

# Penn Wharton Budget Model: Overview

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Combines modern advances of theoretical modeling, big data, Agile testing and development, cloud computing and dynamic visualization to solve challenging government budget questions:

- **Static Model:** Micro-simulation model that allows for a rich amount of heterogeneity and transitions
- **Dynamic Model:** Stochastic OLG model that creates “deltas” to sit on top of the micro-sim model.
- **Data:** A new data store combining large data sets at the household and aggregate level, used for model calibration
- **Cloud Computing:** Thousands of processors solving the economy across the entire set of policy combinations (e.g., for Social Security, 4,096 different policy combinations). Results stored on load-balanced JSON servers for immediate access.
- **Visualization:** Dynamic display reflects user choices

# Dynamic Model: Fundamentals

Integrated with TPC static model, with only a few series coming from our static model for making debt calculations:

- Households make decisions about how much to work and save over their lifecycle, with overlapping generations.
- Decisions based on current and anticipated future economic conditions (such as uncertain wages, uncertain longevity, deterministic interest rates) and government policies
- Labor and capital markets determine the wages and the rental rate of capital that clear those markets.
- Shorter-term “Keynesian-like” effects: borrowing constraints (endogenous hand-to-mouth consumers) who immediately consume most of tax change; labor supply frictions, and a check for nominal wage rigidity (not binding for our purpose)

# Dynamic Model: Key Elements for Tax Reform

Enhancements over many academic-like models:

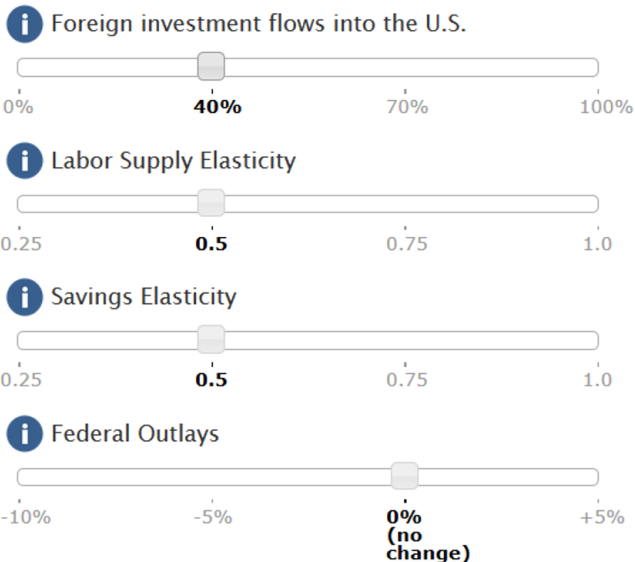
- Unbalanced tax reforms: critical for understanding changes in marginal tax rates and concomitant changes in debt.
- International capital flows: can make different assumptions about how easily foreign capital flows. This feature and debt accumulation are key drivers.
- Dynamic deltas: results can be layered as “deltas” on top of micro-simulation results
- Deeper modeling of hybrid U.S. residential / territorial tax system
  - Household side includes deductions, pass-through share of capital income, progressive tax schedule.
  - Corporate tax is flat, territorial tax treatment with adjustable expensing.

Model calibrated using a rich set of data sets:

- Current Population Survey (CPS)
- Panel Study of Income Dynamics (PSID)
- IRS Statistics of Income (SOI)
- SSA Public Use Files
- National Centers for Health Statistics Vital Statistics
- BEA Integrated Macro Accounts
- Federal Reserve, Survey of Consumer Finances
- Federal Reserve, U.S. Financial Accounts
- National Cancer Institute U.S. Mortality Data
- Bureau of Labor Statistics

