2025 IRS/TPC Research Conference

Abstracts and Presenter Bios

Session 1: Leveraging Machine Learning to Boost Service and Compliance

AI-Enabled Tax Assistance for Low- and Moderate-Income Taxpayers: An Evaluation of RAG-Based LLMs for VITA Volunteer Support

***Sina Gogani-Khiabani**, Rohan Sai Buddhi, Yogesh Dabral, Saeid Tizpaz-Niari (University of Illinois Chicago); Ashutosh Trivedi (University of Colorado Boulder); Shinping Chyi (Certified Public Accountant)*

The complexity of US tax law presents significant challenges for Volunteer Income Tax Assistance (VITA) volunteers who assist low- and moderate-income taxpayers. This paper investigates the accuracy and reliability of artificial intelligence (AI) systems in helping VITA volunteers prepare tax returns. Leveraging advanced large language models (LLMs), such as GPT-4o, or reasoning models, such as o1, combined with sophisticated prompt engineering and retrieval-augmented generation (RAG) systems, the study explores methods to provide real-time, accurate, and context-aware support. By integrating AI with existing tax preparation software and dynamic knowledge bases, this research evaluates the potential of these systems to enhance the quality, efficiency, and accessibility of tax services for underserved communities.

***Sina Gogani Khiabani** is a PhD student in computer science at the University of Illinois Chicago, where he works on AI-driven techniques that use large language models to automatically generate and validate tax-preparation software. He previously served as a research assistant at the University of Texas at El Paso and now holds the same role at the University of Illinois Chicago.*

Estimating the Corporate Tax Gap: An Unsupervised Learning Approach

*Jonathan Fieman, **Kenneth Tester**, Thomas Schuh (Office of Research, Applied Analytics, and Statistics, Internal Revenue Service)*

Large corporate tax audits are some of the most complex, lengthy, and resource-intensive audits the IRS conducts. For more than a decade, large corporate audits have declined in absolute numbers and in scope and depth. This has made producing accurate and reliable corporate tax gap estimates challenging. This paper introduces a clustering-based approach to estimating the corporate tax gap. The flexibility of this new approach allows us to overcome certain distributional assumptions, incorporate new data streams in the model and produce estimates at a more granular level. This paper will include comparisons of results using both legacy and new methodologies.

***Kenneth Tester** is an economist with the Compliance Modeling Lab within the Office of Research, Applied Analytics, and Statistics at the Internal Revenue Service. He obtained a PhD in economics from the University of Kentucky and previously worked as a postdoctoral research fellow at the Tax Administration Research Centre at the University of Exeter. He has experience working across various tax administration and policy issues, including individual and corporate income taxes, state and local tax policy, and value-added taxes.*

FATCA Turns 10: Dynamic Trends from 10 Years of Third-Party Reporting under the Foreign Accounts Tax Compliance Act

*John Iselin (Congressional Budget Office); Niels Johannesen (University of Copenhagen); John Guyton, Patrick Langetieg (Office of Research, Applied Analytics, and Statistics, Internal Revenue Service); Max Risch (Carnegie Mellon University); **Daniel Reck** (University of Maryland); Joel Slemrod (University of Michigan)*

The Foreign Accounts Tax Compliance Act became law in 2010, and the first information reporting by foreign financial institutions began in 2015. We review what we have learned from FATCA reporting and provide an updated summary of offshore wealth reported under FATCA, including dynamic trends in overall wealth, data

quality (including reporting of US Taxpayer Identification Numbers), and ownership structures. We review the associated dynamics of self-reporting of income and offshore wealth over this period, including aggregate trends in the reported income of individuals and partnerships identified as owners of offshore wealth in FATCA records and self-reported wealth on Foreign Bank Account Reports.

Daniel Reck *is an assistant professor of economics at the University of Maryland and a faculty research fellow at the National Bureau of Economic Research. His research interests include tax administration and tax compliance, pension design, and behavioral public economics.*

Valentina Kachanovskaya *is an economist in the Office of Research, Applied Analytics, and Statistics at the Internal Revenue Service.*

Sanith Wijesinghe *is chief engineer at MITRE Public Sector.*

Session 2: Improving Business Compliance: Lessons from Brazil and the US

Behavioral Effects of Tax Enforcement on Noncompliant Business Taxpayers: Evidence from Administrative Tax Data

Alex Turk, ***Yan Sun****, Brett Collins, Corbin Miller, Mark Payne, Sean Roh, Chris Wilson (Office of Research, Applied Analytics, and Statistics, Internal Revenue Service)*

The US income tax system relies on taxpayers who voluntarily file, report, and pay their tax liabilities. How to better motivate the taxpayers to comply with tax law is an important operational challenge. Business taxpayers are an important player in tax administration because they have income tax obligations and withhold and pay the majority of their employees' income and employment tax obligations. In this paper, we examine how enforcement actions affect the compliance behavior of business taxpayers with unpaid tax assessments.

