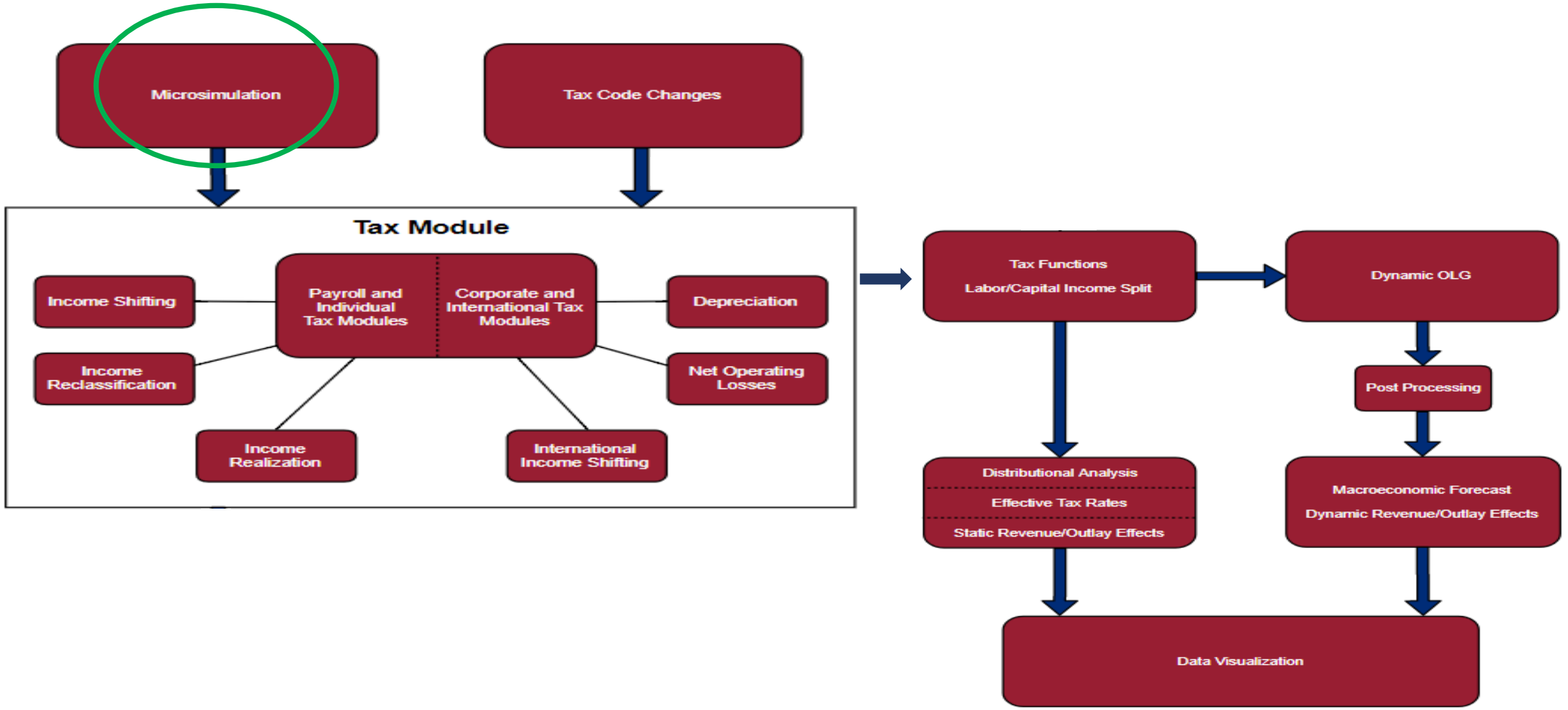
Aggregate Effects of Tax Reform

The Penn Wharton Budget Model

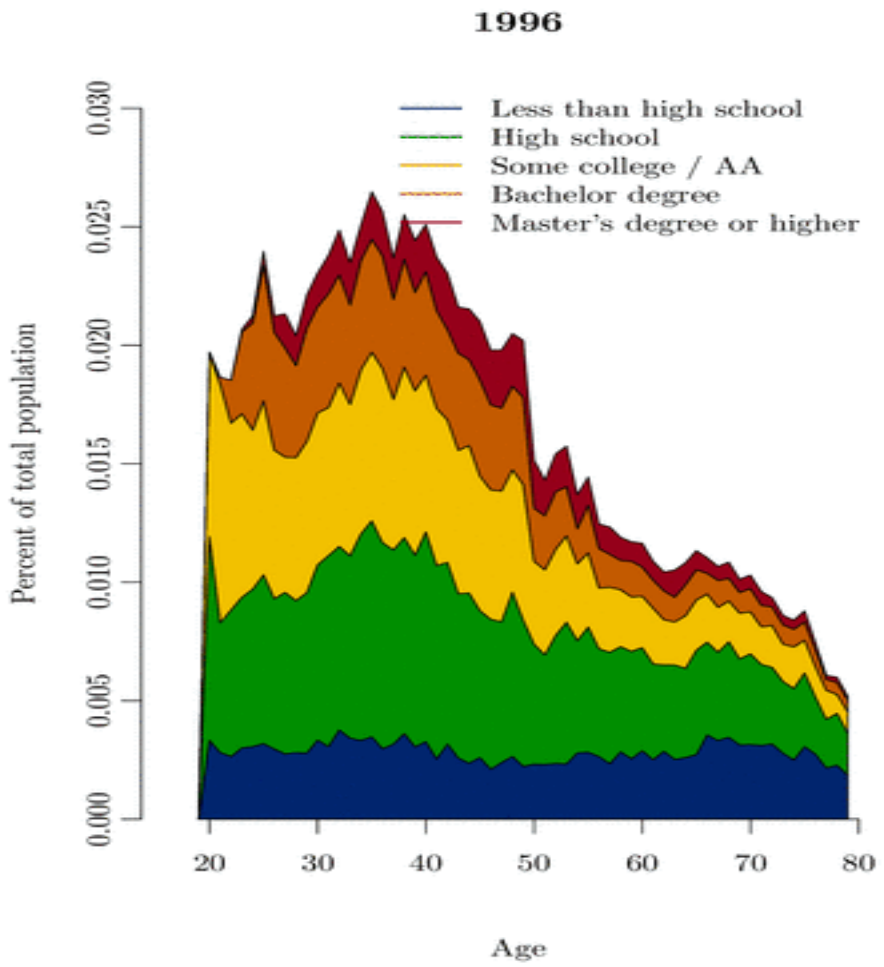
Kent Smetters \ April 12, 2018

The Penn Wharton Budget Model

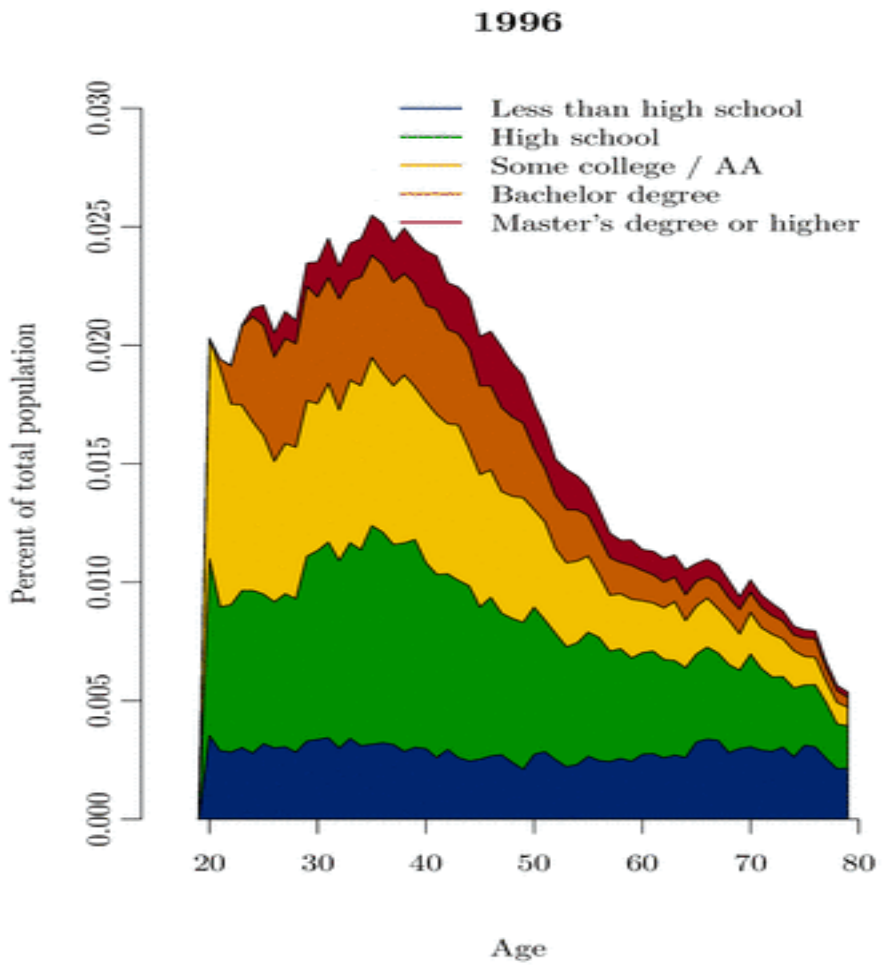


Education (1996 – 2070)

