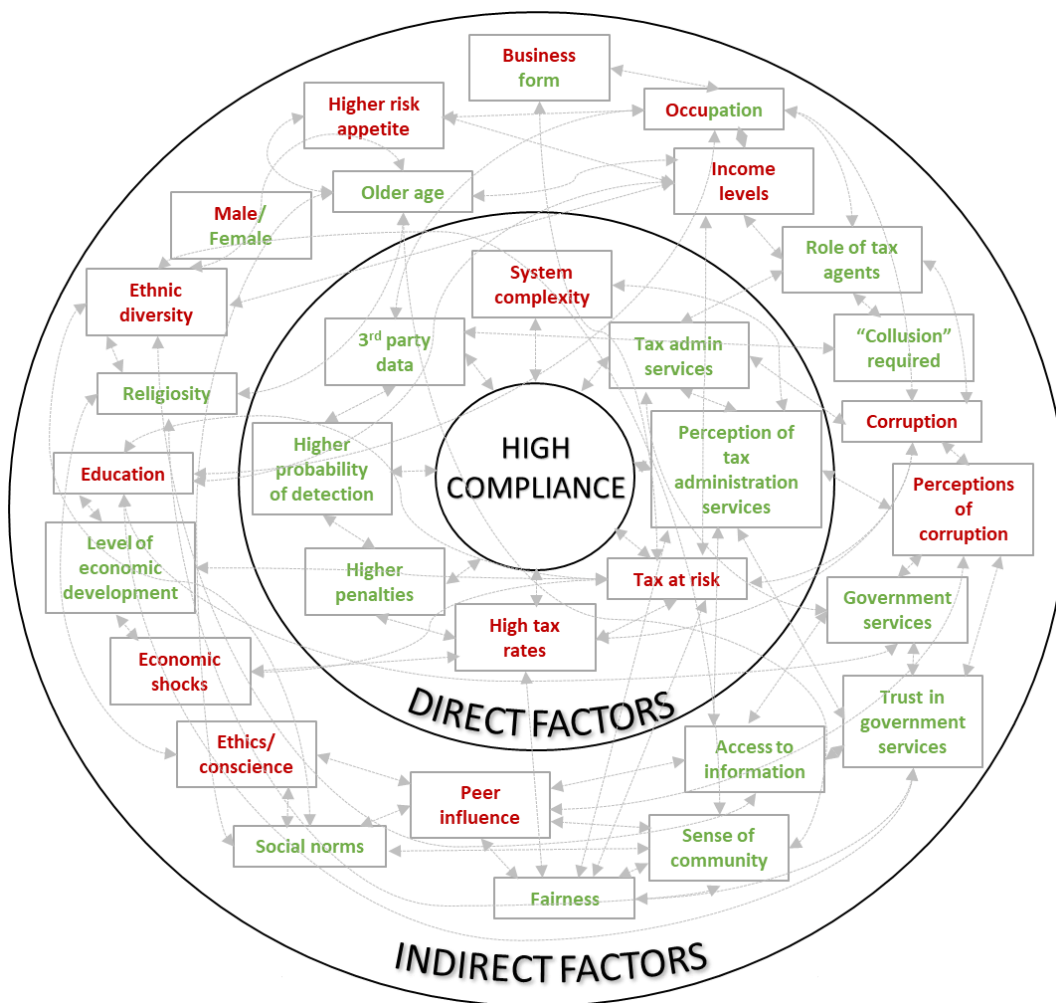
Figure 6 - A model of figures impacting on tax compliance

Key
Box = factor
Green = indicates factor associated with higher compliance
Red = indications factor associated with lower compliance
Arrows = linkage between factors

3.4.2 Grouping factors into clusters

Many of the indirect factors effectively work in clusters, for example:

► An older aged cohort is likely to be correlated with a greater sense of religiosity, higher proportion of female taxpayers and lower risk appetite. It is these secondary factors which are likely to drive increased compliance, but which can potentially be tracked through monitoring population aging and projecting changes in other relevant factors.

► Highly educated taxpayers are likely to earn higher incomes and therefore have more tax at risk, potentially driving lower compliance. Conversely, they are likely to have a greater understanding of tax laws, financial literacy and access to information, supporting a higher compliance level. Tracking education levels across the population can therefore provide insight into a range of compliance drivers.

These clusters are shown in Figure 7, which refines the framework introduced in Figure based on EY's reading of the underlying literature.
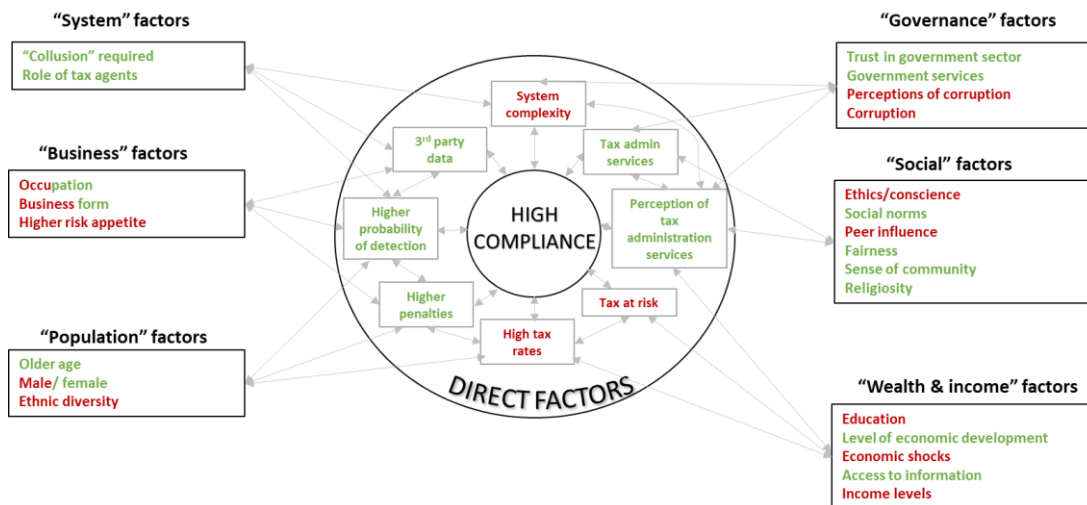
Key
Box = factor
Green = indicates factor associated with higher compliance
Red = indications factor associated with lower compliance
Arrows = linkage between factors

Figure 7 - A stylised model of factors impacting on tax compliance

The enhanced framework in Figure 7 will need to be related to the conditions in Bulgaria, as responses differ across cultures even though there is general consensus on the relevant factors. Many of the factors noted are capable of being measured through a taxpayer perceptions survey, so it is suggested that reviewing the NRA's existing approach to gathering taxpayer perceptions and the data points collected is an option to be examined more closely.

3.4.3 Whether factors likely to improve or reduce compliance

Table 1 provides further details of these factors, grouped in line with the analysis adopted by Fischer et al (1992)[287]. The direction column represents an overall judgment on the impact of those items based on the balance of the literature surveyed.[288]

Table 1: Factors likely to impact on tax compliance behaviour

Group	Factor	Direction	Core metrics
Tax system/ structure	Complexity of tax system	Strongly negative	• Complexity index • Legislation quality

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[287] Fischer CM, Wartick M, Mark M (1992). Detection Probability and Taxpayer Compliance: A Review of the Literature. J. Acc. Lit. 11: 1-46
[288] This table is inspired by O'Shaughnessy, Denise Bowen, "Tax Compliance Determinants: A Proposed Model For Cross-Country Analysis" (2014). Open Access Theses & Dissertations. 1315. https://digitalcommons.utep.edu/open_etd/1315

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Group	Factor	Direction	Core metrics
			• Time to comply
	High probability of detection	Positive	• Proportion of returns audited
			• Taxpayer perception of probability of audit
	High penalties	Positive (up to a point)	• Proportion of taxpayers subject to penalty who comply fully in future
	Higher tax rate	Weakly negative	• Effective and headline tax rates by sector relative to proportion of compliant taxpayers in sector
	(Perceived) corruption	Negative	• Perception of corruption level
Non-compliance opportunities	Tax at risk	Higher less compliant	• Scope of law, for example if there are no transfer pricing regulations, it could be an opportunity for transfer mispricing.
	Third party reporting available	Strongly positive	• Whether third-party reporting applied within sector
			• Whether tax administration can match reported amounts to taxpayer
	Sector/ occupation	Some sectors are well known low compliance sectors	• Proportion of taxpayers completing tax return filing by sector
			• Profitability by sector
	Business form	Some corporate structures may facilitate tax evasion	• Proportion of taxpayers completing tax return filing by corporate form
Demographics	Age	Older more compliant	• Number of years since you were born

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Group	Factor	Direction	Core metrics
	Sex and gender	Females more compliant	• Completed tax returns/ year by sex/gender
	Education	Higher less compliant	• Level of education
	Ethnic diversity	Greater diversity correlates with lower compliance	• Completed tax returns by region • Diversity by region • Proportion of taxpayers born outside country
	Financial condition of taxpayers (level)	Arguably, more income more compliant	• Income level
	Shock to financial condition	External shocks lower compliance	• Compliance rate compared to a baseline year (last year before shock), controlling for changes in the tax system (policy or admin)
	Partnership	Partnered more compliant	• Proportion of population in stable relationships
	Level of economic development	Strongly positive for higher levels of national income/ capita	• Tax returns filed as proportion of total tax returns due correlated with GDP per capita
Attitudes and perceptions	Fairness of tax system	Positive	• Respondents to survey
	Peer influence	Negative	• Respondents to survey
	Social norms	Positive	• Respondents to survey
	Ethics/ conscience	Positive	• Respondents to survey
	Public governance (service) quality	Positive	• Respondents to survey
	Perceived tax service quality	Positive	• Respondents to survey
	Risk appetite	Negative	• Respondents to survey

1. Public information – TLP-WHITE

Group	Factor	Direction	Core metrics
	Religiosity/Sense of community	Greater religious observation more compliant	• Respondents to survey
	Trust in government	Positive	• Respondents to survey
	Other cultural factors		• Respondents to survey

3.5 Data points and data sources

3.5.1 Data points to consider

For the groups of factors identified, **Error! Reference source not found.Error! Reference source not found.** shows sample data points which can measure the non-risk management factors over time. The actual selection of data points by the NRA will depend on which factors are most relevant in the Bulgarian context and data availability. Gaining a full understanding of taxpayer self-reported attitudes is important for most factors.

