Immigration Policy in a Time of Secular Stagnation

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Overview

- Significant demographic transition in the US over last century
- Macroeconomic implications - *Secular Stagnation*
- Fiscal consequences - Social Security, Government Debt, Monetary Policy
- Focus on immigration as an economic policy instrument

Empirical Overview

Value	'75-'85	'08-'18
RGDP Growth	3.2%	1.5%
Investment Growth	5.0%	2.7%
Net Worth/GDP	251%[1]	372%
Interest Rates	2.91%	0.86%

[1] 1987 value

Mechanism

- Rise in life expectancy, decline in birth rate
- Relative rise in share of households nearer to peak of life-cycle wealth
- Rise in wealth relative to output
- Declining interest rates

Related Literature

- Eggertsson, Lancastre, Summers (2018)
- Ariby, Geppert, Ludwig (2017)
- Storesletten (2000)

Questions

- To what extent can immigration policy resolve demographic imbalances?
- How much can skilled immigration improve economic growth?
- How much immigration would it take to reach 4% growth?
- How can immigration impact the fiscal outlook?

Goals

- Present a model accounting for demographics (age, education)
- Explain macroeconomic trends since 1980's
- Evaluate counterfactual immigration policies

Model Overview

- Standard OLG, production economy
- Two types - high/low productivity
- Linear income tax per type
- Cohort-dependent birth rates and survival rates
- Historical immigration rates by education

Agent Optimization

- Agent of cohort j with education e at time t solves:

$$V_{j,t}(a_{j,t}) = \max_{c_{j,t}, n_{j,t}, a_{j,t+1}} \frac{\left(c_{j,t}^{\gamma}(1-n_{j,t})^{1-\gamma}\right)^{1-\sigma}}{1-\sigma} + s_{j,t}\beta V_{j,t+1}(a_{j,t+1}) \tag{1}$$

$$\text{s.t.} \quad c_{j,t} = w_t \epsilon_e z_{t-j+1} n_{j,t} + (1+r_t)a_{j,t} - a_{j,t+1} - \phi_e(\cdot) \tag{2}$$

$$\phi_e(\cdot) = \tau_e \left(w_t \epsilon_e z_{t-j+1} n_{j,t} + r_t a_{j,t}\right) \tag{3}$$

$$\text{and} \quad a_{j,j+J+1} \geq 0, \tag{4}$$

Firm Optimization

- Firms solve:

$$\max_{K_t, L_t} K_t^{\alpha} \left(A_t L_t\right)^{1-\alpha} - (r_t + \delta) K_t - w_t L_t \tag{5}$$

- Optimality conditions:

$$r_t = \alpha \left(\frac{K_t}{A_t L_t}\right)^{\alpha - 1} - \delta \tag{6}$$

$$w_t = (1 - \alpha) \left(\frac{K_t}{A_t L_t}\right)^{\alpha}. \tag{7}$$

Government

- Aggregate tax revenue:

$$\Phi_t = \sum_{j=t}^{t-J+1} \sum_{e \in \{h,l\}} \mu_{j,t}^{e} \phi_e(\cdot). \tag{8}$$

- Government budget constraint:

$$G_t = \Phi_t + B_t, \tag{9}$$

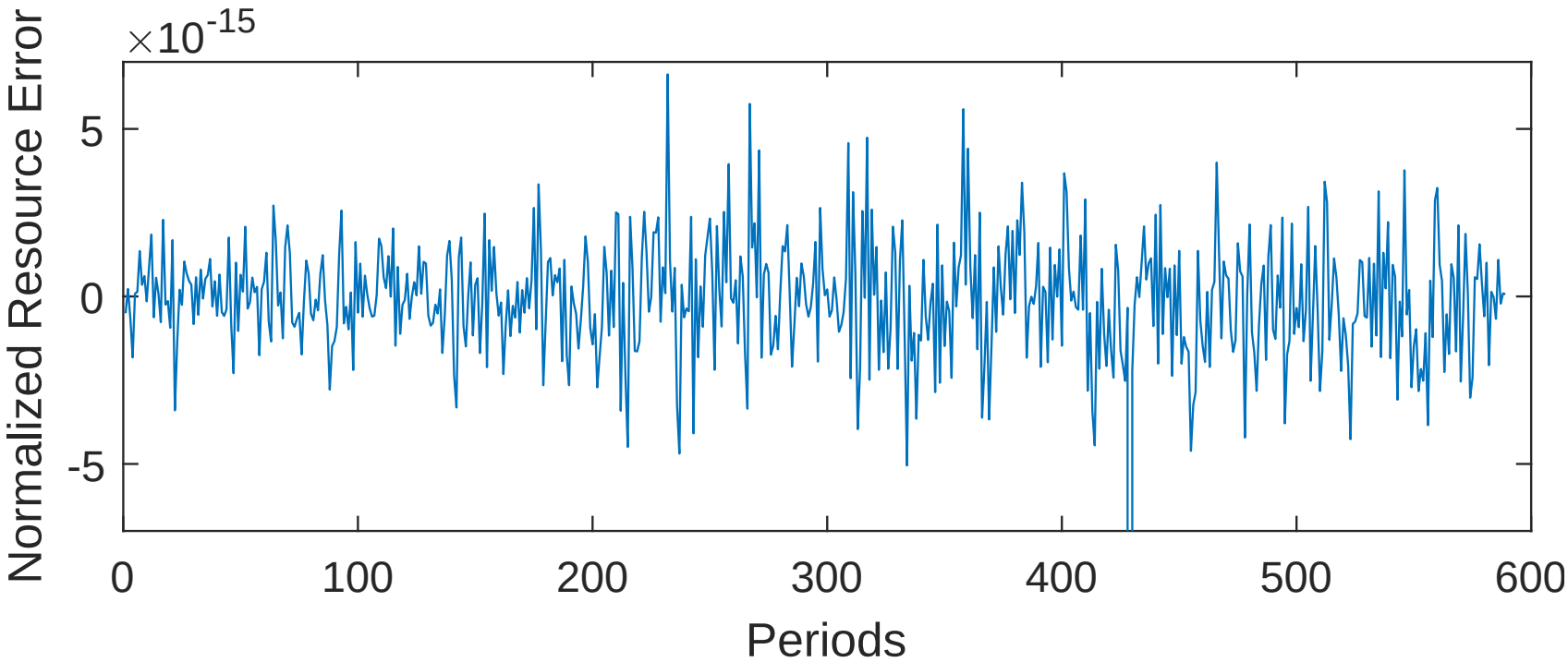
Equilibrium

Dynamic general equilibrium: prices $\{w_t, r_t\}$ and quantities $\left\{c^*_{j,t}, n^*_{j,t}, a^*_{j,t+1}\right\}$ such that:

1. Given prices and government policy, agents choices satisfy Equation 1 - Equation 4,
2. Prices are determined in competitive markets according to Equation 6 and Equation 7,
3. Markets clear:
   - $K_t = \sum_{j=t}^{t-J+1} \sum_{e\in\{h,l\}} \mu^e_{j,t} a_{j,t+1}$
   - $L_t = \sum_{j=t}^{t-J+1} \sum_{e\in\{h,l\}} \mu^e_{j,t} \epsilon_e z_{t-j+1} n_{j,t}$
   - $Y_t = C_t + K_{t+1} - (1-\delta)K_t + G_t$
4. Government budget constraint (9) is satisfied.
5. Accidental bequests received by the government are determined according to

$$B_t = \sum_{j=t}^{t-J+1} \sum_{e\in\{h,l\}} (1 - s_{j,t}) \mu^e_{j,t} a_{j,t+1}. \tag{10}$$

Equilibrium Error



Population Dynamics

- Natives:

$$\mu^e_{j,t+1} = s_{j,t}\mu^e_{j,t} \tag{11}$$

- Immigrants:

$$\tilde{\mu}^e_{j,t+1} = s_{j,t}\tilde{\mu}^e_{j,t} + m^e_{j,t+1} \tag{12}$$

- Population:

$$M_t = \sum_{j=t}^{t-J+1} \sum_{e\in\{h,l\}} \left(\mu^e_{j,t} + \tilde{\mu}^e_{j,t}\right) \tag{13}$$

Population Dynamics

- Native newborns:

$$\sum_{e \in \{h,l\}} \mu^{e}_{t+1,t+1} = \zeta_t M_t \tag{14}$$

  - ζ_t is the birth rate at time t.

  - Education shares determined by education rates by cohort.

Population Dynamics

- Immigrants:

$$\sum_{e \in \{h,l\}} m^e_{j,t} = \psi_t \lambda_{j,t} M_t \tag{15}$$

  - ψ_t is the immigration rate at time t.

  - Education shares determined by immigrant education rates by year.

Population Dynamics

- Define *relative population* at time t as:

$$\left\{ \frac{\sum_{e \in \{h,l\}} \left(\mu^e_{j,t} + \tilde{\mu}^e_{j,t} \right)}{M_t} \right\}_{j=t}^{t-J+1} \tag{16}$$

- Population is *relatively stable* if $\forall\ \varepsilon > 0\ \exists\ t(\varepsilon) > 0$ such that $t > t(\varepsilon) \Rightarrow$

$$\max \left\{ \left| \left\{ \frac{\sum_{e \in \{h,l\}} \left(\mu^e_{j,t} + \tilde{\mu}^e_{j,t} \right)}{M_t} \right\}_{j=t}^{t-J+1} - \left\{ \frac{\sum_{e \in \{h,l\}} \left(\mu^e_{j,t} + \tilde{\mu}^e_{j,t} \right)}{M_t} \right\}_{j=t+1}^{(t+1)-J+1} \right| \right\} < \varepsilon \tag{17}$$

Computing Population Dynamics

1. Using earliest available data, find relatively stable population.

2. Allow demographics to change over the transition.

3. Iterate until new relatively stable population (and stable prices) reached.

Parameters

Parameter	Symbol	Value
Coefficient of Relative Risk Aversion	σ	3
Consumption Share of Utility	γ	0.65
Discount Factor	β	1.025
Maximum Age	J	120
Capital Share	α	0.36
Depreciation Rate	δ	0.085
Labor Productivity Growth Rate	g	0.015
Education Premium	ϵ_e	170%
Tax Rate - college not attained	τ_l	6.2%
Tax Rate - college attained	τ_h	12.1%