CPS

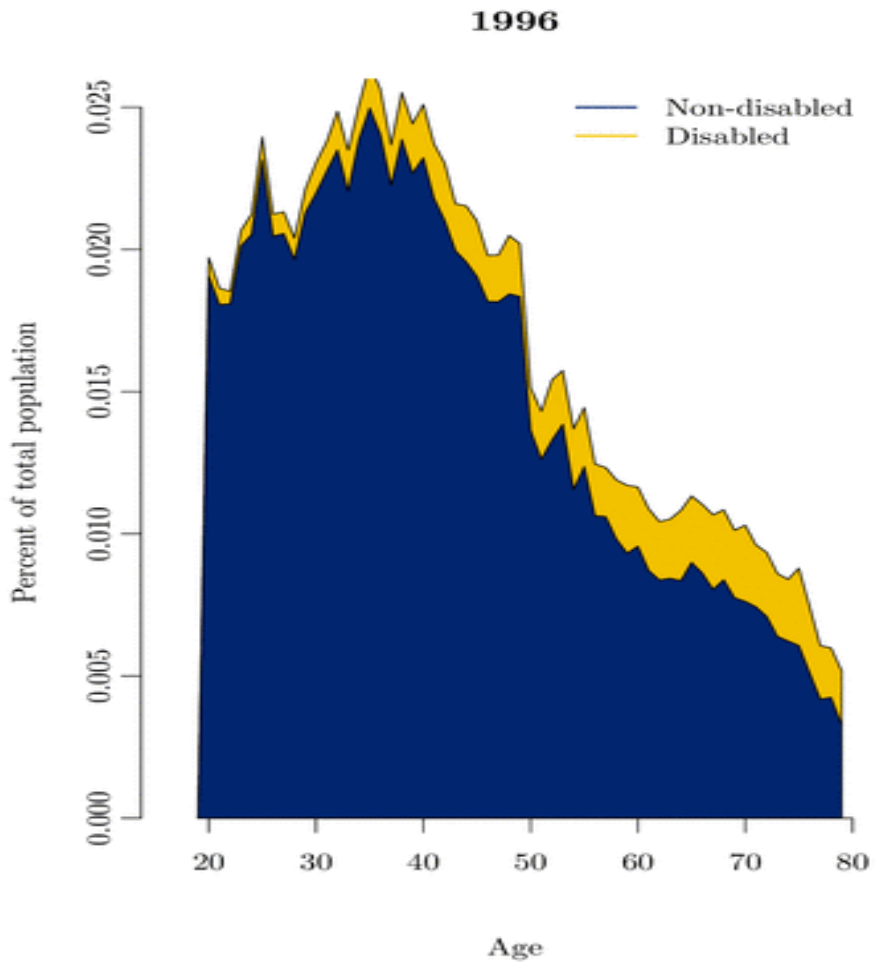


Microsimulation

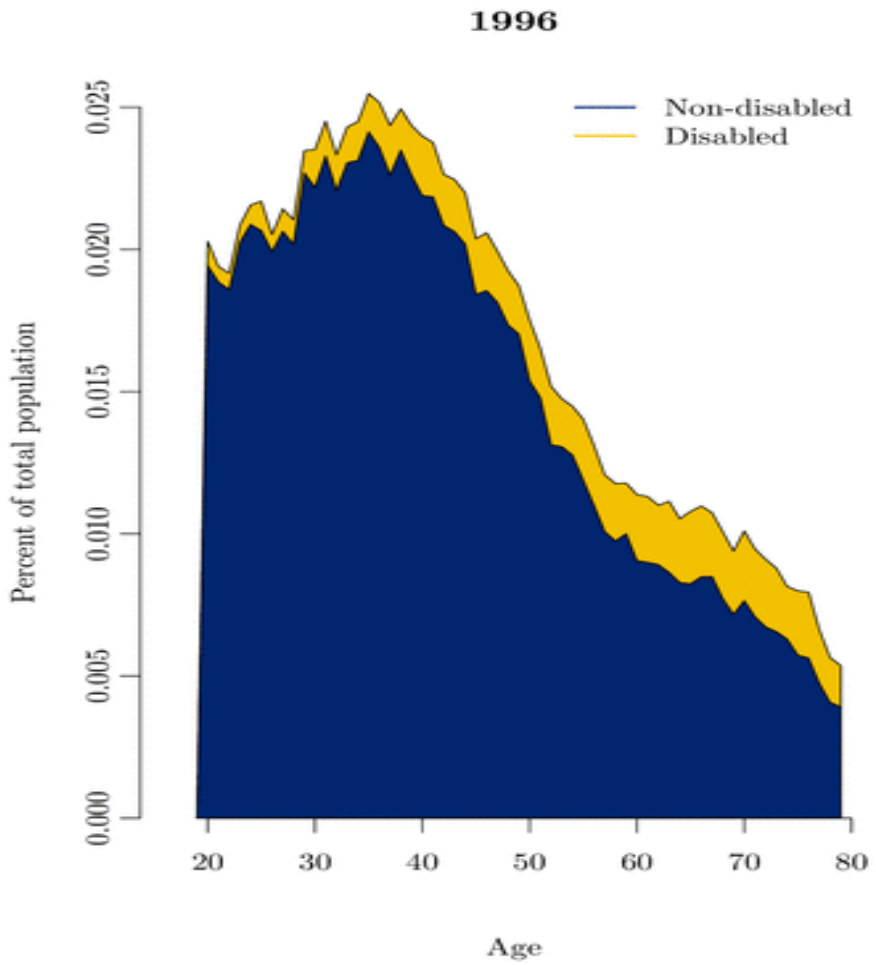


Disability (1996 – 2070)

CPS

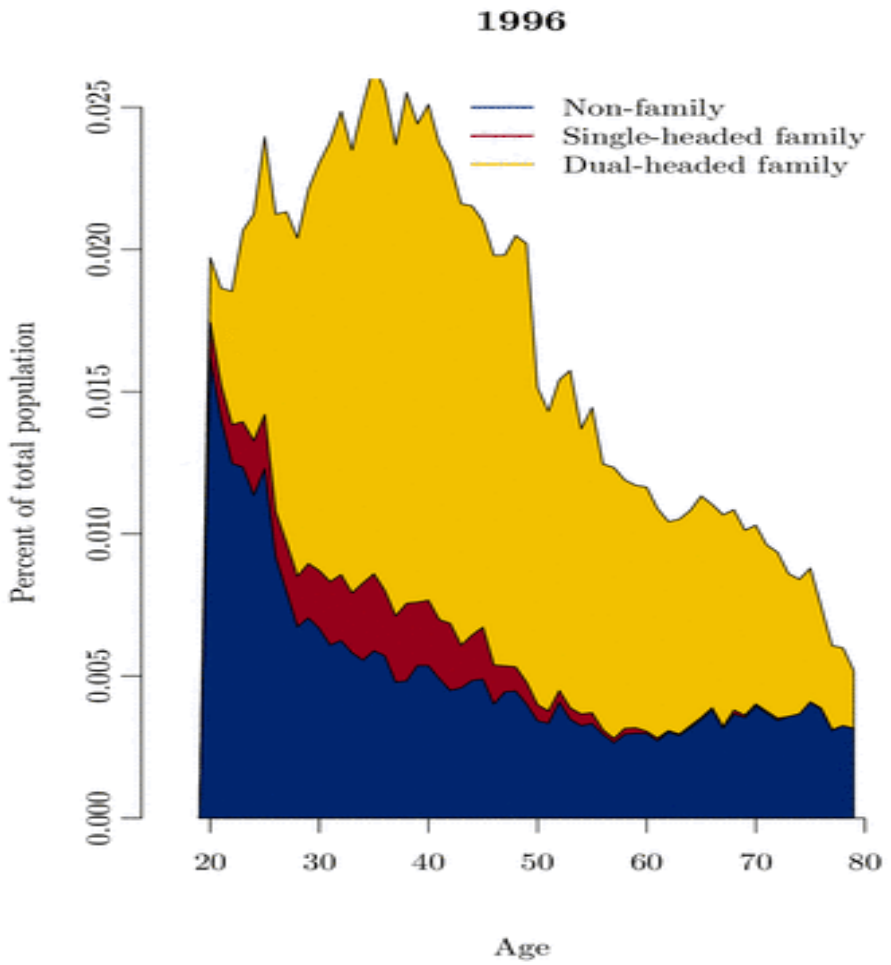


Microsimulation

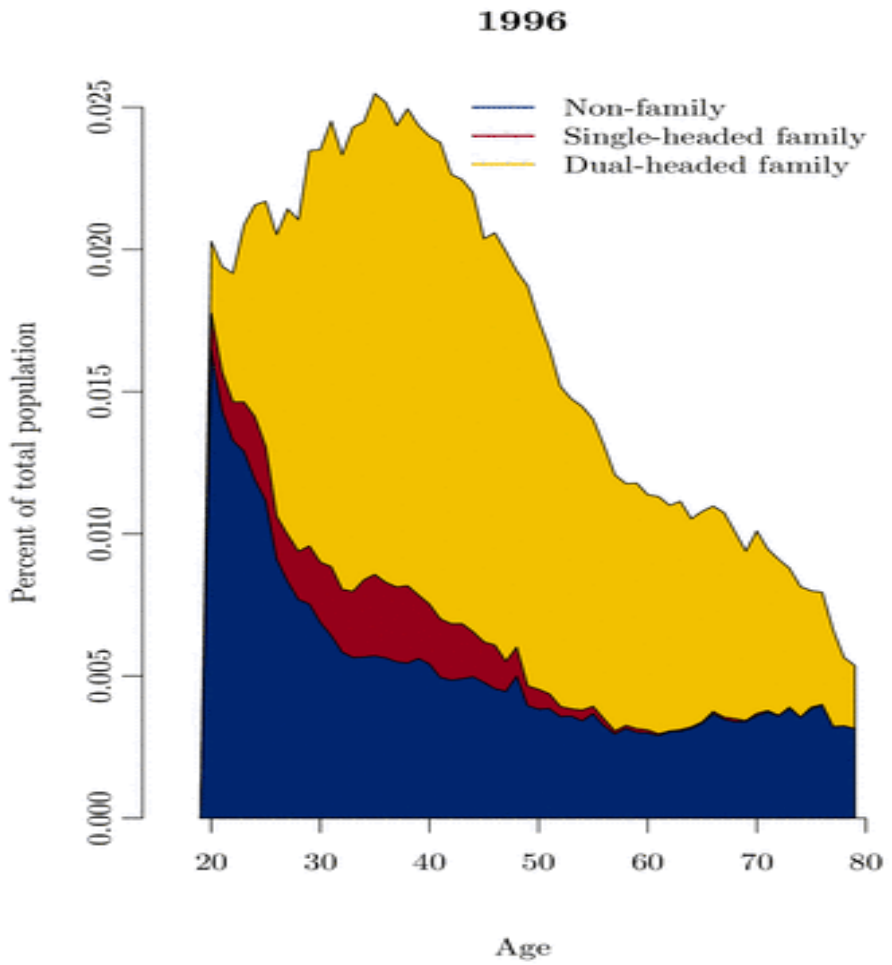


Family Composition (1996 – 2070)

