2015 IRS-TPC Research Conference

Welcome

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# 2015 IRS-TPC Research Conference

## Session 1: Innovative Methods for Improving Resource Allocation

### Moderator:
**Melissa Vigil**  
IRS, RAS, Office of Research

### Estimating Marginal Revenue/Cost Curves for Correspondence Audits
**Alan Plumley**  
IRS, RAS, Office of Research

### Examining the TDA Collectability Curve
**Jeff Wilson**  
IRS, Taxpayer Advocate Service

### Analysis of Flow-Through Entities Using Social Network Analysis Techniques
**Shannon Chen**  
University of Texas at Austin

### Discussant:
**Arnie Greenland**  
University of Maryland
Government Accountability Office:

"IRS Could Significantly Increase Revenues by Better Targeting Enforcement Resources"

(December 2012)

**Dollars of revenue per dollar of cost**

<table>
<thead>
<tr>
<th>Total Positive Income (TPI)</th>
<th>Correspondence</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $200,000</td>
<td>5.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Nonbusiness without EITC</td>
<td>7.4</td>
<td>1.6</td>
</tr>
<tr>
<td>Business without EITC</td>
<td>5.2</td>
<td>1.1</td>
</tr>
<tr>
<td>Nonbusiness returns</td>
<td>25.6</td>
<td>2.9</td>
</tr>
<tr>
<td>Business returns</td>
<td>13.0</td>
<td>1.7</td>
</tr>
<tr>
<td>All types</td>
<td>47.2</td>
<td>6.0</td>
</tr>
<tr>
<td>TPI of $1,000,000 or more</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: GAO analysis of IRS data.
Government Accountability Office:

“A hypothetical shift of a small share of resources (about $124 million) from exams of tax returns in less productive groups… to exams in the more productive groups could have increased direct revenue by $1 billion… (as long as the average ratio of direct revenue to cost for each category of returns did not change).”

- The average R/C is constant only if we select cases randomly.
- If we’re successful in giving priority to the most cost-effective cases, then the average should decline as we increase the budget.
- Making allocations based on average R/C overstates the impact of a change in budget.
Is There Evidence of Marginality?

That is, are the methods used to prioritize potential audit inventory better than random selection?

• If we had to reduce the number audited, would we tend to avoid the least cost-effective ones?

• If we were able to increase the number audited, would the additional ones be less cost-effective than the ones already selected?

Answer: YES, there is evidence of marginality!
Current Research Project

Focused on correspondence (rather than face-to-face) audits

• Many categories of correspondence audits ("projects"), defined by what tax return line item is being questioned

• Begin by trying to improve resource allocation across the projects assuming no change to operational selection system
Method (for a given project and tax year)

Step 1: Identify for each closed audit:
- The tax revenue collected from the audit;
- An estimate of the cost to identify, assess, and collect that revenue (from time applied, series, grade, etc.); and
- The value of the variable used operationally to assign priority to the audit.

Step 2: Sort all closed audits in declining order of the prioritization variable.

When a return was audited is generally not a proxy for priority.

Step 3: Derive for each audit the cumulative revenue and cumulative cost of all returns audited having same or greater priority.

Step 4: Plot cumulative revenue vs. cumulative cost.
The curvature away from the average line is a measure of marginality—the power of the prioritization method to identify returns with higher revenue/cost (at the left).
Step 5: Fit a curve through the plot. A simple quadratic curve displayed an excellent fit for most projects.
Deriving Marginal Revenue/Cost Functions

Step 6: Mathematically derive the marginal Revenue/Cost curve (the slope of the cumulative curve at each point)

- If the cumulative plot is a quadratic curve, then marginal R/C declines linearly as a function of cumulative cost.

Example graph showing the Cumulative Revenue versus Cumulative Cost with point A indicating the marginal Revenue/Cost at that point.
• As more budget is applied to a project, the marginal R/C declines.