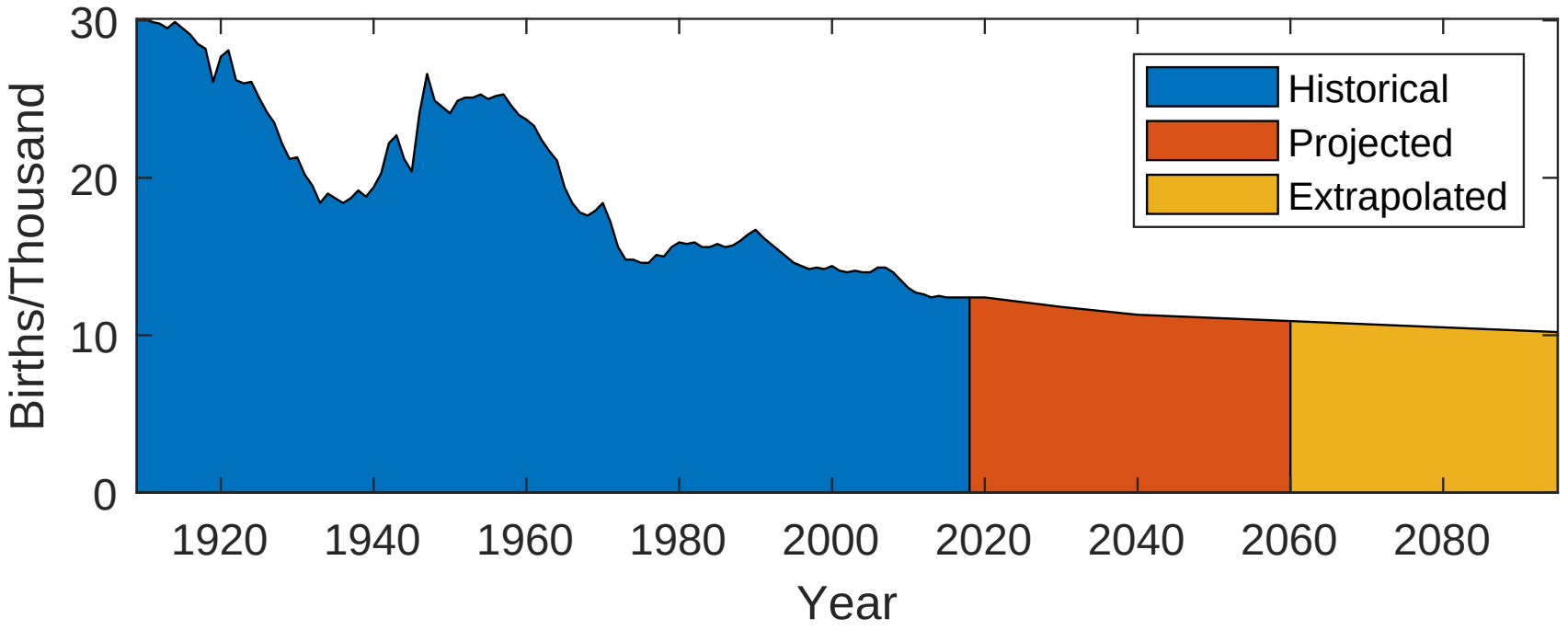
Implementing Demographics

- Total Change horizon: 1900-2095
- Assume initial value is true dating back to 1900
- Allow historical values to change over transition
- Integrate available projections (e.g., birth rates from Census Bureau)
- Extrapolate until 2095

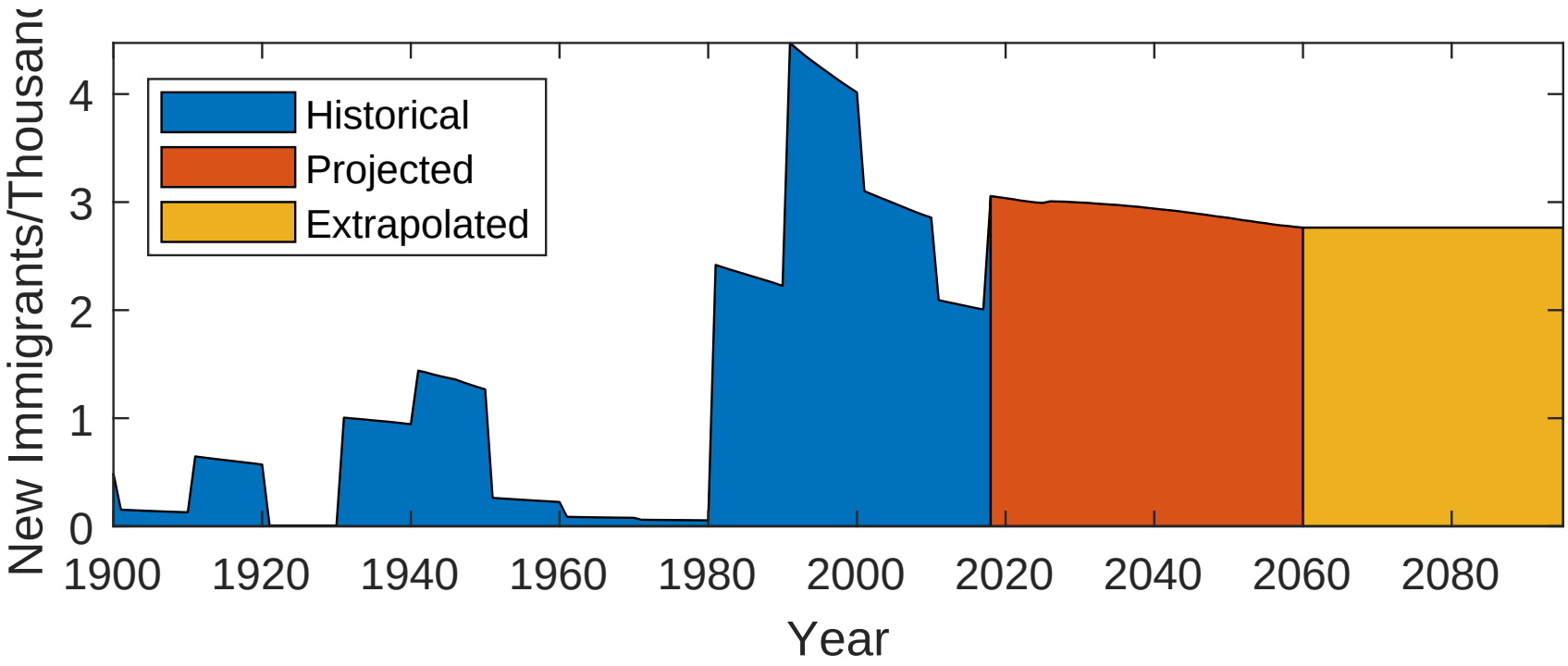
Assumptions

- Age distribution of entrants equals cross sectional age distribution in 2017.
- Birth rate per year is common to all types.
- Children of immigrants draw from native college attainment distribution.
- Capital of immigrants is the same as natives, per type.

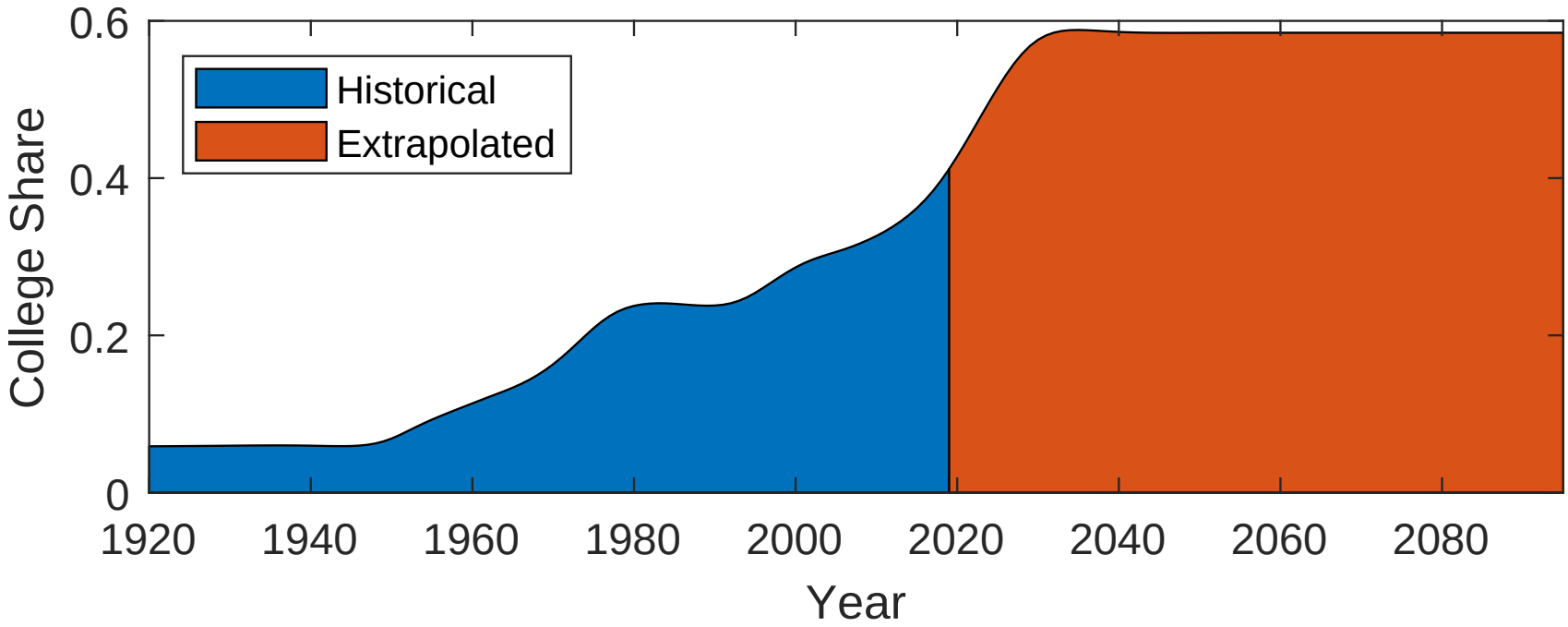
Birth Rates


30
20
10
0
Births/Thousand
1920
1940
1960
1980
2000
2020
2040
2060
2080
Year
Historical
Projected
Extrapolated

