Theoretical and Applied Economics
Volume XXXIII (2026), No. 1(646), Spring, pp. 63-76

The hidden side of VAT: modeling compliance and inferring collection shortfalls in Romania

Mihai-Daniel GAVRILA
Bucharest University of Economic Studies, Romania
gavrilamihai17@stud.ase.ro

Abstract. *This study examines hidden weaknesses in VAT collection by constructing a transparent benchmark for Romania's VAT performance and inferring a model based shortfall when observed revenues fall below levels consistent with macro and policy fundamentals. Using annual data for 2000 to 2023, VAT revenue and household consumption (as percent of GDP) are taken from Eurostat, while unemployment and internet use are drawn from the World Bank to capture cyclical conditions and broad digital diffusion. The analysis links changes in VAT performance to the standard rate regime, the post EU institutional environment, and the 2009 to 2010 crisis period, while controlling for macro structural variation. Predicted VAT outcomes are translated into an implied shortfall proxy and used to identify years of unusually weak performance relative to the benchmark. The results indicate that Romania's shortfall signal is episodic rather than persistent, with the largest implied under collection concentrated in a small set of early years. The average inferred shortfall is about 0.160 percentage points of GDP per year, with a maximum of about 0.752 points in 2004, while 2001 and 2004 emerge as unusually weak performance years. A simple predictive check over 2016 to 2023 suggests higher errors in later years, consistent with structural change. The findings complement official VAT gap assessments by offering a single country time series benchmark suitable for diagnostics and policy discussion.*

Keywords: value added tax gap, tax compliance, electronic invoicing, shadow economy, fiscal administration, econometric benchmarking.

JEL Classification: H20, H21, H26.

Introduction

Value-added tax has remained the most critical revenue pillar in modern tax systems, which does not generally deliver the performance that statutory rates and underlying consumption might suggest. "C inefficiency" has, for a long time, been persistent in the European Union due to a combination of policy design choices and limitations on enforcement together with noncompliance which weakens the base-to-receipts relationship (Keen & Lockwood, 2010; Cnossen, 2022; Hasíková, 2024). Romania perfectly fits into this analysis since there have been changes in VAT rates accompanied by perennial complaints about the outcome of its collection, thus providing an excellent ground for analyzing how fundamentals translate into observed revenues and identifying where systematic shortfalls may arise (Badiu et al., 2024).

The VAT has naturally attracted sustained research interest because, while it is meant to be partially self-enforced through invoice chains and built in cross reporting, it can be vulnerable to evasion and fraud if verification breaks down. The classic compliance model frames evasion as a choice under audit risk and penalties. This baseline helps to suggest how incentives might work in shaping the reporting behavior of individuals (Allingham & Sandmo, 1972). In VAT environments, third-party information is contained within the paper trail; in practice, materializes by raising the probability that underreporting will be detected; indeed, there is empirical work which documents this mechanism on the subject of enforcement and reporting incentives (Pomeranz 2015; Buettner & Tassi 2023).

A major empirical challenge is, of course, measurement since one does not observe compliance and "VAT gaps" are typically inferred rather than recorded. An approach widely adopted in the literature uses VAT efficiency type constructs comparing actual VAT to some benchmark based on consumption and then allowing for shifts due to institutional quality, openness, and policy regimes over time (Aizenman & Jinjarak, 2008; Cnossen, 2022). Reduced rates, exemptions, and regime complexity also have room to erode the tax's ability to convert its potential into collections. Recent evidence from Europe underscores this point suggesting that the efficiency is a function of both the architecture in place and administrative capacity (Dytrychová et al., 2024; Hasíková, 2024).

Digitalization is increasingly seen as a realistic avenue for narrowing compliance gaps by enhancing traceability and reducing monitoring costs. Effects depend on how technologies are integrated into enforcement. Studies using European cross-country evidence indicate that more traceable payment ecosystems are associated with better VAT performance, consistent with reduced scope for sales suppression (Madzharova, 2020). At the same time, quasi experimental evaluations of electronic invoicing reforms provide direct evidence that transaction level reporting can raise compliance and revenues as well as change the strategic environment for firms and auditors (Bellon et al., 2022; Kotsogiannis et al., 2025).

It redirects attention away from descriptive VAT gap estimates toward "fundamentals consistent" VAT performance inferred via a model in a single country time series context. A new log VAT efficiency equation is estimated as a function of policy conditions and

macro structural correlates, then implied level of VAT is reconstructed from which shortfall proxy, defined whenever predicted VAT exceeds observed VAT, can be derived. This fits with wider perspectives that see the joint product of design, enforcement, and economic structure in determining outcomes and connects naturally to evidence that administrative modernization and digital reporting may affect fraud and cross border inconsistency (Mascagni et al., 2023; Heinemann & Stiller, 2024).