# Dial Controls

User can vary key behavioral assumptions

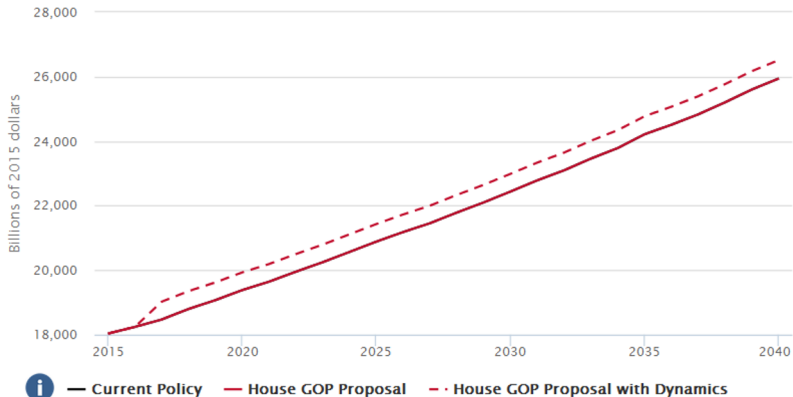


# Most important setting: Foreign Investment

## Open Economy

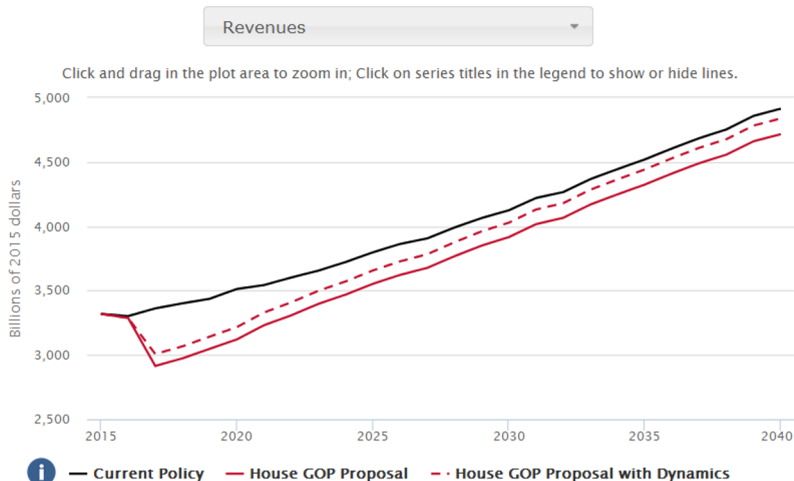
Gross Domestic Product

Click and drag in the plot area to zoom in; Click on series titles in the legend to show or hide lines.