CPS

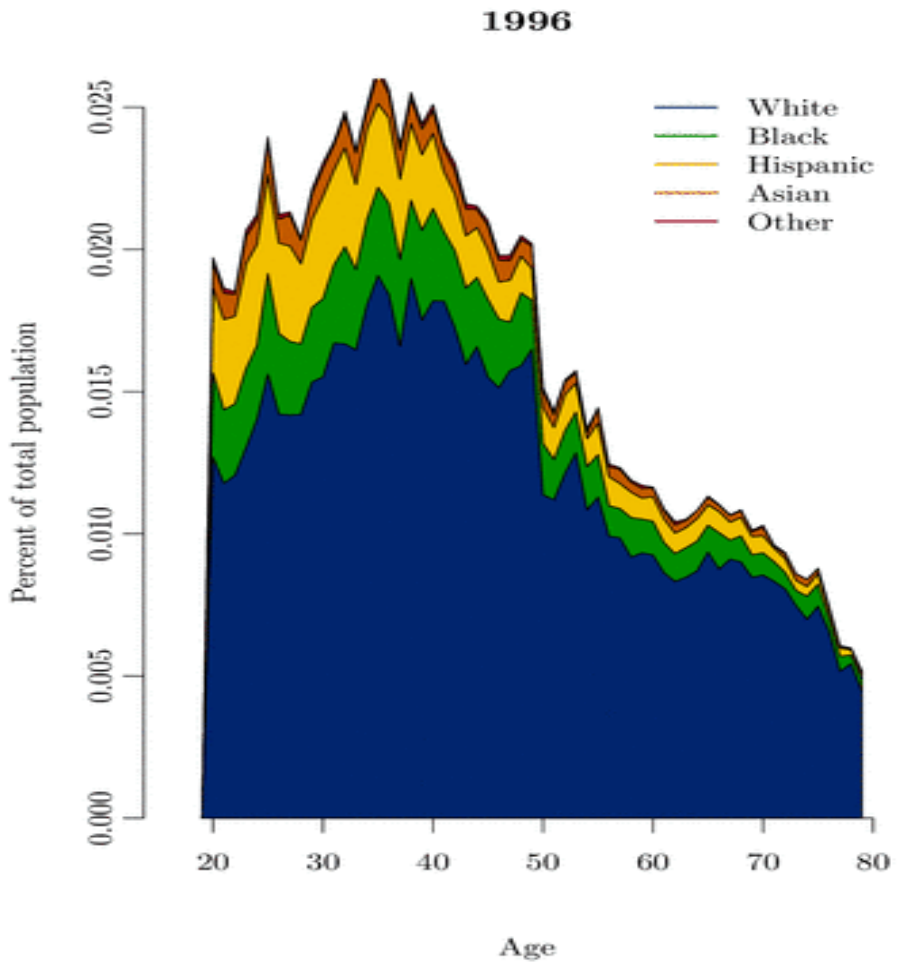


Microsimulation

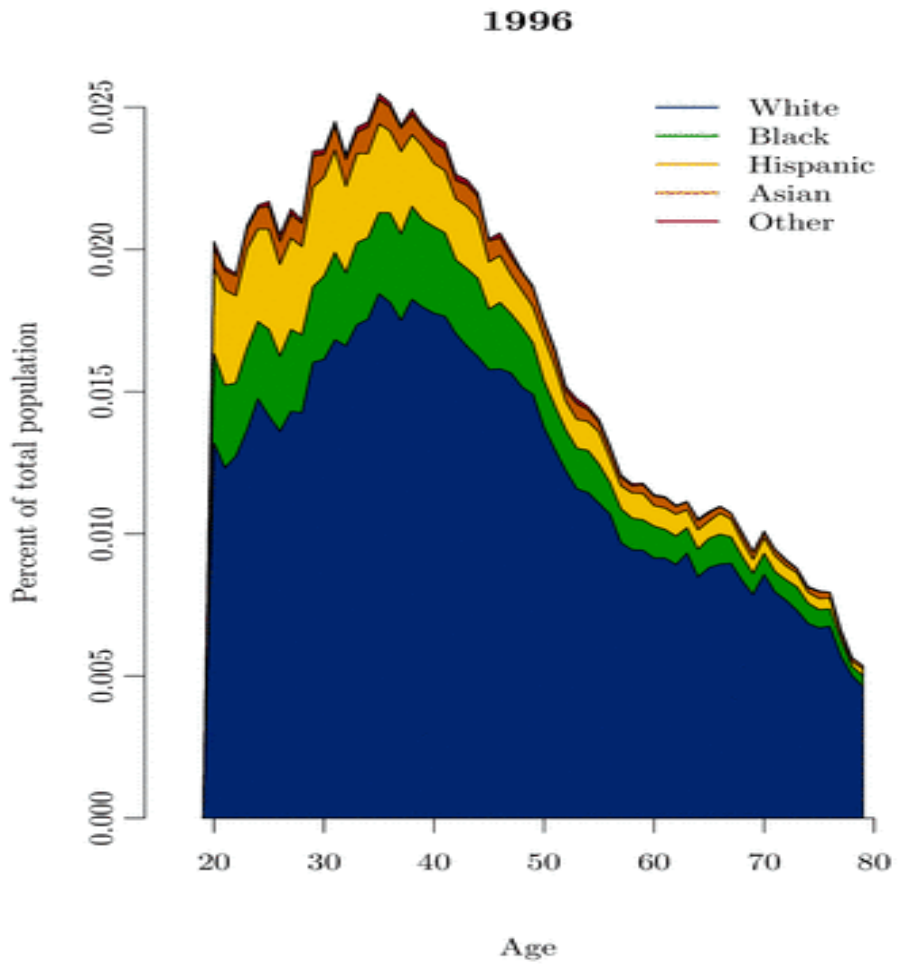


Race composition (1996 – 2070)