Literature review

Romania's VAT shortfall is mostly discussed from the perspective of the VAT Gap, which is the difference between theoretical VAT liability and actual VAT receipts, benchmarked comparatively across EU member states. It is in this respect that Romania is highlighted among higher gap countries in the Commission backed harmonized monitoring framework providing annual estimates and country specific diagnostics. This evidence base sets the empirical background for Romania's persistent compliance challenge, but it also serves to underline how measurement choices and national accounts inputs matter for cross country comparability (European Commission, 2023; Poniatowski et al., 2019). The same framework has since evolved into a recurrent policy instrument linking revenue losses to enforcement capacity and macro conditions, thereby reinforcing why a model-based approach that translates "fundamentals consistent" performance into an implied shortfall can be analytically useful (European Commission, 2025).

Another stream of work moves from levels to drivers i.e. what are the institutional and structural factors due to which some countries, such as Romania underperform on VAT collection against their potential. The EU wide VAT Gap study lays emphasized correlates such as governance quality, macro volatility, and enforcement effectiveness when interpreting persistent deviations from expected VAT liabilities (European Commission, 2018). Reinforcing this are regional empirics for Central and Eastern Europe which relate the VAT Gap to institutional frictions in terms of corruption and socio-economic vulnerability i.e. compliance is also determined by state capacity as well as the incentives of households and firms.

For Romania, specifically, the VAT compliance discussion fits within a broader literature on the shadow economy and tax evasion where underreporting and informality are seen as systemic features rather than temporary shocks. Using macro-based approaches, evidence shows that Romania's shadow economy dynamics can materially affect tax bases and observed revenue performance, implying that VAT under collection may reflect both enforcement gaps and wider informality constraints (Dell'Anno & Davidescu, 2019). Related EU oriented contributions explicitly treat the VAT Gap as a channel through which underground activity and reporting distortions propagate into weaker fiscal outcomes, reinforcing the relevance of efficiency type metrics that relate VAT revenues to consumption-based tax bases (Florin, 2017).

A more targeted Romania oriented empirical line studies how VAT under collection translates into general tax capacity and how revenue performance co moves with the structure of the economy. Recent work on Romania links VAT Gap movements to tax revenue outcomes and explores how institutional weaknesses and macro pressures can amplify collection slippages over time, supporting the view that persistent gaps are not merely cyclical noise (Guiu, 2024). In parallel, Romania focused analyses of the relationship between fiscal revenues and tax bases stress that revenue effort can diverge from base dynamics, which is consistent with interpreting deviations as compliance or administration related, not purely economic (Ogneru & Panait, 2020).

On the policy and administration side, Romania's modernization agenda has been examined through concrete compliance technologies, especially the roll out of electronic fiscal devices and related reporting infrastructure. Evidence from Romania argues that electronic fiscal devices can strengthen transaction recording and reduce the informational opacity that facilitates VAT evasion, with expected spillovers to tax discipline and the credibility of enforcement (Bostan et al., 2017).

More recent contributions have shifted the focus onto digital reporting systems and e-invoicing as mechanisms capable of reshaping VAT compliance through tightening the invoice trail with an opportunity for immediate risk-based verification. RO e Factura of Romania has been referred to both at a conceptual and institutional level in terms of broader digitization of business-to-state interactions, which also has links to certain aspects of SAF-T style data structures and compliance automation. There is, therefore, empirical survey evidence from Romania that will assist in understanding how accounting professionals perceive mandatory e-invoicing regarding its operational and compliance implications—evidence on what is expected to gain but also implementation frictions that may condition real-world effects. The complementary Romania-focused discussion frames such digital instruments in their entirety as a package of compliance levers wherein the effect significantly varies with the adoption readiness, the administrative capacity, and how well-integrated data is into enforcement workflows.

Internationally, the VAT literature provides two channels to mechanisms that may help interpret why digital tools can matter: third party information and invoice trail enforcement. Most evidence demonstrates how increasing the report set weakens collusive underreporting by strengthening receipt verification- but not net revenues as reported sales. This is valuable because extending the information set does indeed weaken collusive underreporting (Naritomi, 2019). Related experimental work finds that credible enforcement messages with third-party transaction references bring non-filing registered firms back into compliance-increasing payments and reported transactions all directly relevant for systems reliant on cross reporting like VAT-increasing payments and reported transactions (Brockmeyer et al., 2019). However, firms are also found to be responding similarly by overreporting on some other margin like costs; hence caution moves misreporting rather than eliminates it Carrillo et al. (2017).

