Canadian Income Taxation: Statistical Analysis and Parametric Estimates

Musab Kurnaz[1] Terry Yip[2]

[1]University of North Carolina

[2]McMaster University

What We Do

- Compare Canadian income and taxation statistics with those of the U.S.
- Provide estimates of parametric tax specifications which are readily to use

Motivation

- Income taxation is one of the most regulated and complicated government policies
- The complexity comes from tax unit, number of tax brackets, family size dependent tax benefits and various tax credit
- Difficult to include all aspects in their quantitative analysis
- The literature has created parametric functions (specifications) to represent the entire income tax system and estimated them using *survey* data
- This paper provide estimates of existing tax specifications for a cross-section of Canadian households using *administrative* data

Literature

- Guner et al. (2014) provides income and tax statistic and estimates of four common parametric specifications using the administrative dataset in U.S.
- We compare Canadian and US income and taxation facts using Guner et al. (2014)
- How we differ?
  - Introduce a better tax specification
  - Include provincial taxes
  - Estimate benefit function with refundable tax credits and other benefits

Data and Sample Selections

- Longitudinal Administrative Databank (LAD) (year 2000)
- Sample unit is at household level instead of individual level, because
  - a common ground to compare to Guner et al. (2014)
  - spousal income and tax liabilities directly impact the intra-household decisions
  - include additional estimations using individual level
- As in Guner et al. (2014), we have similar key sample restrictions:
  - have strictly positive income
  - average tax rates are less than the highest statutory marginal tax rate

Income Definition

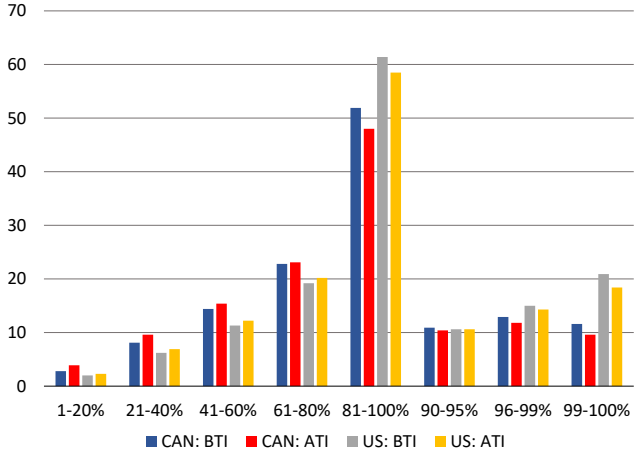
- Our benchmark income notion is *household* income and consist of the following three components:

Table: Before Tax Income (BTI) Breakdown

Labour Income	Capital Income	Transfer Income
Earnings from T4 slips	Capital gains or losses, net	CPP/QPP benefits
Indian exemption for employment income	Limited partnership income, net	Employment insurance benefits
Other employment income	Dividends	Old Age Security pension
Alimony or support income	Interest and investment income	
Other income	Rental income, net	
$\frac{2}{3}$ Self-employment, net income	$\frac{1}{3}$ Self-employment, net income	
Pension and superannuation		
RRSP income		

- Family Benefit, Provincial refundable tax credit, Child Tax benefit, GST and FST credits are left out from this definition

Income Share by Before Tax Income (BTI) Group



- Lower income household has higher after tax income (ATI) share than their BTI share
- Top 10% contribute over 30% of the total income
- Gini for BTI (ATI) in Canada is 0.48(0.44) and in the US is 0.59(0.56)

Source of Income (U.S. vs. Canada)

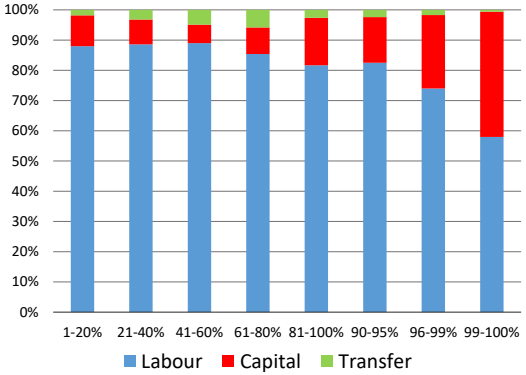


Figure: U.S.