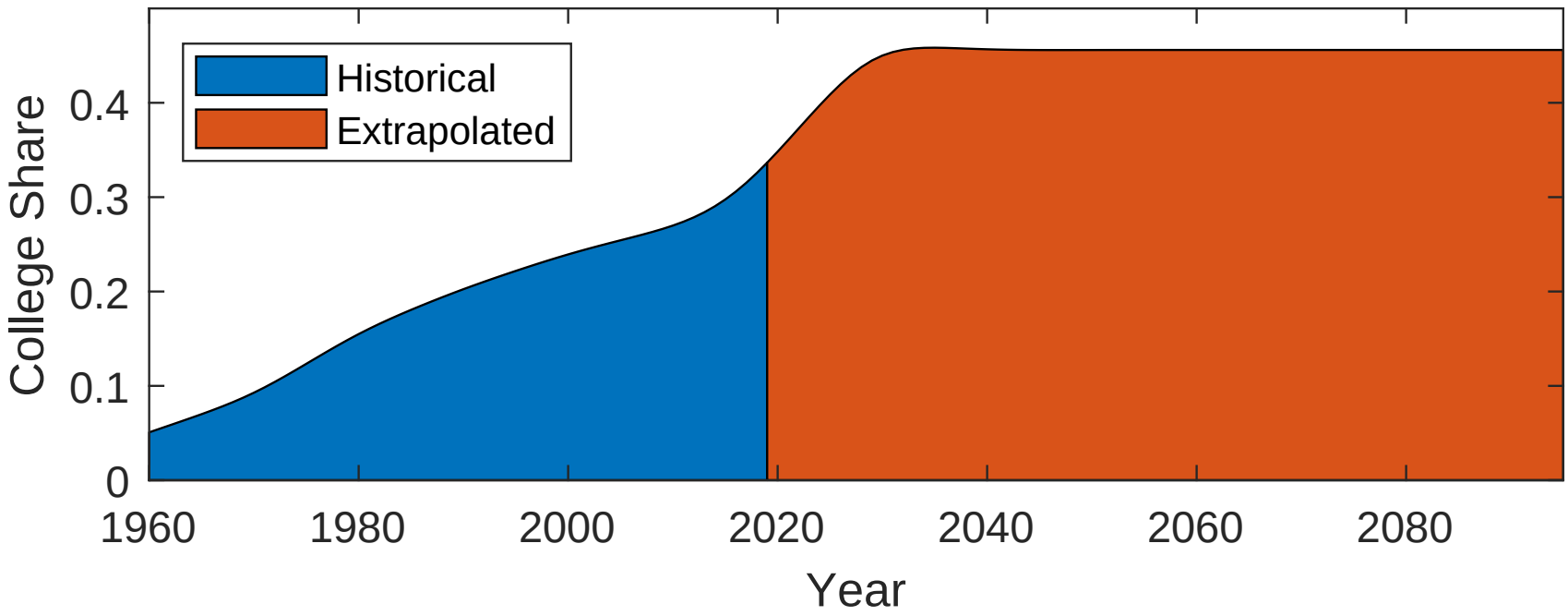
Immigration Rates



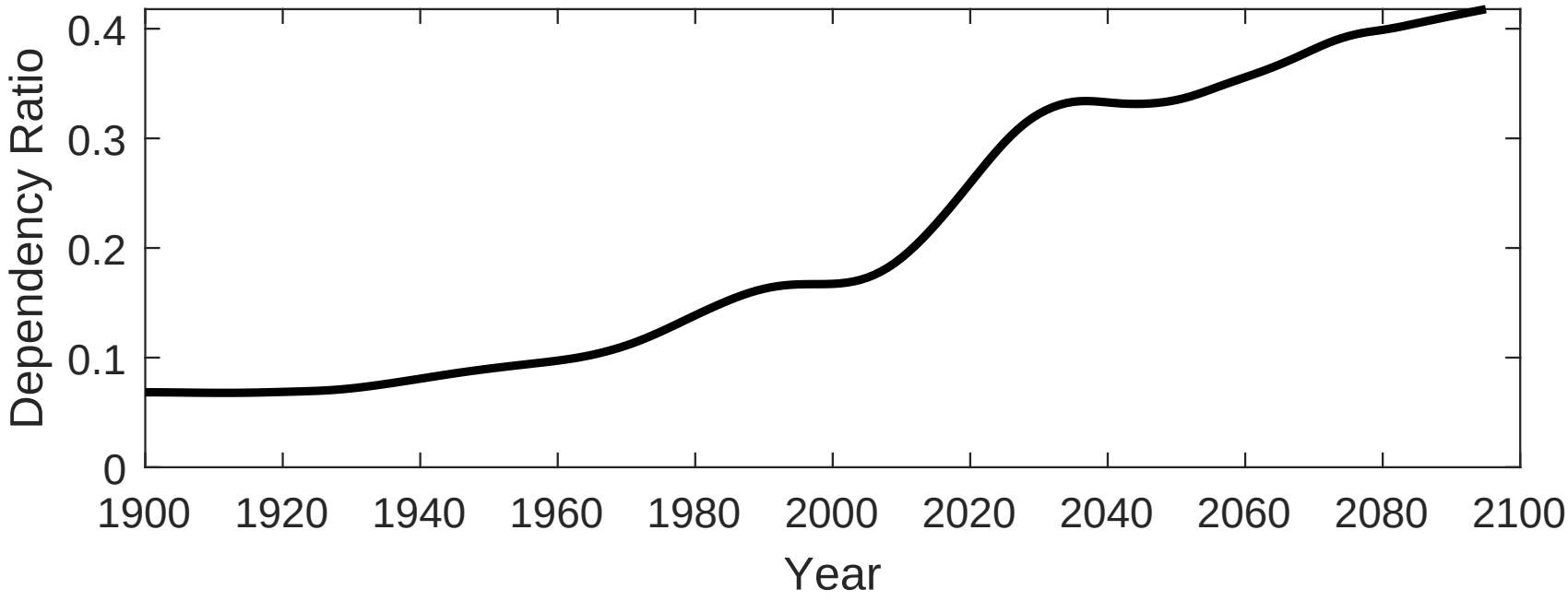
Education Rates: Natives



Education Rates: Immigrants



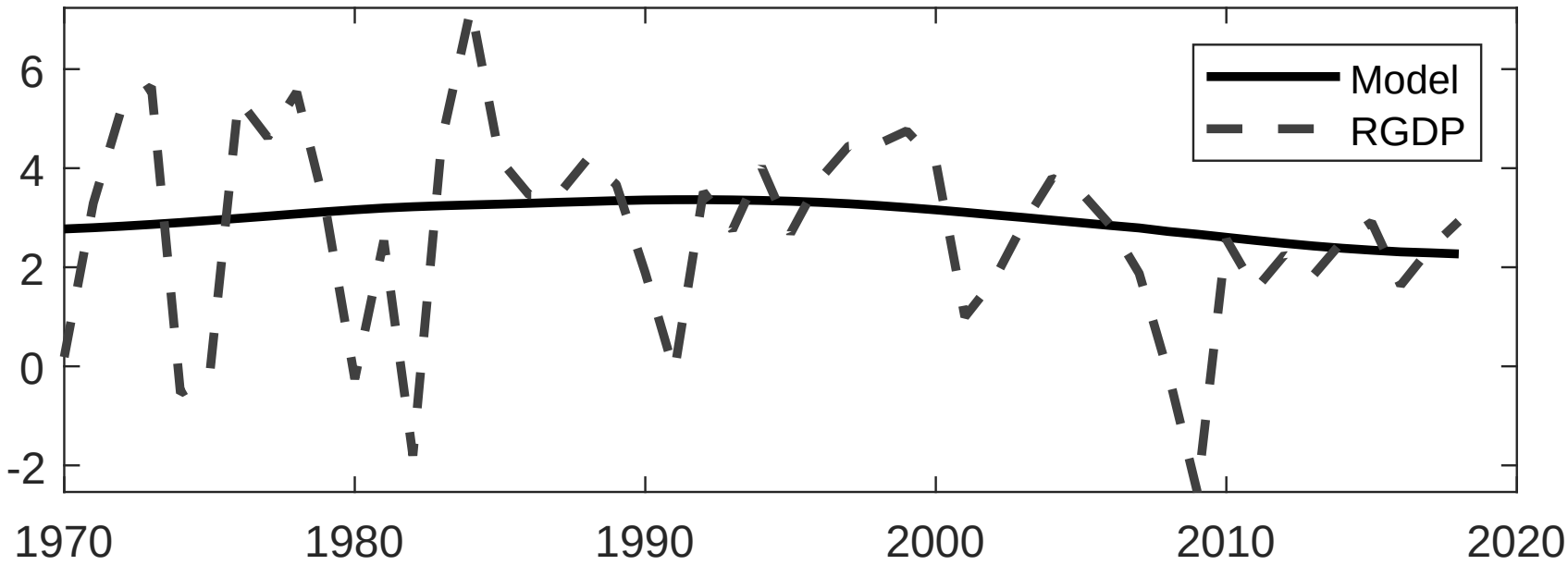
Dependency Ratio



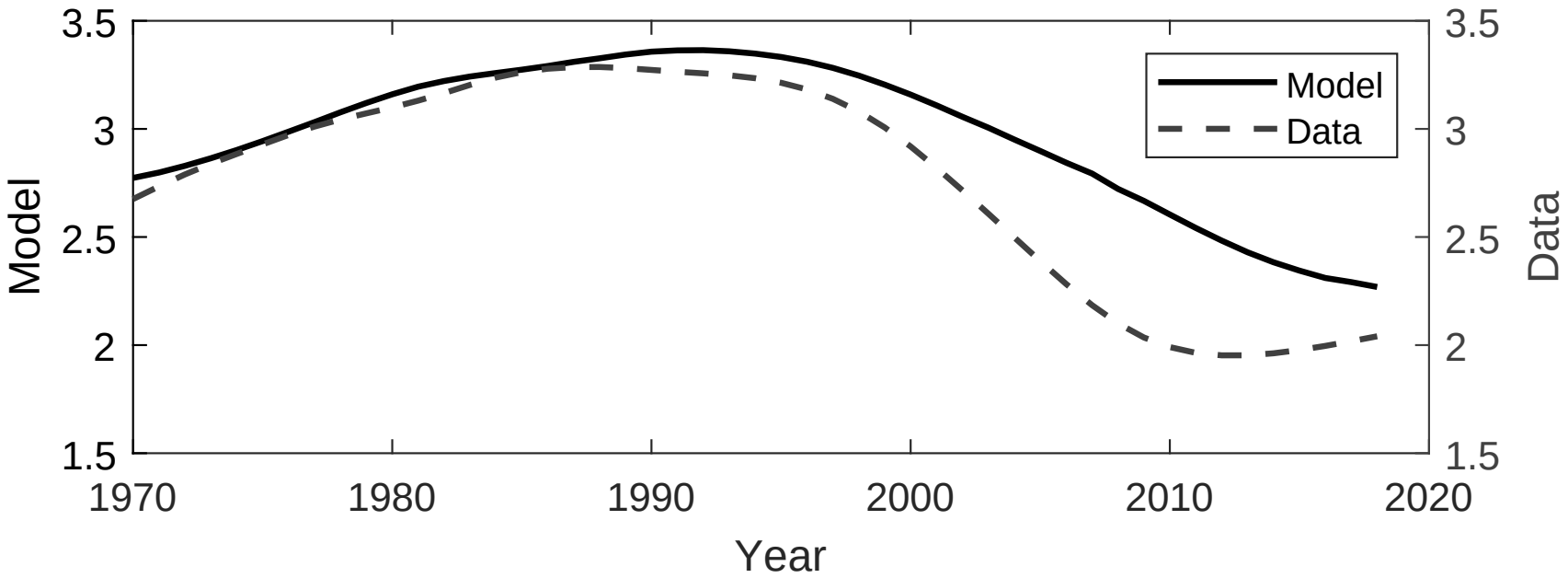
Computing Equilibrium Path

- Value function iteration + iterating over K/L ratio
- Problem: Don't want to shock the economy with changing demographics.
- Solution: Add more initial periods until economy is "stationary" over the first N periods.

