Measuring the Impact of Business Tax Incentives: A Dynamic Scoring Approach

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How do Business Tax Incentives Affect Macro Aggregates?

- Recent tax reforms in the United States and Japan have changed business tax incentives
  - In the United States: TCJA and OBBBA
  - In Japan: Abe's "Third Arrow" structural reforms

- Question: How do we quantify the impact of tax reforms on GDP in the long run?
  - Standard "static" analysis: No impact

- This paper: "Dynamic" analysis that considers how behavioral responses change GDP
  - Linearization of this methodology applied by CEA in analysis of TCJA and OBBBA
  - We describe a full-nonlinear application and compare it to two alternative approaches

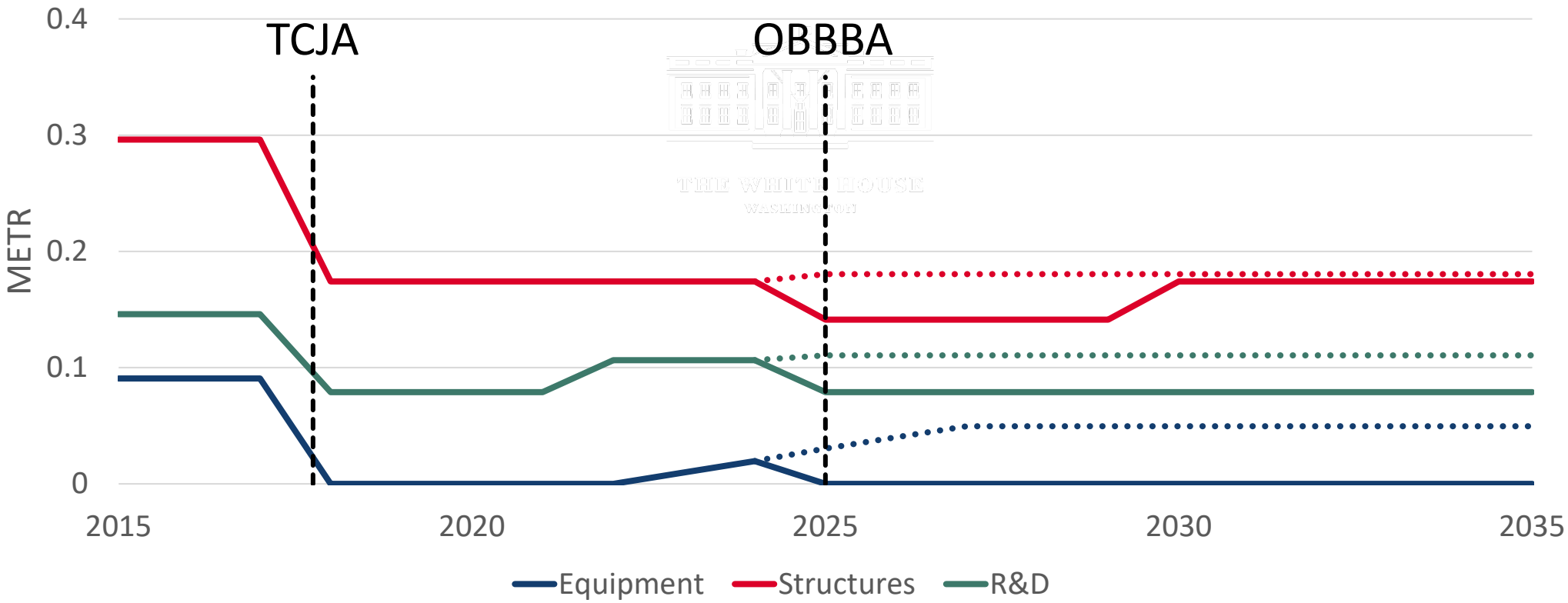
Tax Reforms Transmit through the Marginal Effective Tax Rate

- The marginal effective tax rate is the tax wedge in the cost of capital:

$$\text{Marginal Effective Tax Rate} = 1 - \frac{\overbrace{1-\tau}^{\text{Tax on return to existing capital}}}{\underbrace{1-\tau\lambda}_{\text{Subsidy on new investment}}}$$

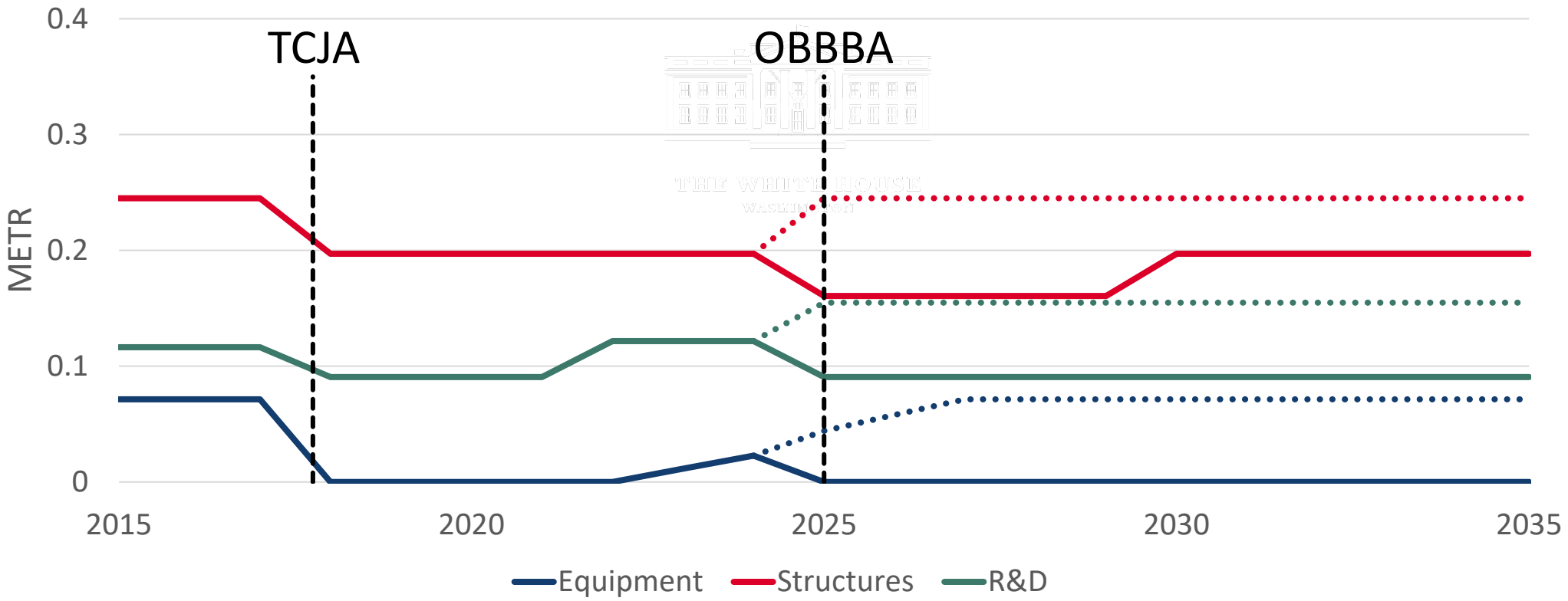
- Standard business tax incentives work through
  1. Increasing the after-tax return on capital (income rate cuts $\tau \downarrow$)
  2. Making investment in new capital cheaper (investment subsidies $\lambda \uparrow$)
- TCJA and OBBBA cut τ, while also increasing λ for equipment, structures, and R&D

TCJA and OBBBA Cut Marginal Tax Rates on Corporate Capital



Source: CEA Calculations. Dotted lines denote marginal tax rates if OBBBA did not pass.