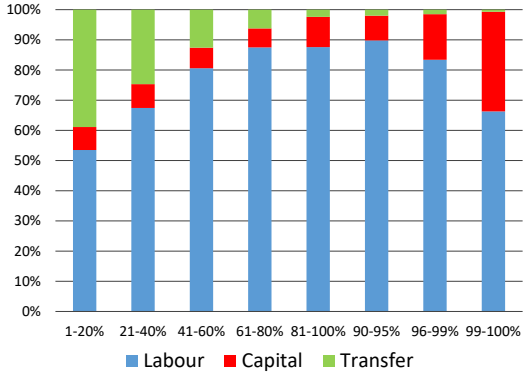
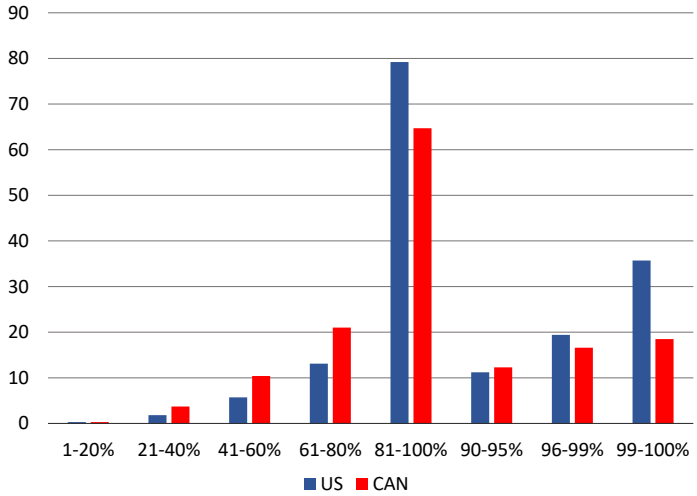


Figure: Canada

- Capital share increase with income in both countries and the share of top incomes are higher in the U.S.
- Much larger transfer share in Canada than in the U.S.

Share of Tax Liabilities



- Overall, high income households has larger share of tax liability in US than in Canada
- Potential reasons: (i) higher income in US at the top; (ii) higher tax rate in US

Parametric Tax Functions

- Parametric tax functions should be easy to analyze and a good fit of the data
- Four tax specifications + one new specification

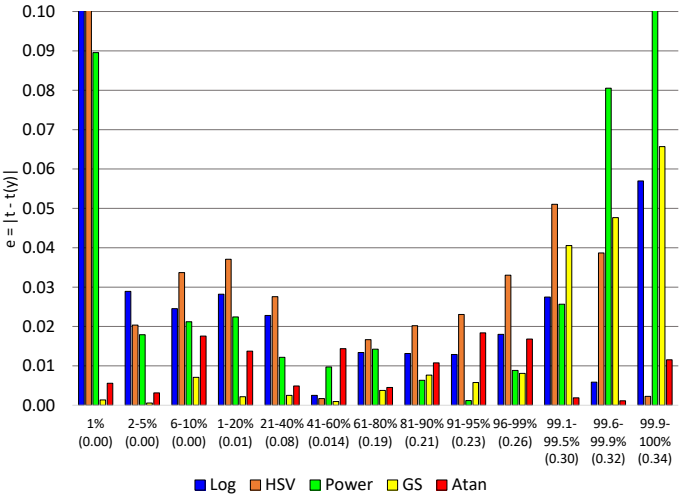
$$
\begin{aligned}
\textit{Log}: &\quad t(\tilde{y}) = \alpha + \beta \textit{log}(\tilde{y}) \\
\textit{HSV}: &\quad t(\tilde{y}) = 1 - \lambda \tilde{y}^{-\tau} \\
\textit{Power}: &\quad t(\tilde{y}) = \delta + \gamma \tilde{y}^{\epsilon} \\
\textit{GS}: &\quad t(\hat{y}) = b\left[1 - (s\hat{y}^{p} + 1)^{-1/p}\right] \\
\textit{Atan}: &\quad t(\tilde{y}) = \nu + \mu \textit{arctan}(\tilde{y})
\end{aligned}
$$

  where $t(\cdot)$ is the average tax rate, $\tilde{y}$ is multiple of mean (before-tax) income, and $\hat{y}$ is income/1,000

- We introduce *Atan* form because it can capture bottom and top income tax rate better
- Beside *Log* and *Atan*, all the other form are estimated using non-linear least squares

