Fiscal Policy

EC502 Macroeconomics
Topic 11

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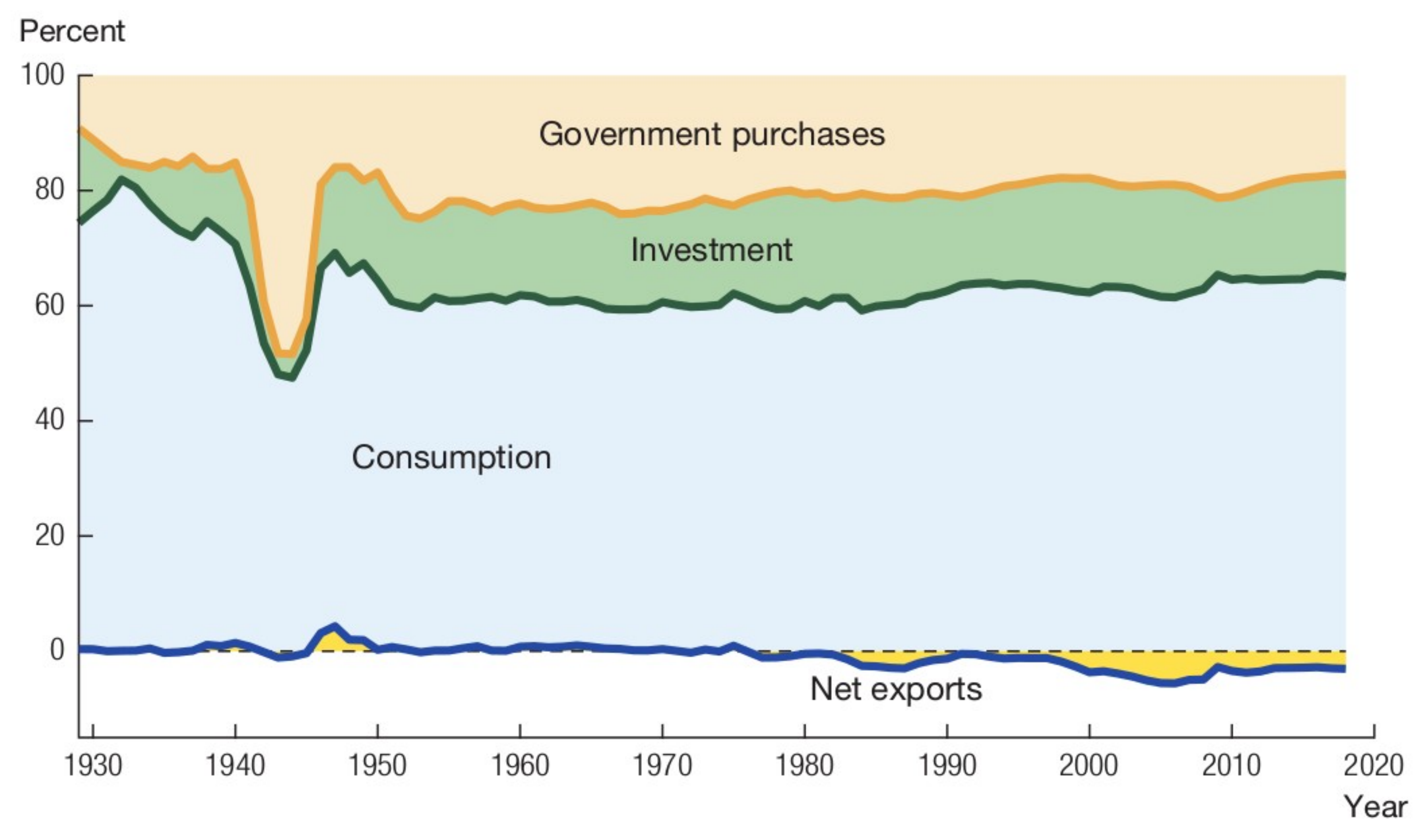
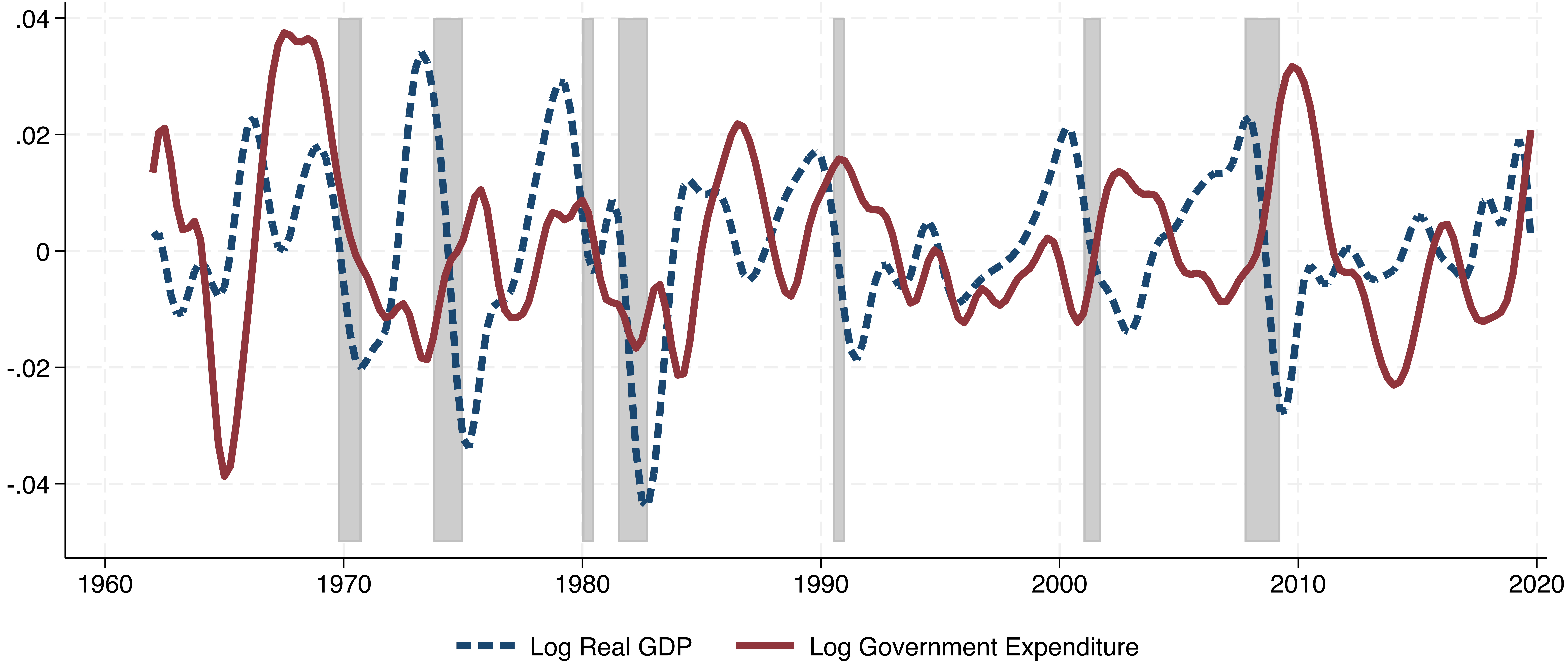
Government Purchases in GDP