We employ data from the decade leading up to the COVID-19 pandemic (2010–19) to study behavioral effects of the IRS's tax interventions on noncompliant business taxpayers. Our regression analysis shows that tax filing and payment enforcement programs have a significant direct impact on securing delinquent business tax returns in a timely manner. Among these tax treatments, notices with deterrence messages—such as notice of intent to levy, which emphasize the penalty enforcement for the continuing tax compliance behavior—are more effective to collect the default tax. We also find evidence of indirect impacts: when the tax administration's appropriation had fallen and enforcement capability had shrunk from 2010 to 2019, delinquent business taxpayers in general were less likely to resolve their tax debt.

Yan Sun *is an economist in the Knowledge Development and Application Division of the Office of Research, Applied Analytics, and Statistics at the Internal Revenue Service. Sun's current research includes tax compliance, public economics, and applied econometrics. She earned her PhD in economics from the George Washington University.*

Influencing Taxpayers' Behavior: Tax Revenue Increase following Compliance Initiative

Edson Koji Matsumoto, Erika Gleissner Ohara Tanabe, Luiza Rodrigues Guimarães, Patricia Garcia Gonçalves de Almeida, ***Vinícius Lara de Oliveira*** *(Department of Federal Revenue of Brazil)*

This study examines the medium-term impacts of a compliance initiative targeting small- and medium-size enterprises in Brazil that were enrolled in the simplified tax regime "Simples Nacional." Launched in 2020, the initiative identified approximately 26,000 taxpayers with discrepancies between their income tax declarations and the amounts reported on specific commercial invoices (Nota Fiscal Eletrônica). These taxpayers received electronic notifications outlining the discrepancies for the years 2018 and 2019, along with instructions and deadlines for rectification. As a result, 33.45 percent of the taxpayers complied, leading to an increase of approximately 304 million Brazilian reals in declared taxes. Noncompliant companies were

subsequently subjected to enforcement actions, generating an additional 600 million reals in tax revenue. Following the operation's conclusion, the Brazilian Federal Revenue Office continued to monitor the compliance behavior of Simples Nacional taxpayers for two years, including those who were not selected to receive notifications. To assess the initiative's impact on revenue growth, a study was conducted on the behavior of values taxpayers declared. Analyses were performed on two groups of taxpayers: those whose declared activities were included in the operation (group A) and those whose declared activities were not included (group B). The study developed graph curves to estimate the declared revenue and tax values for each group from 2021 to 2023. These estimates were based on the values declared in 2018, adjusted for inflation using the official index for the period, and for the increase in the number of taxpayers opting for the Simples Nacional. These amounts were compared with the actual increase in declared values of the groups: for group A, the declared revenue values and the declared tax values were higher than estimated. In contrast, for the companies in group B, the declared revenue values and declared tax values were lower than estimated. The estimated increase in tax revenue for group A was approximately 30 billion reals. Therefore, the analyses indicate that the entire business sectors targeted by the operation, not just the enterprises selected to receive notifications, demonstrated a greater willingness to adhere to tax regulations. Considering that the year with the most significant difference between the estimated curve and the actual values was 2022, when the enforcement actions were performed, it is possible to conclude that three factors contribute to the impact on the change in taxpayer behavior: the regularization phase, the need for enforcement actions for those who do not regularize, and the operation's consistency. Although the regularization phase shows positive results, if it is not followed by the enforcement stage, there is a tendency for discrepancies to return. Similarly, even if the operation includes both stages, a tendency for discrepancies to return was also identified; hence the need for this model of compliance initiative to become regular, frequent, and consistent.

