

Alternative Individual Income Tax Forecasting Models: In Search of Accuracy & Flexibility

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Motivation

Currently, WI DOR has a state economic model and an annual model to forecast individual income tax revenue involving more than 1,000 equations. Both constructed in the 1976 by DRI (GI's predecessor).

- We are required to present monthly GPR forecasts.
 - Data issues: change of the processing and accounting systems and data cleansing procedures that generate discontinuities and less reliable data.
 - Filing extension to October is too close to the November 20th statutory due date for the next biennial forecast.
- ⇒ Create a new individual income tax model. More flexible to use for monthly meeting and as an assessment/benchmark for our original model

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Model Comparison

Comparison Criteria	Original Model	New Model
Data Frequency	Annual	Quarterly
Data source	Returns data	Collections data
Macroeconomic data	Yes (annual)	Yes
Stochastic / Simulation	Both	Stochastic
Number of Equations (incl. identities)	1,000+	120

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Original model

Block 1: Stochastic - Forecast for 5 filing status
AGI, N^o of Returns, N^o of Dependents, N^o
of people above 65 years old.

Block 2: Simulation - apply tax law by filing
status (5) and income class (37).
Result: aggregated total gross tax

Block 3: Stochastic - Forecast total net tax and
liability by tax year, and total income
collections by fiscal year.

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Original Model -- Block 1 -- Stochastic

- **AGI:** total and by 5 filing status (FS)
=F (WI taxable personal income, prices, unemployment, WI capital gains, WI capital gains tax rate)
- **Number of Returns:** total and by 5 FS
=F (employment, unemployment, population)
- **Number of Dependents:** total and by 5 FS
=F (number of returns, population, unemployment)
- **Number of Filers 65 Years or More:** total and by 5 FS
=F (number of returns, population (65+), unemployment)

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Original Model -- Block 2 -- Simulation

- Extrapolate AGI, number of returns, number of dependents and number of filers 65 or older to the 37 income classes for each of the 5 filing status (185 groups).
- Apply standard deduction and personal exemptions to each group to get taxable income.
- Apply brackets and rates to get gross tax.
- Aggregate to produce **Total Gross Tax**.

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Original Model -- Block 3 -- Stochastic

- **Non-refundable Credits:** married couple, property tax, itemized deduction, etc.
- **Total Net Tax** = Gross Tax - Credits
- **Tax Year Liability** = f (total net tax, minimum tax)
- **Fiscal Year Collections** = f (liability, (whFY/whTY), (estFY/estTY))

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New Model

- Collections Data from the accounting system
- Incorporates the state macro economic forecast
- Stochastic equations to forecast the five components of individual income tax revenue:
 - **Quarterly forecast:** WH and Estimated Payments
 - **Annual forecast:** Final Payments, Refunds, and Refundable Credits and Donations

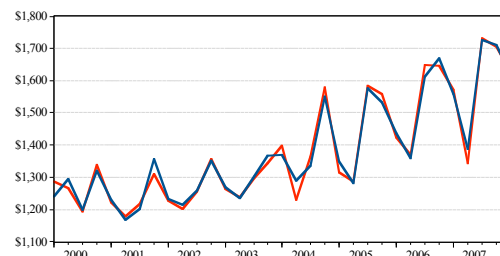
$$\text{PIT} = \text{WH} + \text{EST} + \text{Final} - \text{Refunds} + \text{Credits}$$

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Withholding Forecast

- **Withholding Collections** = f (withholding by time period covered (DOR), dummy to capture the end of a quarter on a weekend and number of Fridays in a quarter, WI wages (BEA))

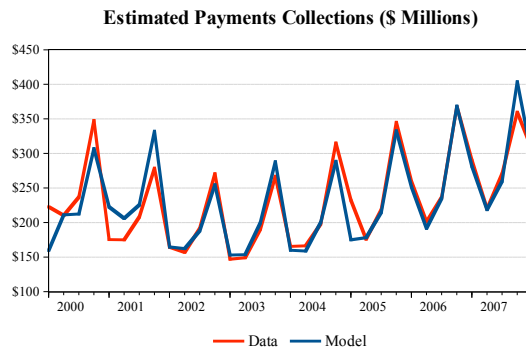
Mean	\$ 1,400 Million
MAE	\$ 19 Million
MAPE	1.4% (00Q1-08Q1)



Estimated Payments Forecast

- **Estimated Payments Collections** = f (WI taxable personal income excluding wages (BEA), SP500 Index, and WI effective income tax rate)

Mean	\$ 230 Million
MAE	\$ 17 Million
MAPE	7% (00Q1 08Q1)



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Annual Components Forecast

- **Final Payments** = f (withholding (t-1), estimated payments (t-1), net tax (t-1), and SP500 Index (t-1), MA(1))
MAPE (00-06) = 4.8%
- **Refunds** = f (withholding(t-1), estimated payments (t-1), and net tax (t-1), AR(1))
MAPE (00-06) = 2.8%
- **Refundable Credits and Donations** = f (own lag, population, AR(1))
MAPE (00-06) = 3.2%

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Data Availability

Forecast Date	Original Model	New Model		
	Annual AGI	Quarterly Collections	# Quarters of Collections Data	
			FY07	FY08
November-06	2005	06Q3	one Q	-
February-07	2005	06Q4	two Q	-
May-07	2005	07Q1	three Q	-
November-07	2006	07Q3		one Q
February-08	2006	07Q4		two Q
May-08	2006	08Q1		three Q
July-08	2006	08Q1		three Q

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Results Comparison

FY 2008 Individual Income tax Collections = \$6,668 Million				
Forecast Date	Original Model	New Model	Original-error	New-error
Nov-06	2005	06Q3	-\$146.4 -2.2%	\$17.7 0.3%
Feb-07	2005	06Q4	-\$195.1 -2.9%	-\$42.9 -0.6%
Nov-07	2006	07Q3	-\$175.7 -2.6%	\$79.5 1.2%
Feb-08	2006	07Q4	-\$99.7 -1.5%	\$56.0 0.8%
Jul-08	2006	08Q1	-\$95.7 -1.4%	\$1.4 0.02%

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Conclusions

Comparison criteria	Original Model	New Model
Accuracy	-	+
Capture law changes	+	-
Timeliness and reliability of input data	-	+
Collection data to capture turning points	-	+
Horizon time	+	-
Manageable and less time consuming for monthly meetings	-	+

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"Economics, is a science of thinking in terms of models, joined to the art of choosing models which are relevant to the contemporary world."

Keynes (1938)

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