• Greater curvature in the Cumulative Revenue vs. Cumulative Cost plot corresponds to steeper slope in the Marginal R/C plot.

• How should the available budget be allocated to these projects to maximize direct revenue?
Direct revenue is maximized when the marginal R/C ratio is **the same** for all projects.

Otherwise, revenue could be increased by **shifting resources** from projects with low MR/C to those with higher MR/C.

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**Marginal Revenue/Cost as a Function of Budget, Tax Year 2006**

![Graph showing marginal revenue/cost ratio as a function of cumulative cost for different projects.](image-url)
These are “optimal” allocations only in the sense that they maximize net direct revenue in the absence of any constraints. They are not truly optimal since they don’t account for indirect effects, other benefits or costs, constraints, or valuations of benefits and costs other than dollars.

<table>
<thead>
<tr>
<th>Project</th>
<th>Actual Allocation</th>
<th>Optimal* Allocation</th>
<th>Change in Cost</th>
<th>Change in Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Revenue</td>
<td>Total Cost</td>
<td>Net Revenue</td>
<td>Average Rev/Cost</td>
</tr>
<tr>
<td>C1</td>
<td>$27.6</td>
<td>$4.0</td>
<td>$23.6</td>
<td>6.90</td>
</tr>
<tr>
<td>A1-Lo</td>
<td>$151.9</td>
<td>$13.4</td>
<td>$138.5</td>
<td>11.33</td>
</tr>
<tr>
<td>A1-Hi</td>
<td>$18.6</td>
<td>$2.4</td>
<td>$16.2</td>
<td>7.83</td>
</tr>
<tr>
<td>A2</td>
<td>$61.7</td>
<td>$7.1</td>
<td>$54.6</td>
<td>8.67</td>
</tr>
<tr>
<td>A3</td>
<td>$21.9</td>
<td>$4.3</td>
<td>$17.6</td>
<td>5.12</td>
</tr>
<tr>
<td>A4</td>
<td>$36.3</td>
<td>$3.0</td>
<td>$33.4</td>
<td>12.22</td>
</tr>
<tr>
<td>O</td>
<td>$287.1</td>
<td>$37.0</td>
<td>$250.0</td>
<td>7.75</td>
</tr>
<tr>
<td>Total</td>
<td>$605.1</td>
<td>$71.2</td>
<td>$533.9</td>
<td>8.50</td>
</tr>
</tbody>
</table>

*These are “optimal” allocations only in the sense that they maximize net direct revenue in the absence of any constraints. They are not truly optimal since they don’t account for indirect effects, other benefits or costs, constraints, or valuations of benefits and costs other than dollars.
Next Steps

- Work with Campus Exam and OCA to incorporate MR/MC functions in the Exam Planning Scenario Tool to support the FY16 Exam Plan.

- Identify constraints
  - How much can we expand projects with high MR/MC?
  - How easily can examiners work different projects?

- Make assumptions about indirect effects
  - Minimum coverage constraints, etc.

- Improve workload selection (screening, prioritization variables)
IRS Collectability Curve

Taxpayer Advocate Service
Research & Analysis
June 2015
Focus

• Taxpayer Delinquency Account (TDA) liabilities.

• Individual Master File

• Collection statute (generally 10 years)
Background

• Over 50 percent of the IRS Individual Master File (IMF) TDA inventory has been in the function assigned the delinquency for at least 10 months.

• Over 70 percent of the IMF TDAs in IRS inventory at the end of 2014 are Tax Year 2010 and prior liabilities.

• Over 20 percent of the IMF TDAs have less than four years remaining on the collection statute, meaning that the delinquency has existed for over six years.
Objectives

- Determine dollars collected during each year after TDA assignment.
- Distinguish between TDA dollars collected from subsequent payments and offsets.
- Determine how dollars collected vary by categories of TDA balance due.
Objectives

• Determine how TDA dollars collected vary by type of assessment (self-reported and IRS imposed)

• Quantify the effect of assessed penalties and interest on the TDA balance due.