Prior research has clarified how VAT gaps are measured and which macro institutional factors correlate with under collection, while Romania focused work has documented the role of informality and the promise of compliance technologies. Much of the evidence either relies on externally produced VAT Gap estimates or on broad revenue capacity frameworks. There are fewer studies building a compact, transparent econometric proxy that maps Romanian VAT performance to policy and macro fundamentals and then converts model implied efficiency into an interpretable shortfall series. This therefore motivates a time series-oriented approach that sits between VAT Gap accounting exercises and generic tax effort models, and that explicitly flags abnormal under performance episodes in a small sample setting (Hoza & Żabka, 2021; Le et al., 2008; Sen Gupta, 2007).

Methodology

This study uses annual data for Romania over 2000–2023, compiled from Eurostat (VAT revenue and household final consumption expenditure as % of GDP) and the World Bank database (internet users as a digitalization proxy and unemployment as % of population). The objective is to build an econometric proxy for VAT compliance/collection shortfall by linking VAT performance to policy and macro fundamentals in a small-sample setting.

The research question is: How do VAT policy conditions and macro-structural factors shape Romania's VAT collection efficiency over time, and what model-implied shortfall can be inferred when observed VAT revenue falls below fundamentals-consistent levels? To address this, we define VAT efficiency and model its log form:

$$\mathrm{VE_t} = \frac{\mathrm{VAT_t}}{\mathrm{CONS_t}}, \ln\mathrm{VE_t} = \ln(\mathrm{VE_t})$$

where $\mathrm{VAT_t}$ is "Value added taxes" as % of GDP and $\mathrm{CONS_t}$ is household final consumption expenditure as % of GDP.

We test a compact set of hypotheses consistent with the model structure:

- H1 (policy): changes in the standard VAT rate affect efficiency ($\beta_{\mathrm{rate}} \neq 0$)
- H2 (cycle/compliance): unemployment is associated with efficiency ($\beta_{\mathrm{unemp}} \neq 0$)
- H3 (digitalization): internet adoption improves efficiency ($\beta_{\mathrm{net}} > 0$)
- H4 (institutional/regime): the post-EU period is associated with higher efficiency ($\beta_{\mathrm{EU}} > 0$)
- H5 (shock): the 2009–2010 crisis period reduces efficiency ($\beta_{\mathrm{crisis}} < 0$)

The empirical approach estimates a parsimonious candidate set suitable for annual data and limited degrees of freedom: (i) a static specification, (ii) an ARDL(1) specification including $\ln\mathrm{VE_{t-1}}$ and (iii) ARDL(1) with a deterministic trend. The preferred specification is selected via the small-sample corrected information criterion:

$$\mathrm{AICc} = \mathrm{AIC} + \frac{2\mathrm{k}(\mathrm{k}+1)}{\mathrm{n}-\mathrm{k}-1}$$

For statistical inference, coefficients are reported with Newey-West robust standard errors (annual; lag fixed at 2). As a robustness check to serial correlation, we also estimate GLS with AR(1) errors:

$$\mathrm{u_t} = \rho \mathrm{u_{t-1}} + \eta_t, |\rho| < 1$$

The baseline regression links efficiency to policy and controls:

$$\ln \mathrm{VE_t} = \alpha + \beta_{\mathrm{rate}} \ln(\mathrm{rate_t}) + \beta_{\mathrm{unemp}} \mathrm{unemp_t} + \beta_{\mathrm{net}} \mathrm{net_t} + \beta_{\mathrm{trend}} \mathrm{trend_t} +$$

$$+ \beta_{\mathrm{crisis}} \mathrm{crisis_t} + \beta_{\mathrm{EU}} \mathrm{postEU_t} + \varepsilon_t$$

where $\mathrm{rate_t}$ is the standard VAT rate (annualized for the mid-2010 change), $\mathrm{postEU_t}$ is a post-2007 dummy and $\mathrm{crisis_t}$ flags 2009-2010. Variables are harmonized and checked to ensure positivity for log transformations.

To obtain a shortfall proxy, fitted $\ln \mathrm{VE_t}$ values are retransformed using a smearing correction to reduce log-bias:

$$\mathrm{VE_t} = \exp(\ln \mathrm{VE_t}) \cdot \left(\widehat{\frac{1}{\mathrm{n}} \sum_{\mathrm{t}} \exp(\hat{\varepsilon}_t)} \right), \ \mathrm{VAT_t} = \widehat{\mathrm{VE_t}} \cdot \mathrm{CONS_t}$$

We define the model-based gap and shortfall proxy as:

$$\mathrm{gap_t} = \widehat{\mathrm{VAT_t}} - \mathrm{VAT_t}, \ \ \mathrm{loss_t} = \max(\mathrm{gap_t}, 0)$$

Also, unusually weak performance is flagged via standardized log-residuals $\mathrm{z_t} = \hat{\varepsilon}_t / \mathrm{sd}(\hat{\varepsilon})$ using $z_t < -1.5$ and ($z_t < -2$ as a stricter robustness threshold), and predictive credibility is summarized using an expanding-window pseudo out-of-sample evaluation (train/test split such as 2001-2015 vs. 2016-2023), reporting RMSE/MAE.