Vinícius Lara de Oliveira *has been a tax auditor at the Department of Federal Revenue of Brazil since 2002. He holds graduate and postgraduate degrees in computer science and an MBA in contemporary management.*

Implementing a Cooperative Compliance Program in Brazil

Flávio Vilela Campos, Márcio Henrique Sales Parada, ***Patrícia Bacheschi Gomez de Lamadrid****, Paulo Eduardo Nunes Verçosa, Virgínia Valladares Rodrigues (Department of Federal Revenue of Brazil)*

Confia is the Brazilian Cooperative Compliance Program, conceived and administered by the Brazilian Federal Revenue Service. "Confia" means "trust" in Portuguese. The project was launched in 2021 and aims to shift the paradigm in the relationship between tax administration and taxpayers, guided by transparency, good faith, mutual trust, and cooperation. The goal is to achieve predictability and legal certainty to increase tax compliance and to reduce litigation. By applying the concept of risk management and analyzing the behavior, compliance records, and taxpayers' tax control frameworks, the tax administration can interact with each one effectively and efficiently. Confia seeks to engage with taxpayers in a proactive, continuous, and systemic manner, also contributing to the improvement of companies' tax control frameworks with a focus on tax compliance. One of Confia's key pillars is collaborative development with taxpayers from the outset. Thus, the Confia Dialogue Forum was created. Companies participating in that forum could propose topics technical groups would discuss, suggesting improvements for the program's design. A test of procedures was conducted. Participation in this test was voluntary, contingent on the company formally joining Confia's Dialogue Forum and signing the cooperation protocol. In December 2023, a pilot program was launched. The goal was to expand the test of procedures and trial an opt-in process, along with quantitative and qualitative criteria. Validated companies were invited to collaboratively prepare a compliance work plan. The plan's purpose is to provide predictability to taxpayers about the key issues the tax administration intends to address with them. This article focuses on describing, analyzing, and predicting costs and results of this experience, which is of interest to all tax administrations that intend to implement programs of this nature and to companies that consider participating.

Patrícia Bacheschi Gomez de Lamadrid *has been a tax auditor at the Brazilian Federal Revenue Service since 2010, currently working in the Cooperative Tax Compliance Program (Confia). Additionally, she holds a master's degree in tax law from Fundação Getulio Vargas (2020) and a specialization in finance and financial markets from Fundação Instituto de Administração (2021). She graduated in law (2014) and production engineering (2006) from the University of São Paulo and in engineering from Ecole Centrale de Lyon (2006) through a double degree program with a scholarship from Egide. Previously, she worked for two years as a business analyst at McKinsey & Co.*

Masanue Vah *is a social scientist in the Office of Research, Applied Analytics, and Statistics at the Internal Revenue Service.*

Li Liu *is a senior economist in the Fiscal Affairs Department at the International Monetary Fund. Previously, she was a senior research fellow at the Oxford University Centre for Business Taxation. Her research focuses on public economics, particularly corporate taxation and finance, and development economics. Liu is also a research fellow at the University of Oxford and ZEW in Mannheim and an associate editor of* International Tax and Public Finance*.*

Keynote Address: Tax Simplification: Is it Possible? Through the Eyes of a Taxpayer and Tax Administrator

Alan Plumley *is a former technical adviser within the Office of Research, Applied Analytics, and Statistics at the Internal Revenue Service. His expertise is in compliance measurement and modeling for efficient workload selection and resource allocation. A 40-year veteran of IRS research, Plumley earned his PhD in public policy from Harvard University. His dissertation on the determinants of individual income tax compliance broke new ground in the effort to estimate the impacts of various IRS activities on the general population's voluntary compliance behavior. He has presented research papers at many tax conferences and has coauthored chapters for two books related to tax administration and compliance.*

Session 3: Investigating Filing Behavior and Underreporting

Modeling Voluntarily Paid Tax and Tax Administration Cost: A Preliminary Study on Linkages between Service and Revenue

Michael Udell*, Natalie Rico, Danyal Choudhry, Max Hodal, Rosemarie Foley, Britanny Beebe, Kyle Richison, Christina Hui (Office of Research, Applied Analytics and Statistics, Internal Revenue Service)*

Vector autoregression (VAR) models are used in economics and finance for forecasting. These models are well suited to forecasting high-frequency data series. We apply VAR models to weekly individual income tax return filing and processing data at IRS service centers to forecast filing-year weekly volumes. This is a first step toward a model to provide return-on-investment analysis of IRS activities other than direct enforcement.

Unlike classical econometric analysis that posits a relationship between a dependent variable and independent variables, the VAR model uses only endogenous relationships between a dependent variable, its lagged values, and other endogenous variables. It has been shown that this type of model produces accurate forecasts.