• Determine the percentage of TDA liabilities abated by the IRS and if abatements vary by sources of assessment.
Objectives

• Determine the percent of TDA cases full paid within 10 years.

• Determine if TDA dollars collected vary by collection channel.
Methodology

• Analyzed balance due (from IMF ARDI) at initial TDA assignment.

• Analyzed cases entering TDA status (by year entered) from calendar year 2003 through 2012.

• Used IMF data to distinguish between subsequent payments, offsets, penalties, interest, and adjustments (classified by transaction code).
Methodology

- Used ARDI *major source of assessment* to determine type of IRS assessment (self-assessed or IRS imposed).

- Used *TRCAT* code to determine if case was assigned to ACS, collection queue, or CFF.
Limitations

- Changes in module balances include assessed and accrued penalties and interest; however, the specific finding on penalties and interest only includes assessed amounts.

- Amounts abated because of accepted offers in compromise are included in the sections on abatements; however, in FY 2014, accepted offers in compromise only accounted for about one percent of the initial TDA balance.
Findings

• Dollars collected generally decreased by more than 50 percent from the first year to the second year.

• In the third year, collections decrease by about a third from the amount collected in the second year.
Findings – Percent of Payments Collected per Year

Percent Collected by Years Elapsed

Years Elapsed

0% 10% 20% 30% 40% 50% 60%

2003 2005 2007 2009 2011
Findings - Dollars collected also decline as a percent of the available balance.
Findings – Dollars Collected by Subsequent Payment Have Decreased

- In the earlier years, dollars collected by subsequent payment are nearly triple dollars collected through offset however, in more recent years, this margin has decreased to only double.

- Overall, dollars collected on TDAs by subsequent payment appear to be decreasing from 2003 to 2012.
Findings – Percent of Dollars Collected vary by TDA Balance

• Nearly Three-quarters of TDAs have balances of $5,000 or less.

• However, over 80 percent of the balance owed is contained in TDAs with balances above $5,000.

• The IRS Collects a Higher Percentage of dollars when the TDA Balance is Smaller.
Findings – Percent of Dollars Collected vary by TDA Balance

- The IRS offsets the highest percent of dollars to TDAs under $5,000.

- As time progresses, the percent of TDAs with initial balances of $5,000 or less are decreasing, while the percent of the total initial TDA balance above $5,000 is increasing.
Findings – Source of Assessment

• On a percentage basis ...

  • The IRS Collects twice as much from TDAs resulting from self-assessments than from audit assessments.

  • In recent years, the IRS also collects about twice as much from TDAs resulting from self-assessments than AUR assessments (the difference was not quite as large in earlier years).
Findings – Source of Assessment

• The IRS generally collects the least on SFR assessments.

• The IRS collects the highest percentage from offsets on TDAs from AUR assessments.

• The IRS generally offsets a slightly higher percentage on TDAs from audit assessments than self-reported assessments.
### Findings – Source of Assessment

#### Subsequent Payments

<table>
<thead>
<tr>
<th>Year</th>
<th>Self-Reported Assessments</th>
<th>Substitute for Return</th>
<th>Audit Assessments</th>
<th>AUR Assessments</th>
<th>Trust Fund Recovery Penalties</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>56%</td>
<td>14%</td>
<td>23%</td>
<td>33%</td>
<td>16%</td>
</tr>
<tr>
<td>2005</td>
<td>60%</td>
<td>13%</td>
<td>28%</td>
<td>31%</td>
<td>17%</td>
</tr>
<tr>
<td>2007</td>
<td>51%</td>
<td>10%</td>
<td>24%</td>
<td>25%</td>
<td>12%</td>
</tr>
<tr>
<td>2009</td>
<td>45%</td>
<td>9%</td>
<td>21%</td>
<td>24%</td>
<td>9%</td>
</tr>
<tr>
<td>2011</td>
<td>40%</td>
<td>7%</td>
<td>15%</td>
<td>21%</td>
<td>8%</td>
</tr>
</tbody>
</table>