Results and discussions

The empirical results turn the notion of "fundamentals consistent" VAT performance into a compact set of estimates that can be read both statistically and institutionally. At the core is VAT efficiency, defined as VAT revenue relating to household consumption. The question asked by the analysis is whether policy regimes and macro structural conditions explain systematic movements in this ratio, and what benchmark fitted implies periods of under collection when observed VAT falls below predicted levels.

Table 1. *Model selection using AICc*

Candidate model	AICc	ΔAICc
static	-45.75	0.00
dyn	-43.73	2.02
dyn_trend	-41.25	4.50

Source: Authors' processing using RStudio

The model favors the most parsimonious specification once a small sample penalty is imposed, to help guard against overfitting in annual data with such limited degrees of freedom. According to AICc ranking, the static model beats the two dynamic alternatives because the ARDL(1) versions offer only modest improvement in fit relative to their added complexity - as reflected by higher corrected information criteria as sown in Table 1. In substantive terms, this means that persistence in ln(VE) does not have enough incremental explanatory power given the sample length to outperform a level specification that already includes policy, macro controls, and regime dummies.

Table 2. *Main regression results for ln(VE), robust inference and robustness check*

Variable	OLS with Newey West SE (lag 2)	GLS with AR(1) errors
Constant	-1.777** (0.457)	-2.037*** (0.476)
ln(Standard VAT rate)	0.528** (0.180)	0.427 (0.204)
Unemployment	0.054* (0.022)	0.067** (0.023)
Internet users	0.013 (0.011)	0.016 (0.008)
Time trend	-0.050 (0.045)	-0.063 (0.033)
Crisis 2009–2010	-0.126* (0.049)	-0.145* (0.051)
Post EU (>=2007)	0.127* (0.057)	0.159* (0.059)

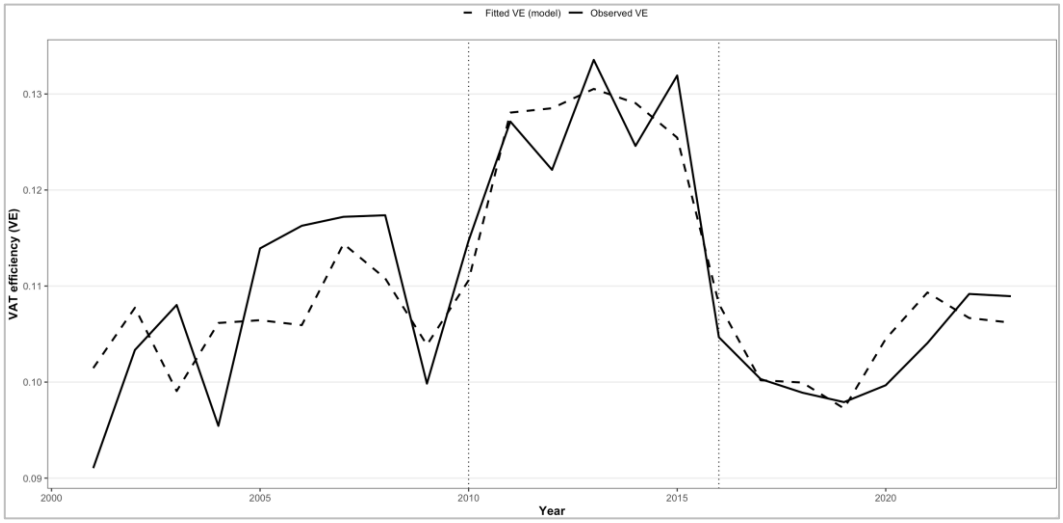
Notes: Dependent variable is ln(VE), where VE = VAT/CONS. Significance: *** p<0.001, ** p<0.01, * p<0.05, p<0.10.
Source: Authors' processing using RStudio

The chosen specification delivers patterns of coefficients that can be interpreted under the robust inference. Since the log standard VAT rate comes out with a positive coefficient, this means higher statutory rates correlate with net measured efficiency (conditional on controls) and is consistent with the notion that policy shifts can change the effective conversion of consumption into VAT receipts through enforcement intensity, base interactions, or compositional effects in taxable consumption. The crisis dummy comes out negative and statistically meaningful-consistent with deteriorated collection performance during 2009 and 2010 when economic disruption and compliance stress can weaken remittance, while post EU dummy is positive-consistent with improved compliance environment after institutional alignment and administrative reforms. Unemployment comes in with a positive sign, which could mean reduced scope for certain forms of evasion during downturn conditions or as a compositional mechanism on the consumption base. Care should be taken in the interpretation since this could also be picking up broader cyclical shifts. On the other hand, the digitalization proxy and deterministic trend do not even come close to being significant in the preferred model-in other words, there is little identifiable variation in this small sample once policy and regime controls have been included. The main sign pattern is preserved under GLS with AR(1) errors; also, regime effects and crisis effects remain aligned with baseline support stability to alternative error structures, as shown in Table 2.