Table 2 - Data points to measure factors

Sample data points (for each cohort)	Direct factors	System	Business	Population	Governance	Social	Wealth and income
Taxpayer self-reported attitudes	X	X	X	X	X	X	X
Number of exemptions within legislation	X						
Number of reliefs within legislation	X						
Number of legal acts or similar in a specified period	X						
Readability index of legislation (e.g., Gunning-Fox)	X						
Total length of legislation/regulation (in pages)	X						
Availability of guidance by tax type	X						
No of data points required to submit tax return	X						
Proportion of tax returns audited	X						
Taxpayer perception of probability of audit	X						
Tax paid post imposition of penalties relative to pre-penalty period	X						
Proportion of taxpayers filing tax returns post-penalty period	X						
Headline tax rates of cohort	X						
Effective tax rates of cohort	X						
Existence of third-party reporting by income source	X	X					
Extent to which tax administration matches data	X	X					
Accuracy of calculations and transactions performed by NRA	X						
Recorded evasion by sector			X			X	
Proportion of taxpayers completing tax return by sector			X			X	
Benchmark profitability by sector			X				X
Proportion of taxpayers submitting data by business form			X			X	
Median age of cohort				X			X
Old age dependency ratio of cohort				X	X		
Age-specific death rates in a given time interval				X			
Life expectancy				X			
Economic dependency ratio				X			X

Sample data points (for each cohort)	Direct factors	System	Business	Population	Governance	Social	Wealth and income
Physical health/quality of life measures				X			
Proportion of working years to retirement/education years				X			
Male/female proportion of cohort				X			
Ethnic diversity of cohort				X			
Corruption perception indices					X		
Perceptions of the likelihood of political instability					X		
Satisfaction with government services, e.g., public transport, education, infrastructure					X		
Perceptions regarding ability of government to formulate and implement policy					X		
Perceptions of the rule of law, e.g., contract enforcement					X		
Trust in government measures by business, media, government and NGOs					X		
Proportion of cohort in stable relationships						X	
Statistics regarding fairness, e.g., GINI coefficient, METR by income decile, METR by sector						X	
Social media commentary						X	
Frequency of religious service attendance						X	
Frequency of prayer						X	
Mean years of schooling of cohort							X
Highest level of education							X
Learning attainment measures, e.g., reading proficiency							X
Scale of economic shock as a percentage of GDP							X
Scale of economic shock as a percentage of FDI/capita							X
Change in tax return percentage following shock							X
GDP per capita of cohort by decile							X
FDI/capita							X
Tax return filing proportion by decile							X
Employment rate as a share of employees aged 15-64							X
Rate of inflation measured on the basis of the harmonized index of consumer prices							X
Public debt as a debt-to-GDP ratio in %							X

3.5.2 Potential data sources

Error! Reference source not found. considers potential data sources for the data points noted in **Error! Reference source not found.**. It identifies relevant data that can be obtained from within the NRA itself, other government agencies and international bodies which already obtain data from Bulgaria. In some cases, notably ensuring that the preferred taxpayer perceptions details are obtained, the NRA may consider instigating additional primary research.

The potential sources include:

Taxpayer perceptions survey

Complexity index

Tax administration records

External reviews of tax administration

National census records

National and supra-national statistical agencies (e.g., Eurostat, World Bank, UNESCO)

Company registrar's records

Official records of births, marriages and deaths

Government economic data

Bulgarian content of international governance, trust, corruption and similar survey

Randomised control tests for different approaches to encouraging co compliance

Tax gap studies by tax type, business form, behaviour, sector and region

Academic literature regarding tax compliance in Bulgaria, including cross-national studies

Social media

Immigration/visa records

These sources can provide multiple data points, as set out, by means of example, in the table below.

Table 3 - Sources of data

Sample data sources	Taxpayer perceptions survey	Complexity index	Tax administration records	External reviews of tax administration	National census records	National and supra-national statistical agencies (e.g., Eurostat, World Bank, UNESCO)	Company registrar's records	Official records of births, marriages and deaths	Government economic data	Bulgarian content of international governance, trust, corruption and similar surveys	Randomised control tests for different approaches to encouraging co compliance	Tax gap studies by tax type, business form, behaviour, sector and region	Academic literature regarding tax compliance in Bulgaria, including cross-national studies	Social media	Immigration/visa records
Taxpayer self-reported attitudes	X					X				X	X				
Number of exemptions within legislation		X	X												
Number of reliefs within legislation		X	X												
Number of Finance Acts or similar in a specified period		X	X												
Readability index of legislation (e.g., Gunning-Fox)		X													
Total length of legislation/regulation (in pages)		X	X												
Availability of guidance by tax type	X	X	X												
Number of data points required to submit tax return		X	X												
Proportion of tax returns audited			X												
Taxpayer perception of probability of audit	X														
Tax paid post imposition of penalties relative to pre-penalty period			X												
Proportion of taxpayers filing tax returns post-penalty period			X												
Headline tax rates by sector			X												
Effective tax rates by sector			X												
Existence of third-party reporting by income source			X												
Extent to which tax administration matches data			X												
Accuracy of calculations and transactions performed by NRA			X												
Recorded evasion by sector			X	X		X						X	X		

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Sample data sources	Taxpayer perceptions survey	Complexity index	Tax administration records	External reviews of tax administration	National census records	National and supra-national statistical agencies (e.g., Eurostat, World Bank, UNESCO)	Company registrar's records	Official records of births, marriages and deaths	Government economic data	Bulgarian content of international governance, trust, corruption and similar surveys	Randomised control tests for different approaches to encouraging co compliance	Tax gap studies by tax type, business form, behaviour, sector and region	Academic literature regarding tax compliance in Bulgaria, including cross-national studies	Social media	Immigration/visa records
Proportion of taxpayers completing tax return by sector			X	X	X		X		X		X	X	X		
Benchmark profitability by sector			X		X	X	X		X						
Proportion of taxpayers completing tax return by business form			X		X		X								
Median age					X			X							
Old age dependency ratio					X	X			X						
Age-specific death rates in a given time interval					X			X							
Life expectancy					X			X							
Economic dependency ratio					X				X						
Physical health/quality of life measures	X				X	X									
Proportion of working years to retirement/education years					X				X						
Male/female proportion of population			X		X	X		X		X					
Ethnic diversity by region					X										X
Corruption perception indices	X									X				X	
Perceptions of the likelihood of political instability	X									X					
Satisfaction with government services, e.g., public transport, education, infrastructure	X									X					
Perceptions regarding ability of government to formulate and implement policy	X									X					
Perceptions of the rule of law, e.g., contract enforcement	X									X					
Trust in government measures by business, media, government and NGOs	X									X					
Proportion of population in stable relationships					X			X							
Statistics regarding fairness, e.g., GINI coefficient, METR by income decile, METR by sector			X		X	X				X			X		
Social media commentary														X	
Frequency of religious service attendance					X	X									
Frequency of prayer					X	X									
Mean years of schooling					X	X									
Highest level of education					X	X									
Learning attainment measures, e.g., reading proficiency						X									
Scale of economic shock as a percentage of GDP									X						
Change in tax return percentage following shock			X												
GDP per capita by decile									X						
Tax return filing proportion by decile			X												
Scale of economic shock as percentage of FDI/capita									X						
FDI/capita									X						
Employment rate as a share of employees aged 15-64						X									
Rate of inflation measured on the basis of the harmonized index of consumer prices									X						
Public debt as a debt-to-GDP ratio in %									X						

3.6   Methods for data analysis

The present chapter of the report focuses on the provision of an overview of potential analytical methods and tools as well as instruments, that are used in academic research and could potentially find application in the practice of tax administrations, in the area of evaluation of tax compliance, or respectively non-compliance and building a better understanding of its determinants, meaning external factors that could in any way influence the taxpayers' compliance decisions.