CPS

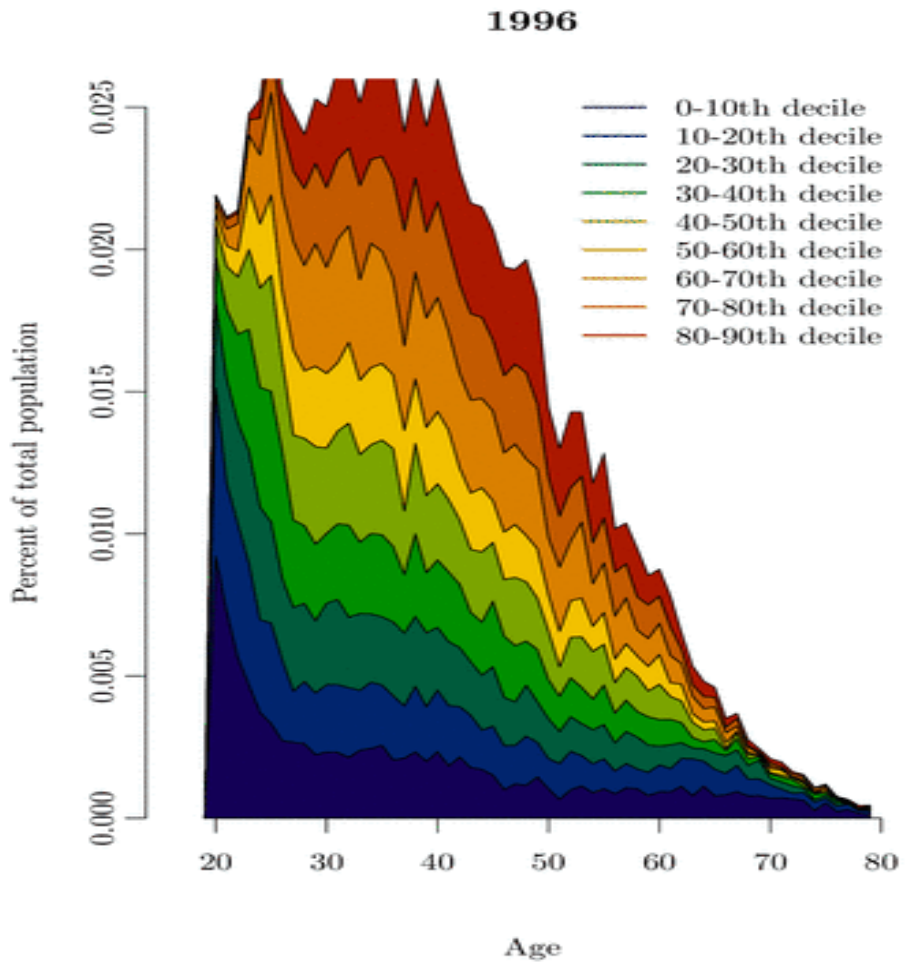


Microsimulation

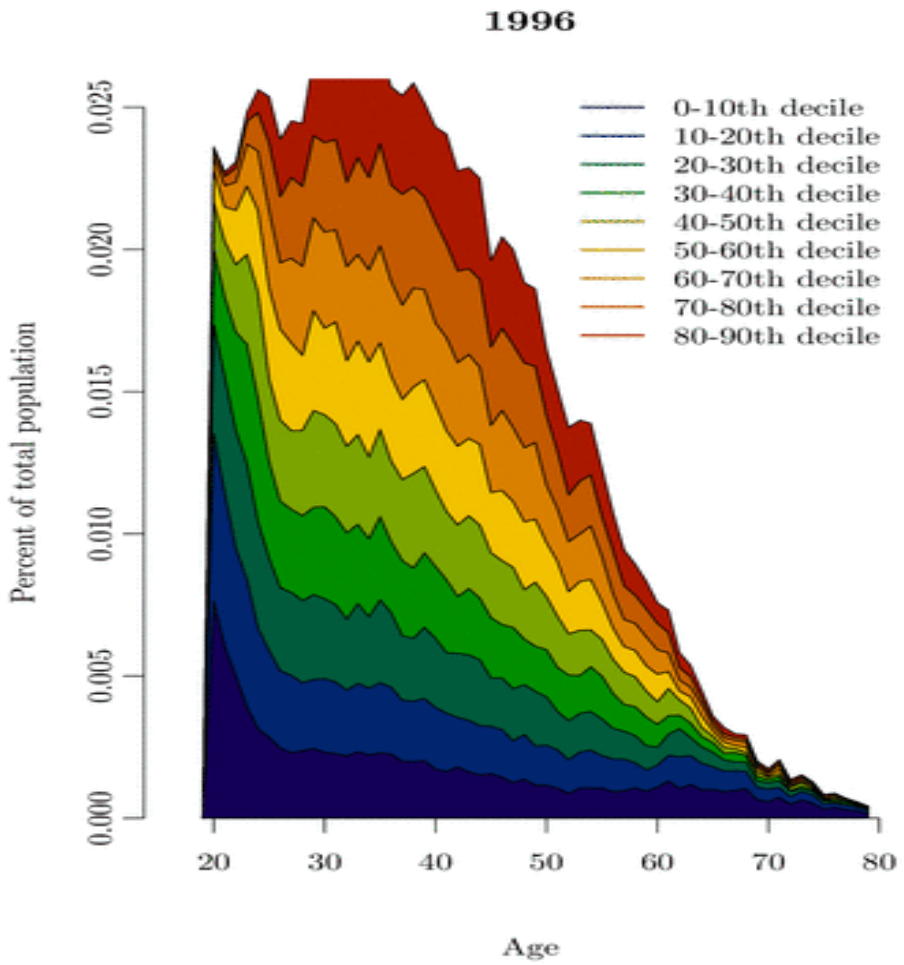


Wage income deciles (1996 – 2070)

CPS

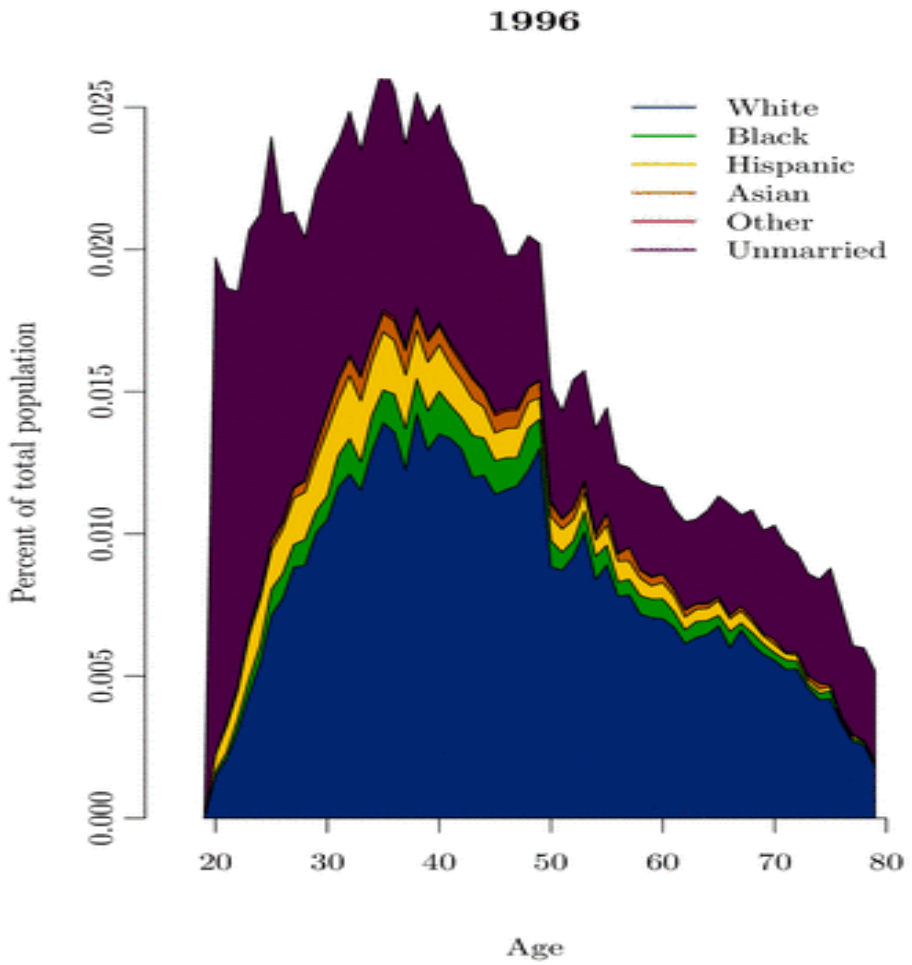


Microsimulation

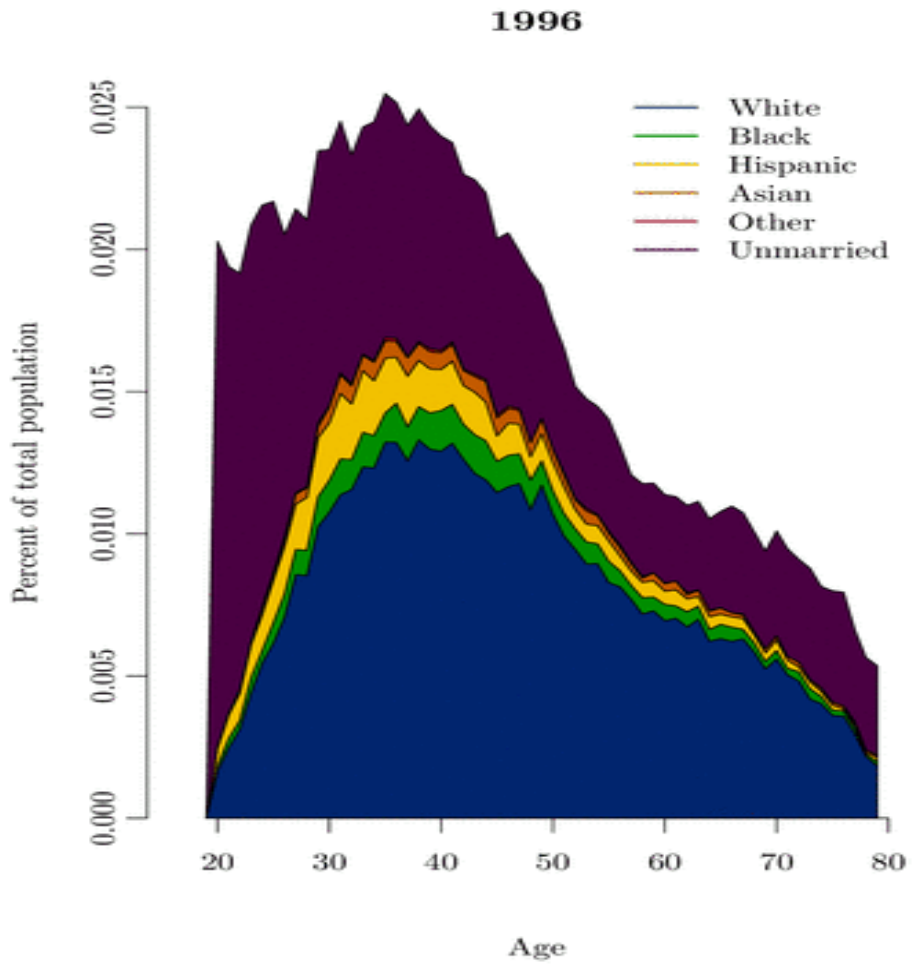


Race levels of marriage (1996 – 2070)