Observed and fitted VAT efficiency series show a close co-movement for much of the sample with notable divergences concentrated in the early years where efficiency drops below the model implied benchmark. The vertical markers around the 2010 rate increase and the 2016 rate cut visually separate distinct policy regimes and already fitted path

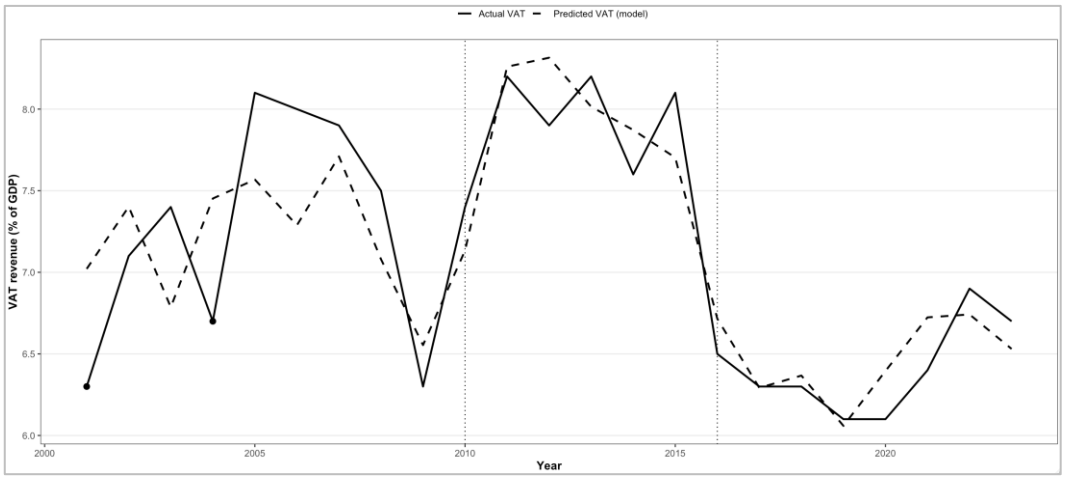
suggesting that the efficiency level is higher in the early 2010s than in post 2016 period even after controlling for unemployment and digital proxy. This is also consistent with a regime view in which policy and institutional environments shape how effectively over time does the VAT system convert consumption into revenue (see Fig. 1).

Figure 1. *VAT efficiency (VE) observed versus fitted values, with VAT rate regime markers (2010, 2016)*



When mapping the fitted efficiency back into predicted VAT revenues, the actual and predicted series broadly track each other but with periods where the model implies a wedge between fundamentals-consistent VAT and observed VAT. In the mid-2000s the observed series often meets or exceeds the predicted benchmark while later periods show episodes where the predicted series lies above the realized one-consistent with inferred underperformance relative to the modeled benchmark.

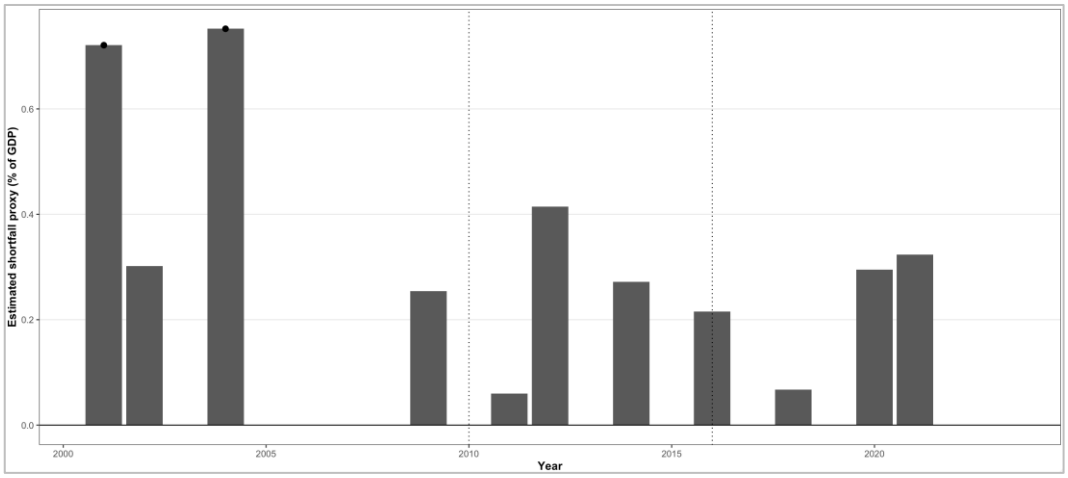
Figure 2. *Actual versus model implied VAT revenue, with flagged negative ln(VE) deviations (z < -1.5)*



The highlighted points marking strong negative deviations identify years where ln(VE) under shoots its fitted value by a large standardized margin-supporting interpretation of those observations as unusually weak efficiency outcomes rather than minor noise around the fit as shown in Fig. 2.