Log Government Expenditure



Fiscal Policy

- Government expenditure…
  - is a big component of GDP (20%)
  - is strongly counter-cyclical
- Popular idea: government spending is effective in stimulating output
  - The idea goes back to Keynes
- What does our model say?

Government Spending: Theory

Introducing Government

- Consider the two-period New Keynsian model in the previous lecture note
- We will introduce the government into the model
- The government
  1. spends G_t at time t
  2. finance the spending by taxing households through lump-sum tax T_t
- The government budget constraint is

$$P_t G_t = T_t$$

- We assume government spending is a total waste
  - Households do not enjoy utility from G_t

Households and Firms

- Households solve

$$\max_{C_0, C_1, A_0, l_0} u(C_0) - v(l_0) + \beta u(C_1)$$

subject to

$$P_0 C_0 + A_0 = W_0 l_0 + D_0 - T_0$$

$$P_1 C_1 = (1+i) A_0 + W_1 l_1 + D_1 - T_1$$

- Firms solve

$$\max_{L_0, L_1} D_0 + \frac{1}{1+i} D_1$$

$$D_0 = p_0 F_0(K_0, L_0) - W_0 L_0$$

$$D_1 = p_1 F_1(K_1, L_1) - W_1 L_1$$

$$K_1 = (1-\delta) K_0$$

Retailers

- The retailer's optimal price setting implies

$$P_0 = (1-\lambda)\frac{\eta}{\eta-1}p_0 + \lambda\bar{P}_0, \quad P_1 = \frac{\eta}{\eta-1}p_1 = \bar{P}_1$$

- The goods market clearing is

$$C_t + G_t = F(K_t, L_t)$$

Equilibrium Conditions

- Household labor supply is

$$C_0^{-\sigma}\frac{W_0}{P_0} = \bar{v}L_0^{\nu} \tag{1}$$

- Euler equation is

$$C_0^{-\sigma} = \beta(1+i)\frac{P_0}{P_1}C_1^{-\sigma} \tag{2}$$

- Firm's labor demand

$$(1-\alpha)A_tK_t^{\alpha}L_t^{-\alpha} = \frac{W_t}{p_t} \tag{3}$$

- Retailer's price setting

$$P_0 = (1-\lambda)\frac{\eta-1}{\eta}p_0 + \lambda\bar{P}_0, \quad P_1 = \frac{\eta}{\eta-1}p_1 = \bar{P}_1 \tag{4}$$

- Goods market clearing

$$C_0 + G_0 = A_0K_0^{\alpha}L_0^{1-\alpha}, \quad C_1 + G_1 = A_1K_1^{\alpha}L_1^{1-\alpha} \tag{5}$$

Aggregate Supply and Demand

- Combining (1), (3), (4), and (5), we obtain the Phillps curve:

$$P_0 = \frac{1}{1-(1-\lambda)\frac{\eta-1}{\eta}\frac{(A_0K_0^\alpha L_0^{1-\alpha}-G_0)^\sigma}{(1-\alpha)A_0K_0^\alpha}\bar{\nu}L_0^{\nu+\alpha}}\lambda\bar{P}_0$$