The OBBBA Tax Cut is Larger for Passthrough Businesses



Source: CEA Calculations. Dotted lines denote marginal tax rates if OBBBA did not pass.

Our Approach to Scoring Business Tax Reform

- We build a fully dynamic, multisector capital model with heterogeneous adjustment costs

- CEA predicts that OBBBA business provisions
  - Lead to a ten-year GDP increase of 0.85%
  - Reduce the static score by $400B

- Our model teaches us three lessons about dynamic scoring:
  1. Adjustment costs (and therefore regulatory policy) matter for scoring tax changes
  2. Ten-year windows bias scoring in favor of temporary provisions
  3. Disaggregated analysis of heterogeneous investment responses matters for the aggregate score

Related Literature

We combine elements from two leading tax models:

1. Barro and Furman (2018): Multisector model with heterogeneous capital but *no explicit dynamics*
   - Scores depend on transition dynamics, not just the steady state
   - Unable to score temporary provisions

2. Chodorow-Reich et al. (2025): Multisector model with *homogeneous* capital and explicit dynamics
   - TCJA and OBBBA feature heterogeneous and temporary tax changes
   - Cannot accurately assess reallocation of capital *between types*

A Neoclassical Model

Environment

- Two sectors (corporate and noncorporate) and three capital types (structures, equipment, and IPP)
- Each sector i produces with Cobb-Douglas technology:

$$Y_{i,t} = z_i \prod_{j \in \{s,e,p\}} K_{i,j,t}^{\alpha_j}, \qquad \sum \alpha_j = \theta < 1 \tag{1}$$

- In both sectors, capital evolves according to

$$K_{i,j,t+1} = I_{i,j,t} + (1 - \delta_j) K_{i,j,t}. \tag{2}$$

- With profit tax τ_i, expensing rate λ_j, and adjustment costs paid in units of output, the NPV of cash flows is

$$\sum_{t=0}^{\infty} \left(\frac{1}{1+r} \right)^t \left\{ (1 - \tau_{i,t}) \left(Y_{i,t} - \frac{\phi_{i,j}}{2} \left(\frac{I_{i,j,t}}{K_{i,j,t}} - \delta_j \right)^2 K_{i,j,t} \right) - \sum_{j=s,e,p} (1 - \tau_{i,t} \lambda_{j,t}) I_{i,j,t} \right\} \tag{3}$$

- Firms choose sequences of capital and investment to maximize (3) subject to (1), (2), and policy.
- Aggregation: $Y_t = \omega_c Y_{c,t} + \omega_{nc} Y_{nc,t}$ with $\omega_c + \omega_{nc} < 1$.

Optimality Conditions

- Suppressing sector and capital type subscripts, firms optimize when

$$\frac{I_t}{K_t} = \frac{q_t - (1 - \tau_t \lambda_t)}{\phi(1 - \tau_t)} + \delta$$

$$q_t = \frac{1}{1+r}\left\{(1-\tau_{t+1})\left[F_K(t+1) + \phi\left(\frac{I_{t+1}}{K_{t+1}} - \delta\right)\frac{I_{t+1}}{K_{t+t}} - \frac{\phi}{2}\left(\frac{I_{t+1}}{K_{t+1}} - \delta\right)\right] + q_{t+1}(1-\delta)\right\}$$

- In steady state, these conditions imply that $q = 1 - \tau\lambda$, so

$$\underbrace{F_K}_{\text{MPK}} = \underbrace{\frac{\overbrace{1-\tau\lambda}^{\text{Tax Term}}}{1-\tau} \times (r+\delta)}_{\text{User Cost of Capital}}$$

Calibration Approach

- Given a user cost elasticity of investment ε, calibrate adjustment cost parameter for our model with

$$\phi_{i,j} \approx \frac{1}{\varepsilon} \times \frac{1}{\delta_j} \times \frac{1-\lambda_j \tau_i}{1-\tau_i}.$$