#### Offsets

<table>
<thead>
<tr>
<th>Year</th>
<th>Self-Reported Assessments</th>
<th>Substitute for Return</th>
<th>Audit Assessments</th>
<th>AUR Assessments</th>
<th>Trust Fund Recovery Penalties</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>18%</td>
<td>4%</td>
<td>12%</td>
<td>34%</td>
<td>6%</td>
</tr>
<tr>
<td>2005</td>
<td>20%</td>
<td>5%</td>
<td>20%</td>
<td>32%</td>
<td>6%</td>
</tr>
<tr>
<td>2007</td>
<td>20%</td>
<td>5%</td>
<td>25%</td>
<td>36%</td>
<td>6%</td>
</tr>
<tr>
<td>2009</td>
<td>15%</td>
<td>4%</td>
<td>20%</td>
<td>28%</td>
<td>6%</td>
</tr>
<tr>
<td>2011</td>
<td>10%</td>
<td>2%</td>
<td>12%</td>
<td>25%</td>
<td>4%</td>
</tr>
</tbody>
</table>
Findings – Assessed Penalties and Interest

• Over equivalent three year periods, assessed penalties and interest have remained relatively constant; however, when sufficient time has elapsed, penalties and interest are increasing.
Findings - Abatements

- Generally, the IRS abates from a quarter to a third of TDA assessments.

<table>
<thead>
<tr>
<th>Year</th>
<th>Initial TDA Balance</th>
<th>$ Abated</th>
<th>% Abated</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>$15,326,191,192</td>
<td>$2,985,977,270</td>
<td>19%</td>
</tr>
<tr>
<td>2005</td>
<td>$25,996,084,845</td>
<td>$8,066,761,341</td>
<td>31%</td>
</tr>
<tr>
<td>2007</td>
<td>$40,678,451,308</td>
<td>$13,086,103,480</td>
<td>32%</td>
</tr>
<tr>
<td>2009</td>
<td>$41,987,700,518</td>
<td>$10,716,623,485</td>
<td>26%</td>
</tr>
<tr>
<td>2011</td>
<td>$42,926,217,917</td>
<td>$11,990,870,525</td>
<td>28%</td>
</tr>
</tbody>
</table>
Findings - Abatements

- SFR assessments have the highest abatement rate (nearly 50 percent in some years).

- Abatements attributable to AUR assessments are growing, while self-reported assessments are the least likely to be abated.
# Findings – Abatements by Source of Assessment

<table>
<thead>
<tr>
<th>Year</th>
<th>Self-Reported Assessments</th>
<th>Substitute for Return</th>
<th>Audit Assessments</th>
<th>AUR Assessments</th>
<th>Trust Fund Recovery Penalties</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>6%</td>
<td>49%</td>
<td>15%</td>
<td>15%</td>
<td>39%</td>
</tr>
<tr>
<td>2005</td>
<td>6%</td>
<td>47%</td>
<td>12%</td>
<td>29%</td>
<td>40%</td>
</tr>
<tr>
<td>2007</td>
<td>12%</td>
<td>43%</td>
<td>14%</td>
<td>28%</td>
<td>35%</td>
</tr>
<tr>
<td>2009</td>
<td>9%</td>
<td>36%</td>
<td>13%</td>
<td>27%</td>
<td>28%</td>
</tr>
<tr>
<td>2011</td>
<td>16%</td>
<td>40%</td>
<td>19%</td>
<td>18%</td>
<td>29%</td>
</tr>
</tbody>
</table>
Findings – Full Payments and Collection Channel

• The full payment rate has been decreasing for TDAs issued in more recent years, while a higher percentage of the initial TDA liability remains due.