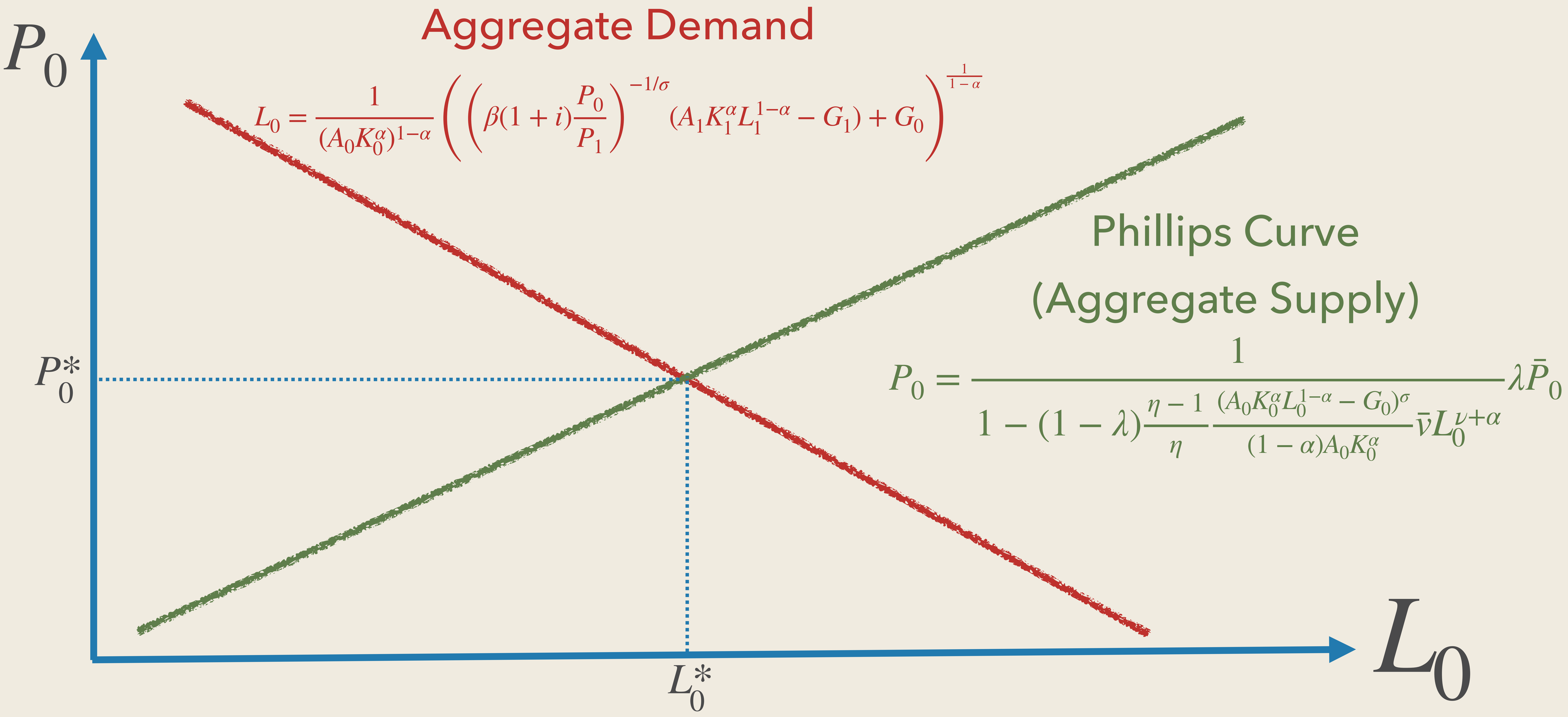
  This defines an increasing relationship between P_0 and L_0 (as before)

- Combining (2) and (5), we obtain the aggregate demand curve:

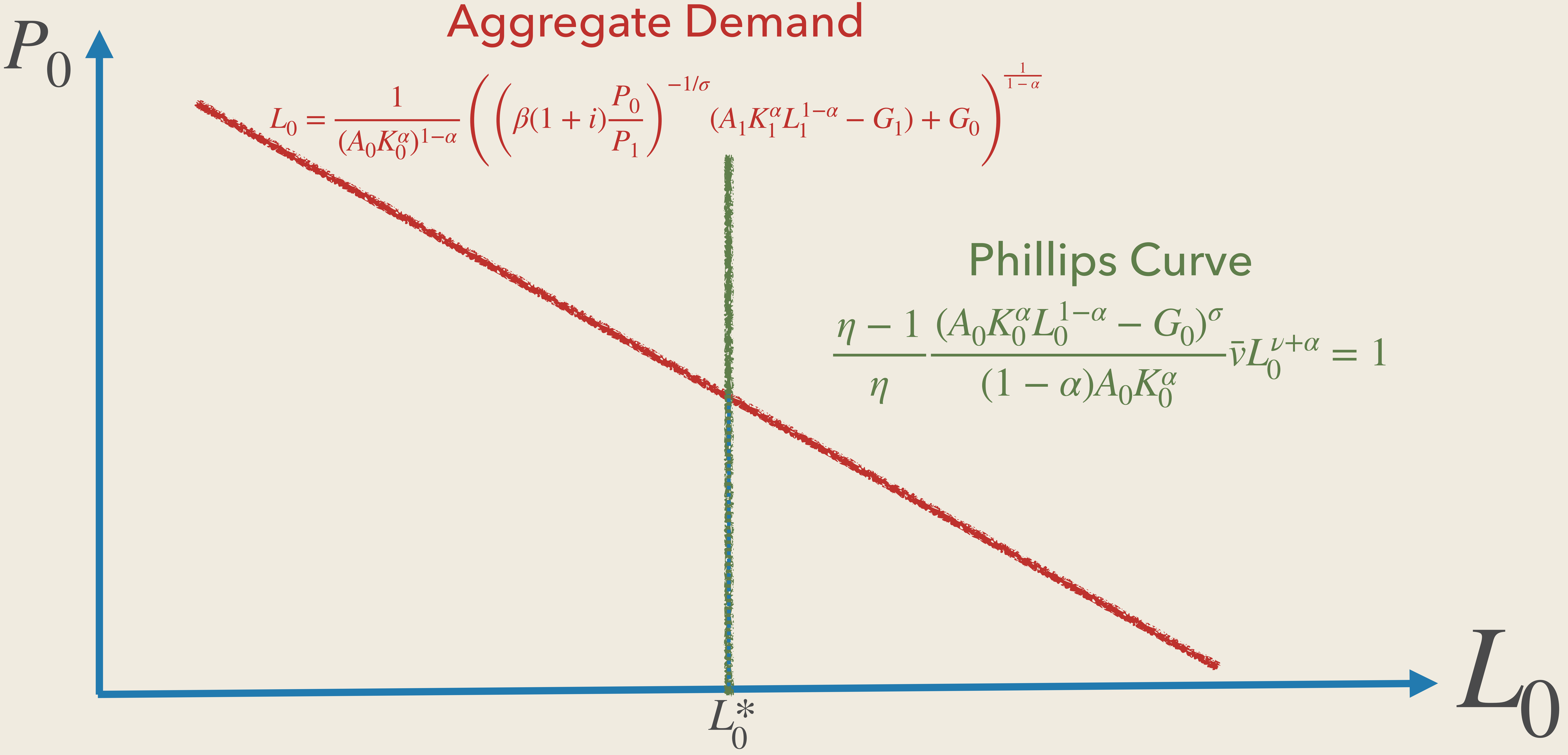
$$L_0 = \frac{1}{(A_0K_0^\alpha)^{\frac{1}{1-\alpha}}}\left(\left(\beta(1+i)\frac{P_0}{P_1}\right)^{-1/\sigma}(A_1K_1^\alpha L_1^{1-\alpha}-G_1)+G_0\right)^{\frac{1}{1-\alpha}}$$

  This defines a decreasing relationship between P_0 and L_0 (as before)