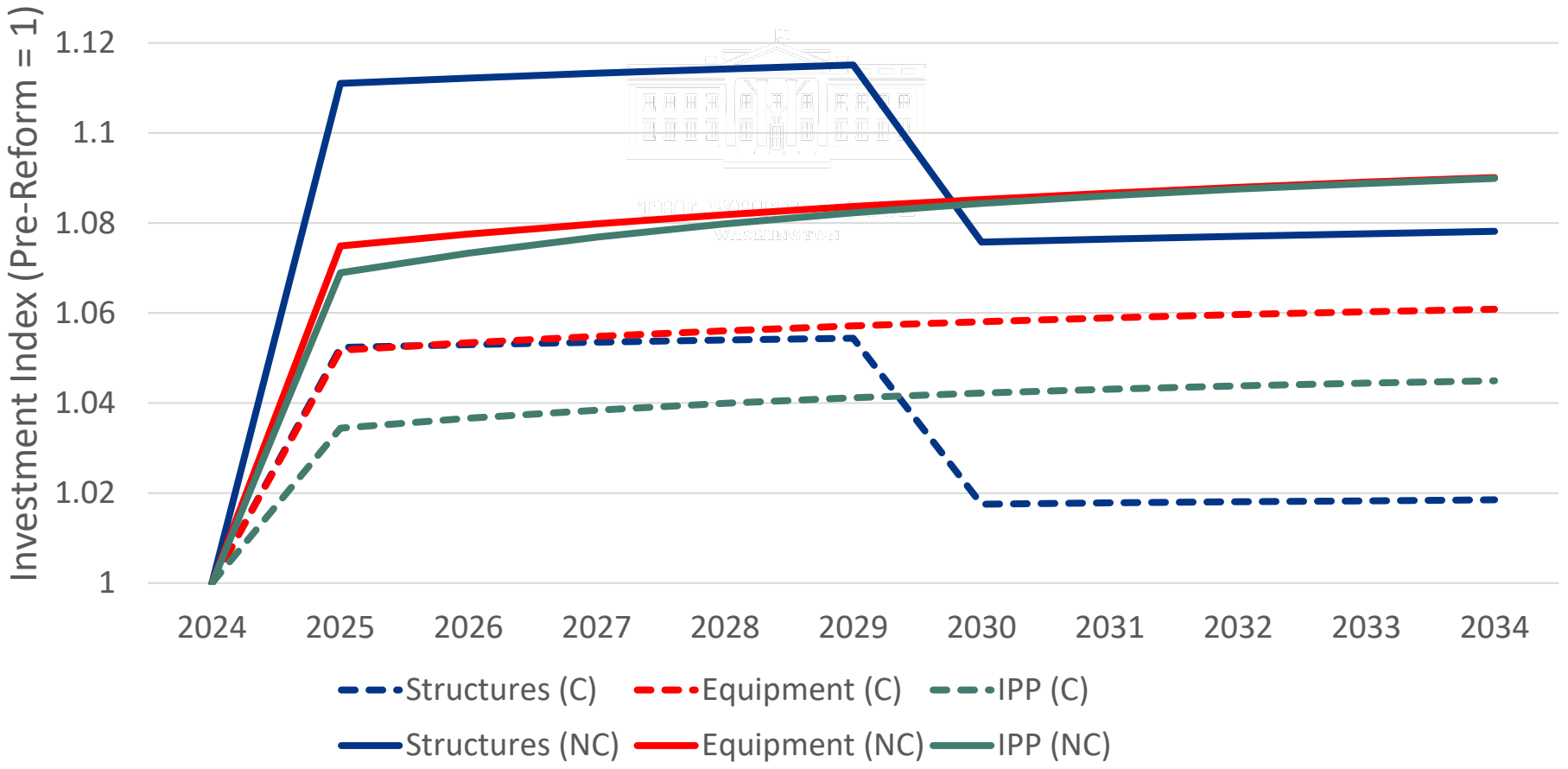
- Following CEA's analysis of OBBBA, use literature consensus $\varepsilon = 1$.

Capital Type	Depreciation Rate δ_j	Corporate Sector		Noncorporate Sector	
		Tax Term	Adjustment Cost	Tax Term	Adjustment Cost
Equipment	0.136	1.05	7.7	1.08	7.9
Structures	0.028	1.22	43.6	1.32	47.3
IPP	0.243	1.12	4.6	1.18	4.9

- We calibrate technology parameters with Barro and Furman (2018)
- Policy parameters are from the CEA's OBBBA analysis compared to a TCJA expiry baseline