The empirical analysis of evasion is highly challenging exercise due to tax evaders' concealment activities. Almost all empirical analyses of evasion, including the most credible ones, don't actually have a reliable measure of evasion, but instead rely on indirect measures. Tax administrations have the same problem: it's not easy to measure evasion.

But scholars have risen to challenge, and there are several promising developments in measuring tax evasion and, more importantly, measuring the determinants of tax evasion and how different policies might affect it.[289]

It shall be explicitly noted, that there could not be a one-size-fits-all solution, when it comes to the issue of developing tax administrations' capabilities to first of all measure the level of non-compliance in a given jurisdiction, and subsequently determine the relevant external factors that drive non-compliance and their precise significance. At present, current academic research, is primarily focusing on individual aspects of this complex probem, by eutilising different methodologies to either provide a more thorough assessment of the level of non-compliance, or explore in detail the correlation between non-complaince and one or several of the external factors that have been reviewd in the previous chapters of the report.

Considering the above, the present chapter provides a brief introduction on the developments of data analytics and machine learning and their potential application to empirical research related to tax compliance. Further to that, the chapter provides a description of several analytical methods, that have up to now, yielded some credible results in terms of the key objectives of the project – namely, developing an understanding of the external context and its impact on taxpayers' compliance decision.

3.6.1   Introduction

Over the last two decades an ever-growing array of real-life problems has found solutions in the domain of statistics and machine learning. The main reasons for this development are cheaper and more accessible computational power, vast theoretical advancements and availability of historical data.

The quantitative assessment and forecasting of human risk behavior in general is one of the many areas where machine learning techniques have successfully been applied (as a matter of fact, every bank relies on such models). Since the taxpayers' behavior is inherently risky and given the goal is a data-driven quantitative assessment of such behavior and its main driving forces, the application of statistics and machine learning algorithms is highly appropriate.

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[289] Slemrod (2016), Tax Compliance and Enforcement: New Research and its Policy Implications

Machine learning refers to a set of tools for modelling and understanding complex datasets[290]. These tools can generally be grouped into supervised and unsupervised where supervised learning involves building a model for predicting an output variable based on one or more input variables. Unsupervised learning, on the other hand, does not have a response variable and is only suitable for discovering structures and patterns in the data having its most widely spread real-life applications in performing segmentation.

Supervised learning, as its name suggests, does have a response variable that supervises the learning process, hence the assessment and prediction are guided and optimized. Depending on whether the output variable is continuous or categorical, this domain is subdivided into regression and classification techniques.

► Regression techniques

► Linear Regression – one or more predictor variables, categorical as well as numeric variables possible, assumes an approximately linear relationship between the input and output, minimization of the residual sum of squares or maximization of the likelihood function, tests for statistical significance, strength of relationship, multicollinearity, homoscedasticity, various predictor variables selection approaches

  ▪ **Non-linear Regression** – a few different variants are available: **Polynomial Regression** – non-linearity is accommodated through inclusion of powers of the predictors, **Regression Splines** – polynomial functions are fit to different regions of the space, **Smoothing Splines** – minimization of the residual sum of squares criterion subject to a smoothness penalty, **Local Regression** – the different regions of the space are allowed to overlap, **Generalized Additive Models** – extension to the multivariate case.

► Classification techniques

  ▪ **Logistic Regression** – one or more predictor variables, categorical as well as numeric variables possible, models the probability of belonging to a certain class, fit by maximum likelihood, minimization of the error rate, tests for statistical significance, weight of evidence and information value application, ROC curve.

  ▪ **Discriminant Analysis –** models the distribution of the predictors separately in each of the response classes, Bayes' theorem application, in certain cases more stable than the logistic regression, more than two response classes possible.

Before or in the process of modelling, some data processing steps may be needed depending on the data quality requirements of the learning algorithms and the characteristics of the dataset like completeness, probability distributions, scale-neutrality, etc. Such steps may be related to: missing data – imputation, non-constant variance of the error terms – transformation of the response using a concave function, outlier detection – studentized residuals, scales comparability – standardization, multicollinearity – variance inflation factor and others.

Furthermore, there is a set of model fine-tuning and optimization algorithms, whose application may lead to reduction of the variance of the coefficient estimates, thus, to improved performance of the statistical model. The two best-known such regularization techniques are **Ridge Regression** – introduces a shrinkage penalty into the regression function but keeps all model coefficients and **Lasso** – introduces a

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[290] For thorough and mathematically rigorous treatment, please see the seminal book on the topic: Hastie, T. et al. (2008), "The Elements of Statistical Learning", accessible at
https://hastie.su.domains/ElemStatLearn/printings/ESLII_print12_toc.pdf

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penalty that, as with the ridge regression approach, shrinks the coefficient estimates towards zero, however, in this case the coefficients can go to exactly zero when the tuning parameter lambda is sufficiently large.

3.6.2 Overview of analytical tools and methods

► Randomised field experiments

Randomized field experiments can be a powerful tool for measuring tax compliance and its determinants. These experiments involve randomly assigning different treatment groups to receive different interventions, and then comparing their compliance behavior with that of a control group that does not receive the intervention. This allows researchers to isolate the effects of specific interventions on tax compliance, and to measure the relative importance of different factors that influence compliance.

For example, a randomized field experiment could be designed to test the effectiveness of different types of enforcement strategies, such as audits ot fines. Researchers could randomly assign taxpayers to different treatment groups, with each group receiving a different type of enforcement intervention. They could then measure the compliance behavior of each group, and compare it to that of a control group that did not receive any intervention.

Another example of a randomized field experiment could be designed to test the effectiveness of different types of tax education and outreach programs. Researchers could randomly assign taxpayers to different treatment groups, with each group receiving a different type of education intervention, such as workshops, informational brochures, or personalized feedback. They could then measure the compliance behavior of each group, and compare it to that of a control group that did not receive any intervention.

Overall, randomized field experiments offer a powerful and rigorous way to measure tax compliance and its determinants, and can provide valuable insights for policymakers and tax administrators seeking to improve compliance rates.

Despite the unrivalled internal validity of well-designed control trials, it is not always clear the results can be "scaled up". General equilibrium effects may matter, and withould understanding the causal channels through wihci policy interventions affect taxpayers' behaviour, it may not be possible to predict the effect of variations in the policy interventions that are credible in an experimental setting may not be credible in an economy-wide setting. For example, Kleven et al. (2011) sent treatment groups 50 percent probability and 100 percent probability audit thret letters, savvy taxpers would know that either policy is prohibitively expensive were either of those treatments to be expanded to the entire population. [291]

► Regression Discontinuity Analysis[292,293,294]

Regression discontinuity analysis is another statistical method that can be used to measure tax compliance and its determinants. RDA is a quasi-experimental design

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[291] Slemrod (2016), Tax Compliance and Enforcement: New Research and its Policy Implications
[292] Slemrod (2016), Tax Compliance and Enforcement: New Research and its Policy Implications
[293] Jacob, B. A., & Lefgren, L. (2004). The impact of research grants on academic output: Evidence from the introduction of the NIH's R37. Journal of Public Economics, 88(9-10), 1987-2010.
[294] Lee, D. S. (2008). Randomized experiments from non-random selection in US House elections. Journal of Econometrics, 142(2), 675-697.

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that exploits the sharp discontinuity in treatment that occurs at a predetermined threshold or cut-off point.

For example, in the context of tax compliance, RDA could be used to examine the impact of tax audits on compliance behavior. Researchers could focus on taxpayers who are near the audit threshold (i.e., just above or below a certain income level), and compare the compliance behavior of those who are audited to those who are not. By focusing on this "sharp" threshold, researchers can estimate the causal effect of the audit on compliance behavior, while controlling for other factors that may influence compliance.

RDA can also be used to examine the impact of other policy interventions, such as fines, education campaigns, or changes in tax rates.

One of the main advantages of RDA is that it can provide more robust estimates of causal effects than traditional regression models, which may be biased by unobservable confounding factors. However, RDA also has some limitations, such as the need for a sharp and well-defined threshold, and the potential for regression to the mean effects.

► **Analysis of kinks and notches[295,296,297]**

This method is similar to regression discontinuity analysis in that it focuses on sharp changes in the tax system, but it differs in that it examines changes in tax liability rather than changes in treatment or policy interventions.

For example, in the context of tax compliance, analysis of kinks and notches could be used to examine the impact of changes in tax rates or thresholds on compliance behavior. Researchers could focus on taxpayers who are near a kink or notch point (i.e., just above or below a certain income level or tax threshold), and compare the compliance behavior of those who experience a change in tax liability to those who do not. By focusing on this sharp change in tax liability, researchers can estimate the causal effect of the change on compliance behavior, while controlling for other factors that may influence compliance.

One of the main advantages of analysis of kinks and notches is that it can provide more precise estimates of causal effects than traditional regression models, as it leverages the discontinuity in tax liability to estimate the effect of changes in tax policy on compliance. However, this method also requires careful consideration of potential selection biases and other factors that may influence compliance. By combining multiple methods, researchers can obtain a more comprehensive understanding of the factors that influence tax compliance, and develop more effective policies and interventions to improve compliance rates.