We use the VAR to forecast weekly return filings, return processing, and inventory levels, using high-frequency weekly operational reports from 2010 through 2019. We compare the forecasts for filing years 2020 through 2023 with actual filings during the COVID-19 pandemic. These numbers are quite different. We examine the role of legislative events and IRS instructions to taxpayers during the filing year on the timing and volume of individual returns filed.

We show that taxpayer filing behavior and volumes are responsive to several "events," including IRS guidance about starting dates, due dates, and extension dates, as well as new online portals to assist taxpayers in claiming benefits during the pandemic. We show that the legislative and IRS responses to the

pandemic resulted in statistically significant increases in the number of individual tax returns filed from what was forecasted had the pandemic not happened. At the same time, we illustrate how these behavioral responses decreased the number of taxpayers with "no-touch" taxpayer journeys and increased IRS postfiling workloads during the period.

With this model providing a granular view of the filing year, we plan to extend our analysis to include revenue and current-year refund amounts using CDW data and US Treasury Department daily and monthly statement data. The purpose of this exercise is to model voluntary payments as a function of returns filed, excluding enforcement revenues and payments made by persons who do not file tax returns. Finally, we will extend our analysis to include IRS resource allocation in terms of full-time equivalent employees by budget activity and capital expenditure spending.

Michael Udell *is a senior technical adviser in the Emerging Compliance Issues Lab in the Knowledge Development and Application Division in the IRS's Office of Research, Applied Analytics, and Statistics. Udell is a boomerang employee of the IRS, having begun his career in 1985 in the Research Division working with data from the Tax Compliance Measurement Program. He went on to work at the Joint Committee on Taxation through 2008 and worked for Ernst & Young before founding District Economics Group in 2013. Udell rejoined the IRS in 2023. His research interests span most federal taxes, as well as the value-added tax in Europe. Chief among these interests is building statistical models of tax revenue and compliance. He works with Lori Stuntz in the Emerging Compliance Issues group on a gravity equation model of cross-border tax avoidance. Udell has a PhD in economics from the California Institute of Technology.*

The Distribution of Underreported Income: What We Can Learn from the NRP

Gerald Auten (US Department of the Treasury); ***Patrick Langetieg*** *(Office of Research, Applied Analytics, and Statistics, Internal Revenue Service)*

The paper presents new information about the underreporting of income on individual tax returns over the past 25 years by type of income and income class. The analysis is based on detailed audit studies conducted by the IRS, including the 1988 TCMP study and the 2001 and 2006 through 2013 studies under the National Research Program (NRP). Although the likelihood of having underreported income increases at higher reported income levels, the average ratio of underreported income to reported income actually declines as reported income increases. In addition, underreporting of business income is substantially greater than that of income subject to information reporting and is especially concentrated among taxpayers reporting business losses. We also compare results ranking by reported income with results ranking by audit-corrected incomes. Because of our interest in helping other researchers, our paper provides cross-tabulations by reported income and the percentage of returns with different percentages of income discovered in the NRP audits.

Patrick Langetieg *is a supervisory project analyst within the Office of Research, Applied Analytics, and Statistics at the Internal Revenue Service.*

Characteristics of Amended Returns and Amended Return Filers

Amanda Eng *(Office of Research, Applied Analytics, and Statistics, Internal Revenue Service)*

This paper presents new statistics on the characteristics of amended individual income tax returns and the tax units that file them. This work updates previous work by Dennis and coauthors (2021) to more recent years and includes new analyses of the full population of amended individual income tax returns. In addition, since 2020, the IRS has allowed taxpayers to electronically submit their amended returns. This paper presents estimates of the characteristics of individuals who e-file or paper file their amended returns.

Amanda Eng *is an economist in the Statistics of Income division at the Internal Revenue Service. Her research focuses on the individual income tax, the impacts of programs for low-income families, and higher education outcomes. She received a PhD in economics from Cornell University.*

Timothy O'Brien *is an economist in the Statistics of Income division at the Internal Revenue Service. He specializes in projecting aggregated processed tax form and information return volumes to support planning, logistics, and strategy within the IRS. These projections are published on a recurring basis, providing taxpayers and external stakeholders with transparency of IRS operations. He also has experience conducting financial market research, examining institutional compliance with federal financial laws and regulations, and contributing to Article IV Consultations of various countries throughout Sub-Saharan Africa, South Asia, and the Caribbean.*

Steven Hamilton *is an assistant professor of economics at the George Washington University.*