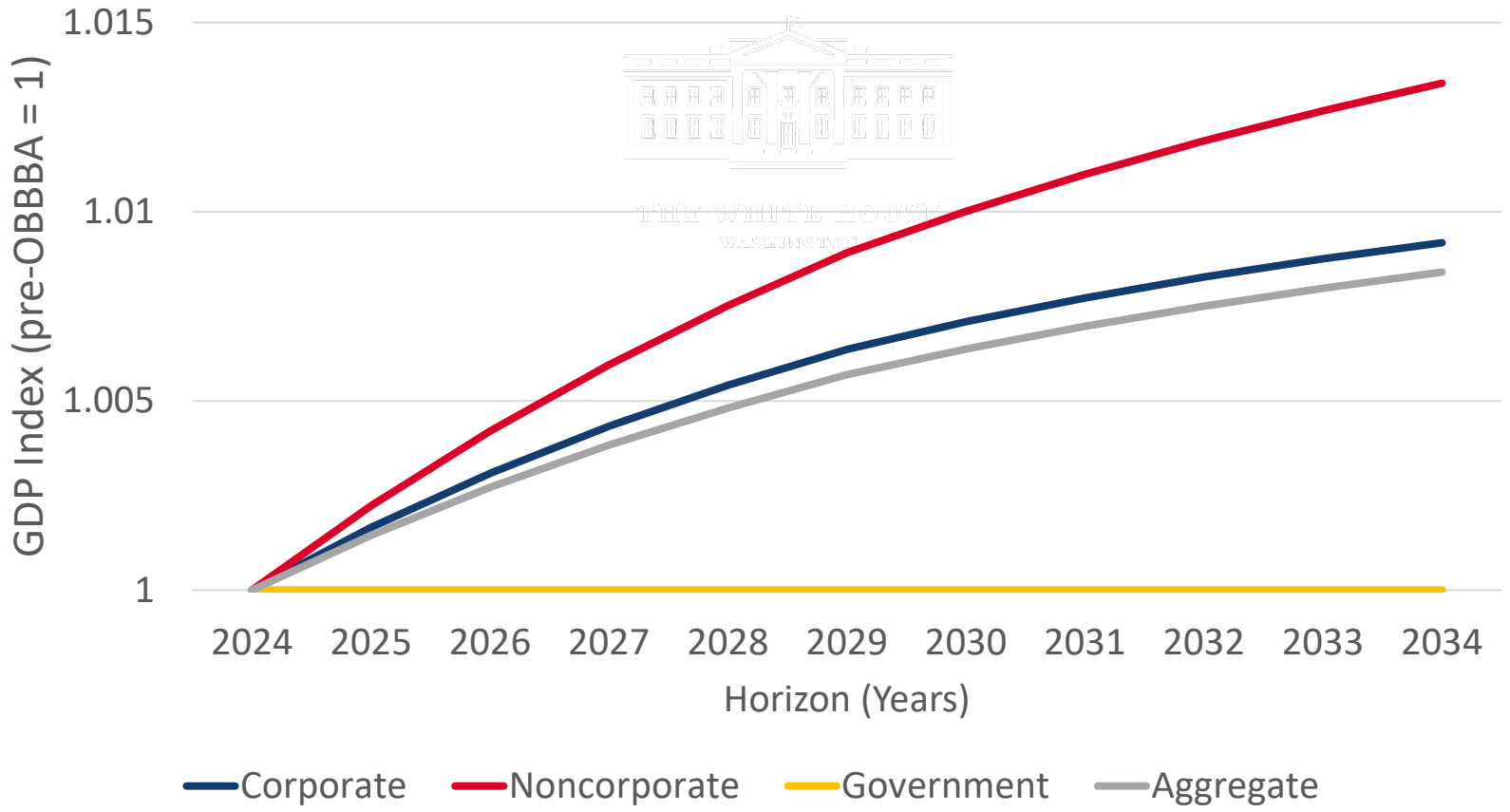
OBBBA Effects on Capital and Output

Investment under OBBBA



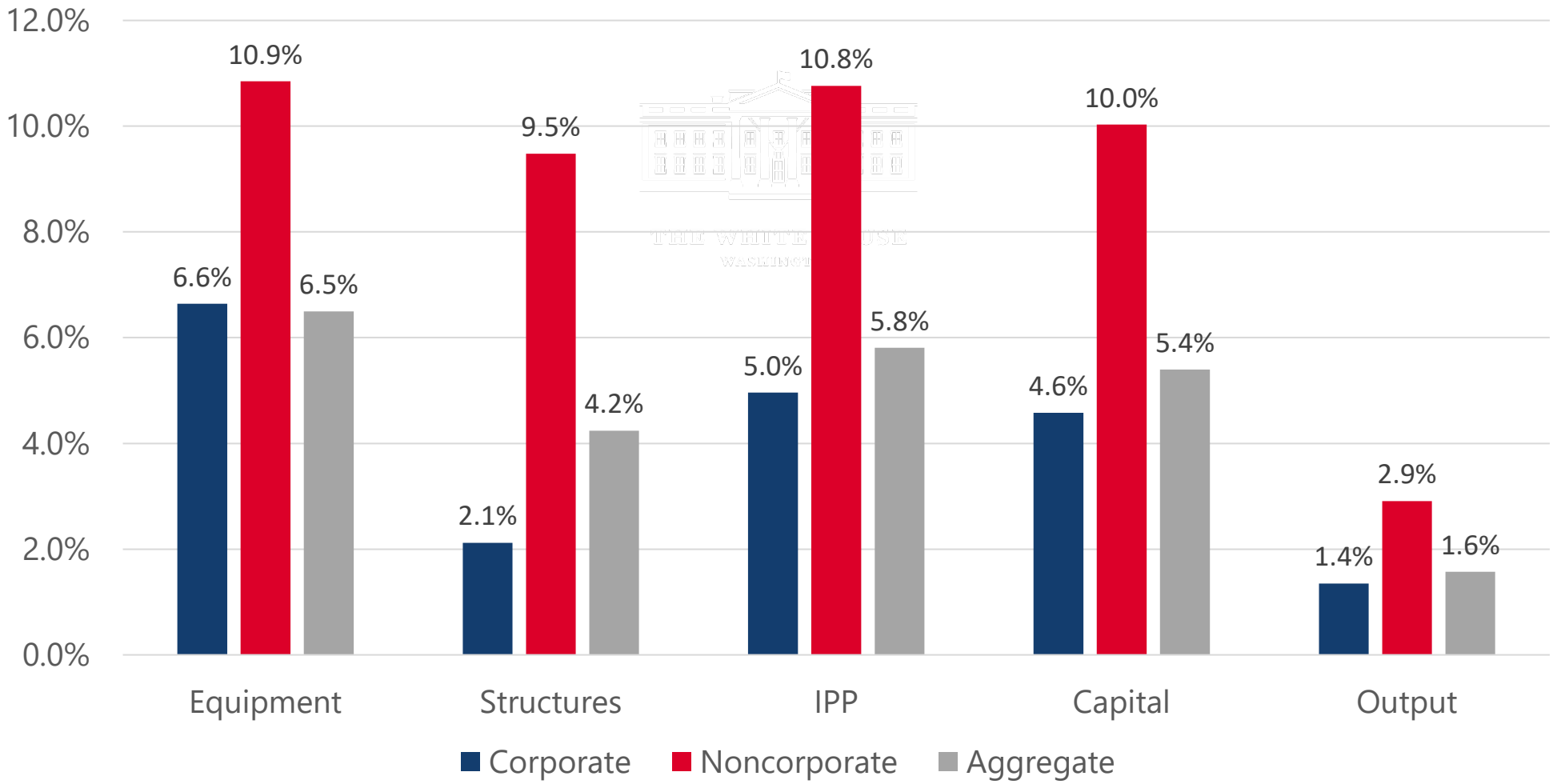
Source: CEA Calculations

Transition Path of Sectoral Output under OBBBA



Source: CEA Calculations

Long-Run Capital and Output by Sector



Source: CEA Calculations

Lesson 1: The Speed of Convergence Determines the Score

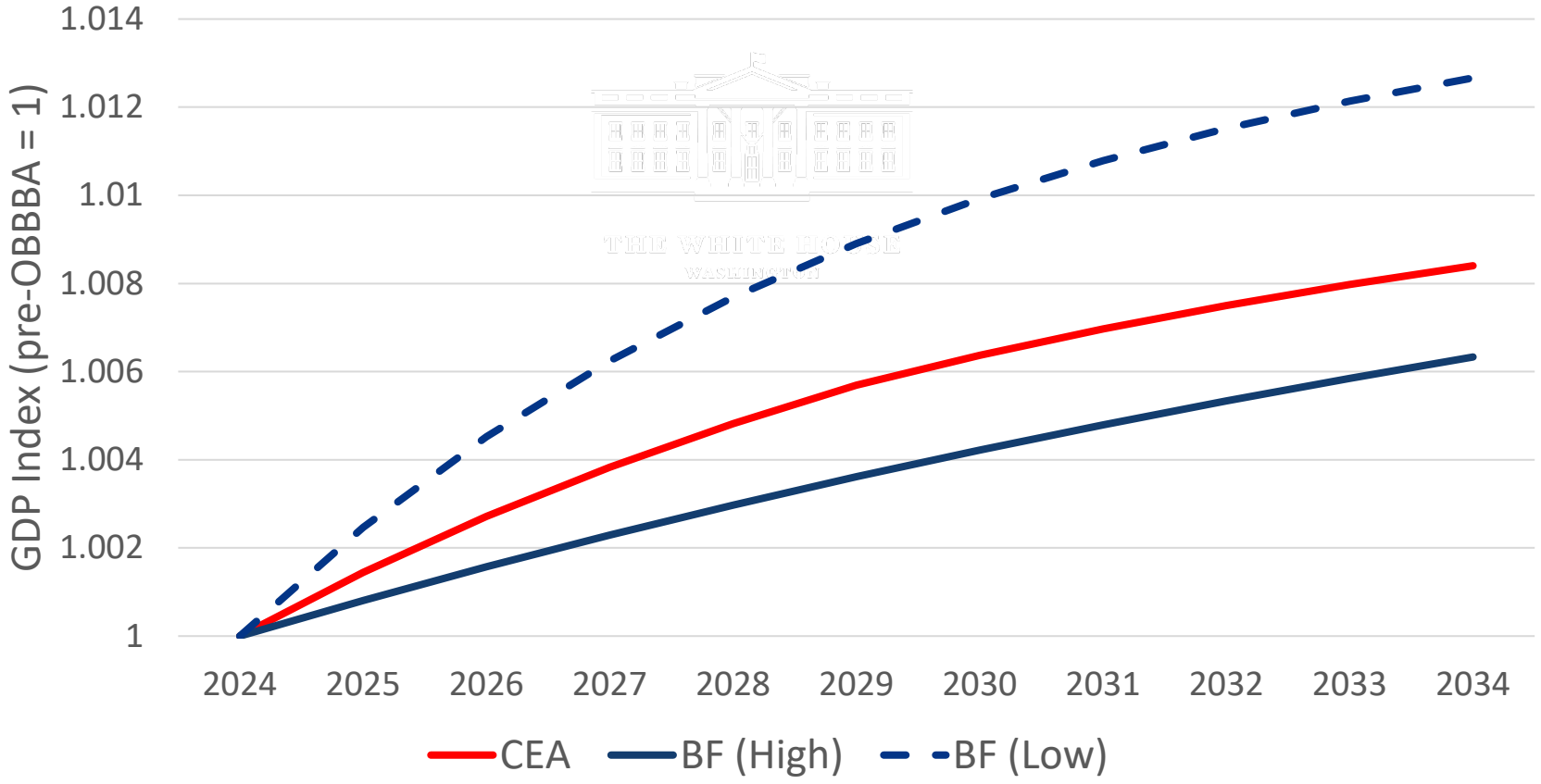
Comparing High and Low Adjustment Costs

- Adjustment costs determine scores