► **Puzzle method[298, 299]**

[295] Slemrod, J., & Yitzhaki, S. (2002). Tax avoidance, evasion, and administration. In Handbook of Public Economics (Vol. 3, pp. 1423-1470). Elsevier.
[296] Kleven, H. J., Knudsen, M. B., Kreiner, C. T., Pedersen, S., & Saez, E. (2011). Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark. Econometrica, 79(3), 651-692
[297] Kleven, H. J., Knudsen, M. B., & Saez, E. (2019). Taxation and international migration: Evidence and policy implications. Journal of Economic Perspectives, 33(4), 121-148.
[298] International Monetary Fund (IMF) - "Tax Compliance Assessment: Methodology and Practices"
[299] Organization for Economic Cooperation and Development (OECD) - "Tax Administration 2019: Comparative Information on OECD and Other Advanced and Emerging Economies"

The puzzle method of data analysis involves breaking down a large dataset into smaller pieces or puzzles to identify patterns, relationships, and anomalies. The goal of this method is to discover insights that might be hidden in the data and to help researchers and analysts make better decisions. The following are the key steps in the puzzle method of data analysis:

- Define the problem: Identify the specific question or problem that needs to be solved using the data.

- Gather the data: Collect and organize the data that is relevant to the problem being studied.

- Divide the data into puzzles: Break down the data into smaller pieces or puzzles, based on the specific aspects of the problem being studied.

- Analyze the puzzles: Examine each puzzle individually to identify patterns, relationships, and anomalies.

- Combine the puzzle pieces: Combine the insights gained from each puzzle to develop a more comprehensive understanding of the data.

- Interpret the results: Draw conclusions based on the insights gained from the analysis and present the findings to stakeholders.

The puzzle method of data analysis is useful for analyzing complex and large datasets that would otherwise be difficult to manage. By dividing the data into smaller puzzles, analysts can more easily identify patterns and relationships that might be hidden in the larger dataset. The method is also useful for identifying areas where additional data is needed, or where further analysis is required to fully understand the problem.

In the context of tax compliance, the method could be used to analyse compliance data for the purpose of identifying trends, patterns, relationships and other that could drive compliance. For example, a specific problem could be the prediction on whether certain taxpayer segment will comply with their obligations or not. The datasets that could be relevant to this particular issue might include past filings, income, age, education level, marital status, and any other relevant demographic data. The next steps is the division of the data into puzzles based on different aspects of the problem e.g. one puzzle could analyse past tax filings to identify patterns in underreporting or non-reporting, another one could analyse demographic data to identify characteristics that are associated with non-compliance.

▶ **Mosaic method[300, 301, 302]**

The Mosaic method is another approach that can be used to measure tax compliance and its determinants. The Mosaic method involves combining multiple sources of data, such as administrative data, surveys, and experiments, to create a more complete picture of tax compliance behavior.

Suppose that tax authorities want to study the compliance behavior of a specific group of taxpayers, such as self-employed individuals. The Mosaic method could be used to

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[300] International Monetary Fund (IMF) - "Tax Compliance Assessment: Methodology and Practices"
[301] Organization for Economic Cooperation and Development (OECD) - "Tax Administration 2019: Comparative Information on OECD and Other Advanced and Emerging Economies"
[302] Deloitte - "Leveraging Data Analytics for Tax Compliance"

combine administrative data on tax returns with survey data on taxpayer attitudes and behaviors, as well as experimental data on the effectiveness of different compliance interventions.

To implement this design, researchers would start by collecting administrative data on tax returns from the target group. They would then conduct a survey of the same group to collect data on their attitudes towards tax compliance, as well as any factors that may be influencing their behavior. Finally, they could conduct randomized field experiments to test the effectiveness of different compliance interventions.

By combining these different sources of data, researchers can gain a more complete understanding of the factors that influence tax compliance behavior among the target group. For example, they may find that self-employed individuals who have a strong sense of social responsibility are more likely to comply with their tax obligations, while those who perceive the tax system as unfair are more likely to engage in non-compliance.

Overall, the Mosaic method can be a useful tool for studying tax compliance and its determinants, especially in situations where multiple sources of data are available.

3.7 Approaches to analyse the scale of tax non-compliance in Bulgaria and impact of selected factors

This section describes selected approaches to investigate the scale of tax non-compliance in Bulgaria and effects of selected factors in this area (including external factors, e.g., business cycle). It is the result of our discussions with the NRA regarding the analyses that could practically be conducted for the country, accounting for data availability.

Since there are various sources and areas of the tax gap (see section 1.2 for the definitions), we proposed the three approaches that use different frameworks and datasets. The first approach concentrates on the shadow (non-observed) economy which is an important source of various types of the tax gap (especially VAT gap and gap for entrepreneurial income taxes). The second method explores in more details the VAT gap. The third type of analysis focuses on unreported income and related PIT gap. The addition of the latter two approaches is important due to the high role of VAT and PIT revenues in the total tax collection and the fact that VAT and PIT gaps are not only caused by the shadow economy but also some other factors (e.g., tax frauds, tax evasion, bankruptcies, etc.). Combination of these three methods in one study enables us to investigate various areas of tax non-compliance as well as to account for its different determinants.

The list of factors that could be tested depends on the data availability and specifics of different approaches. In particular, the selected methods are based on the country, sectoral and individual level data, respectively. For example, data on the country level does not allow to analyse the effects of gender, while data on the individual level does not let us determine the impact of government policies set at the country level. More importantly, while collected country and sectoral level data include many time periods that enable us to test the impact of time varying factors (e.g., related to business cycle), the time period covered by individual level data is much shorter, making such tests quite challenging. There are also some factors that cannot be investigated with the proposed methods and related datasets (e.g., ethnic diversity, risk appetite), mainly due to data availability issues. On the other hand, they allow us to look into some additional aspects of tax non-compliance (e.g., size of companies in the VAT gap analysis) and bring many insights that are hard to obtain from standard analyses of

tax and statistical offices' data. Below we present initial summary of factors that could be tested with proposed approaches, bearing in mind the current state of the data collection process. In next subchapters, for each approach separately, we discuss its potential outcomes, main idea and background, technical details of the approach and required data input.

Table 4 – Initial assessment of the factors that could be tested with proposed approaches

Group	Factor	Shadow economy and related part of the tax gap: currency demand approach	VAT gap: MIMIC model	Unregistered income and the PIT gap: traces-of-true-income approach
Tax system/ structure	Complexity of tax system	x		
	High probability of detection	?		
	High penalties			
	Higher tax rate	x	x	
	(Perceived) corruption	?		
	Tax at risk			
Non-compliance opportunities	Third party reporting available	x		
	Sector/ occupation	x	x	x
	Business form		x	
	Size of companies	x	x	
Demographics / economics	Age			x
	Sex and gender			x
	Education			x
	Ethnic diversity			
	Financial condition of taxpayers (level)		?	
	Shock to financial condition	x	x	
	Partnership			?
	State of/on the labour market	x	?	x
	Level of economic development	x	x	
	Fairness of tax system	?	?	
Attitudes and perceptions	Peer influence			
	Social norms	x		
	Ethics/ conscience	x	?	
	Public governance (service) quality	x		
	Perceived tax service quality			
	Risk appetite			
	Religiosity/Sense of community			

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Trust in government	x
Other cultural factors	?

Notes: x – likely to be tested, ? – to be determined if could be tested, underline – additional factors versus the factors previously included in the literature review.

Source: EY.

3.7.1 Shadow economy and related part of the tax gap: currency demand approach

Potential outcomes

Currency demand approach (CDA) allows us to estimate the aggregate (cash) shadow economy size for Bulgaria as percentage of GDP, including its evolution over time, determine its quantitative relationship with key socioeconomic factors (e.g., state of the labour market, rule of law) and their relative contributions. With further adjustments we are able to estimate shadow economy components of different nature that should be tackled with different measures. Moreover, we can estimate lost revenues from VAT and taxes on entrepreneurial income due to the shadow economy (part of the tax gap). We can also simulate changes in the shadow economy and lost taxes under various scenarios with different values of the socioeconomic variables (including related to external factors).

Main idea and background

The key assumption in the CDA framework is that most of the unregistered transactions are settled with cash (there are some exceptions, e.g., illegal transactions with cryptocurrencies). The CDA approach aims to econometrically decompose the demand for cash into the two components: (1) cash used in the formal economy and (2) the remaining part - "excess" cash used to facilitate the unregistered transactions. This idea started with early contributions of Cagan (1958)[303], followed by Gutmann (1977)[304] and Feige (1979)[305] and with important developments provided by Tanzi (1980,1983)[306]. Later, the relevant contributions were provided by Giles and Tedds (2002)[307], Embaye (2007)[308], Ahumada et al. (2008)[309], Thießen (2010)[310] and Ardizzi et al. (2014)[311], to name the few. The CDA framework was further developed by coauthors of this report, including addressing many issues encountered in the previous

[303] Cagan, P. (1958), The demand for currency relative to the total money supply, Journal of Political Economy, 66(4), 303–328.

[304] Gutmann, P. M. (1977), The subterranean economy, Financial Analysts Journal, 33(6), 26–27.