◂ why top rate matter

Residuals of Specifications for All (Fed+Prov) Tax Rates



- *GS* fits well except the top 10% group; while *atan* fits well at the top with small residuals in the middle

Credit and Benefit Tax Rate

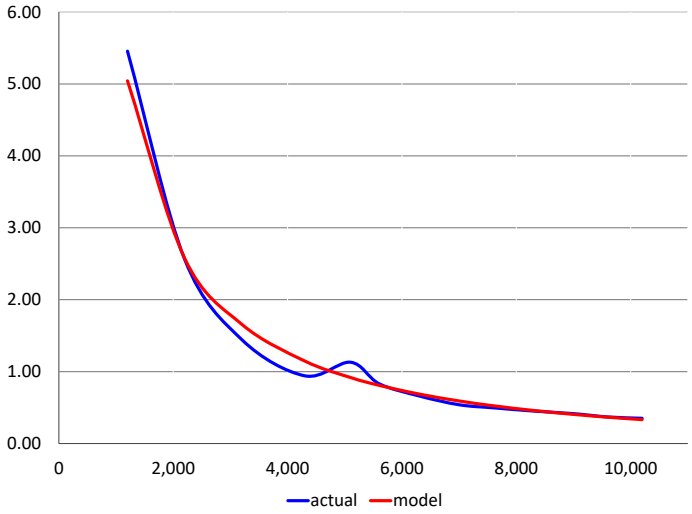
- Researchers may want to incorporate also refundable tax credit into the function
- However, above specifications cannot capture the net credit tax rates $\left(= \frac{tax - benefit}{Income}\right)$
- One solution is combine tax function with benefit function

$$b(\tilde{y}) = \theta_0 + exp(\theta_1)exp(\theta_2\tilde{y})\tilde{y}^{\theta_3}$$

  where $b(\tilde{y})$ is the average benefit rate

- Benefit include both refundable tax credit (e.g., Child Tax benefit , GST credit, etc) and other benefit (e.g., GIS, Workers' compensation payments, Social assistance income)

Benefit Function (data vs. model) - 2% to 10% Income Quantiles



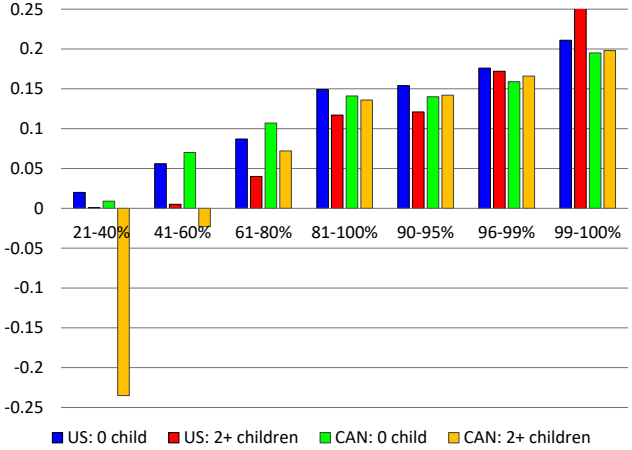
- The function match well at the bottom

Conclusion

- Provide comparison of income and tax statistics for the U.S. and Canada
- Estimate four common parametric tax functions and introduce a new functional form for Canadian tax system
- The new function can match tax rate at both top and bottom income quantiles well, which can be very important in the quantitative analysis of many research
- Further Income and tax statistics and tax function estimates by different family types are provided in the paper detail

Thank You

Net Federal Tax Rates: Married Household



- Child related deduction and credit reduce tax rate in both countries except for the top
- Reduction in tax rate diminish at lower income in Canada than in the U.S., as household switch to single earner

Importance of Capturing Top Rates

- Consider an error of +5% in the average tax rates for top 0.1% ($\sim$ \$2Million)
- If labor supply is inelastic, per-capita taxes would $\uparrow$ by \$943 ($\sim\uparrow$10% original value)
- If labor supply is elastic, total income (GDP) would be reduced by 0.34% by assuming elasticity to be one for high-income earners (see Sillamaa and Veall (2001))
- More calculations can be found in the paper
- These are huge differences which may mislead researchers on quantitative analysis
- Therefore, we believe *Atan* specification is an important contribution to the literature

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