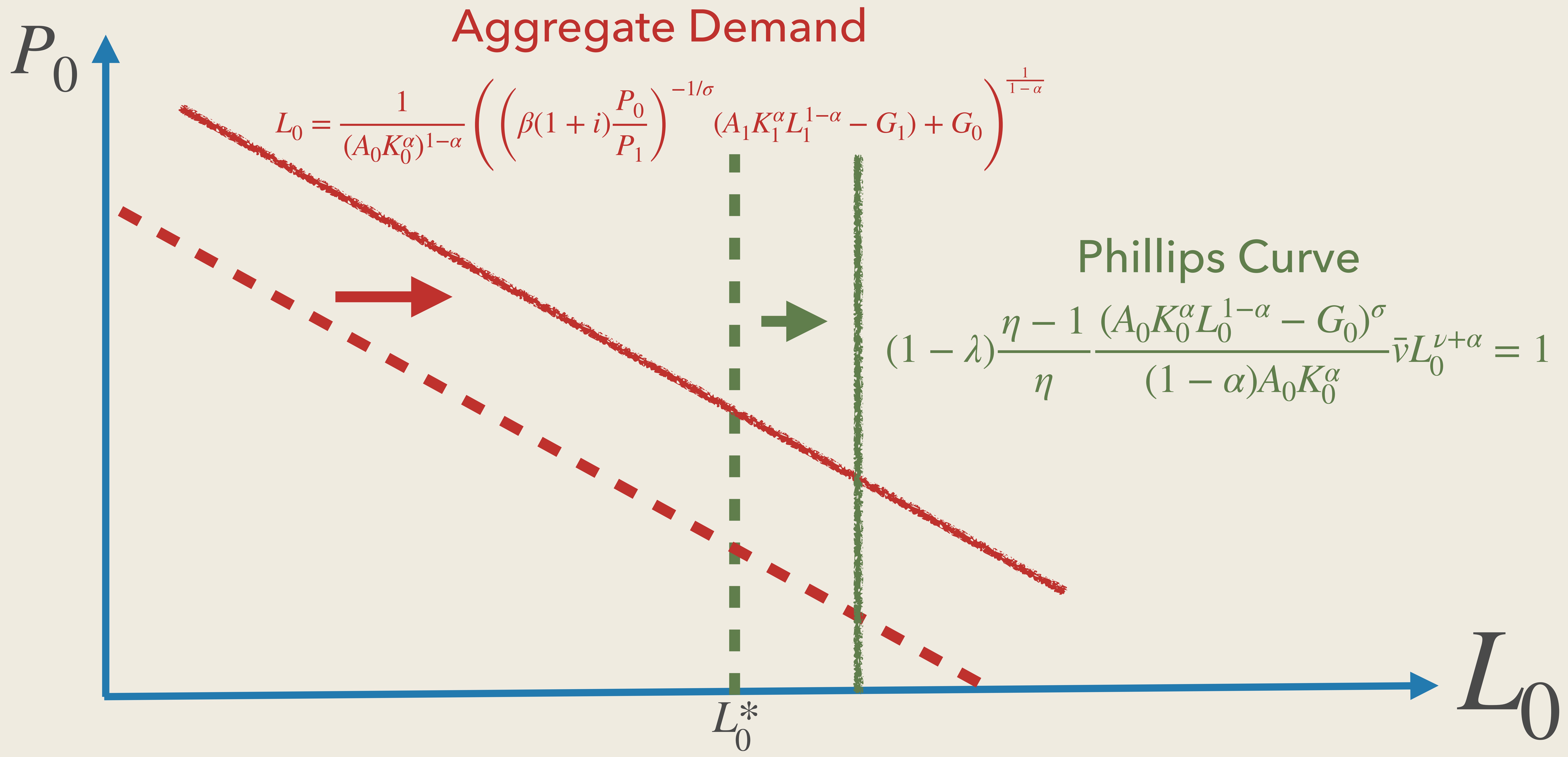
AS-AD Diagram



Flexible Price Case $\lambda = 0$



An Increase in G_0



An Increase in G_0 under Flexible Price

- When prices are flexible, $G_0 \uparrow$ increases employment
- Why? What happens to consumption $C_0 = A_0 K_0^\alpha L_0^{1-\alpha} - G_0$?
- Consumption goes down as G_0 takes the resource away from C_0
  - Households face tax of $T_0 = G_0$ and, as a result, are poorer
- Because C_0 goes down, labor supply increases through income effect
- Do you find this channel intuitive or plausible?