[305] Feige, E. L. (1979), How big is the irregular economy?, Challenge, 22(5), 5–13.

[306] Tanzi, V. (1980), Underground economy built on illicit pursuits is growing concern of economic policymakers, Survey no. 4–2

Tanzi, V. (1983), The underground economy in the United States: Annual estimates, 1930–80, Staff Papers (International Monetary Fund), 30(2), 283–305.

[307] Giles, D. E., Tedds, L. (2002), Taxes and the Canadian underground economy. Toronto: Canadian Tax Foundation.

[308] Embaye, A. (2007), Underground economy estimates for non-OECD countries using currency demand method, 1984–2005, MPRA Paper 20308. Germany: University Library of Munich.

[309] Ahumada, H., Alvaredo, F., & Canavese, A. (2008), The monetary method to measure the shadow economy: The forgotten problem of the initial conditions, Economics Letters, 101(2), 97–99.

[310] Thiessen, U. (2010), The shadow economy in international comparison: Options for economic policy derived from an OECD panel analysis, International Economic Journal, 24, 481–509.

[311] Ardizzi, G., Petraglia, C., Piacenza, M., & Turati, G. (2014), Measuring the underground economy with the currency demand approach: A reinterpretation of the methodology, with an application to Italy, Review of Income and Wealth, 60(4), 747–772.

literature (see Dybka et al., 2018[312] and EY (2019)[313] for a detailed discussion of the issues and improvements) and analysis of uncertainty of the CDA-based shadow economy estimates (Dybka et al. 2022[314]).

Details of the approach

Our approach consists of four steps decomposing the total economy into different components presented in Figure 8 and described below.

Figure 2 – Decomposition of the total economy into shadow and registered components
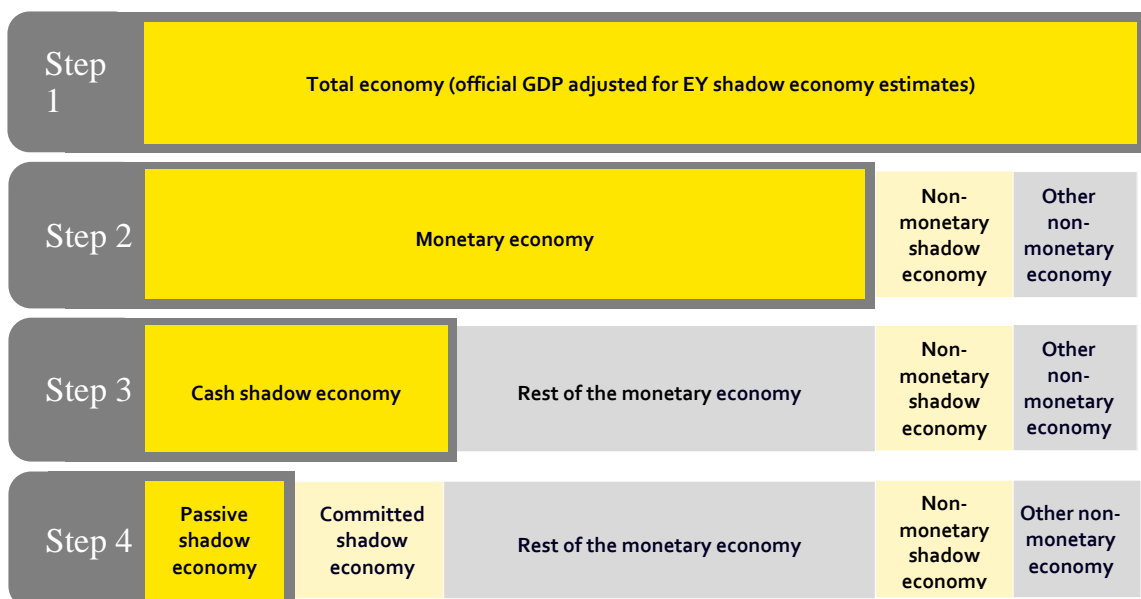
Note: The proportions of the areas above do not reflect the proportions of different components of the total economy.
Source: EY.

► Step 1. Relationship between total economy and official GDP

We start with official GDP figures ($Y_{i,t}^{OFFICIAL}$ for country *i* in period *t)*. We check if information on the shadow (non-observed) economy estimates included in GDP figures of the National Statistical Institute is available. If it is, we later calculate the total economy size (total GDP, $Y_{i,t}^{TOTAL}$) by adjusting official GDP for the difference between our and statistical office's shadow economy estimates. If it is not, we assume for simplicity that such estimates are the same. This step is later needed to express our results in local currency units or as a percentage of official GDP, since our methodology returns outcomes as a percentage of total GDP.

► Step 2. Splitting total economy into monetary and non-monetary components

We split the total economy into monetary ($Y_{i,t}^{MONETARY,TOTAL}$), i.e., payment-based, and non-monetary activities by estimating the latter. Non-monetary economy includes two components: 1) imputed rents of owners-occupiers that could be found in statistical offices datasets and 2) household production of goods for own final use (non-monetary

[312] Dybka, P., Kowalczuk, M., Olesiński, B., Rozkrut, M., Torój A. (2018), Currency demand and MIMIC models: towards a structured hybrid method of measuring the shadow economy", International Tax and Public Finance, 1-37.
[313] EY (2019), Reducing the Shadow Economy Through Electronic Payments. Technical appendices, https://assets.ey.com/content/dam/ey-sites/ey-com/en_pl/topics/eat/pdf/03/ey-shadow-economy-study-technical-appendices.pdf
[314] Dybka, P., Olesiński, B., Rozkrut, M., Torój, A. (2022), Measuring the model uncertainty of shadow economy estimates, International Tax and Public Finance.

shadow economy, $Y_{i,t}^{NMSE}$, mainly related to agriculture). Sometimes value of 2) is also available at the statistical office. Otherwise, we estimate it based on the role of agriculture in the economy and results of Blades (1975) who analysed its link with the non-monetary shadow economy in various countries (for details see EY (2019)[315]). Yet, for most developed countries the non-monetary shadow economy is rather small and not relevant from the perspective of policies to increase tax compliance.

► Step 3. Estimating the cash shadow economy: currency demand analysis (CDA)

In step 3 we first focus on measuring the share of the monetary (or "cash") shadow economy in total monetary economy ($\frac{Y_{i,t}^{CASH,SHADOW}}{Y_{i,t}^{MONETARY,TOTAL}}$).

Inspired by the existing and our CDA research, we propose a modified approach, recognized by other shadow economy researchers.[316] We distinguish following substeps.

Substep 3.1. Estimation of CDA model

The first substep is an econometric estimation of the currency demand equation:

$$CASH\_M1_{i,t} = \alpha_i + \beta_{i,t}^{(1)} x_{1,i,t} + \beta_{i,t}^{(2)} x_{2,i,t} + \beta_{i,t}^{(3)} x_{3,i,t} + \varepsilon_{it}, (1)$$

where i represents the analysed country and t stands for the analysed time period. In this equation, the explained (dependent) variable is the share of currency in circulation ("cash") in the M1 monetary aggregate ("total transactional money" including "cash" and overnight deposits). To explain its variation, we use three groups of explanatory variables:

"Typical" cash shadow economy determinants (x_1). They mostly affect the willingness of agents to operate in the shadow economy (e.g., state of labour market, rule of law, etc.) and through this channel impact the dependent variable.

Electronic payments system variables (x_2). Higher levels of these variables (e.g., number of payment cards) may be associated with two effects: (1) drop in the shadow economy (it becomes more difficult not to report transactions) and (2) replacement of the registered cash transactions with electronic payments (no impact on the cash shadow economy).

Other control variables (x_3). These variables, after controlling for the influence of x_1 and x_2 determinants, should not (directly) impact the shadow economy, but may still have influence on the dependent variable. They are related to the level of the economic development, monetary conditions, etc.

$\beta_{i,t}^{(1)}$, $\beta_{i,t}^{(2)}$ and $\beta_{i,t}^{(3)}$ represent vectors of the regression coefficients (they may also include interactions with real GDP per capita to account for their conditionality on the development level). Finally, ε_{it} is the error term. Additionally, we include the individual effects, α_i, which represent time-invariant, unobservable country characteristics that affect the demand for cash in each country.

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[315] EY (2019), op. cit.
[316] See e.g. Medina L., Schneider F. (2018), "Shadow Economies Around the World: What Did We Learn Over the Last 20 Years?", *IMF Working Paper*, no. WP/18/17.

The construction of the coefficients α_i, $\beta_{i,t}^{(1)}$, $\beta_{i,t}^{(2)}$ and $\beta_{i,t}^{(3)}$ reflects country heterogeneity which is crucial when using data for many countries. Individual effects (α_i) are estimated as fixed effects. Panel data makes it possible to incorporate such effects that can represent constant unobservable cultural factors.

We consider a wide range of potential explanatory variables from the three groups discussed above (for the list, see e.g., EY (2019)[317]). Our preferred approach to the selection of variables and assessment of their impact is based on the frequentist and/or Bayesian model averaging procedure in which a wide array of variants of equation (1) is estimated using the Panel Corrected Standard Errors (PCSE) method[318], with different combinations of considered variables.