Session 4: Mind the Tax Gap: New Understanding and Insights

Undetected Income: Identification, Estimation, and Uncertainty

Patrick Vossler, ***Aviv Caspi****, Jonathan Hennessey, Daniel E. Ho (Stanford University); John Guyton, Andrew Johns, Dan Rosenbaum (Office of Research, Applied Analytics, and Statistics, Internal Revenue Service); Jacob Goldin (University of Chicago)*

Identifying the amount of taxes owed but unpaid (i.e., the "tax gap") is complicated by the fact that audit outcomes might vary across examiners, even for returns with the same underlying compliance. When this variation in examiner outcomes reflects differences in skill, it can be leveraged to estimate the undetected portion of unreported taxes. This paper introduces a new method for this general class of estimation problems. We make three contributions. First, we show that additional assumptions are needed to identify a parameter along the detection–underreporting frontier. Second, we introduce a Bayesian estimation procedure that regularizes imprecise examiner estimates and allows for the extraction of valuable signal from more sources than existing alternatives. The procedure additionally embeds a test for when variation in examiner outcomes is in fact normatively relevant as opposed to driven by noise. Third, we provide uncertainty estimates, which existing methods rarely do. We implement our method using IRS random audit data.

Aviv Caspi *is a postdoctoral fellow at the Regulation, Evaluation, and Governance Lab at Stanford University. He completed a PhD in economics at Cornell University.*

A New Methodology for Estimating the Underreporting Tax Gap for the Individual Income and Self-Employment Tax

Dan Rosenbaum*, Andrew Johns, Kenneth Tester, Vanessa Vinoles, Caroline Simmons (Office of Research, Applied Analytics, and Statistics, Internal Revenue Service)*

We describe a new methodology for estimating the underreporting tax gap for the individual income and self-employment tax. This new methodology employs binning and matching algorithms to estimate and project the tax gap at aggregate and line-item levels, preserving the distributional properties from the National Research Program (NRP) audits. The flexibility of the new methodology allows for the inclusion of older NRP audits, non-NRP audits, and partially completed audits to supplement information from the new NRP samples. In previous years, NRP samples consisted of approximately 14,000 stratified random audits per year. But the samples are being reduced to approximately 1,500 stratified random audits per year plus 2,500 audits per year randomized within high-risk populations. These NRP changes likely will result in more information for some (high-risk) populations but significantly less information for many medium- and low-risk populations. NRP redesign seeks to draw samples that minimize that information loss, but the large reduction in the sample size will still result in significantly less information for many types of returns. The flexibility to use older NRP audits, non-NRP audits, and partially completed audits to help fill in gaps is the motivation for the new binning and matching methodology. This paper will include comparisons of results using both legacy and new methodologies.

Dan Rosenbaum *is a supervisory economist leading the Compliance Model Lab within the Office of Research, Applied Analytics, and Statistics at the Internal Revenue Service. He is an PhD economist from Northwestern University, has been at the IRS for a little over two years, and formerly has been an economics professor, a senior economist at the Council of Economic Advisers and Office of Management and Budget, a specialist leader at Deloitte, and a basketball analytics and strategy consultant and executive for the Cleveland Cavaliers, Atlanta Hawks, and Detroit Pistons.*

Who Evades Taxes? The Distribution of the US Tax Gap

William Gorman, Jamie McGuire, ***David Splinter*** *(Joint Committee on Taxation)*

Tax gaps measure underpaid taxes. IRS tax gap estimates, however, do not show how noncompliance rates vary by income. Using random audit studies and certain IRS assumptions, we show that tax noncompliance rates are highest among those with the lowest incomes. This result is robust to different assumptions. Tax noncompliance rates are three times higher for the bottom quintile than for the top 1 percent of the income distribution. This divergence increased over time; the bottom quintile became less compliant and the top 1 percent became more compliant.

David Splinter *is a senior economist at the Joint Committee on Taxation in the US Congress. His research focuses on income inequality and tax progressivity.*

John Iselin *is an economist at the Congressional Budget Office's Tax Analysis Division. His research focuses on high-income tax avoidance, as well as labor supply and migration responses to tax policy changes.*

Janet Holtzblatt *is a senior fellow at the Urban-Brookings Tax Policy Center. Holtzblatt's recent research focuses on tax administration, the tax treatment of families and workers, racial disparities in the individual income tax, and wealth taxes. Before joining the Tax Policy Center, Holtzblatt was the unit chief for tax policy studies in the Congressional Budget Office's Tax Analysis Division.*