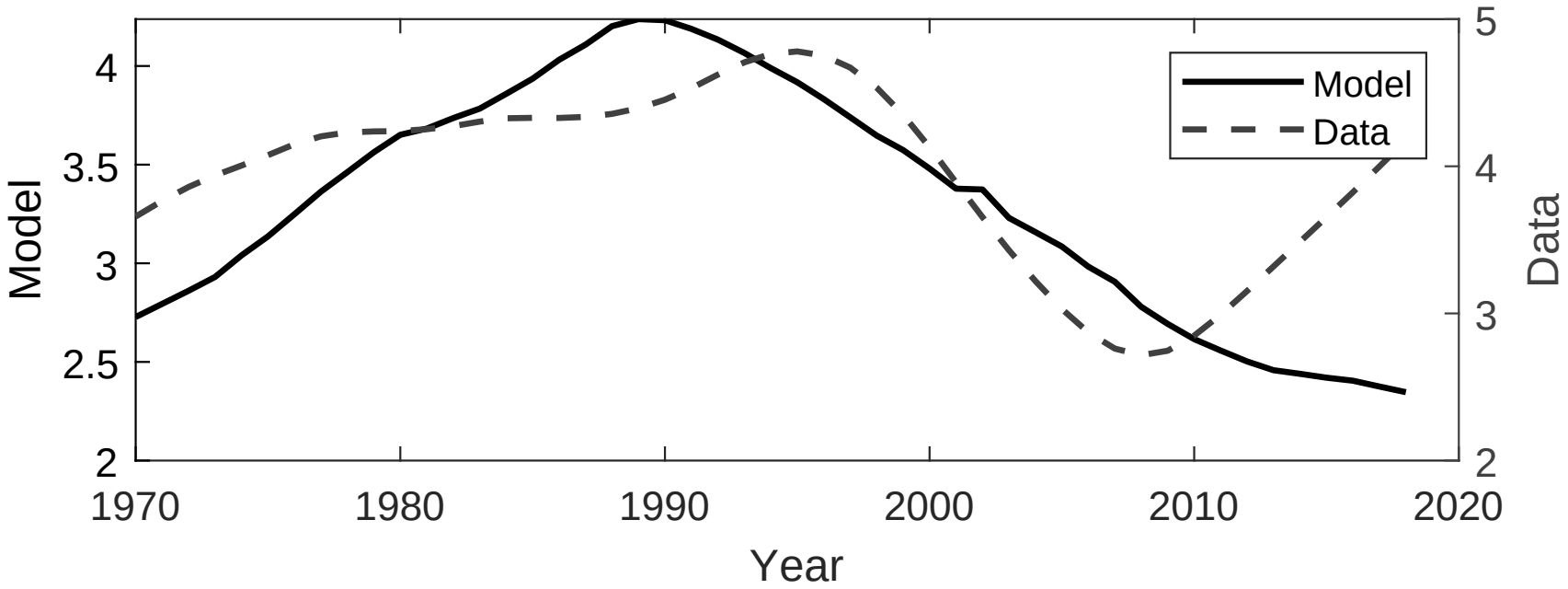
Baseline Economy: Economic Growth



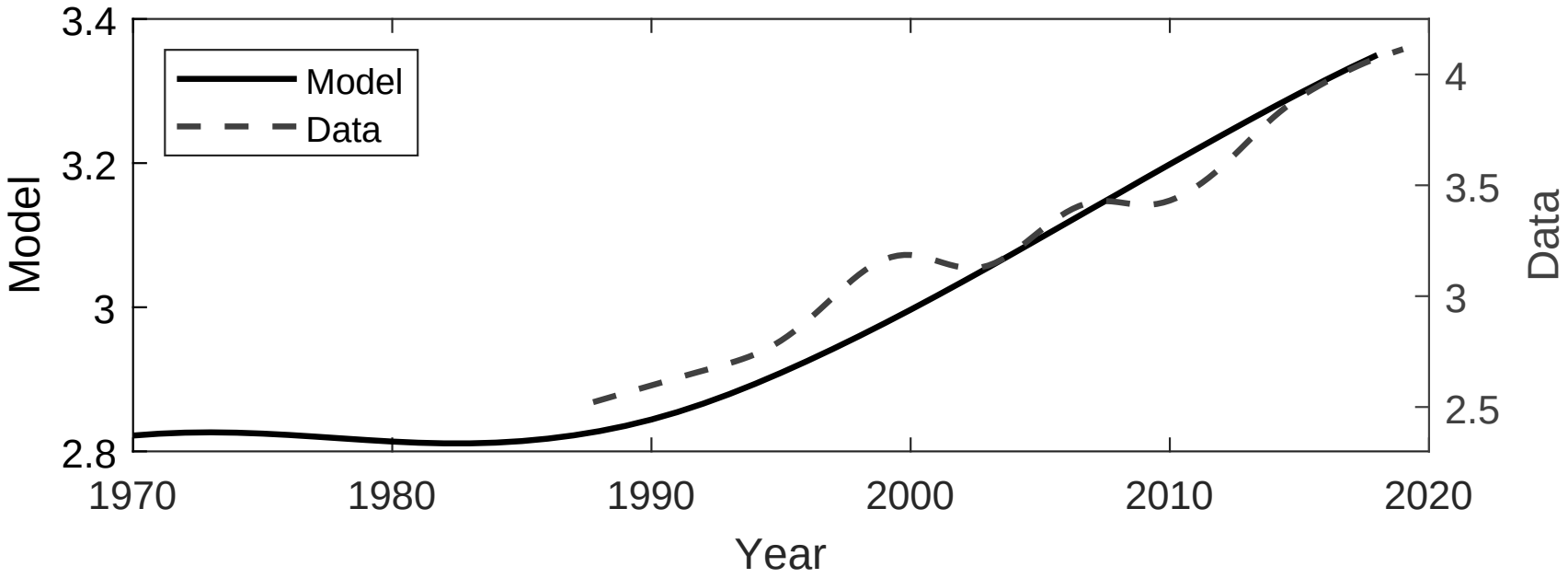
Baseline Economy: Economic Growth



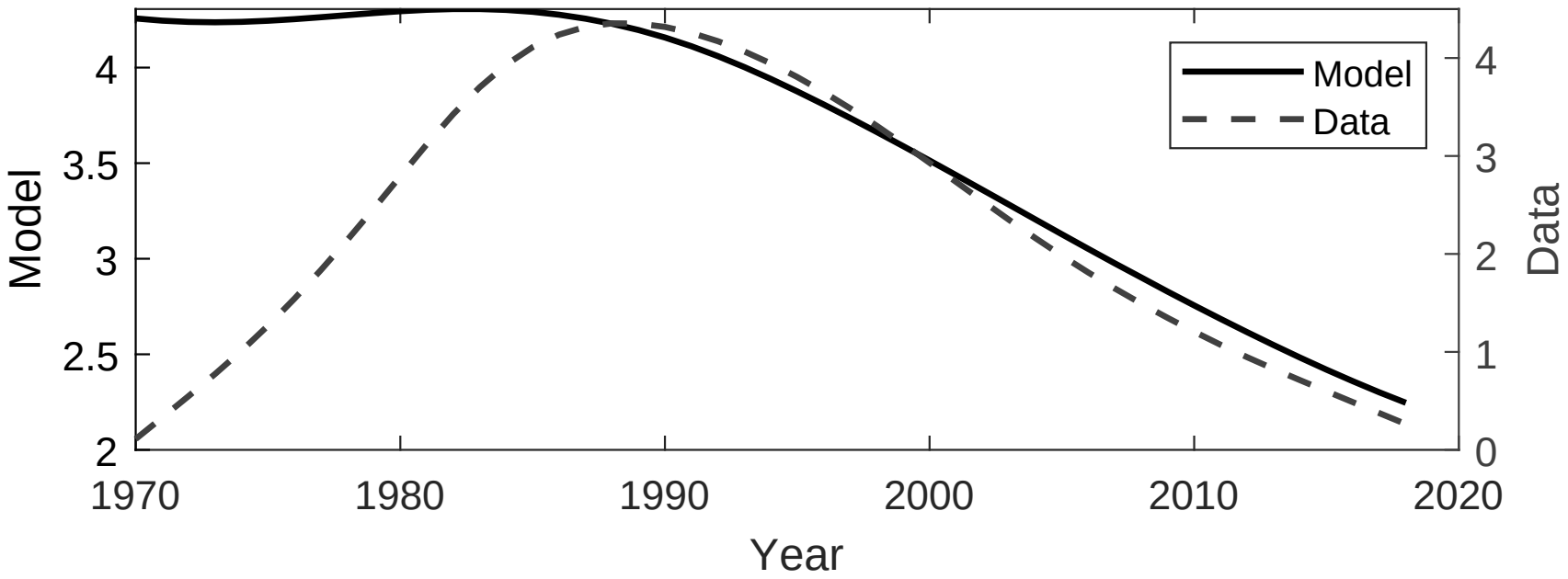
Baseline Economy: Investment Growth



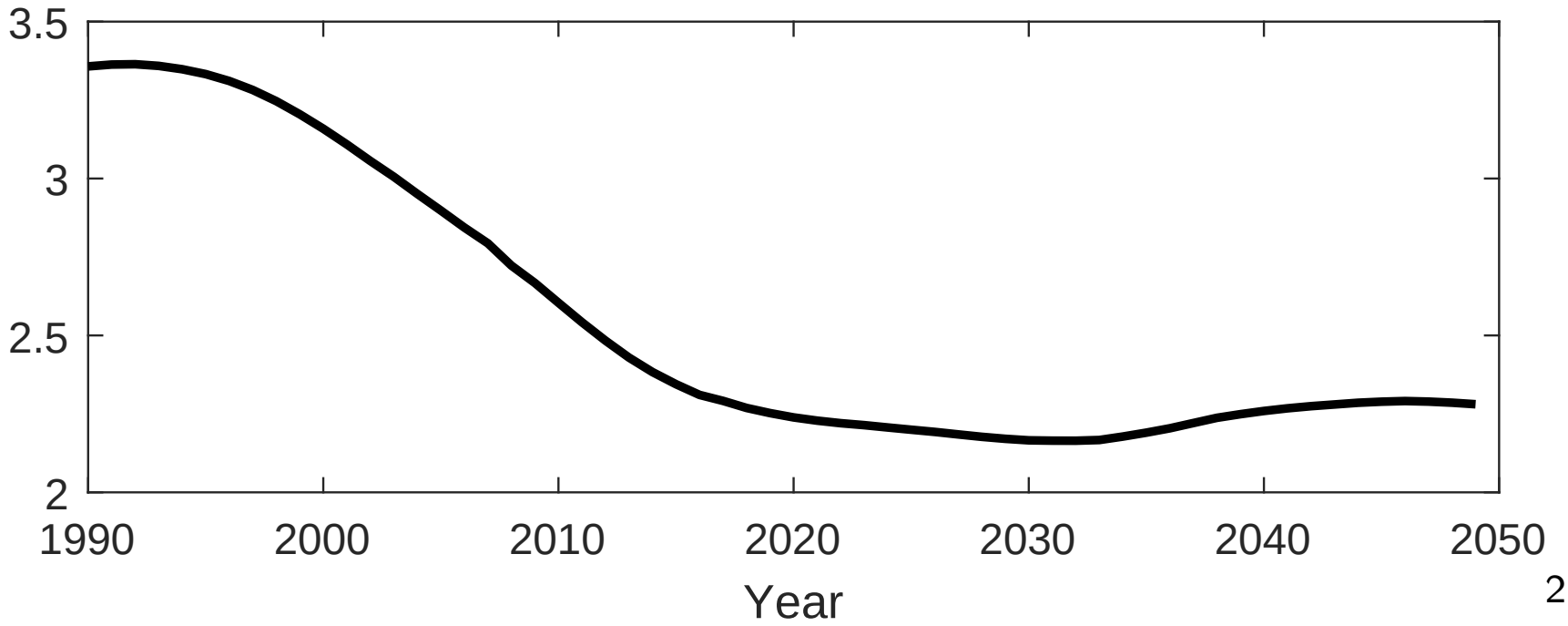
Baseline Economy: Capital-to-Output



Baseline Economy: Real Interest Rates

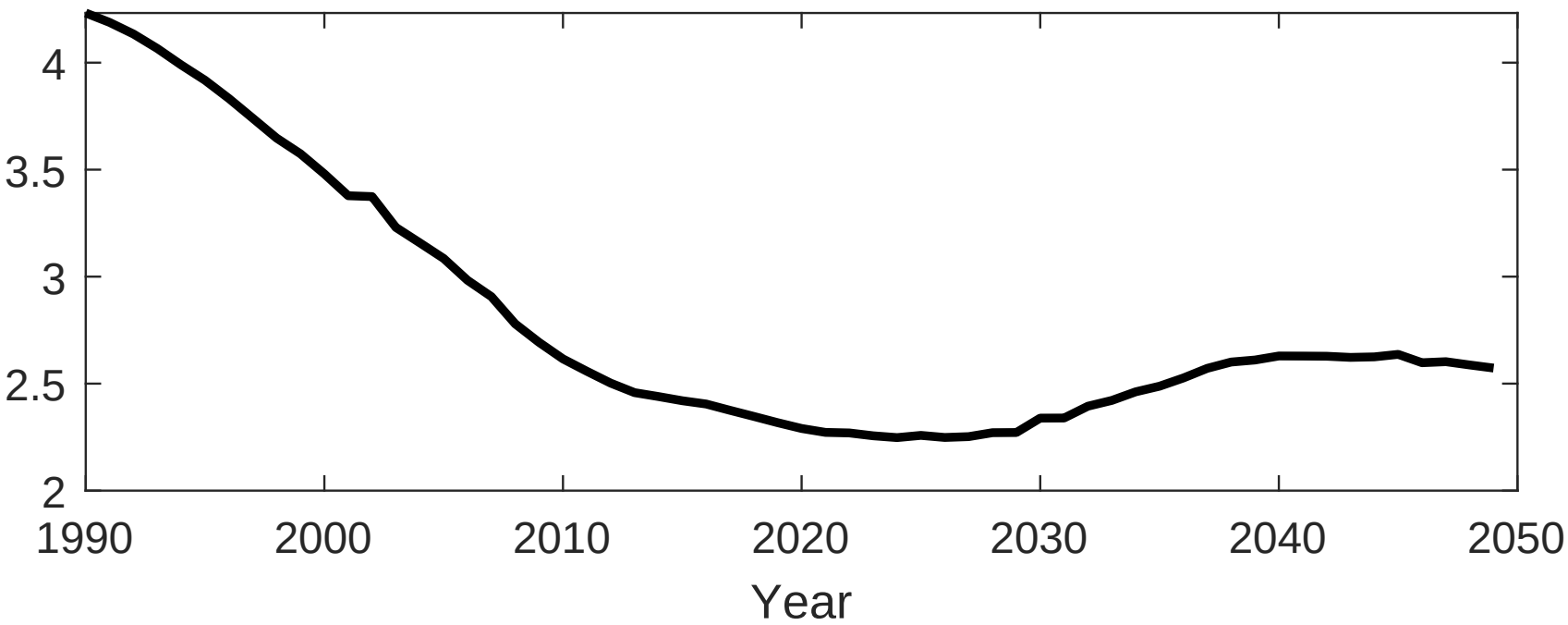


Baseline Projection: Economic Growth