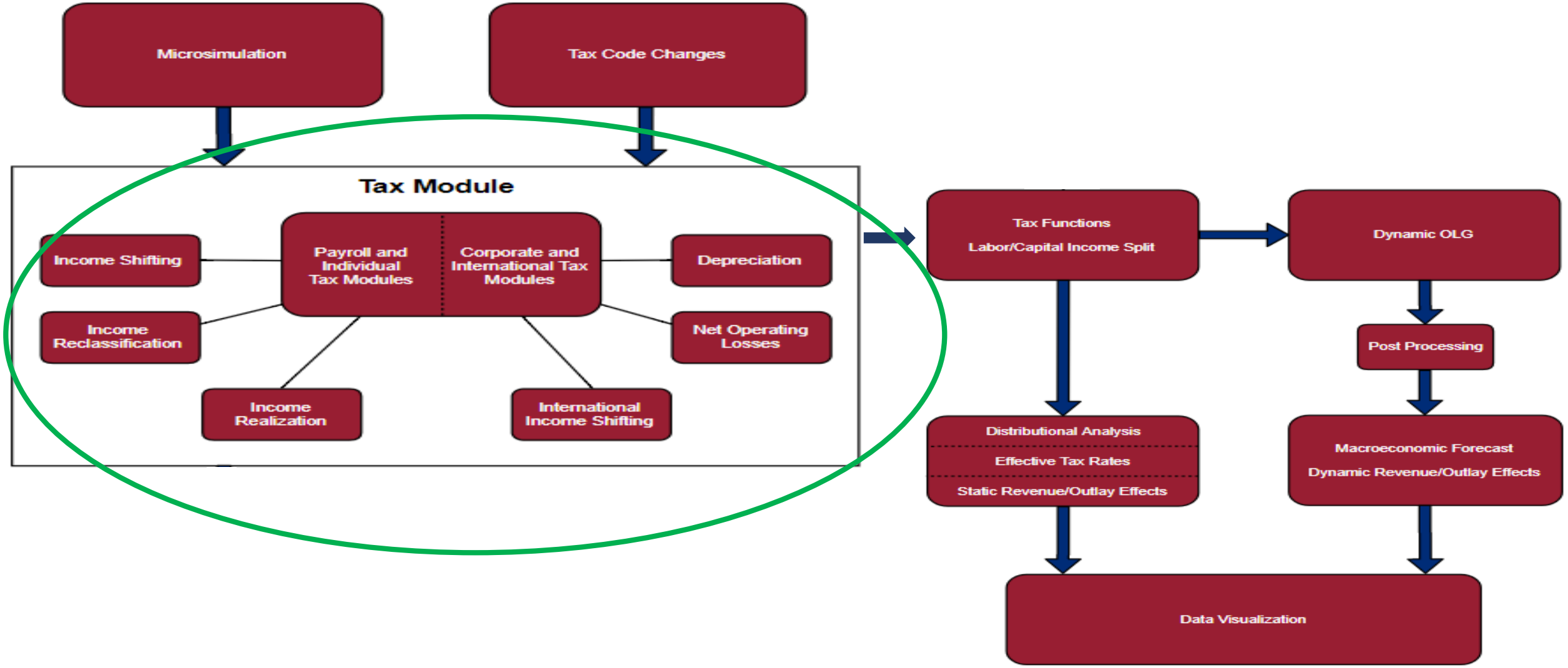
CPS



Microsimulation



The Penn Wharton Budget Model



Effective static corporate tax rates

Industry	Scenario	2018	2023	2027	2040
All industries	*Current law*	*21.18*	*23.53*	*22.95*	*21.93*
	TCJA	*9.16*	*17.33*	*18.88*	*16.06*

(Lots of heterogeneity by industry. See Appendix.)

We project that static ETR's will return most of the way to current law within 10 years => smaller impact on corporate side than first meets the eye

- *Temporary expensing substitutes depreciation*
- *2027 vs. 2040*

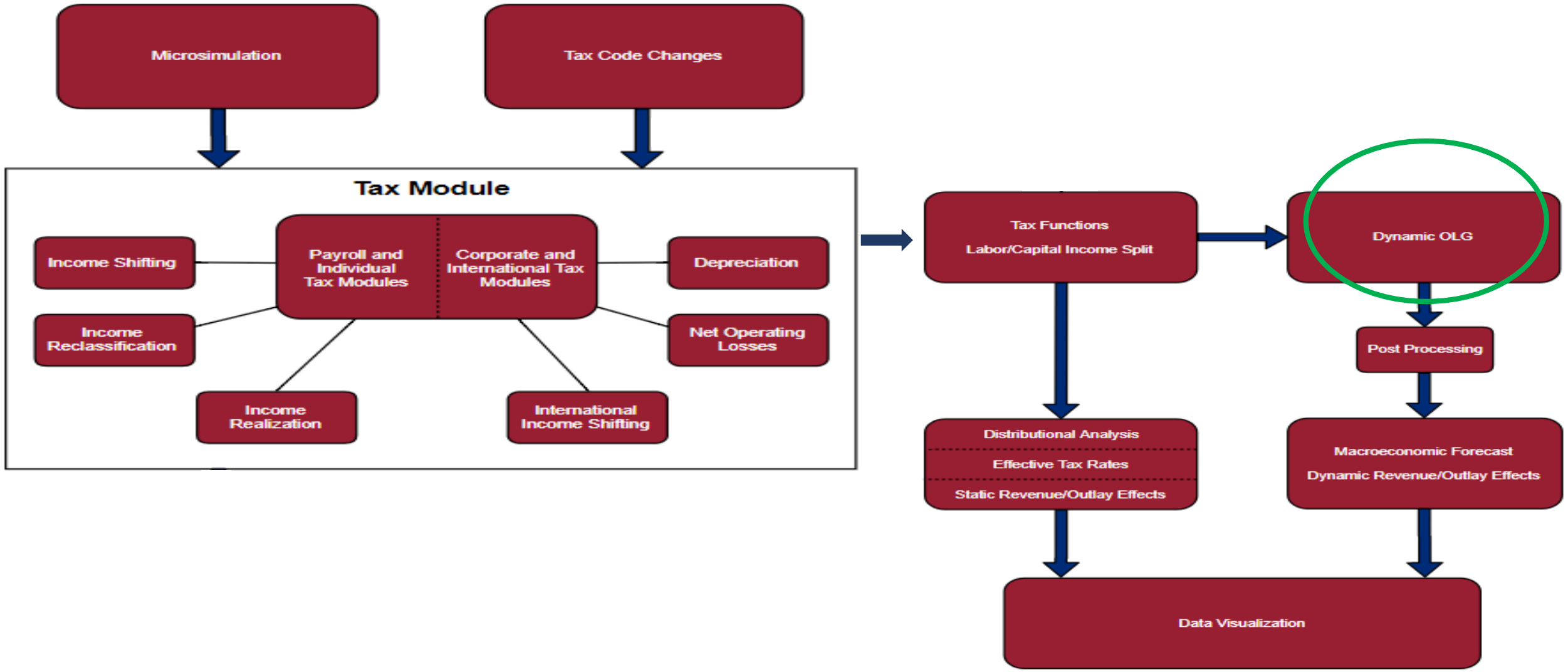
Static Estimates of JCTA Relative to Current Policy

	Revenue Effect 2018-2027 (billions of $)		Revenue Effect 2018-2040 (billions of $)
Major Category *	**JCT**	**PWBM**	**PWBM**
Individual	-1,127	-1,281	-59
Corporate	-654	-978	-2,443
International	324	291	495
Total (with Outlay Effects)	***-1,456***	***-1,968***	***-2,007***
Revenue (Total without Outlay Effects)	***-1,649***	***-2,209***	***-3,077***

We project $500 billion more in lost revenue than JCT, partly due to differences in base shifting.

Because dynamic OLG model is not fully Ricardian, having a good micro-sim and static tax model critical for dynamics.

The Penn Wharton Budget Model



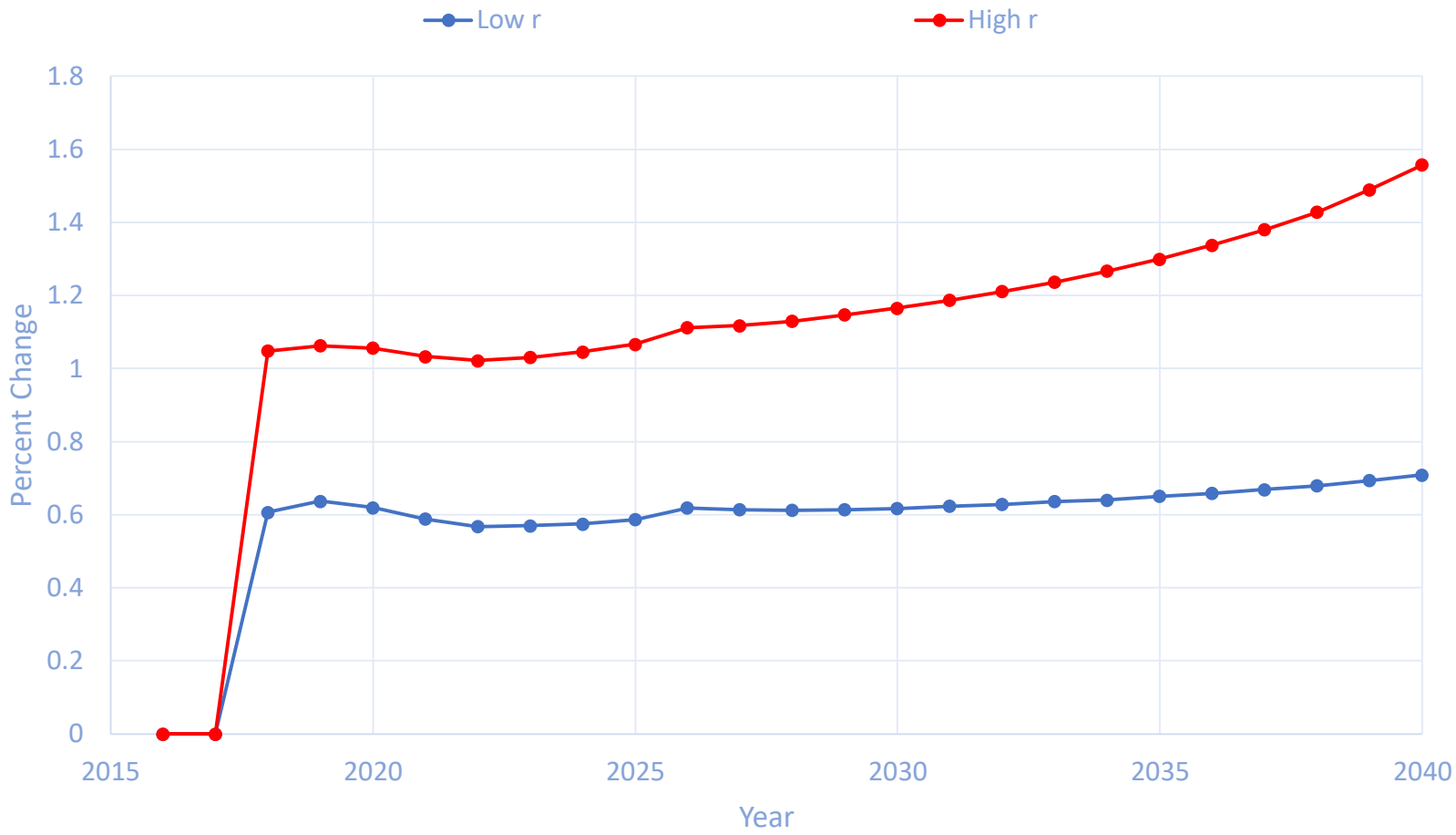
Dynamics Estimates of JCTA Relative to Current Policy, with Hybrid Expectations and Different Initial Values of *r*