Substep 3.2. Using the CDA model to measure the shadow-economy-related cash

In the second substep, we set the values of x_1 and x_2 vectors in equation (1) at their "best" observable levels for the countries in the sample (e.g. the lowest unemployment rate) and estimate the theoretical value of the explained variable in the case of the lowest possible cash shadow economy.

For electronic payments system variables (x_2) we apply a conservative approach and assume that their impact on the shadow economy is related only to a fraction of $\beta_{i,t}^{(2)}$, specifically equal to the the proportion of the average impact on the dependent variable of typical shadow economy determinants (x_1) and control variables (x_3).

The difference between the fitted value from the model, calculated on the basis of the factual values of x_1 and x_2, and the counterfactual theoretical value may be interpreted as <u>the share</u> of cash in the M1 aggregate that is related to cash shadow economy transactions ($\frac{C_{i,t}^{SHADOW}}{M1_{i,t}}$). Given the observed stock of the M1 aggregate for a given country and period, the obtained difference allows us to calculate <u>the amount</u> of cash that is attributable to the cash shadow economy ($C_{i,t}^{SHADOW}$).

Substep 3.3. Conversion of the shadow cash into the cash shadow economy

In the third substep, we estimate the size of the cash shadow economy[319]. First, we assume that the *velocity* of money in the cash shadow economy is equal to the velocity of money in the overall monetary economy:

$$\frac{Y_{i,t}^{MONETARY,TOTAL}}{M1_{i,t}} = \frac{Y_{i,t}^{CASH,SHADOW}}{C_{i,t}^{SHADOW}}, \ (2)$$

where $Y_{i,t}^{MONETARY,TOTAL}$ and $Y_{i,t}^{CASH,SHADOW}$ denote the monetary output in the total and shadow economy, respectively; $C_{i,t}^{SHADOW}$ stands for the amount of cash used for settling transactions in the cash shadow economy and $M1_{i,t}$ is the M1 total transactional money.

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[317] EY (2019), op. cit.

[318] The method is robust to: contemporaneous correlation of error terms between panel units, serial correlation of order 1 of the error term (a common serial correlation coefficients for all the panels is selected) as well as to heteroskedasticity.

[319] The size of the cash shadow economy corresponds to the part of monetary output / monetary GDP that is generated in the shadow economy.

We transform equation (2) to estimate the share of the cash shadow economy output in the total monetary output (including also the cash shadow economy) without knowing the exact value of the velocity of money:

$$\frac{Y_{i,t}^{CASH,SHADOW}}{Y_{i,t}^{MONETARY,TOTAL}} = \frac{C_{i,t}^{SHADOW}}{M1_{i,t}}. \quad (3)$$

Note that $\frac{C_{i,t}^{SHADOW}}{M1_{i,t}}$ is the endpoint of the substep 3.2. However, it is only related to those economic activities that include monetary transactions. In order to obtain the estimate of the total shadow economy $Y_{i,t}^{TOTAL,SHADOW}$ (as a share in total economy $Y_{i,t}^{TOTAL}$), we use the following formula:

$$\frac{Y_{i,t}^{TOTAL,SHADOW}}{Y_{i,t}^{TOTAL}} = \frac{Y_{i,t}^{CASH,SHADOW}}{Y_{i,t}^{MONETARY,TOTAL}} \times \frac{Y_{i,t}^{MONETARY,TOTAL}}{Y_{i,t}^{TOTAL}} + \frac{Y_{i,t}^{NMSE}}{Y_{i,t}^{TOTAL}}, \quad (4)$$

in which $\frac{Y_{i,t}^{MONETARY,TOTAL}}{Y_{i,t}^{TOTAL}}$ is the output of Step 2 and the $Y_{i,t}^{NMSE}$ is the non-monetary shadow economy estimated earlier. Finally, the share of the total shadow economy in the official GDP estimate is obtained using the following adjustment:

$$\frac{Y_{i,t}^{TOTAL,SHADOW}}{Y_{i,t}^{OFFICIAL}} = \frac{Y_{i,t}^{TOTAL,SHADOW}}{Y_{i,t}^{TOTAL}} \times \frac{Y_{i,t}^{TOTAL}}{Y_{i,t}^{OFFICIAL}}, \quad (5)$$

in which $\frac{Y_{i,t}^{OFFICIAL}}{Y_{i,t}^{TOTAL}}$ is the result of the Step 1.

► Step 4. Estimating the passive and committed shadow economy and lost government revenues

Passive shadow economy (for this and other definitions see section 1.2) consists in underreporting of the revenues by registered, legally operating entities. We assume that the remaining part of the shadow economy, i.e., the committed shadow economy and the non-monetary shadow economy, is related to the value added generated by unregistered labour and we estimate such value in two substeps.

First, we use the share of unregistered employment in the total employment based on the research of the statistical office. If not available, we econometrically estimate relation between such share and various determinants (e.g., role of self-employment) in different countries and based on the factual values of the determinants in Bulgaria calculate the ratio for this country.

Second, we assume that the value added generated by the shadow labour force is related to remunerations. Therefore, we multiply the share of informal employment in the total employment by the labour income share in GDP which yields the initial ratio of the committed shadow economy plus non-monetary shadow economy to the total GDP. Next, we multiply the obtained result by the ratio of the minimum wage to the average monthly wage (or the ratio of the average monthly wage paid for performing elementary occupations to the official average monthly wage if there is no minimum wage) to account for the lower level of remunerations of the informal workers. Such an approach is essentially an approximation of the actual labour productivity in the informal employment.

After applying the above-discussed corrections, the adjusted estimate of the share of informal employment in the total employment allows us to approximate the share of

the committed shadow economy and the non-monetary shadow economy in the total economy. Expressing other estimates also as shares in the total economy, we subtract from the two components our estimate of the non-monetary shadow economy (calculated in step 2) to arrive at the committed shadow economy estimate. Finally, to obtain the passive shadow economy estimate, we subtract the committed shadow economy from our cash shadow economy estimate (calculated in substep 3.3).

Last but not least, using the information on tax rates and government revenues we estimate lost revenues from VAT and taxes on entrepreneurial income due to the cash, passive and committed shadow economy (part of the tax gap). We also estimate how such lost revenues (a measure of tax compliance) can increase / decrease in reaction to potential changes in the considered socioeconomic factors.

Data requirements

The key advantage of this approach is that it does not require a lot of non-publicly available information. Main inputs to the method include various monetary, macroeconomic and institutional indicators that can be found in open-access datasets. In addition, it is useful to collect information on the statistical office's estimates of the shadow (non-observed) economy already included in GDP and unregistered employment, data on collected taxes (especially VAT and taxes on entrepreneurial income) as well as electronic payments system.

3.7.2 VAT gap: MIMIC model

Potential outcomes

The Multiple Indicators Multiple Causes (MIMIC) model can be used to create an index measuring the extent of the VAT gap prevalence among the different sectors of the Bulgarian economy. A higher value of the index would indicate a larger difference between the value of VAT tax that should be collected and the value of the actual VAT collection due to the shadow economy, frauds, or other factors (e.g., bankruptcies) when compared to other sectors.

The MIMIC VAT gap index can be recalculated to the nominal VAT gap values on the basis of an external aggregate VAT gap estimate, e.g., provided by the European Commission[320], with a particular focus on the compliance gap, i.e., the part related to illegal actions focused on the evasion of the VAT. This would allow identification of the sectors on which the NRA should focus on in order to combat VAT evasion and frauds.

Main idea and background

The MIMIC model is one of the most popular tools used to estimate the shadow economy for a panel set of countries. Initial studies that applied the MIMIC model to evaluate shadow economy include Frey and Weck (1983[321]) and Frey and Weck-Hannemann (1984[322]), which has been greatly popularized in multiple works of Giles

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[320] European Commission (2022). VAT gap in the EU. Report 2022.
[321] Frey, B. S., Weck, H. (1983). Estimating the shadow economy: A 'naive' approach. Oxford Economic Papers, 35(1), 23–44.
[322] Frey, B. S., Weck-Hannemann, H. (1984). The hidden economy as an 'unobserved' variable. European Economic Review, 26(1–2), 33–53.

(1999[323]), and Schneider (2005[324], 2007[325]), Schneider et al. (2010[326]), Schneider (2016[327]). Although the application of the MIMIC model is often criticized due to some controversial assumptions, a more recent study of Dybka et al. (2019[328]), proposed solutions to many identified weaknesses of the MIMIC model using the hybrid CDA-MIMIC approach.

In our approach we intend to use the concepts from Dybka et al. (2019[329]), to develop a sectoral MIMIC model in the context of the VAT gap. Such a model requires two types of data: (1) causes, which affect the level of VAT gap and (2) consequences (indicators), which are influenced by the VAT gap. To our knowledge, such an approach has not been used in the economic literature yet (likely due to the lack of publicly available data on the sectoral VAT revenues that are required to construct the consequences variables). Moreover, we propose to focus on the decomposition of the sectoral structure of the VAT gap (i.e., what is the percentage share of the total VAT gap generated in each sector) instead of measuring the nominal value of the VAT gap in each sector. This way, we will require less additional assumptions in the process of calibration of the MIMIC model index.