The shortfall proxy focuses only on the positive part of the wedge, that is when predicted VAT is above observed VAT, thereby yielding a time varying measure of model implied under collection in percentage points of GDP. It is not uniformly distributed but rather quite episodic with big surges at the beginning of the sample and later periods of shortfalls which are smaller but noticeable, including around major macro disruptions where collection lags what fundamentals would suggest. That shortfall spikes do occur in years identified as outliers to the negative side does provide some internal consistency since both signals emanate from essentially the same benchmarking logic albeit expressed in different units, log efficiency deviations versus implied revenue gaps, as shown in Fig. 3.

Figure 3. *Model implied VAT collection shortfall proxy, with VAT rate regime markers*



A brief performance summary helps to set the visual narrative into quantitative context and offers one spot for reference of fit, magnitude, or predictability. In the sample, the ln(VE) model explains a largely considerable share of variation, while percentage point terms on reconstructed VAT series bring moderate fit though the average implied shortfall is meaningfully less than its maximum. This means that the proxy is based upon just a few years with much high underperformance and not sustained deficits. Only 2001 and 2004 return screens as efficiency anomalies using this threshold; pseudo out-of-sample tests suggest forecasting error increases further in later periods relative to in-sample fits when small annual models are asked to generalize across such regime shifts and shocks. These metrics collectively reinforce the notion that the proxy should be utilized mainly for benchmarking and diagnostics rather than for high frequency forecasting. They also emphasize that what the inferred shortfall series captures are deviations from a conditional benchmark, not an accounting identity relative to the official VAT gap as shown in Table 3.

Table 3. *Model fit, inferred shortfall, and predictive diagnostics*

Metric	Value
Estimation sample	2001–2023
Observations (n)	23
Selected model (AICc)	static
R-squared	0.7350
Adj. R-squared	0.6357
In sample RMSE, VAT (pp of GDP)	0.3862
In sample MAE, VAT (pp of GDP)	0.3204
Average annual shortfall proxy (pp of GDP)	0.1599
Maximum annual shortfall proxy (pp of GDP)	0.7521 (year 2004)
Cumulative shortfall proxy (pp of GDP-years)	3.6773
Anomaly years (z < -1.5)	2001, 2004
Pseudo out of sample split	2001–2015 train, 2016–2023 test
OOS RMSE (pp of GDP)	0.8262
OOS MAE (pp of GDP)	0.5371
OOS n	8

Source: Authors' processing using RStudio

This evidence argues the framing of VAT performance in Romania better as a discrete regimes sequence, rather than some smooth trend, with policy shifts and macro disruptions converting consumption into VAT receipts. That is to say, the model tells us that statutory conditions and institutional regime markers matter while the shortfall proxy gets concentrated in a small set of pronounced underperformance episodes; hence, weaknesses in compliance do not distribute evenly across time but instead cluster when enforcement capacity, economic stress, or implementation frictions likely interact. However simultaneously this finding should caution against any equation of broad internet adoption with compliance gains because revenue relevant channel is more plausibly tied to targeted administrative systems such as e-invoicing, risk analytics, and transaction level reporting rather than general connectivity. The results are broadly consistent with treating the inferred shortfall as a diagnostic signal that can guide deeper institutional interpretation and policy auditing. It should be noted that it remains a model-based benchmark and must always be read in conjunction with complementary evidence from official VAT gap accounting, administrative reforms, and developments in sector level compliance.

Conclusions

The empirical evidence shows that Romania's VAT efficiency can be significantly benchmarked to a fundamentals consistent path and the shortfall proxy is a case of discrete episodes rather than a uniform one over time. The optimal parsimonious specification, chosen via AICc, accounts for a heavy proportion of the variance in log VAT efficiency, but the reconstructed VAT series suggests moderate in sample error and nontrivial implied under collection. By level of magnitude, the average annual shortfall proxy is approximately 0.160 percentage points of GDP, with its zenith near 0.752 percentage points

of GDP in 2004, indicating that the shortfall signal is induced by a small number of high underperformance years.

With respect to the aforementioned hypotheses, the study's results also lend support to the effect of policy and regime determinants. H1 is supported by the positive and statistically significant relationship between the log standard VAT rate and the log VAT efficiency, indicating that statutory rate regimes are associated with higher modeled efficiencies given controls. H4 is also confirmed, in that, post 2007 the dummy for the regime is positive, indicating better efficiency environment in the post European Union period. H5 is similarly maintained, i.e., with a negative crisis coefficient for 2009 and 2010, which is consistent with the prediction that significant macro disturbances will weaken the extent of performance in collections in comparison with what the fundamentals would require. H2 is supported on the basis that unemployment is statistically correlated with VAT efficiency in the preferred fit model (positive) but requires a cautious view.