• ACS collects a higher percent of TDA dollars by both subsequent payment and offset than CFf (may be a reflection of inventory composition).

• Often, over a third of TDA dollars assigned to CFf are abated.
Conclusions

• Dollars collected in aggregate and as a percent of the balance due decrease significantly during the first three years after the IRS assigns a liability to TDA status.

• When continuing to look at the collection of liabilities after the third year of the initial TDA assignment, collections continue to dwindle and the reduction in the module balance declines almost completely.

• Overall, dollars collected through the offsets of other overpayments are much less than dollars collected through subsequent payments.
Conclusions

• Delinquent modules with balances due not in excess of $5,000 comprise the vast majority of TDAs. However, over 80 percent of the total amount due resides with TDAs with balances greater than $5,000.

• The IRS collects both a higher percentage of subsequent payments and offsets in the lowest balance due categories.

• The percent of the TDA balance collected is significantly greater for self-reported liabilities than when the IRS makes additional assessments.

• Penalty and interest significantly increase the balance owed by taxpayers, particularly when the underlying balance remains unresolved for several years.
Conclusions

• The IRS abates between a quarter and a third of TDA liabilities. The IRS abates about 40 to 50 percent of its substitute for return (SFR) assessments.

• The IRS completely resolves most of its TDA modules within the 10 year collection statute, with a resolution rate of about 80 percent for TDAs assigned in 2003 and 2005. Unfortunately, the percent of TDAs resolved appears to be declining for TDAs initiated in later years. Additionally, the balance owed on these delinquencies has only been reduced by less than 50 percent.

• ACS realizes the largest percent of TDA balances collected by subsequent payment and offset. While the percent of dollars abated is high in all TDA collection channels, the abatement rates are significantly higher in the queue and CFf than in ACS.
ANALYSIS OF FLOW-THROUGH ENTITIES USING SOCIAL NETWORK ANALYSIS TECHNIQUES

Ashish Agarwal
Shannon Chen
The University of Texas at Austin

Rahul Tikekar
Ririko Horvath
Larry May
IRS, RAS

Advisory Roles: Robert Hanneman (UC Riverside), Lillian Mills (UT Austin)
Research Question(s)

• **Application:** Can Social Network Analysis (SNA) be a useful technique for IRS “big data” analysis of flow-through entities?

• **Compliance Risk:** Do the ways “enterprises” embed flow-throughs in their corporate structure facilitate noncompliance?
  • Do SNA characteristics of greater network complexity explain tax noncompliance?
  • (How) Do loss flow-through entities create more compliance risk?
Prior Evidence

Prior work examines the association between firm characteristics and corporate noncompliance.

- Hanlon, Mills, & Slemrod (2005) examine firm size, industry, multinationality, public vs. private firms, choice of executive compensation, and corporate governance.

Some academic work on complexity and tax avoidance or tax risk generally.

- Wagener and Watrin (2013) find that organizational complexity (number of subsidiaries, ownership chain length, cross-country links, and ownership percentage) is associated with greater income shifting incentives.
- Balakrishnan et al. (2012) argue that tax avoidance increases financial complexity as evidenced by decreased corporate transparency.
Prior Evidence (cont.)

- Some academic work on choice of overall business structure.

- Some recent academic work on use of special purpose entities, which include LLCs, LLPs, trusts, and other flow-through entities.
  - Feng et al. (2009) & Demere et al. (2015)

- However, there is a lack of empirical evidence on the effect of flow-through entities on tax noncompliance specifically.
## Data Sample