For sectoral analysis of the VAT gap, one can also use the IMF Fiscal Affairs Department's Revenue Administration Gap Analysis Program (RA-GAP) as described by Hutton (2017)[330]. Yet, obtaining correct sectoral estimates of the VAT gap with this approach requires access not only to the detailed NRA VAT data but also detailed national accounts information. Crucially, it is based on the assumption that national accounts accurately reflect the scale of the true economic activity in the analysed sectors. Yet, such an assumption is least likely to hold for the sectors where the VAT gap is high (e.g., due to the high shadow economy and problems of estimating the scale of economic activity in such sectors). In this context, less direct methods like the MIMIC approach could be preferred.

Details of the approach

In the MIMIC framework there are two types of sectoral variables related to the analysed phenomenon (see Figure 9). The first category includes the causes, which affect the level of the VAT gap such as:

► Prevalence of micro- and small enterprises. Those types of enterprises are more likely to be active in the shadow economy that leads to losses of VAT (and other taxes).

[323] Giles, D. E. (1999). Measuring the hidden economy: Implications for econometric modelling. The Economic Journal, 109, F370–F380; Giles, D. E. (1999). Modelling the hidden economy and the tax-gap in New Zealand. Empirical Economics, 24, 621–640.
[324] Schneider, F. (2005). Shadow economies around the world: What do we really know? European Journal of Political Economy, 21, 598–642.
[325] Schneider, F. (2007). Shadow economies and corruption all over the world: New estimates for 145 countries. Economics: The Open-Access, Open-Assessment E-Journal, 1, 1–66.
[326] Schneider, F., Buehn, A., Montenegro, C. E. (2010). Shadow economies all over the world. New estimates for 162 countries from 1999 to 2007. World Bank Policy research working paper.
[327] Schneider, F. (2016). Comment on Feige's paper reflections on the meaning and measurement of unobserved economies: What do we really know about the 'shadow economy'? Journal of Tax Administration, 2(2), 82–92
[328] Dybka, P., Kowalczuk, M., Olesiński, B., Torój, A., Rozkrut, M. (2019). Currency demand and MIMIC models: Towards a structured hybrid method of measuring the shadow economy. International Tax and Public Finance, 26(1), 4–40.
[329] Ibid.
[330] Hutton, E. (2017), The Revenue Administration–Gap Analysis Program: Model and Methodology for Value-Added Tax Gap Estimation, IMF Technical Notes and Manuals No. 2017/004.

► The share of self-employed and contributing family workers in the overall number of employed in a given sector. Self-employed are more likely to gain from activity in the shadow economy that leads to losses of VAT (and other taxes).

► The share of the private sector in gross value added generated in the sector. In general, one can expect that publicly-owned companies would not engage in deliberate actions to evade taxes.

► Efficiency indices (e.g. gross value added per worker) of the sector. Sectors with lower productivity might be more willing to engage in shadow economy activities or tax evasion.

► Tax morale observed in the sector. Such information can be obtained from the surveys conducted among the enterprises.

► Other control variables that take into account different factors that affect the collection of VAT on the sector and overall [331]economy level.

The second category includes consequences, which are variables affected by the prevalence of the VAT gap such as:

► Value of VAT collected per unit of gross value added.

► Difference between the VAT reported and the VAT collected.

► Difference between the theoretical VAT rate in the sector and the effective VAT rate.

The causes and consequences are linked in the model through a latent (i.e., not directly observable) variable, which in our approach is the VAT gap. It needs to be pointed out that the above list includes only examples of variables that will be considered in the analysis. The final selection of the variables will depend on available data as well as statistical tests and verification of the MIMIC model properties.

Figure 3 – Illustration of the VAT gap MIMIC model structure
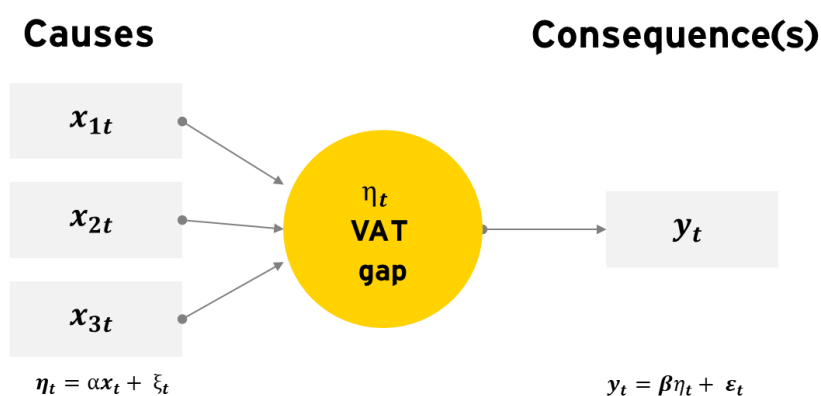
Source: EY elaboration

The goal of the MIMIC model is to estimate two equations. The first equation shows the relation between the observable causes (vector x_t) and the VAT gap (denoted as η_t):

$$\eta_t = \alpha x_t + \xi_t$$

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[331] That includes business cycle variables. Those variables are often available on the whole economy level, so we can use interaction terms (multiplication of two variables) with the sector-specific binary variables to measure the sensitivity of the sector VAT gaps in Bulgaria to the business cycle. The measurement of the impact of business cycle on the VAT gap is conditional on the availability of sufficiently long time series of VAT data.

1. Public information – TLP-WHITE

And the second equation, where the VAT gap is the explanatory variable, shows how the VAT gap affects its observable consequences (y_t):

$$y_t = \beta\eta_t + \varepsilon_t$$

The result of the MIMIC model is an index that shows the deviations from the mean value of the VAT gap in each sector. It has no particular units and is hard to interpret, so, to evaluate the share (%) of total VAT gap generated in each sector, the index requires recalibration. The exact procedure will be determined while working with data for Bulgaria, but it should basically include the following steps:

1. Using the MIMIC model, we obtain an index that shows the deviations of the VAT gap in a given sector from the mean value of the VAT gap.
2. We identify the lowest observed VAT gap index value (negative number) and assume that the VAT gap in that particular sector and in that year was equal to 0. We add the absolute value of the index for that observation to all MIMIC index values of all the remaining sectors to rescale the variable.
3. We multiply the value obtained in step 2 by the gross value added generated in the sector in a given year to obtain a measure of a given sector's contribution to the VAT gap.
4. We divide the value obtained in step 3 for a given sector in a given year by the sum of the values obtained in step 3 for all the sectors in a given year, thus obtaining the share of the analysed sector in the VAT gap in a given year.

Potential challenges to the approach

To our knowledge, the MIMIC model has so far not been used in the economic literature to estimate the VAT gap, which means that this is a novel approach. As a result, there is a risk that the MIMIC model would turn out to be not working properly due to (1) lack of data (especially for the indicators, where external data from the National Revenue Agency are required), (2) problems with estimation stemming from properties of the data (e.g. measurement errors on the sectoral level) or (3) counterintuitive results due to potential endogeneity (resulting from e.g. omitting important, non-measurable factors).

In the case that the MIMIC approach would prove to be unsuccessful, we will use a simplified approach, where we would construct an index of VAT gap (and/or shadow economy) prevalence across sectors. To construct the index, we will identify the key determinants of the VAT gap on the basis of literature review. Next, we will present the level of VAT gap determinants in each sector and construct a common index that would allow identification of sectors where the VAT gap should be most prevalent.

Data requirements

The MIMIC model would rely on a selection of sector-level economic variables from publicly available sources (see the examples described above) and some additional data that need to be delivered by the National Revenue Agency:

1. Reported VAT revenues in each sector
2. Collected VAT revenues in each sector
3. Results of the enterprise survey conducted by the NRA among the enterprises, with sectoral breakdown of the answers to the questions regarding tax morale (while without the data from the enterprise survey we can still estimate the MIMIC model, it would be difficult to include sectoral measures of tax morale in the framework, thereby making our results less reliable).

The data should be provided for detailed sectors (the more detailed the better) and the longest available period. In addition to this, a summary of the key regulatory changes to the VAT law each year (especially changes in rates, exemptions etc.) will be collected and support the analysis.

3.7.3 Unregistered income and the PIT gap: traces-of-true-income approach

Potential outcomes

Traces-of-true-income approach is a frequently used method for estimating the extent of income underreporting among households or individuals and related PIT gap. This method is based on econometric modeling of micro data and therefore it allows for identification of socio-demographic characteristics of taxpayers – such as sex, age, level of education and sector of employment – that can be associated with lower tax-compliance. Potential outcome from this analysis is the assessment of the share of unreported income of households broken down into different socio-demographic groups. By adopting a few additional assumptions, we can estimate the scale of lost budget revenues from personal income tax and social security contributions at the level of the entire country. Depending on the scope of the analysis and available data, we can be able to draw some conclusions on the impact of macroeconomic situation on the scale of tax compliance.