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## Open Economy



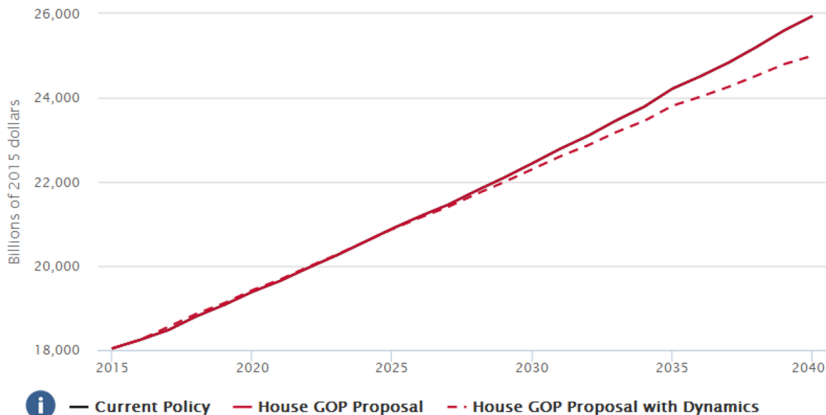


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Closed Economy

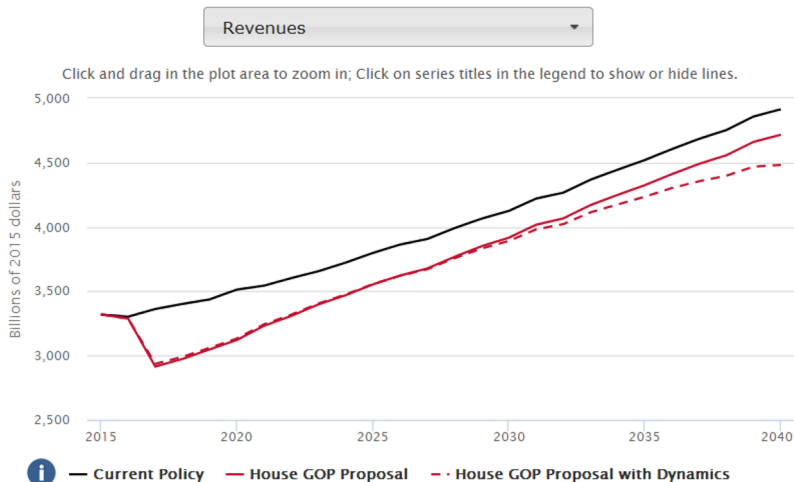
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Closed Economy

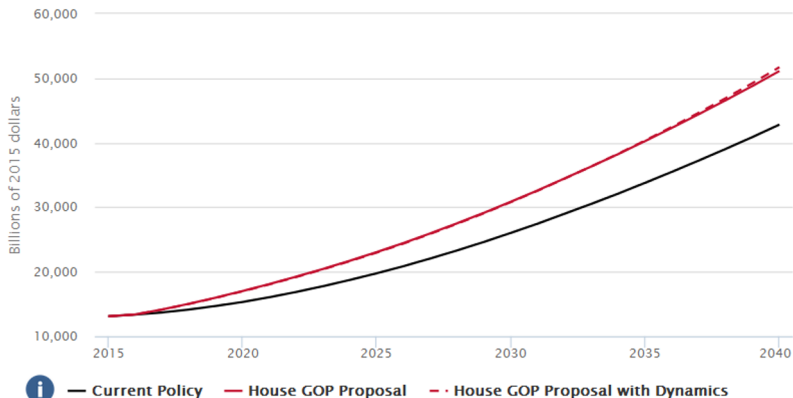


# Most important setting: Foreign Investment

## Closed Economy

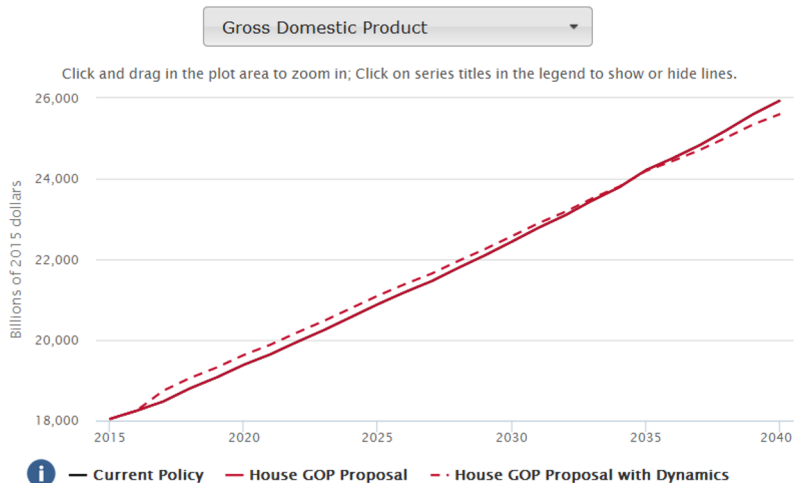
Debt Held by the Public

Click and drag in the plot area to zoom in; Click on series titles in the legend to show or hide lines.