<table>
<thead>
<tr>
<th></th>
<th>Sample Based on Proposed Deficiency Database</th>
<th>Random Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
<td>2009</td>
<td>2009</td>
</tr>
<tr>
<td><strong>Number of Enterprises</strong></td>
<td>5,913</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Entities</strong></td>
<td>107,638</td>
<td>31,884</td>
</tr>
<tr>
<td><strong>k-1 links</strong></td>
<td>411,644</td>
<td>28,210</td>
</tr>
<tr>
<td><strong>Parent-Sub links</strong></td>
<td>75,832</td>
<td>1,225</td>
</tr>
<tr>
<td><strong>Primary-Secondary links</strong></td>
<td>55</td>
<td>2,590</td>
</tr>
</tbody>
</table>

- The following pictures describe SNA variables.
Sample Enterprise Plots

Enterprise X

Enterprise Y

- Parent or Subsidiary Node
- Flow through Node
- Primary or Secondary Node
Preliminary Evidence on Our Research Questions

- Effort last summer yielded learning how to use YK1 data and applying SNA approach to measure various nodal and linkage characteristics of about 6,000 enterprises in the 1120 LB&I taxpayer population for 2009.

- Some measures of network complexity are associated with higher detected noncompliance (proposed deficiencies).
  - Controlling for raw predictors of audit selection like size, profitability, DAS.
## SNA Measures

<table>
<thead>
<tr>
<th>Network Measure</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density</strong></td>
<td>( \frac{1}{2} n(n - 1) )</td>
</tr>
<tr>
<td><strong>Diversity</strong></td>
<td>( \sum_{i} p_i^2 )</td>
</tr>
<tr>
<td><strong>Degree Centrality</strong></td>
<td>( \frac{\text{Number of Links per Node}}{n - 1} )</td>
</tr>
<tr>
<td><strong>External Degree Centrality</strong></td>
<td>( \frac{\text{Total Number of External Links}}{\text{Total Number of Links}} )</td>
</tr>
<tr>
<td><strong>Closeness Centrality</strong></td>
<td>( \left[ \frac{\sum_{j=1}^{n} \text{Distance} (i, j)}{n - 1} \right]^{-1} )</td>
</tr>
</tbody>
</table>
Node Diversity

![Graph showing node diversity against number of nodes for PDD Sample and Random Sample.](image)

**PDD Sample** | **Random Sample**
Degree Centrality

PDD Sample

Random Sample
Centralization & Node Level Degree Centrality

Centralization = 0.05

Centralization = 0.1875

Centralization = 0.45
External Degree Centrality

PDD Sample

Random Sample
Closeness Centrality

PDD Sample

Random Sample
Outlier Analysis

![Graph showing outlier analysis with nodes and external degree centrality.](image)
Identifying Economically Important Nodes

Centralization = 0.05

Centralization = 0.1875

Centralization = 0.45
Relationship Between Deficiency and SNA Measures (Preliminary Analysis)

- Regression:

\[
\text{Deficiency} = a_0 + a_1 \text{ Assets} + a_2 \text{ DAS} + a_3 \text{ NetIncome} + a_4 \text{ ClosenessCentrality} + a_5 \text{ Nodes} + a_6 \text{ Degree} + a_7 \text{ NodeDiversity} + a_8 \text{ DegreeCentrality}
\]

- As expected, Deficiencies are higher for larger and more profitable firms.

- Relevant to our question, Deficiencies are significantly higher when the nodes are further away \((a_4 < 0)\) or when the node type is more concentrated \((a_7 << 0)\).
Project Status

• Initial contract for Ashish Agarwal and Shannon Chen ended September 2014, simple results shown today.

• Waiting to re-establish IPA and Disclosure.

• Great opportunities for future work when access restored.
Future Work

• Refine measures
• Generate measures for multiple years
• Conduct validation of measures
• Explore other enterprise definitions
• Contribute to tax administration of complex organizations
• Academic Paper on Noncompliance (Agarwal, Chen & Mills)
# 2015 IRS-TPC Research Conference

## Session 1: Innovative Methods for Improving Resource Allocation

**Moderator:**

Melissa Vigil  
IRS, RAS, Office of Research

<table>
<thead>
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<th>Topic</th>
<th>Presenter</th>
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