	GDP (% change)		Labor Services (% change)		Capital Services (% change)	
Year	High return to capital	Low return to capital	High return to capital	Low return to capital	High return to capital	Low return to capital
2027	1.1%	0.6%	0.3%	0.4%	2.4%	0.8%
2040	1.6%	0.7%	0.2%	0.3%	4.5%	1.3%

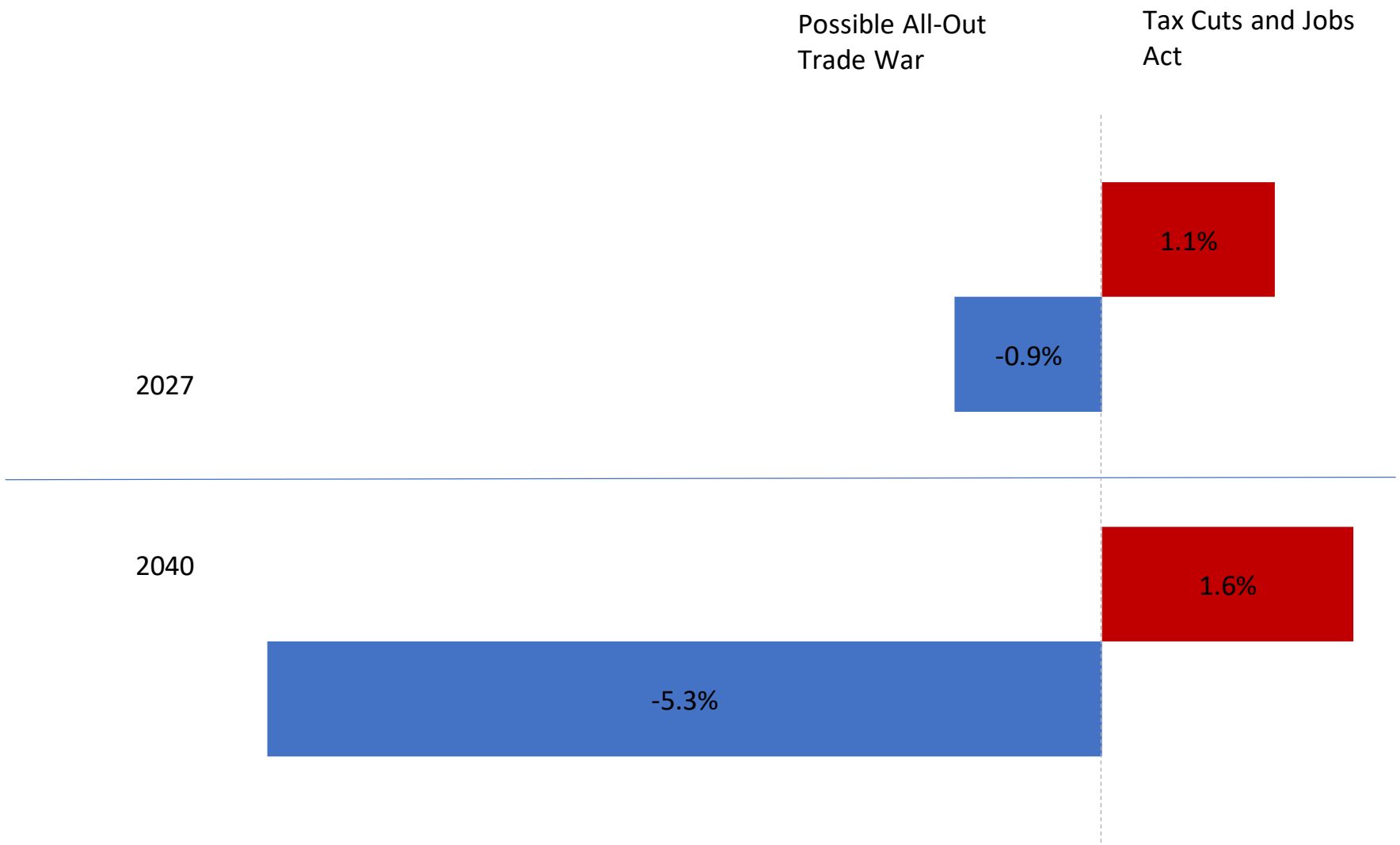
	Average Annual GDP Growth Rate (percentage point change)	
Years	High return to capital	Low return to capital
2018-2027	0.12%	0.06%
2028-2040	0.03%	0.01%

U.S. Gross Domestic Product (GDP)

Percent Change from Current Law



Potential of All-Out Trade War

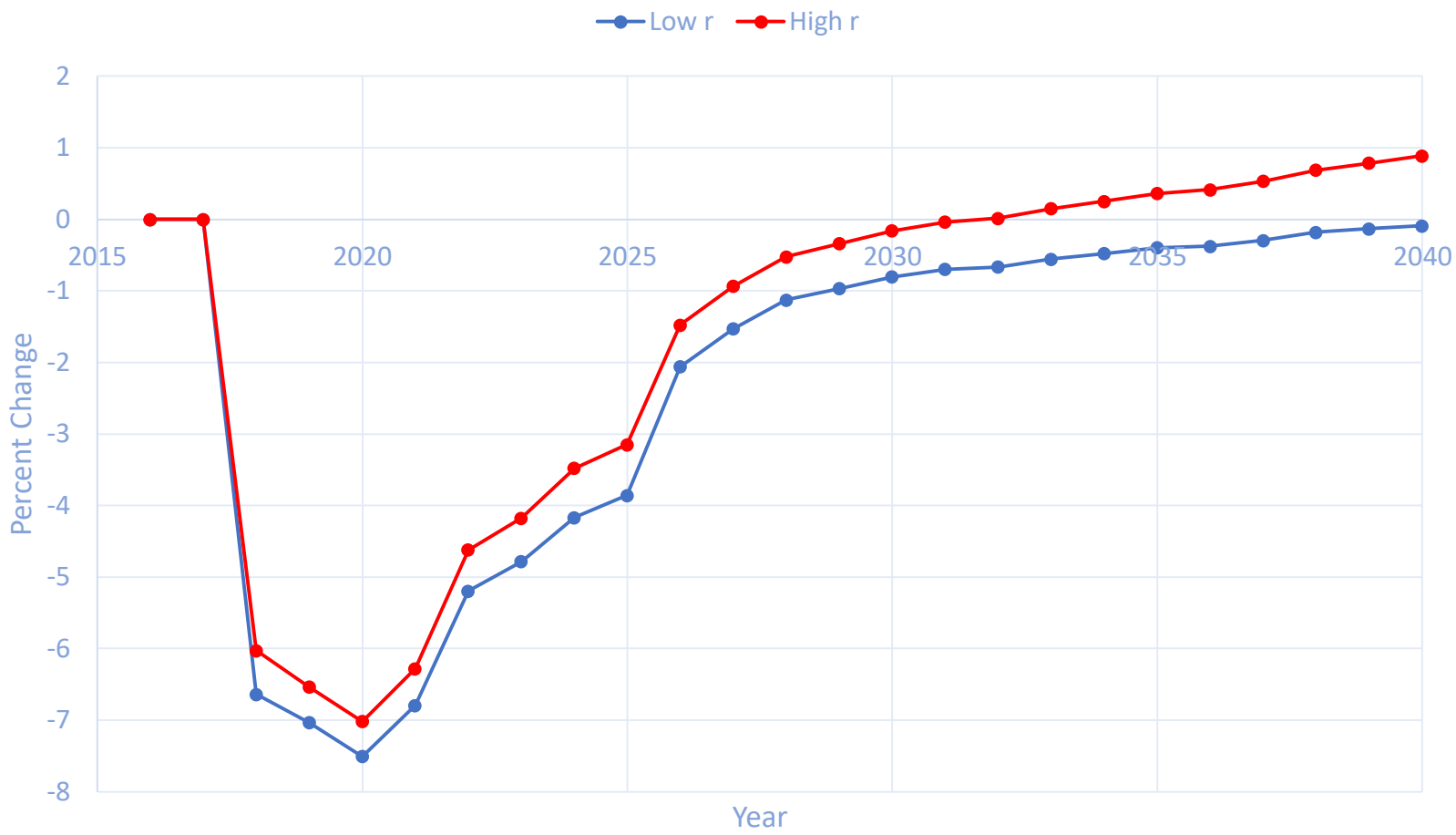


Static and Dynamic Revenue and Debt Projections

	Cumulative Revenue (billions of $)			Change in Debt (billions of $)		
	Static	Dynamic		Static	Dynamic	
Years		High return to capital	Low return to capital		High return to capital	Low return to capital
2018-2027	-$2,209	-$1,786	-$2,038	$2,387	$1,941	$2,238
2018-2040	-$3,077	-$1,540	-$2,442	$4,005	$2,181	$3,466