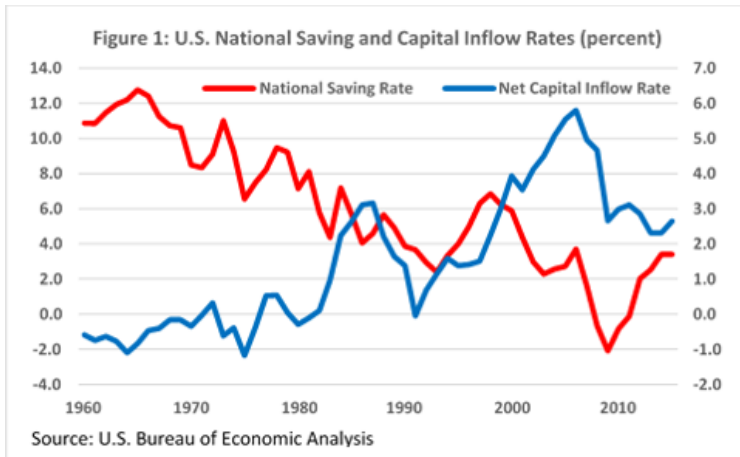
# Most important setting: Foreign Investment

Baseline Economy (40%)

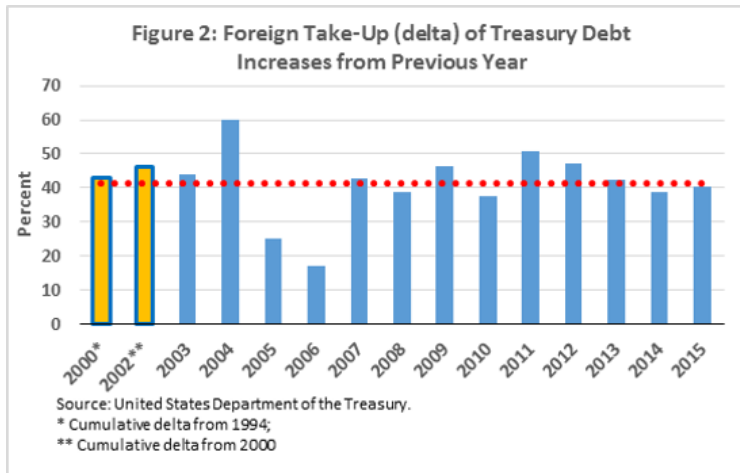


# Most important setting: Foreign Investment

Why our Default Choice of 40%?



# Most important setting: Foreign Investment



# Why capital fails to flow more?

- Feldstein and Horioka (1980): “home bias” (e.g., different legal structures, investing in what you know, etc.) producing a reluctance to diversify financial portfolios across countries
- Obstfeld and Rogoff (2000): Home bias declined over time, but it still remains high.
- Today: foreign entities (individuals, corporations, and governments) hold only 18.5% of total financial securities issued by U.S. domestic sectors (including federal, state, and local governments).
- So, our 40% value is probably generous
- Moreover, no free lunch: more capital flows implies more foreign capital stock ownership

- Will soon add more detail to website breaking down national income and tax revenue by source (working hard to line up with TPC definitions)
- Add adjustment costs and other features
- Clinton and Trump, to be released



# Main Takeaway

## New Versus Old Capital

- Business investment has indeed declined in U.S.
- Also, U.S. corporate statutory rate is higher than other developed countries.
- Tax plan above attempts to “doubly encourage” capital investment by increasing expensing (bonus depreciation) and by reducing the corporate income tax rate.
- But, these two features actually work in opposite directions for stimulating the economy in our model.

# Main Takeaway

## Expensing

- Expensing is a powerful mechanism for stimulating **new** investment, as it applies only to new capital
- Full expensing implies new investment pays no taxes in present value (unless there are rents, which *could* be efficient to tax)
- Unless adjustment costs are high, existing capital takes a hit.
- In math: Tobin's  $q = 1 - \tau_k * Z$ , where  $Z$  is the expensing rate and  $\tau_k$  is the corporate tax rate
- Increasing  $Z$  alone lowers  $q$ , which is an efficient lump-sum “wealth tax” used to reduce future tax rates.
- Lowering  $\tau_k$  at the same time is like wearing two pairs of (costly) socks: new capital is already effectively untaxed as  $Z$  approaches 1. So, lowering  $\tau_k$  just rewards existing capital, increasing deficits.
- Biggest bang for buck (Bradford's X tax): set  $Z = 1$  (full expensing) while setting  $\tau_k$  at highest marginal PIT rate.