Instead of suggesting that increasing unemployment mechanically better predicts higher compliance, our estimate reflects that the composition of consumption and/or reporting activities may be cyclically altered in order to impact on VAT to consumption mapping, or that unemployment is a proxy for macro effects not yet fully reflected in the remaining covariates. The central implication is that macrostructural conditions should be considered part and parcel of VAT efficiency benchmarkings since divergence from forecast performance can be partially explained by cycle-related measures in addition to enforcement and administration. H3 is not satisfied in the present design, as the internet users proxy cannot be statistically validated well in the baseline model and only weakly under the alternative AR(1) error. This would appear to indicate that general digital diffusion is a wrong proxy for enforcement sensitive digitalization, one that can more easily be understood as functionings under dedicated compliance infrastructure (transaction level reporting, e invoicing imperatives, real time cross checks, integrated risk analytics).

More importantly, the outcome supports the distinction between general connectivity and the individual administrative technologies that dictate audit probabilities and detection power. There are several caveats to these conclusions. The analysis draws on an annual small sample, which encourages concision with specification but may not allow for more robust institutional measures, multiple break forms or sectoral decomposition without lowering degrees of freedom. The nominal VAT rate changes would be discrete and rare and mean that to some extent the estimated effect on a rate point-spread captures also the regime at its best, rather than a clean threshold elasticity in marginal rates.

The shortfall series inferred is a model based diagnostic benchmark not an accounting measure of the official VAT gap, and it needs to be considered conditional underperformance compared with the underlying fundamentals rather than a direct estimate of legally due but uncollected liabilities. Identification and policy relevance can be enhanced in future works by employing closer indicators of enforcement, such as timing and coverage of e invoicing, SAF-T style reporting, audit intensity, arrears management or

data integration capacity to test digitalization through compliance closer mechanisms. Extensions to high-frequency data, when available, can increase statistical power and the capacity to make more accurate accounting of regime timing and shock transmission.

In this way, a comparative systematic method between model-based proxy and external VAT gap accounting estimates can reveal where the two methods meet and where signals can coalesce, while other validation designs can enhance predictive credibility in periods characterised by structural change.

Acknowledgements

This paper was co-financed by The Bucharest University of Economic Studies during the PhD program.

References

Aizenman, J., and Jinjarak, Y. (2008). The collection efficiency of the value added tax: Theory and international evidence. *Journal of International Trade & Economic Development, 17*(3), 391–410. <https://doi.org/10.1080/09638190802137059>

Allingham, M.G., and Sandmo, A. (1972). Income tax evasion: A theoretical analysis. *Journal of Public Economics, 1*(3–4), 323–338. <https://doi.org/10.1016/0047-2727(72)90010-2>

Badiu, C.E., Bărbuță Mișu, N., Chirita, M., Soare, I., Zlati, M.L., Fortea, C., and Antohi, V.M. (2024). Modelling the impact of VAT fiscality on branch level performance in the construction industry, Evidence from Romania. *Economies, 12*(2), 30. <https://doi.org/10.3390/economies 12020030>

Bellon, M., Dabla Norris, E., Khalid, S., and Lima, F. (2022). Digitalization to improve tax compliance: Evidence from VAT e invoicing in Peru. *Journal of Public Economics, 210*, 104661. <https://doi.org/10.1016/j.jpubeco.2022.104661>

Bostan, I., Onofrei, M., Popescu, C., and Andrieș, A.M. (2017). Economic and social effects of implementing electronic fiscal devices in Romania. *Amfiteatru Economic, 19*(45).

Brockmeyer, A., Smith, S., Hernandez, M., and Kettle, S. (2019). Casting a wider tax net: Experimental evidence from Costa Rica. *American Economic Journal: Economic Policy, 11*(3), 55–87. <https://doi.org/10.1257/pol.20160589>

Buettner, T., and Tassi, A. (2023). VAT fraud and reverse charge: Empirical evidence from VAT return data. *International Tax and Public Finance, 30*(3), 849–878. <https://doi.org/10.1007/ s10797-023-09776-y>

Butu, I., and Brezeanu, P. (2021). The impact of corruption and poverty on VAT gap in Central and Eastern Europe. In *Proceedings of the International Management Conference* (pp. 354–370).

Carrillo, P., Pomeranz, D., and Singhal, M. (2017). Dodging the taxman: Firm misreporting and limits to tax enforcement. *American Economic Journal: Applied Economics, 9*(2), 144–164. <https://doi.org/10.1257/app.20140495>

Cnossen, S. (2022). The C inefficiency of the EU VAT and what can be done about it. *International Tax and Public Finance, 29*(1), 215–236. <https://doi.org/10.1007/s10797-021-09683-0>

Dell'Anno, R., and Davidescu, A.A. (2019). Estimating shadow economy and tax evasion in Romania. A comparison by different estimation approaches. *Economic Analysis and Policy, 63*, 130–149.