Federal Tax Revenues

Percent Change from Current Law



Effects of Extending the Changes to Individual Taxes in the TCJA on Revenue and Debt Relative to Current Policy

	Cumulative Revenue (billions of $)			Change in Debt (billions of $)		
	Static	Dynamic		Static	Dynamic	
Years		High return to capital	Low return to capital		High return to capital	Low return to capital
2018-2027	-$394	-$407	-$389	$439	$736	$573
2018-2040	-$3,556	-$3,968	-$3,772	$4,793	$6,054	$5,245

Negative dynamic score: very little marginal effects on individual side coming from extensions.

APPENDIX

The Penn Wharton Budget Model

- Static micro-simulation model to create "levels" in the presence of demographic changes
  - Has a production function for ensuring consistency between macro and micro variables.
  - But, except for things like immigration that directly impact L, GDP, for example, not impacted.
  - Tax bases, of course, changes in a static sense, as does debt.

- Dynamic OLG model to create "deltas"
  - Static mode: run with new fiscal policy targets (e.g., tax functions, revenue targets, debt) from micro-sim model with *pre-reform* household decision rules (i.e., Bellman "policy functions")
  - Dynamic mode: allow household decision rules to change. Targets like debt now fully endogenous, unless, of course, 100% international capital flows (small open economy)
  - Delta's: calculate the difference

- Layer dynamic deltas on top of static model results for final levels
  - Assumes deltas are largely independent of demographics (CBO and PWBM have tested this point)

➡ Net effect: ability to score actual legislation with the workhorse dynamic model in public economics

Micro-simulation model: Overview

- Transition rules: fertility; immigration; mortality; education; marriage and divorce; disability; labor-force participation and earnings; employment status changes (into and out of self-employment); unemployment spells; retirement; tax payments and transfer receipts from welfare programs; capital assignments to each individual
  - Estimated using CPS, PSID, HRS, CDC, and many other data sets
  - Some rules estimated using reduced-form Markov transition rules
  - However, big decision rules like marriage/divorce are structurally estimated using a dynamic programming marriage model brought to PSID data

- Cross-walk empirical exercise between IRS SOI tax data and CPS data for doing longer-term projections (CBO also does this, but not JCT or other entities).

- Validation

OLG model: Overview

- Production: Representative firm used for our TCJA estimates
  - Adjustment costs turned off
  - No aggregate risk ("curse of dimensionality"): factor prices perfectly forecasted
- Heterogenous households:
  - Lifecycle agents that face idiosyncratic wage and mortality risks
  - Taxes paid at household level, but we distinguish between C corp (double tax) and pass-through
  - Capture empirical income distribution very well and wealth distribution fairly well
  - Keynesian effects through borrowing constraints; labor market frictions turned off
- Tax policies:
  - Use actual individual tax functions (not smoothed) based on micro-sim model
  - Closure rule forces debt-GDP ratio to stabilize at 2040 by cutting "wasteful" spending thereafter
- Calibration:
  - Small open economy case calibrated to micro-sim, e.g., debt projections. Then, we allow growing pre-reform debt path to impact the economy along "dynamic baseline" as we move to large, open economy, where 40% of each additional dollar of debt is purchased by foreigners.
  - Other calibration choices to hit various elasticities (labor, savings), interest rate, etc.

The "Big Dirty Secret" of all Dynamic Tax Models

- The usual elasticities are really second order in importance
  - Matter more with revenue-neutral exercise
  - The assumption about international capital flows is much more important
  - For example, a full-scale trade war undoes all gains by 2027 by 4X gains by 2040

- Even with an infinite savings elasticity, the assumed initial interest rate determines most of the results
  - High initial interest rate (with equity premium) => bigger gains
  - Lower initial interest rate (no equity premium) => smaller gains
  - With no price uncertainty, seems silly to assume higher initial interest rate. However, barring full loss offsets (a la Domar and Musgrave), hard to observe world with only a risk-free return (e.g., pick the right capital-output ratio).
  - Problem: Assumed model is lower dimension than true model generating the data
  - Ultimately, we need models that deal with curse of dimensionality.

Effective corporate tax rates by industry

Service

Industry	Scenario	2018	2023	2027	2040
All industries	*Current law*	*21.18*	*23.53*	*22.95*	*21.93*
	TCJA	*9.16*	*17.33*	*18.88*	*16.06*
Accommodation and food services	Current law	15.13	16.29	15.41	13.60
	TCJA	8.46	10.60	10.42	7.83
Administrative and support and waste management and remediation services	Current law	25.68	28.50	27.75	26.46
	TCJA	13.90	19.82	20.30	16.34
Arts, entertainment, and recreation	Current law	26.61	30.09	29.10	27.37
	TCJA	15.37	23.04	23.99	20.40
Educational services	Current law	28.95	31.95	31.34	30.46
	TCJA	16.42	23.58	24.34	21.30
Health care and social assistance	Current law	29.42	32.40	31.57	29.54
	TCJA	16.59	24.04	24.76	21.10
Professional, scientific, and technical services	Current law	25.41	28.82	28.11	26.83
	TCJA	14.29	22.10	22.62	19.69
Other services	Current law	29.41	32.55	31.96	31.15
	TCJA	16.32	23.84	24.65	21.51

Finance and Real Estate

Industry	Scenario	2018	2023	2027	2040
All industries	*Current law*	*21.18*	*23.53*	*22.95*	*21.93*
	TCJA	*9.16*	*17.33*	*18.88*	*16.06*
Finance and insurance	Current law	26.08	28.90	28.52	27.88
	TCJA	14.30	20.82	20.71	18.61
Real estate and rental and leasing	Current law	26.50	30.22	29.30	27.99
	TCJA	10.85	22.96	24.17	20.50
Management of companies (holding companies)	Current law	16.17	17.18	16.82	15.92
	TCJA	8.73	10.19	9.10	8.93
Information	Current law	22.40	25.23	24.63	23.63
	TCJA	12.76	19.34	19.91	16.46

Manufacturing and Construction

Industry	Scenario	2018	2023	2027	2040
All industries	*Current law*	*21.18*	*23.53*	*22.95*	*21.93*
	TCJA	*9.16*	*17.33*	*18.88*	*16.06*
Construction	Current law	28.50	31.76	31.16	30.30
	TCJA	16.01	23.58	24.32	21.21
Manufacturing	Current law	17.51	19.36	18.77	17.68
	TCJA	10.94	15.92	16.26	14.02
Mining	Current law	15.83	18.66	17.56	16.01
	TCJA	7.37	11.87	14.64	2.88
Transportation and warehousing	Current law	28.78	31.86	31.27	30.52
	TCJA	15.97	23.23	24.22	21.31
Utilities	Current law	28.83	32.17	31.22	29.72
	TCJA	15.62	23.43	24.64	21.42

Trade

Industry	Scenario	2018	2023	2027	2040
All industries	*Current law*	*21.18*	*23.53*	*22.95*	*21.93*
	TCJA	*9.16*	*17.33*	*18.88*	*16.06*
Retail trade	Current law	27.49	30.28	29.68	28.82
	TCJA	15.58	22.18	22.96	20.25
Wholesale trade	Current law	25.90	28.68	28.09	27.21
	TCJA	14.45	20.60	21.31	18.41
Agriculture, forestry, fishing, and hunting	Current law	30.06	33.27	32.71	32.01
	TCJA	16.72	24.46	25.36	22.47

Service

Industry	Current Law	TCJA	Tax Saving
Accommodation and food services	39.5	21.5	18.0
Administrative and support and waste management and remediation services	40.5	21.5	19.0
Arts, entertainment, and recreation	5.0	5.5	-0.5
Educational services	9.0	5.3	3.7
Health care and social assistance	28.3	22.4	5.9
Professional, scientific, and technical services	130.0	107.3	22.7
Other services	10.5	5.9	4.6

Finance and Real Estate

Industry	Current Law	TCJA	Tax Saving
Finance and insurance	715.6	466.2	249.4
Management of companies (holding companies)	321.1	166.9	154.2
Real estate and rental and leasing	42.3	29.6	12.7
Information	322.0	222.8	99.2

Estimates of the Effect of the Tax Cuts and Jobs Act on Federal Tax Revenues Relative to Current Policy

Individual

	Revenue Effect 2018-2027 (billions of $)		Revenue Effect 2018-2040 (billions of $)
Tax Provision	**JCT**	**PWBM**	**PWBM**
New tax rate and bracket structure	-1,214	-1,307	-1,364
Expand the standard deduction and repeal personal exemptions	491	438	438
Index tax provisions to chained CPI	134	88	765
New pass-through business deduction	-415	-542	-758
Pass-through business loss limits	150	140	114
Expand Child Tax Credit (CTC) and new non-child dependent credit	-573	-511	-532

Individual (cont.)