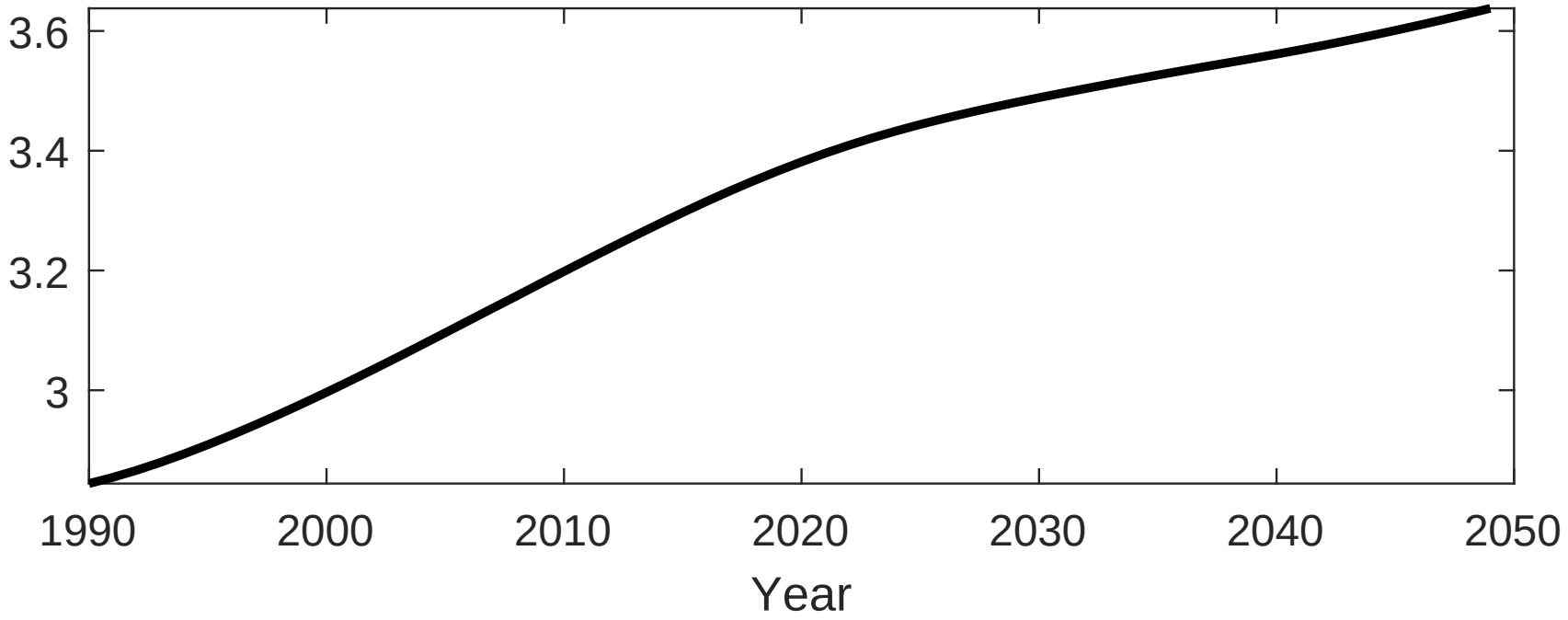


[2]LR: Population Growth $= 0$, Econ Growth Rate $= g$

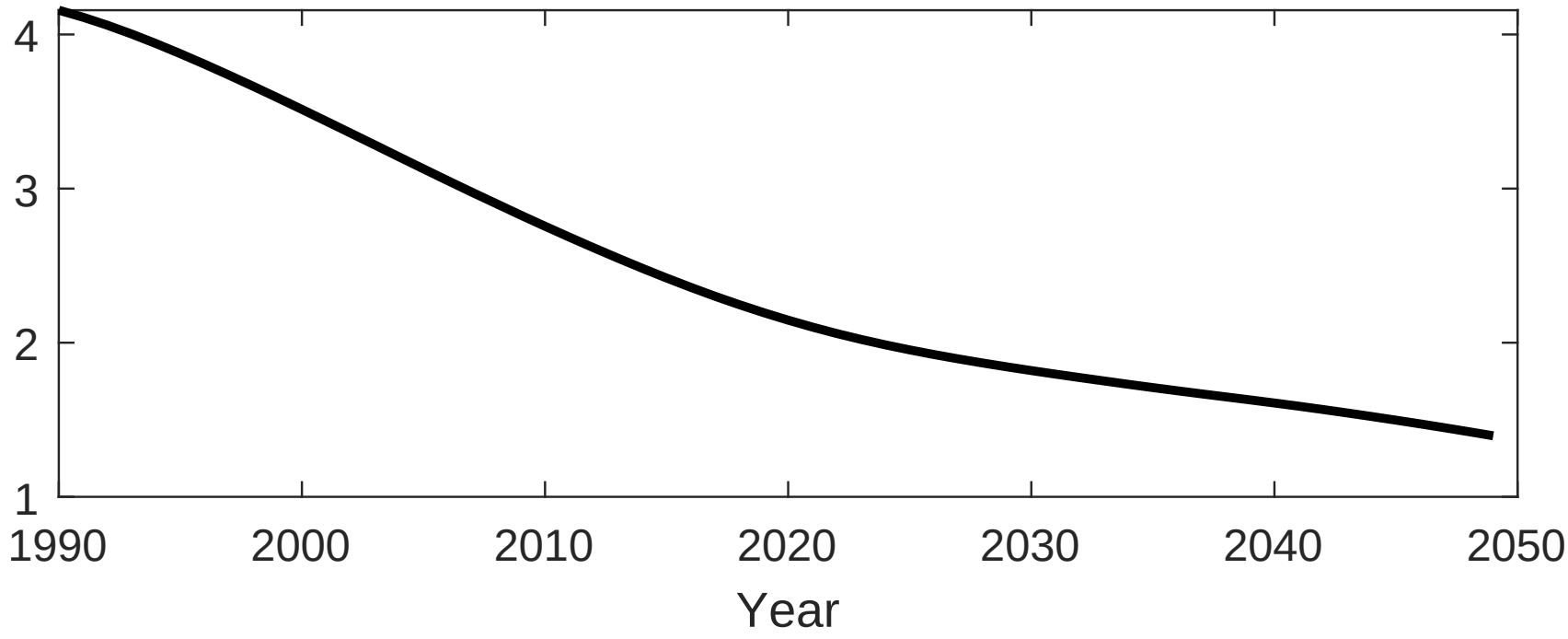
Baseline Projection: Investment Growth



Baseline Projection: Capital-to-Output



Baseline Projection: Real Interest Rates



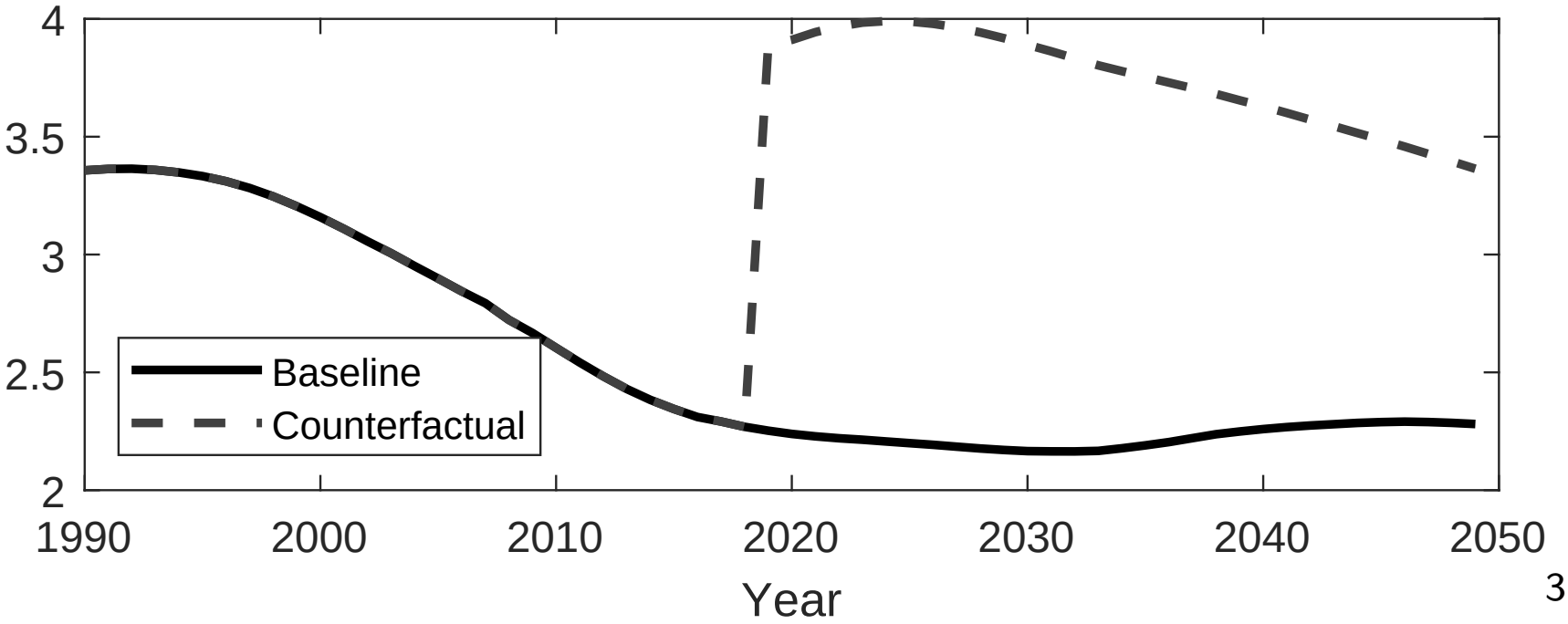
Counterfactual #1

- Increase the immigration rate by 4 $\times$ baseline

- Mathematically:

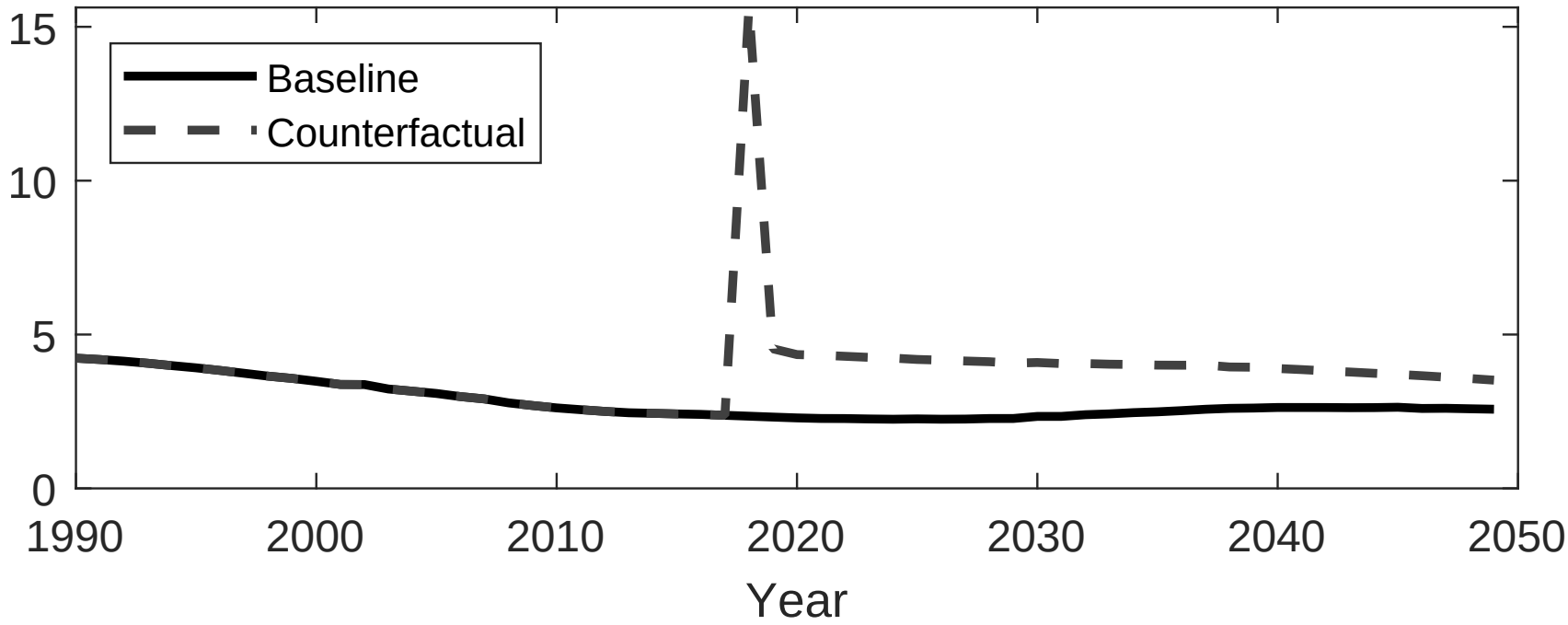
$$\sum_{e \in \{h,l\}} m^{e}_{j,t+1} = 4\psi_t \lambda_{j,t} M_t \tag{18}$$