Dytrychová, J., Vlach, J., Huber, P., and Scharinger, K. (2024). European VAT collection under the stress: Best to use few reduced rates. *Journal of Policy Modeling*. Advance online publication. <https://doi.org/10.1016/j.jpolmod.2024.08.002>

European Commission. (2018). *Study and reports on the VAT gap in the EU 28 Member States: 2018 final report*. Directorate General for Taxation and Customs Union.

European Commission. (2023). *VAT gap in the EU: Romania, country report*. Directorate General for Taxation and Customs Union.

European Commission. (2025). *VAT gap in the EU*. Directorate General for Taxation and Customs Union.

Florin, R. (2017). The impact of VAT gap on EU economy. *Review of Economic Studies and Research Virgil Madgearu, 10*(1), 5–26.

Guiu, S. (2024). VAT gap and tax revenue collection: An analysis of Romania. *Journal of Advanced Research in Economics and Administrative Sciences, 5*(4), 1–15.

Haraguè, M., Tamas, I.Z., and Tamas, I. (2024). The implementation of digital instruments on tax compliance in Romania: Efficiency in tax fraud prevention. *Finance, Challenges of the Future, 1*(26), 18–31.

Hasíková, I. (2024). Exploring determinants of VAT gaps using structural equation models: A MIMIC approach. *European Journal of Government and Economics, 13*(2), 189–205. <https://doi.org/10.17979/ejge.2024.13.2.9940>

Heinemann, M., and Stiller, W. (2024). Digitalization and cross border tax fraud: Evidence from electronic invoicing in Italy. *International Tax and Public Finance*. Advance online publication. <https://doi.org/10.1007/s10797-023-09820-x>

Hoza, B., and Żabka, A. (2021). Determinants of the VAT gap. *Zeszyty Naukowe Politechniki Śląskiej. Organizacja i Zarządzanie, 153*, 156–165.

Keen, M., and Lockwood, B. (2010). The value added tax: Its causes and consequences. *Journal of Development Economics, 92*(2), 138–151. <https://doi.org/10.1016/j.jdeveco.2009.01.012>

Kotsogiannis, C., Salvadori, L., Karangwa, F.M., and Murasi, T. (2025). Electronic invoicing, tax audits, and VAT compliance: Evidence from e invoicing in Tanzania. *Journal of Development Economics, 172*, 103403. <https://doi.org/10.1016/j.jdeveco.2024.103403>

Le, T. M., Moreno Dodson, B., and Rojchaichaninthorn, J. (2008). *Expanding taxable capacity and reaching revenue potential: Cross country analysis*. World Bank Policy Research Working Paper.

Madzharova, B. (2020). Traceable payments and VAT design: Effects on VAT performance. *CESifo Economic Studies, 66*(3), 221–247. <https://doi.org/10.1093/cesifo/ifaa003>

Mascagni, G., Dom, R., Santoro, F., and Mukama, D. (2023). The VAT in practice: Equity, enforcement, and complexity. *International Tax and Public Finance, 30*(2), 525–563. <https://doi.org/10.1007/s10797-022-09743-z>

Naritomi, J. (2019). Consumers as tax auditors. *American Economic Review, 109*(9), 3031–3072. <https://doi.org/10.1257/aer.20160658>

Ogneru, A. A., and Panait, I. (2020). Analiza relației dintre veniturile fiscale și bazele de impunere în cazul României. *Studii Financiare, 4*(2), 19–31.

Ogneru, A.A., and Stancu, S. (2022). The impact of the VAT gap on the degree of taxation of an economy. In *Proceedings of the International Conference "Innovative Business Management and Global Entrepreneurship"* (450–454).

Pomeranz, D. (2015). No taxation without information: Deterrence and self enforcement in the value added tax. *American Economic Review, 105*(8), 2539–2569. <https://doi.org/10.1257/aer.20130393>

Poniatowski, G., Bonch Osmolovskiy, M., and Belkindas, M. (2019). *Study and reports on the VAT gap in the EU 28 Member States: 2019 final report*. CASE, Center for Social and Economic Research.

Radu, V., Savu, A.C., and Zhan, X. (2022). Digitization of business relations in Romania by using electronic invoices. *Social Economic Debates, 11*(1), 1–11.

Sen Gupta, A. (2007). Determinants of tax revenue efforts in developing countries. *IMF Working Paper*.

Socoliuc, M. (2024). E invoicing system in the accounting professionals' view: An empirical research. *Studies and Scientific Researches. Economics Edition, 40*. <https://doi.org/10.29358/sceco.v0i40.600>