	Revenue Effect 2018-2027 (billions of $)		Revenue Effect 2018-2040 (billions of $)
Tax Provision	**JCT**	**PWBM**	**PWBM**
Repeal and modifications to itemized deductions	668	459	496
Alternative Minimum Tax (AMT) changes	-637	-317	-313
Reforms to certain deductions and credits	25	26	9
Reforms to certain individual tax expenditures, including the ACA's individual mandate	328	328	1,169
Estate Tax Exemption Doubled	-83	-83	-83
Subtotal	***-1,127***	***-1,281***	***-59***

Corporate

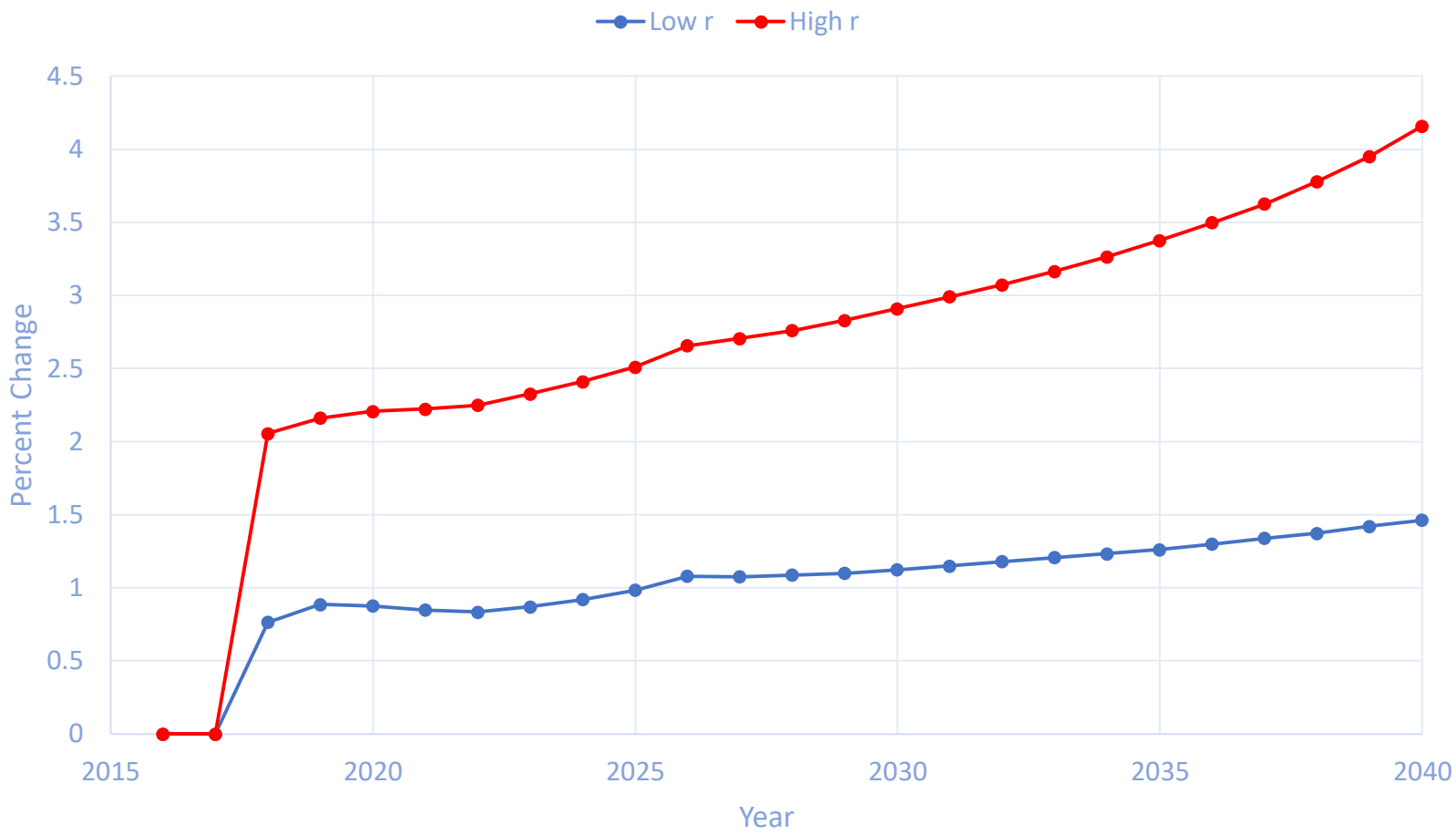
	Revenue Effect 2018-2027 (billions of $)		Revenue Effect 2018-2040 (billions of $)
Tax Provision	**JCT**	**PWBM**	**PWBM**
Corporate tax rate 20% starting 2019	-1,389	-1,435	-4,185
Net interest deduction capped at 30% of income	253	193	753
Changes to the treatment of investment	-86	-180	-152
Modification to net operating loss deductions	201	145	169
Amortize research & experimentation costs	120	51	88
Repeal of Domestic Production Deduction	98	100	300
Reforms to certain business tax expenditures	149	148	584
Subtotal	***-654***	***-978***	***-2,443***

International

	Revenue Effect 2018-2027 (billions of $)		Revenue Effect 2018-2040 (billions of $)
Tax Provision	**JCT**	**PWBM**	**PWBM**
Territorial System	-224	-173	-509
Special one-time repatriation rate	339	254	232
Other international reforms	210	210	772
Subtotal	***324***	***291***	***495***

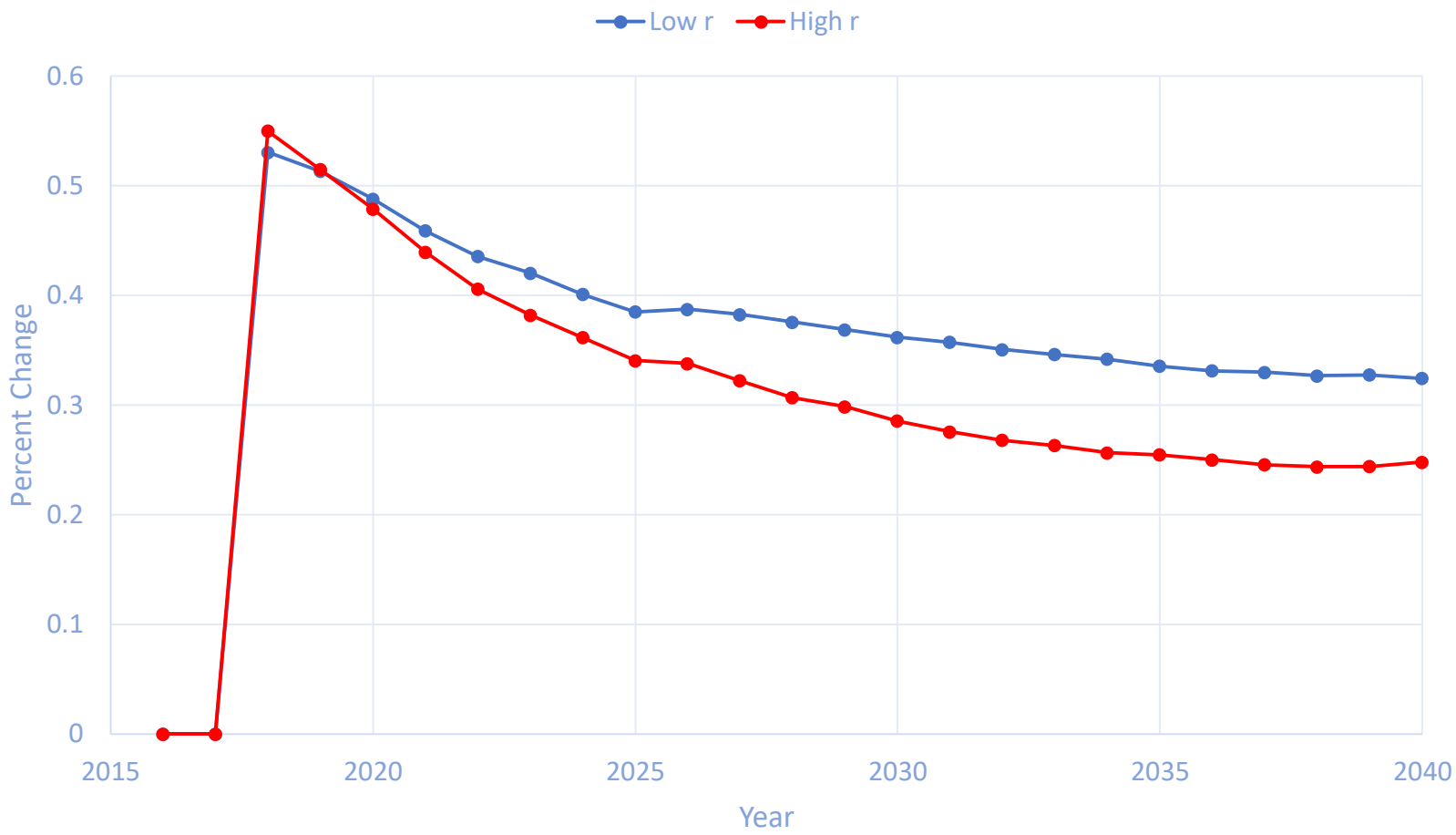
Capital Services

Percent Change from Current Law



Hours Worked

Percent Change from Current Law



Federal Debt

Percent Change from Current Law