- Consider an alternative model à la Barro and Furman with
  - Identical technology → Same steady state
  - *High* adjustment costs (40% convergence after 10 years)
  - *Low* adjustment costs (80% convergence after 10 years)

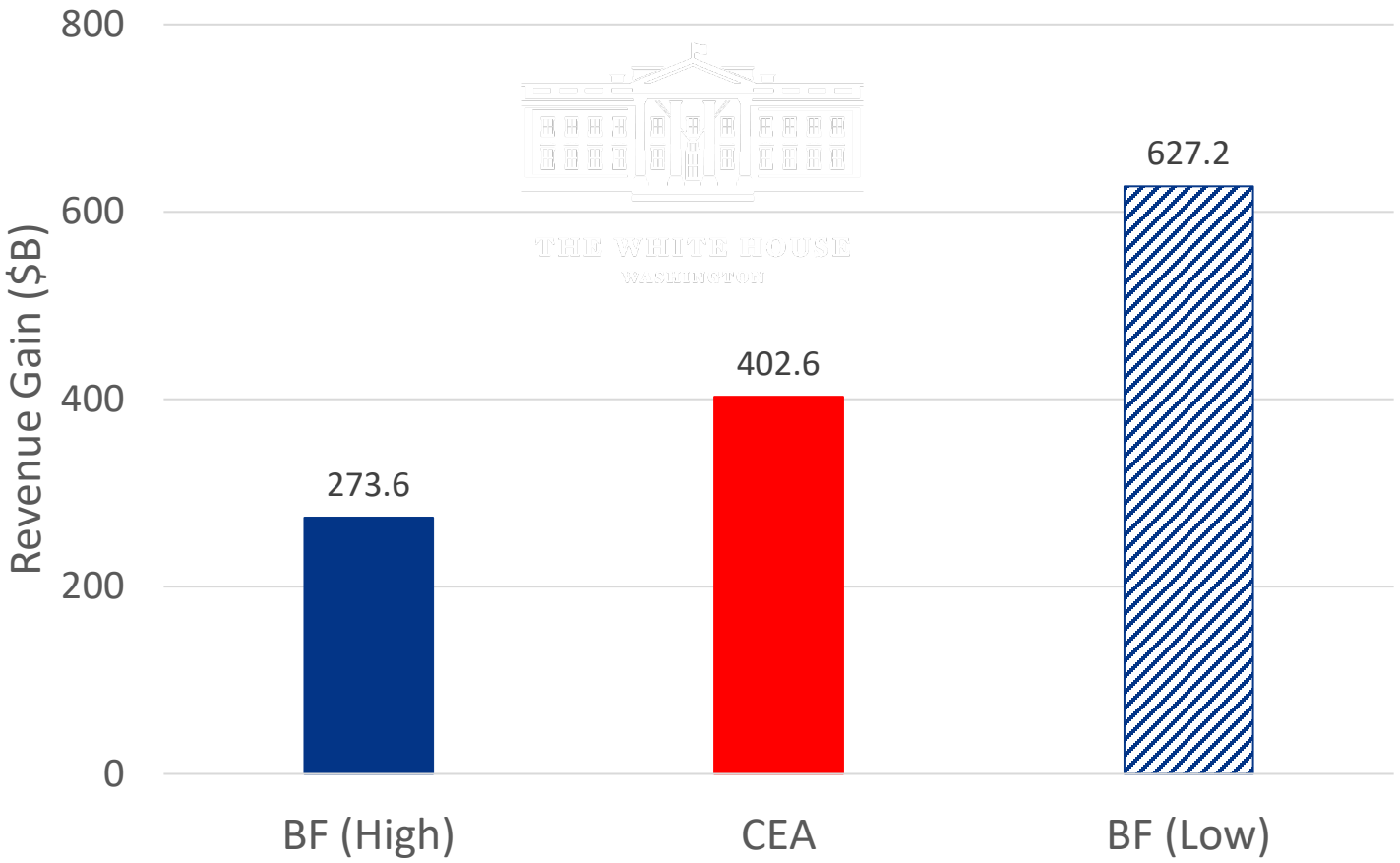
- Lower adjustment costs frontload GDP gains

Lower Adjustment Costs → Higher GDP



Source: CEA Calculations. BF (High) has high adjustment costs, while BF (Low) has low adjustment costs.