Counterfactual #1: Economic Growth

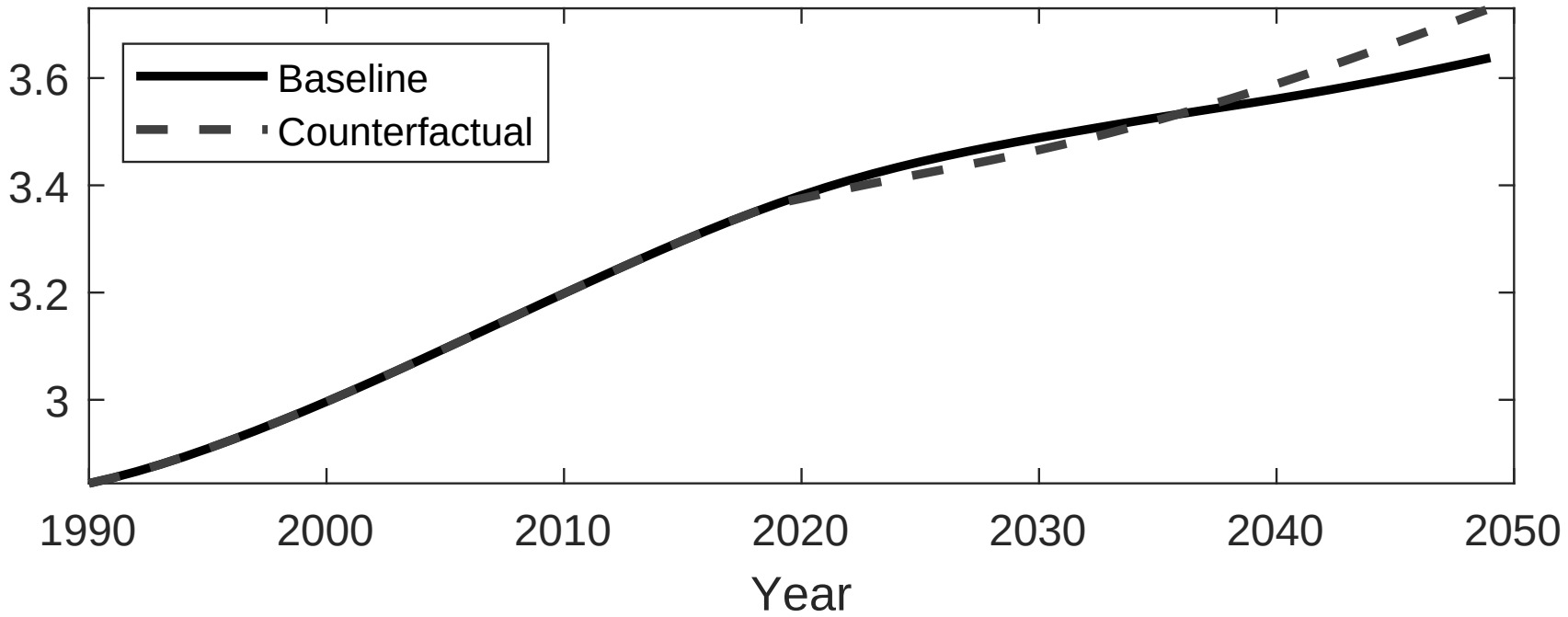


[3] LR: Population Growth = 1.15%, Econ Growth Rate = 2.65%

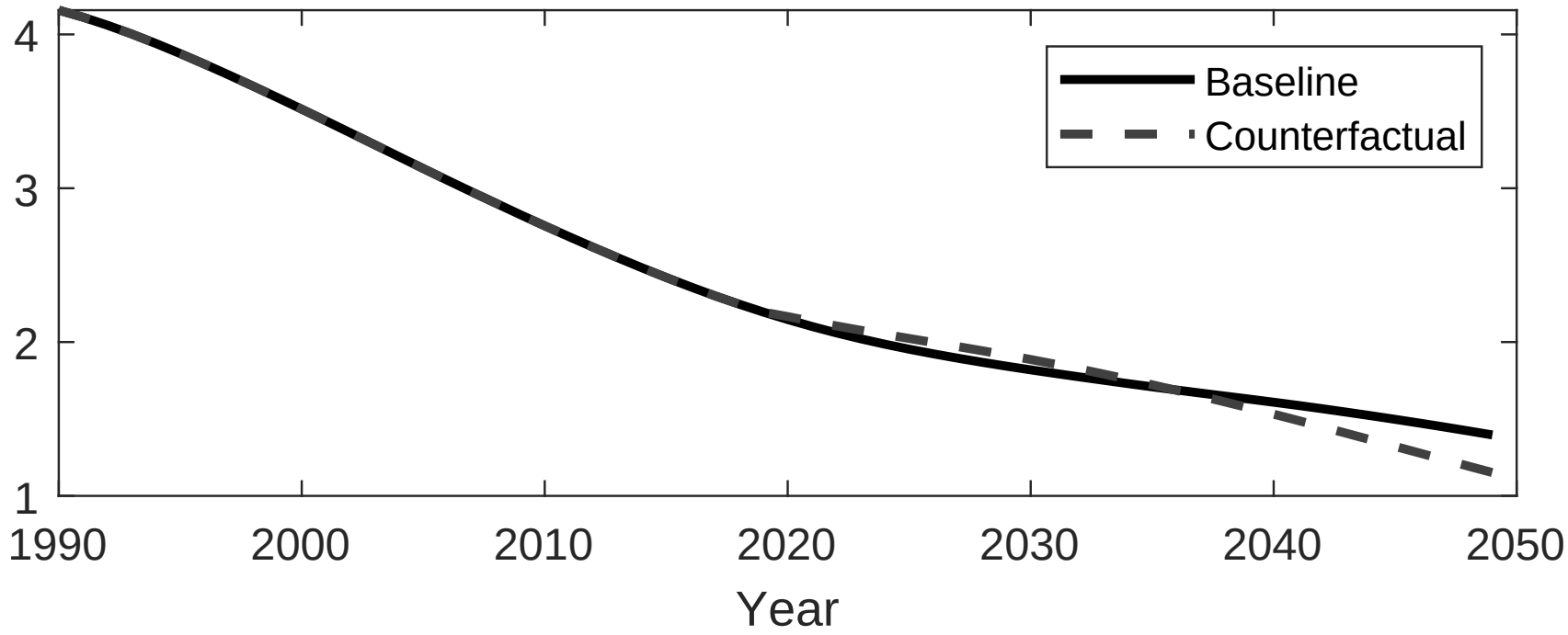
Counterfactual #1: Investment Growth



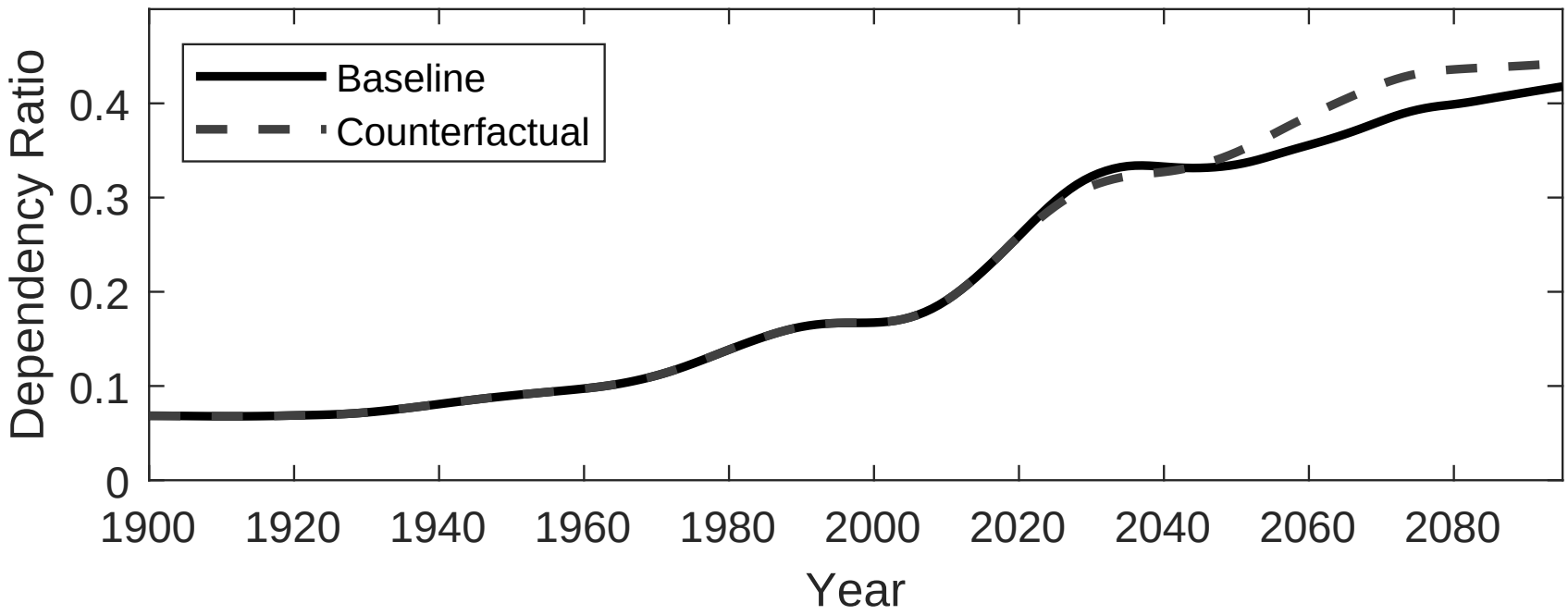
Counterfactual #1: Capital-to-Output



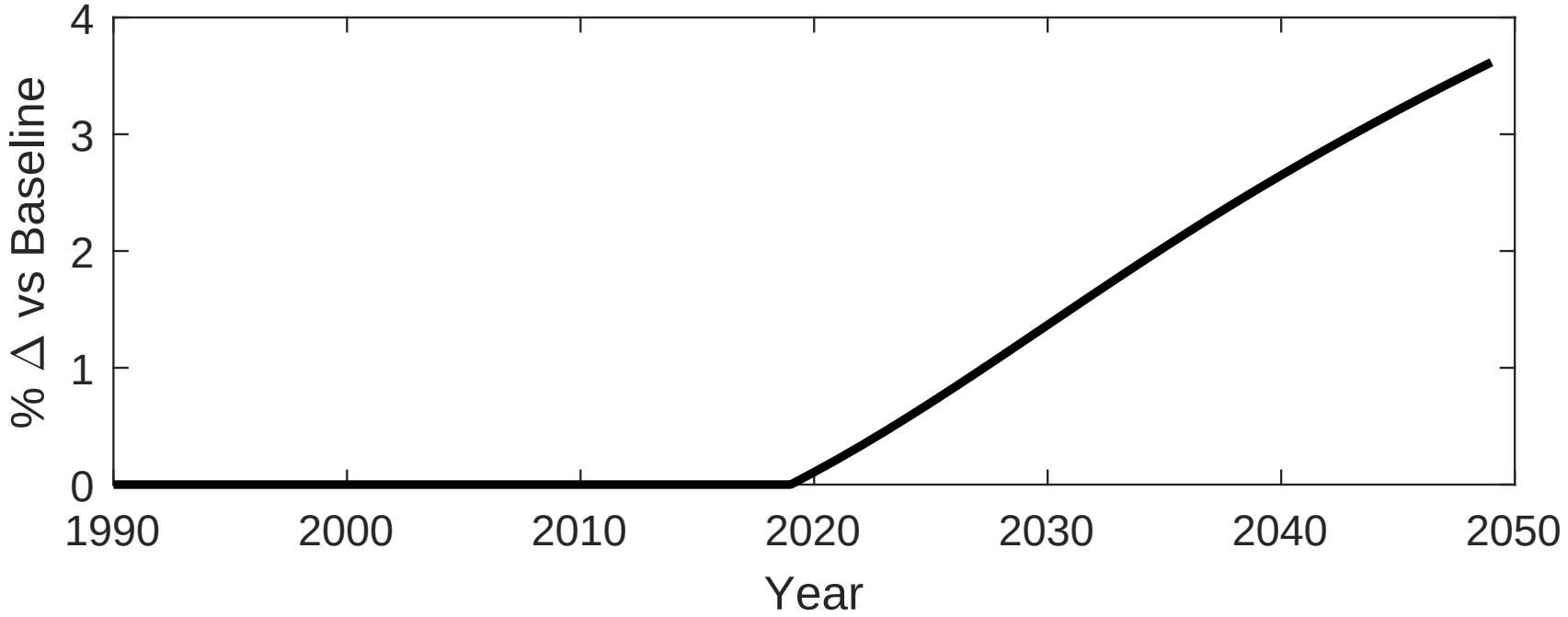
Counterfactual #1: Real Interest Rates



Counterfactual #1: Dependency Ratio



Counterfactual #1: Taxes-to-Output

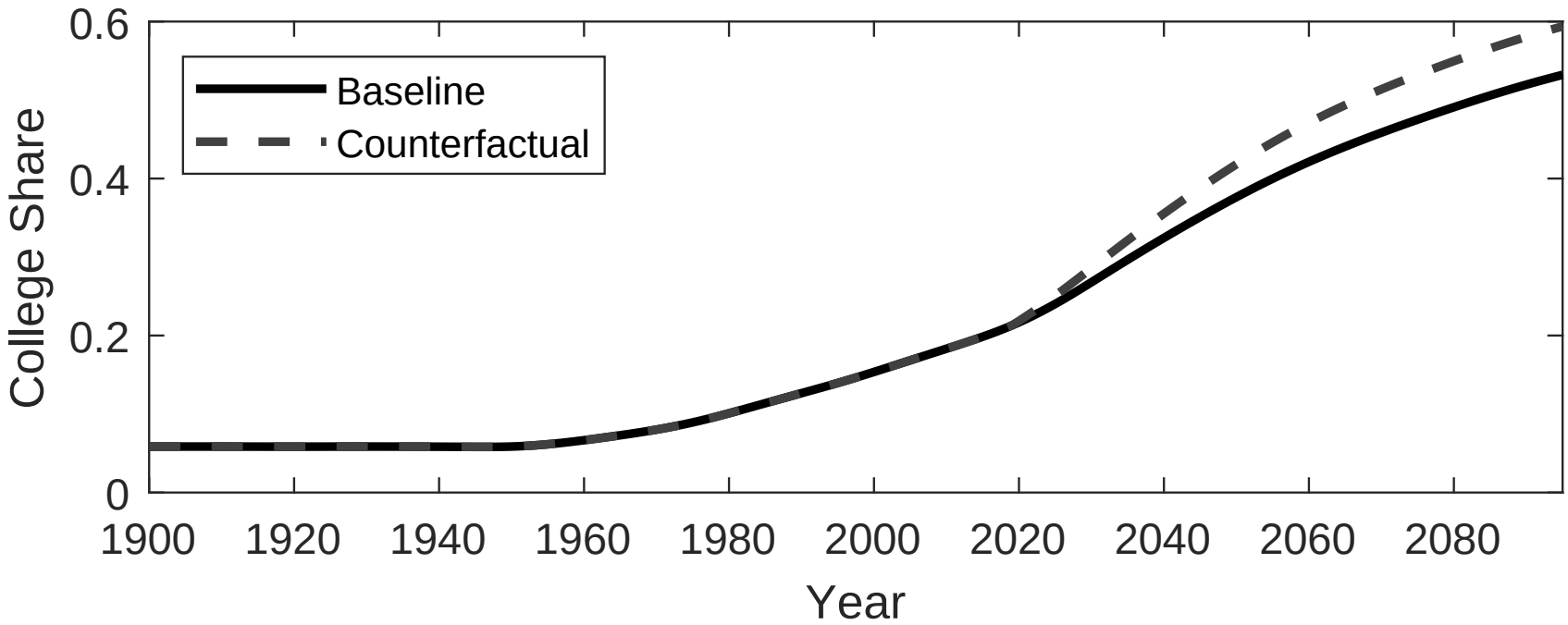


Counterfactual #2

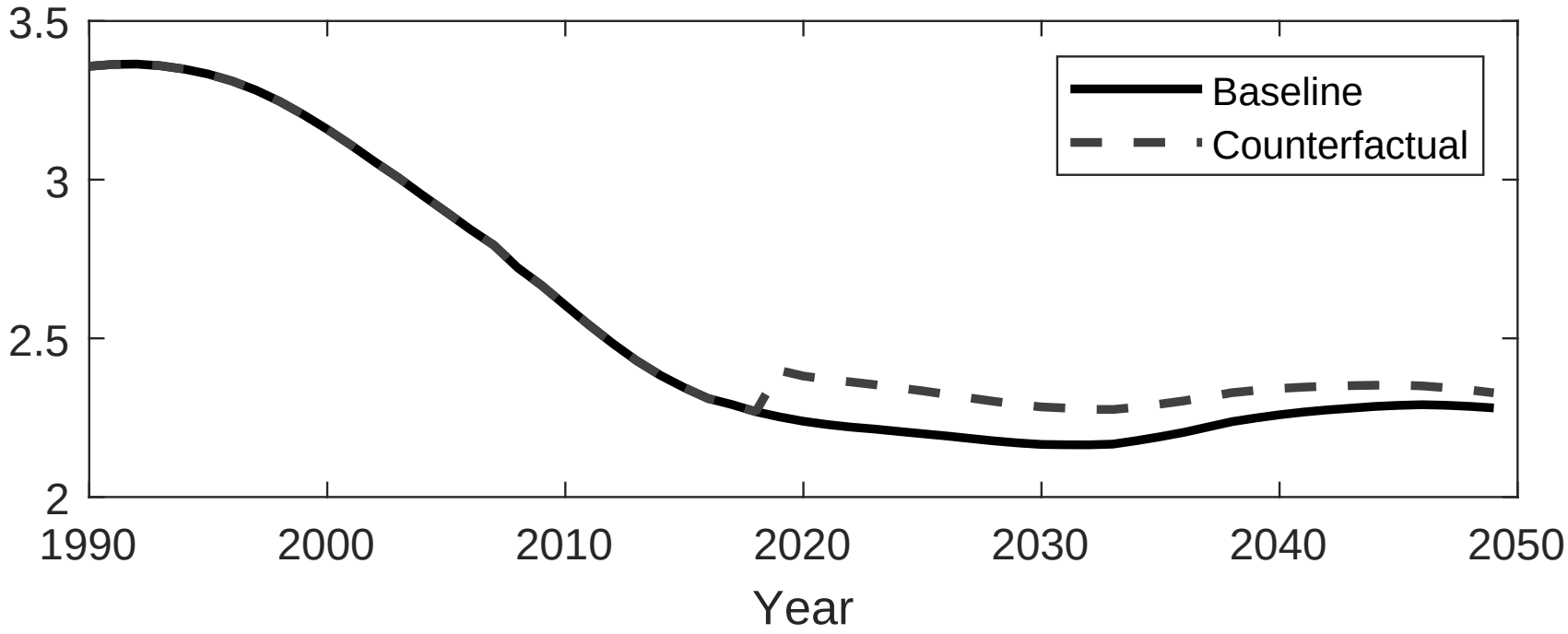
- Permanently increase college requirement to 100% of immigrants