Main idea and background

Traces-of-true-income approach is an indirect method of measuring tax non-compliance based on discrepancies in expenditure and reported income patterns identified through econometric modelling. Pissarides and Weber (1989[332]) first provided an estimation framework for assessing the scale of underreporting among self-employed in the UK by comparing the relationship between food expenditure and income of the self-employed to that of the employees who were assumed to be fully compliant. The authors assumed that how much someone spends on food is based on their true income and socio-demographic characteristics, but not on whether they work as self-employed or employees. In addition, the opportunity to hide income was considered to be much greater for self-employed than employees. Therefore, if food expenditure was higher for self-employed than for employees for a given level of income, this would indicate underreporting of income by self-employed. Using the results from 1982 Family Expenditure Survey, the authors estimated that the average true self-employed income in the UK was 1.55 times as much as what was reported.

Traces-of-true-income approach is now well-established in the literature and several changes to the original framework have been tested, including:

► **Using data on reported income from tax returns instead of surveys.** Feldman and Slemrod (2007[333]) conducted the analysis for the US relying solely on unaudited tax returns data by using charitable contributions reported for tax purposes as an expenditure variable. However, the assumption that charity expenditure does not depend on the employment status is considered by the authors to be stronger than the respective assumption about food. Tax returns data directly matched with household budget survey data were used by Paulus

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[332] Pissarides, C. A., & Weber, G. (1989). An expenditure-based estimate of Britain's black economy. Journal of public economics, 39(1), 17-32.
[333] Feldman, N. E., & Slemrod, J. (2007). Estimating tax noncompliance with evidence from unaudited tax returns. The Economic Journal, 117(518), 327-352.

(2015[334]) in the case of Estonia and by Cabral, Gemmell and Alinaghi (2021[335]) in the case of New Zealand. Thanks to matching two data sources, the authors could use the most reliable source of reported income data while having access to a wide set of expenditure variables which are considered to be fairly well reported in surveys. The former study even provided the comparison of the results under different measures of income. The estimated level of underreporting by self-employed turned out to be about two times lower when using income estimates from surveys instead of tax returns. Therefore, measurement error typical for survey income estimates and associated attenuation bias may lead to significant underestimation of the level of noncompliance.

► **Using public sector employees instead of all employees as a reference group less prone to tax evasion.**

The assumption that all employees honestly report their income is considered untenable in some countries where employees have strong incentives and many opportunities to hide their income (e.g., by so-called envelope wages). If this is the case, comparing income and expenditure patterns of self-employed to those of employees would lead to underestimated or insignificant results. Instead, some authors (see Ekici and Besim, 2014[336], in the case of North Cyprus), decided to treat public sector employees as a reference group and estimate the level of income underreporting and tax evasion for self-employed as well as private sector employees.

► **Using other expenditure categories than food as a "trace of true income".** Food expenditure is the baseline option; however, other expenditure categories can be considered in the case of lack of data (this was the reason for using charity contributions in the 2007 study by Feldman and Slemrod[337] and for using spending on utilities in the 2015 study by Paulus[338]). Other expenditure categories are also used for the purposes of sensitivity analysis.

A comparative study by Kukk, Paulus and Staehr (2020[339]) was the first in which the method was used for a large number of countries (14 EU countries including Bulgaria) using common specification of the model and harmonized microdata (2010 wave of the EU Household Budget Survey). The results indicated that the level of underreporting of income by self-employed varies between those countries from under 10% to over 40% of declared income and that those differences are not associated with the level of countries' development. One of the potential reasons for relatively low estimates for Southern European countries (including Bulgaria) – as explained by the authors – was using all employees as a reference group while in the case of those countries private sector employees may be to a larger extent engaged in tax evasion. Therefore, it is worth testing whether they should be excluded from the reference group.

Details of the approach

Based on the literature review, the preferable approach to traces-of-true-income analysis for Bulgaria would be to use expenditure and socio-demographic data from Household Budget Survey directly matched to income data from tax records. In

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[334] Paulus, A. (2015). Income underreporting based on income expenditure gaps: Survey vs tax records (No. 2015-15). ISER Working Paper Series.

[335] Cabral, A. C. G., Gemmell, N., & Alinaghi, N. (2021). Are survey-based self-employment income underreporting estimates biased? New evidence from matched register and survey data. International Tax and Public Finance, 28(2), 284-322.

[336] Ekici, T., & Besim, M. (2016). A measure of the shadow economy in a small economy: Evidence from household-level expenditure patterns. Review of Income and Wealth, 62(1), 145-160.

[337] Feldman, N. E., & Slemrod, J. (2007). Ibid.

[338] Paulus, A. (2015). Ibid

[339] Kukk, M., Paulus, A., & Staehr, K. (2020). Cheating in Europe: underreporting of self-employment income in comparative perspective. International Tax and Public Finance, 27(2), 363-390.

addition, public sector employees should be used as a reference group, while the estimation of the level of underreporting may be done for self-employed and private sector employees. Therefore, we would assume that public sector workers honestly declare their income while others can evade. Consequently, unobservable true income (Y_i^{True}) of households in those groups can be represented by the following equation:

$$Y_i^{True} = \begin{cases} k_i Y_i^{registered} & if\ self-employed\ or\ private\ sector\ employee \\ Y_i^{registered} & if\ public\ sector\ worker \end{cases}$$

where k_i is the scaling factor resulting from underreporting.

The modeling framework proposed in Pissarides and Weber (1989[340]) consists in estimating a food consumption function (Engel curve) in the form:

$$\log(C_i) = \beta \log(Y_i'^{registered}) + \gamma PSW_i + X_i \alpha + \epsilon_i$$

where:

C_i - food expenditure of household i

$Y_i'^{registered}$ - instrumented registered income of household i. Using instrumental variable approach was included in Pissarides and Weber estimation framework to address the problem of endogeneity of the income variable.

β – the elasticity of food consumption with respect to income

PSW_i – a dummy variable indicating a household with private sector worker (self-employed and/or private sector employee)

γ – parameter identifying additional expenses on food of households with private sector worker above those resulting from their registered level of income

$X_i \alpha$ - control variables and their corresponding parameters

ϵ_i - white noise error term

Based on the values of estimated parameters, one can calculate the average scaling factor $\bar{k}$ and the average income gap (the share of unreported income) $\overline{IG}$:

$$\bar{k} = \exp(\frac{\gamma}{\beta})$$

$$\overline{IG} = 1 - \frac{1}{\bar{k}}$$

The results could be biased due to the fact that income from self-employment is more volatile than the income from employment. To take that into account, it is common to calculate the lower and upper bound of the average income gap. It can be done based on the variances of the residuals from the first-stage income equation within instrumental variable framework (see Pissarides and Weber, 1989[341]).

Income gap $\overline{IG}$ calculated from the presented micro-econometric model combined with country-level information on the average reported income of self-employed and private

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[340] Pissarides, C. A., & Weber, G. (1989). Ibid.
[341] Pissarides, C. A., & Weber, G. (1989). Ibid.

sector employees, the population of respective groups of taxpayers and tax rates can then serve to estimate the value of unreported income on the country level as well as the resulting PIT gap and unpaid social security contributions.

The study can be extended with an analysis of factors that increase the risk of non-compliance. First, the analysis can be conducted separately for self-employed and private sector employees (in both cases we would use public sector employees as a reference group).

Second, in order to identify socio-demographic groups that are more prone to personal income tax evasion, one can interact private sector worker dummy variable (PSW_i) with the characteristics of household members. For example, in the UK study of Cabral, Kotsogiannis and Myles (2019[342]), PSW_i was interacted with each category n of characteristic N (sex, age group and region) in order to estimate the average income gaps $\overline{IG}_n$ separately for each of those socio-demographic groups. The consumption function was extended as follows:

$$\log(C_i) = \beta \log(Y_i'^{registered}) + \gamma_n PSW_i * N_n + X_i \alpha + \epsilon_i$$

Finally, with an access to a long dataset (15-20 years), one can estimate a panel model where private sector workers dummy variable (PSW_i) is interacted with time-varying variables depicting the macroeconomic situation ($Macro_t$):

$$\log(C_{i,t}) = \beta \log(Y_{i,t}'^{registered}) + \gamma_t PSW_{i,t} * Macro_t + X_{i,t} \alpha + \epsilon_{i,t}$$

However, as such large datasets are not usually available, we have not found an example of such an analysis in the literature.

Data requirements

The minimum requirement for using traces-of-true-income approach is the access to individual (household-level) data from a single (preferably most up to date) wave of a household budget survey (HBS). However, if it is possible to directly match the HBS respondents to their administrative tax records, for all available waves of HBS, it would be the best possible data set for this kind of study. In this case, we would use expenditure and socio-demographic variables from the HBS and reported income variables from the tax register. The match should be performed for all members of a given household in Household Budget Survey and should include their after-tax (net) income, personal income tax paid and social security contributions paid. In addition, information on the average income and population of different groups of taxpayers as well as their tax rates is crucial to estimate the PIT gap, hidden income and unpaid social security contribution at the country level.

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[342] Cabral, A. C. G., Kotsogiannis, C., & Myles, G. (2019). Self-Employment Income Gap in Great Britain: How Much and Who?. *CESifo Economic Studies*, *65*(1), 84-107.

1.   Public information – TLP-WHITE