Lower Adjustment Costs → Higher GDP → More Tax Revenue



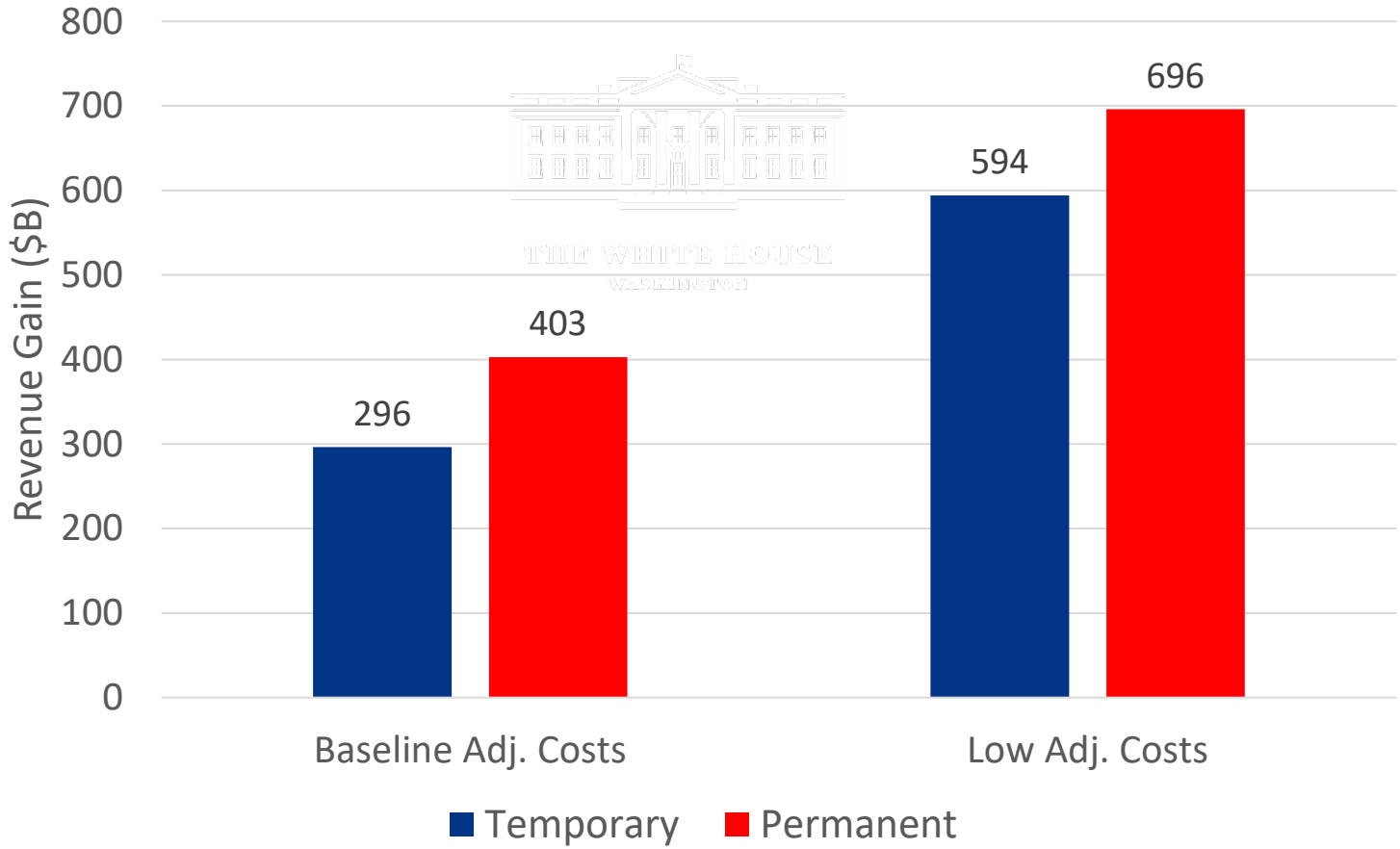
Source: CEA Calculations. BF (High) has high adjustment costs, while BF (Low) has low adjustment costs.

Lesson 2: Ten-Year Scoring Standards are Biased Against Permanent Provisions

Comparing Temporary and Permanent Provisions

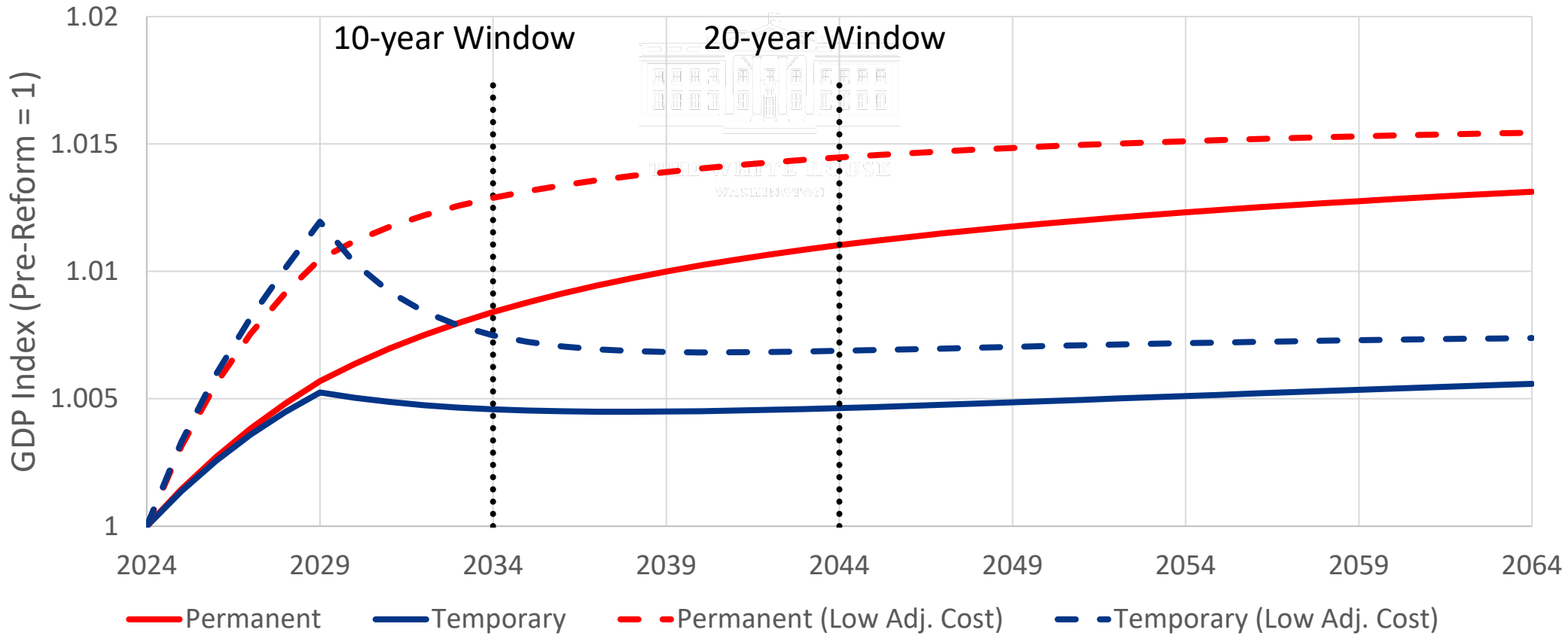
- Statically: permanent provisions are more expensive
- Dynamically: Permanent provisions better for long run GDP and therefore raise more revenue
- Ten-year scores + adjustment costs make permanent and temporary provisions look similar
  - Myopic focus on ten-year window creates a bias in favor of temporary policies
  - More dramatic difference with low adjustment costs, which pull investment forward
- Dynamic scores inherently constrained by arbitrary ten-year window
- Example: Compare OBBBA growth with permanent vs. temporary equipment/IPP expensing

Ten-Year Windows Make Temporary and Permanent Seem Similar



Source: CEA Calculations.