- Gives an upper bound of skill requirement effect

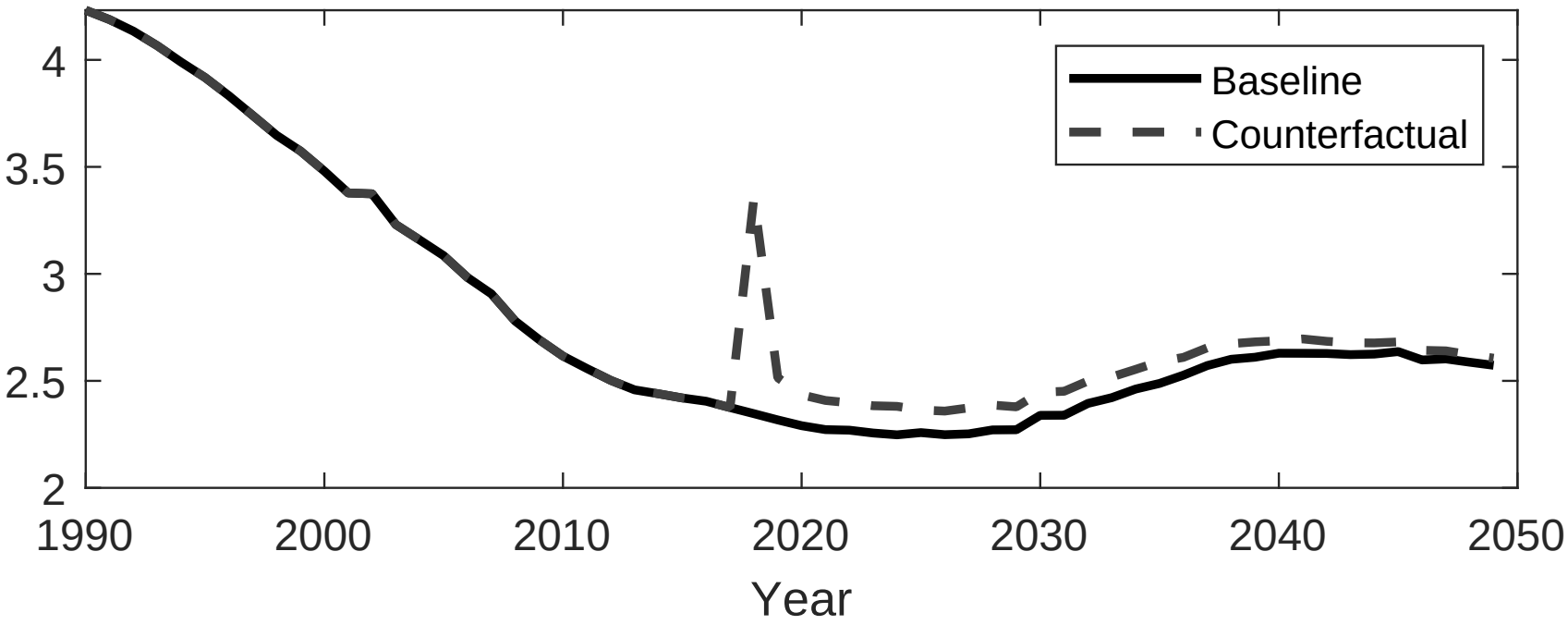
Counterfactual #2: College Share



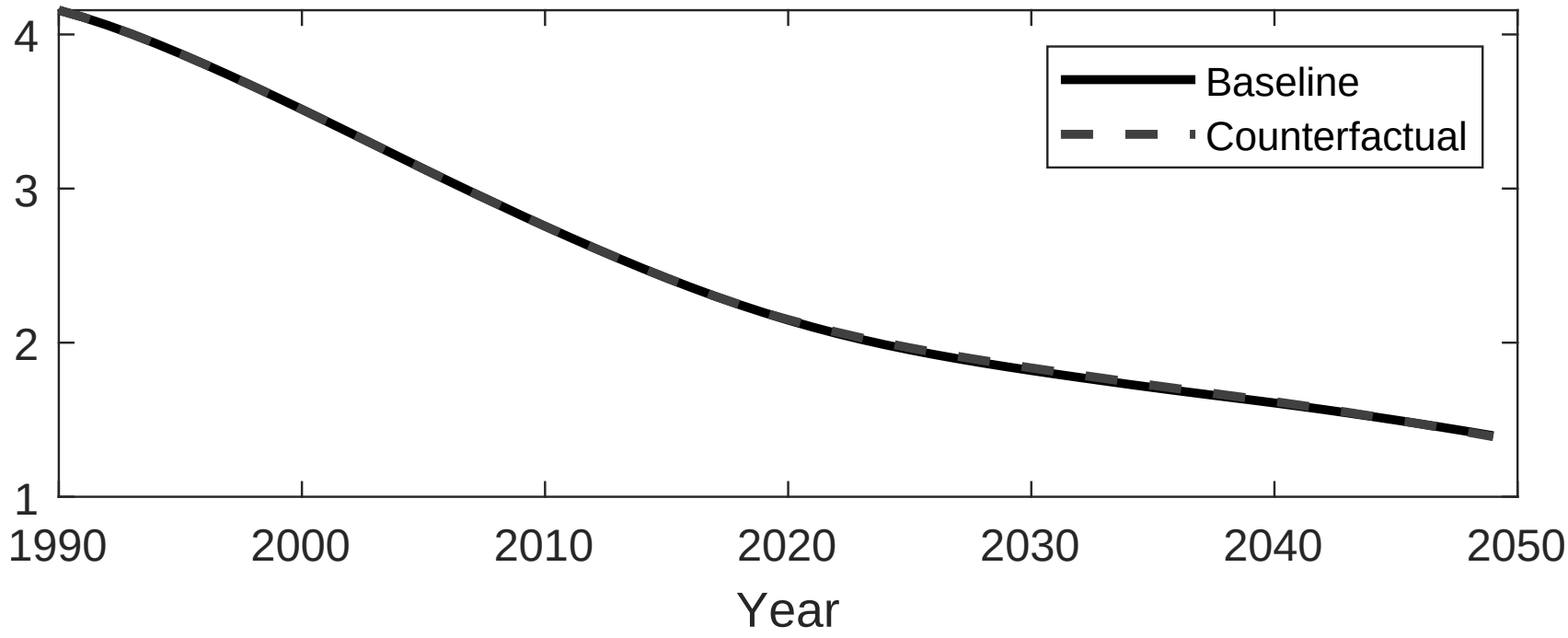
Counterfactual #2: Economic Growth



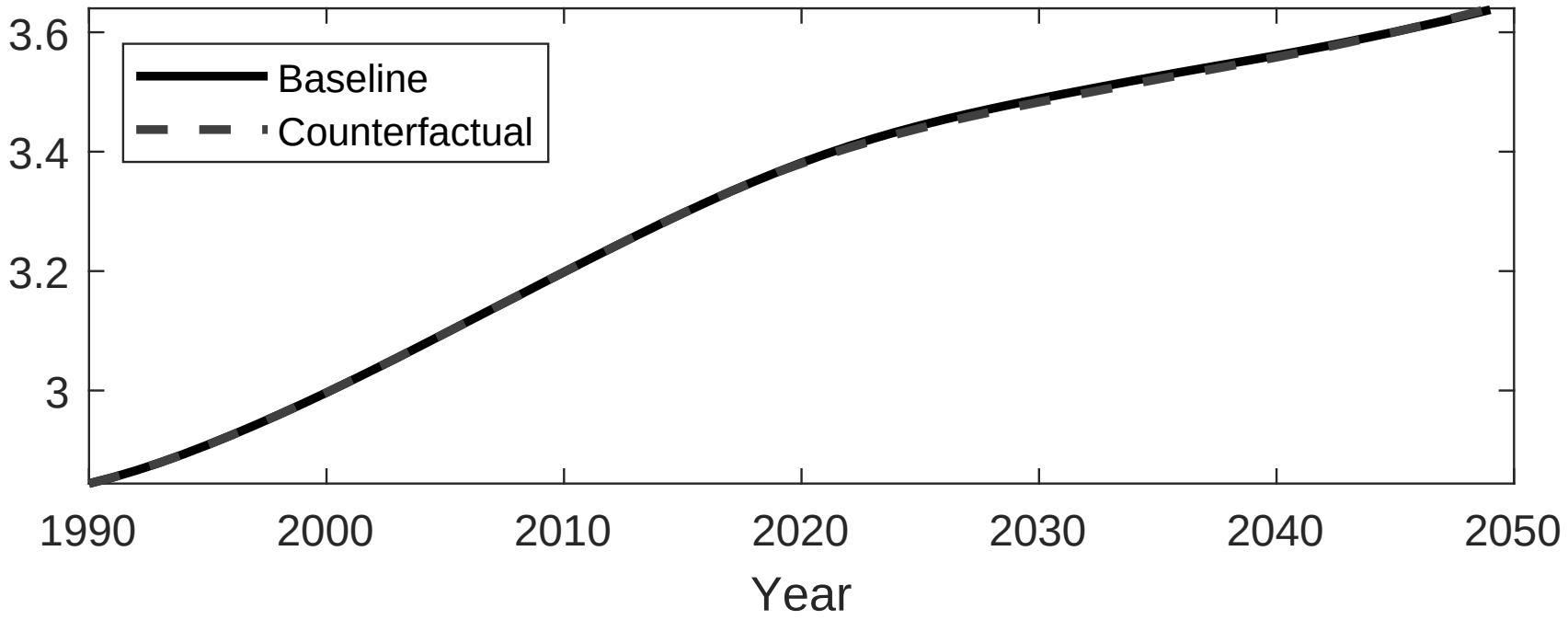
Counterfactual #2: Investment Growth



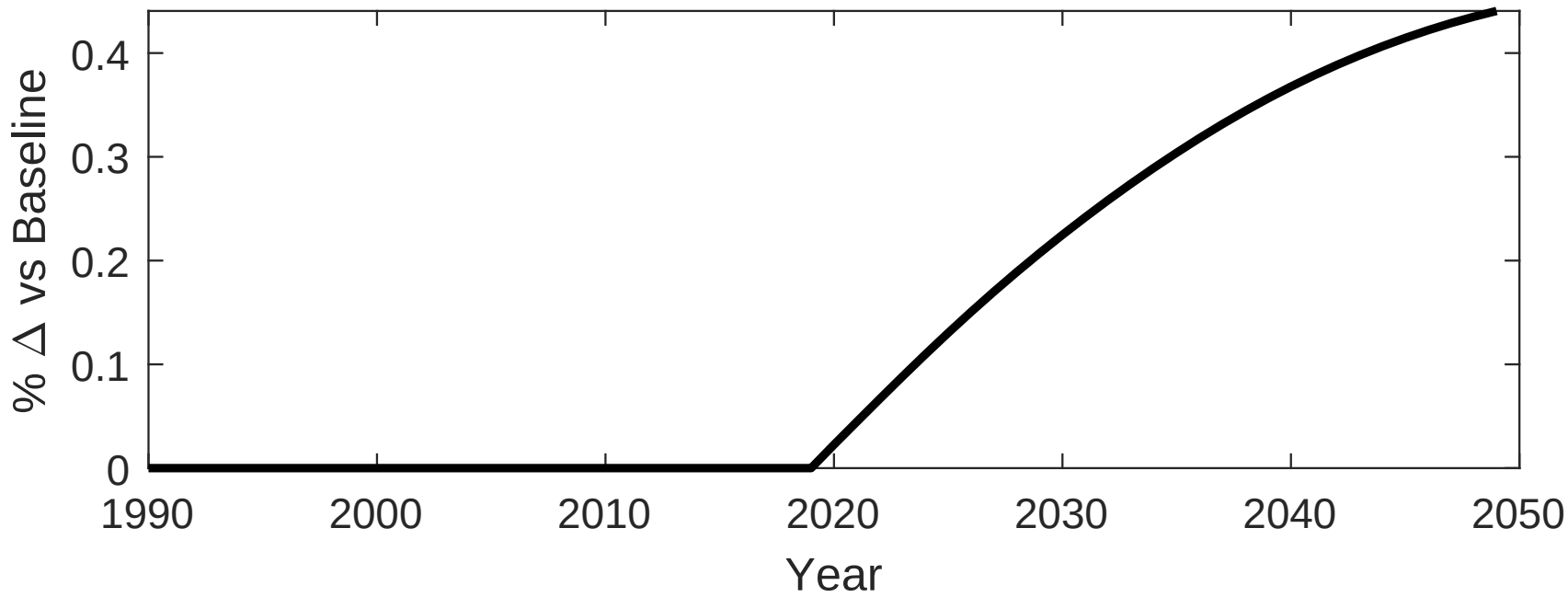
Counterfactual #2: Real Interest Rates



Counterfactual #2: Capital-to-Output



Counterfactual #2: Taxes-to-Output



Conclusion

- Increased immigration rates might not resolve demographic imbalances.
- Immigration could possibly alleviate budget issues - requires significant immigration and little corresponding government expenditures.
- 4% growth is possible through 4$\times$ immigration rate.

Future Work

- Improve demographics - e.g., birth rates by type, and data inputs
- Get more out of the model and understand the mechanism
- Richer fiscal policy - e.g., Social Security and government debt
- Evaluate alternative assumptions

Remaining Questions

- Are prices really determined in a "closed" economy?

- What are the consequences of rising debt?