Ten-Year Windows Make Temporary and Permanent Seem Similar



Source: CEA Calculations.

Lesson 3: Heterogeneity is Required for Accurate Long-Run and Short-Run Analysis

Heterogeneity Matters in the Long Run and the Short Run

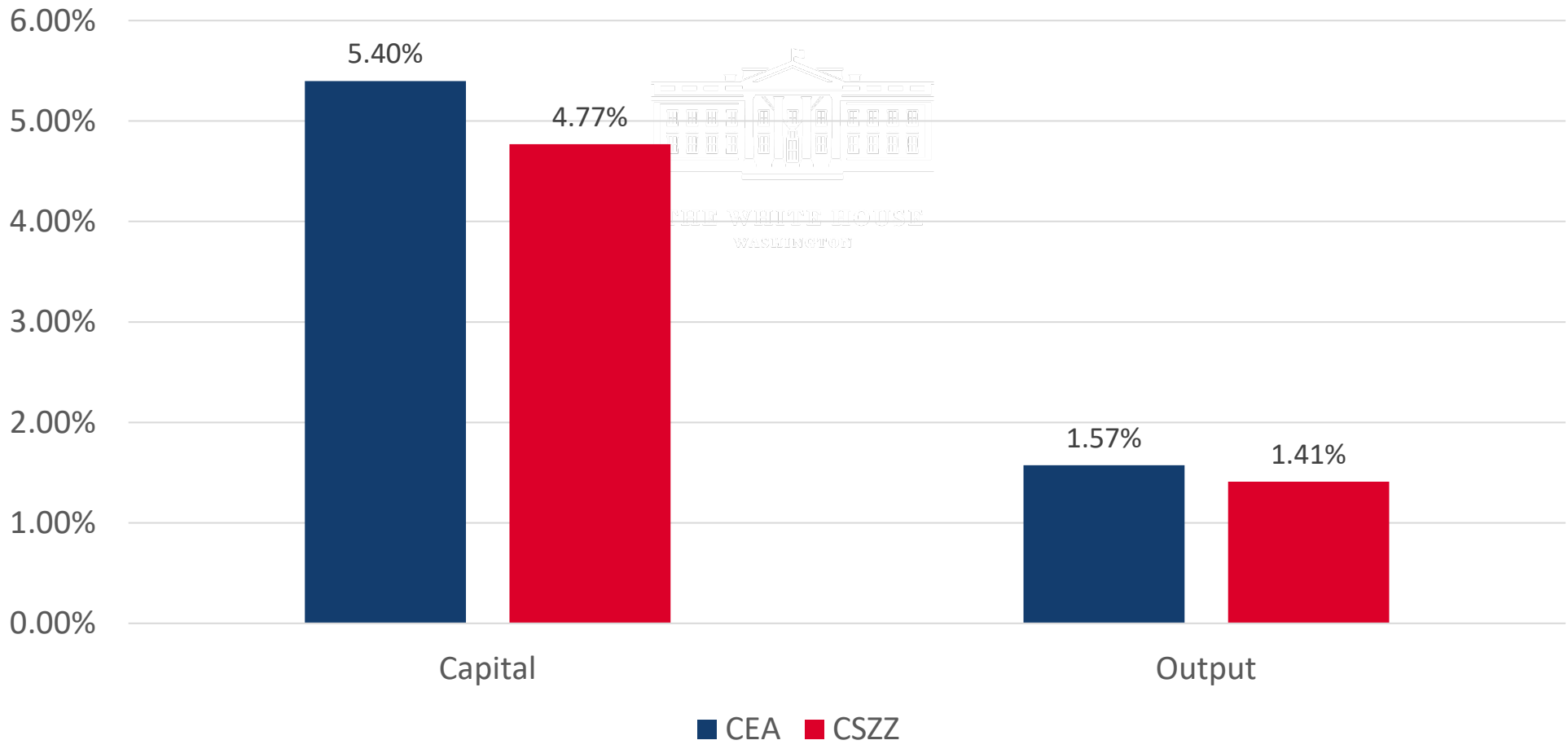
- Our model features heterogeneous capital and adjustment costs, which allows us to
  - Accurately capture short-run dynamics
  - Account for reallocation between capital types

- Many dynamic scoring models feature homogeneous capital and therefore struggle in two ways:

  1. Cannot capture reallocation in the long run → smaller steady state effects

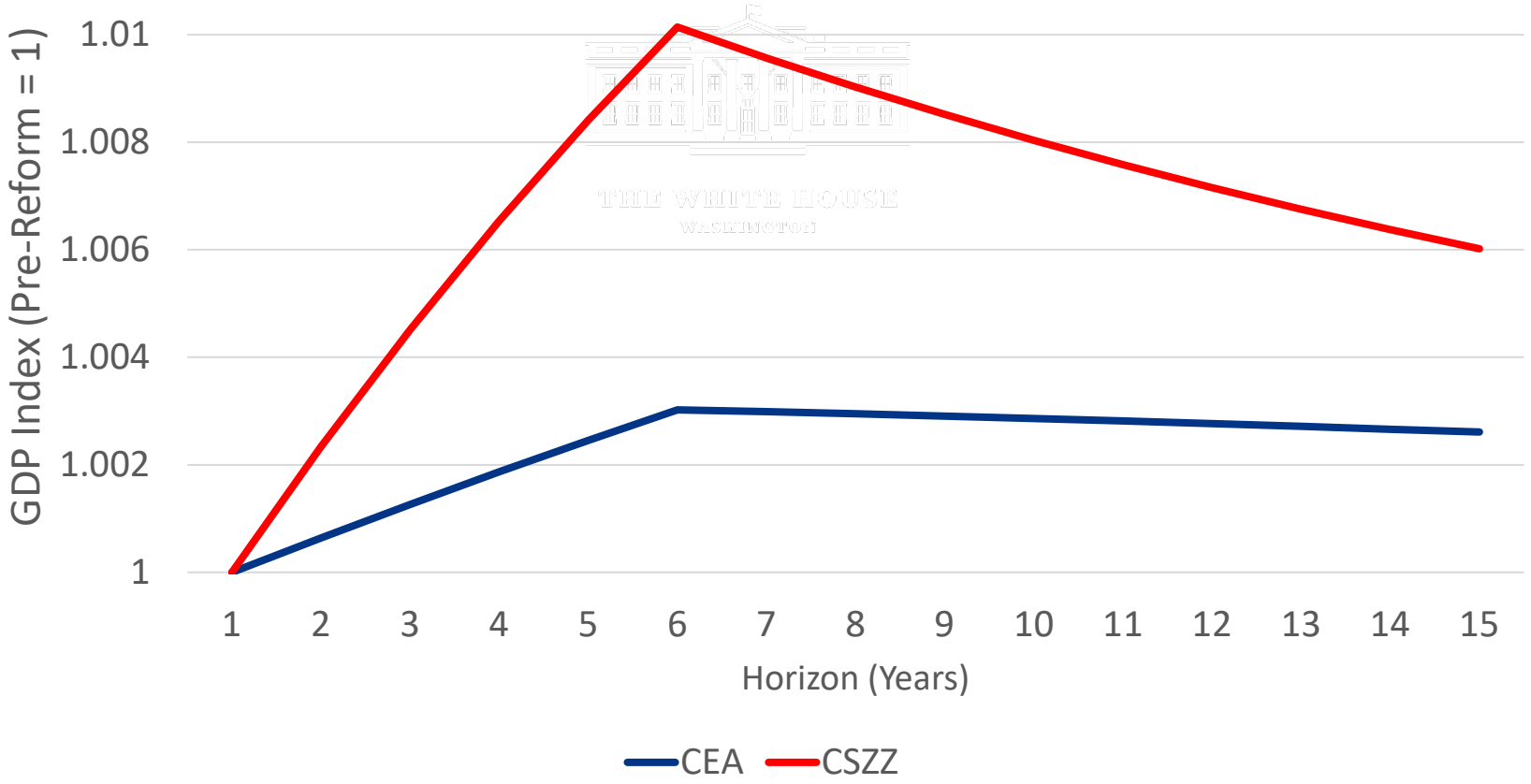
  2. Using an average adjustment cost
     - Overstates dynamic effect of tax cut on long-lived capital
     - Understates dynamics effect of tax cut on short-lived capital

Homogeneous Capital Fails to Capture Long-Run Reallocation



Source: CEA Calculations. CSZZ is the homogeneous capital model.

Inappropriate Adjustment Costs: Long-Lived Capital



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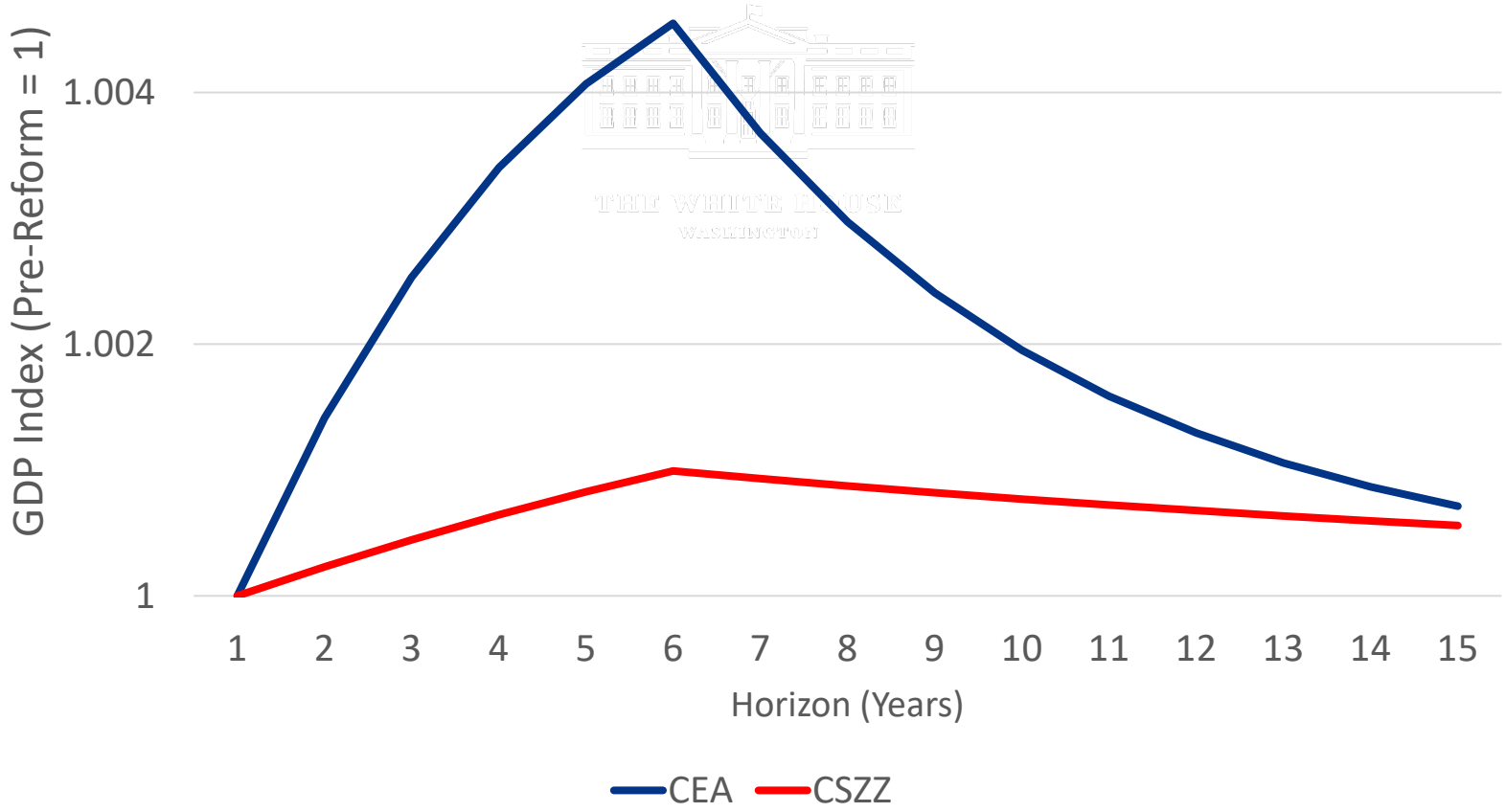
Inappropriate Adjustment Costs: Short-Lived Capital



Source: CEA Calculations. CSZZ is the homogeneous capital model.

Conclusion

- Dynamic scoring requires model with optimizing firms and transition dynamics
- Capital heterogeneity can generate larger long-run GDP effects through reallocation
- Adjustment cost heterogeneity can generate larger short-run GDP via convexity
- If we accounted for deregulatory aspects of the bill, convergence may be faster