Government Spending Multiplier

- We define government spending multiplier as

$$\frac{dY_0}{dG_0}$$

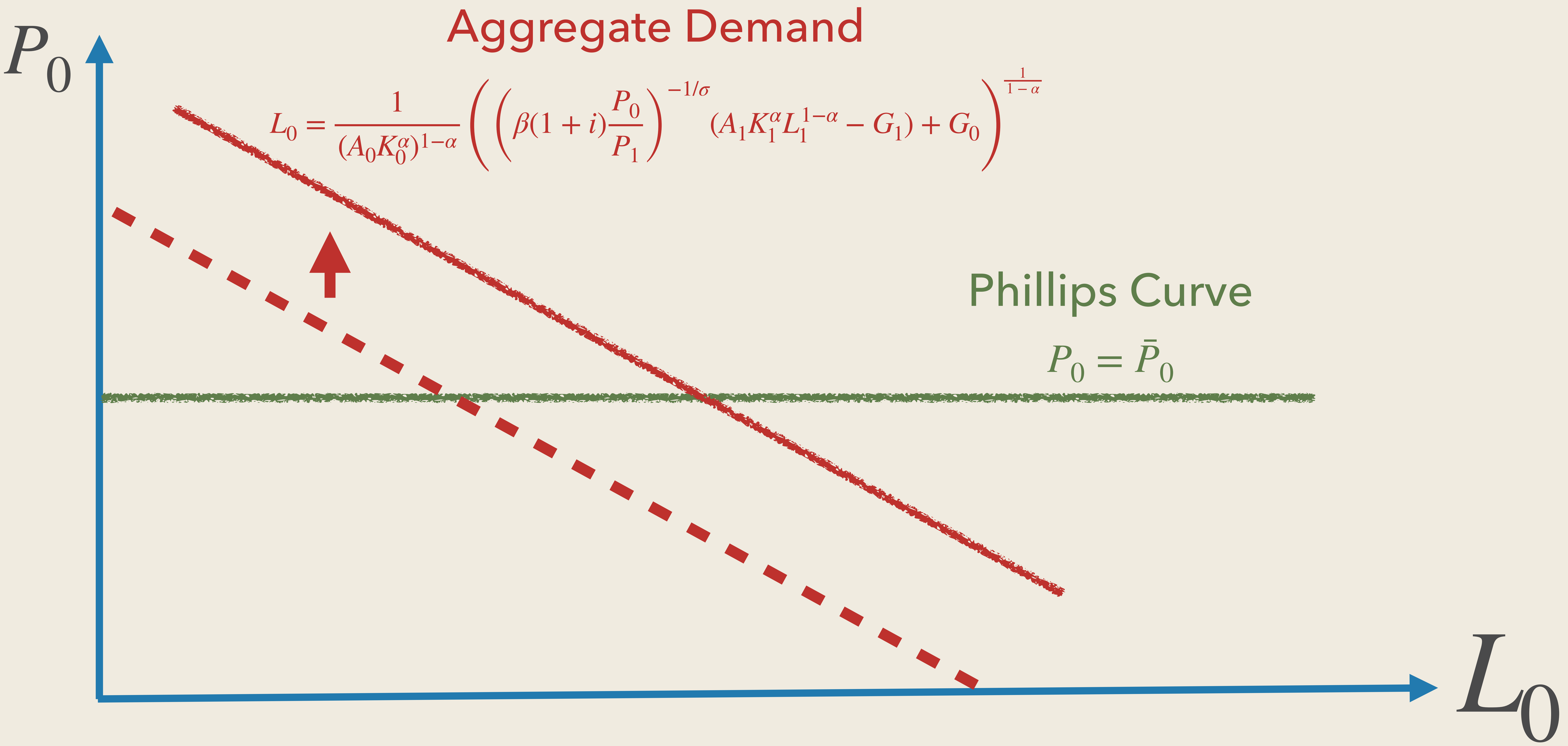
How much \$1 increase in G_0 increases GDP

- Here, we have

$$\frac{dY_0}{dG_0} = \underbrace{\frac{dC_0}{dG_0}}_{<0} + 1 < 1$$

- The multiplier is always lower than 1 because it crowds out consumption

RIgid Price Case $\lambda = 1$

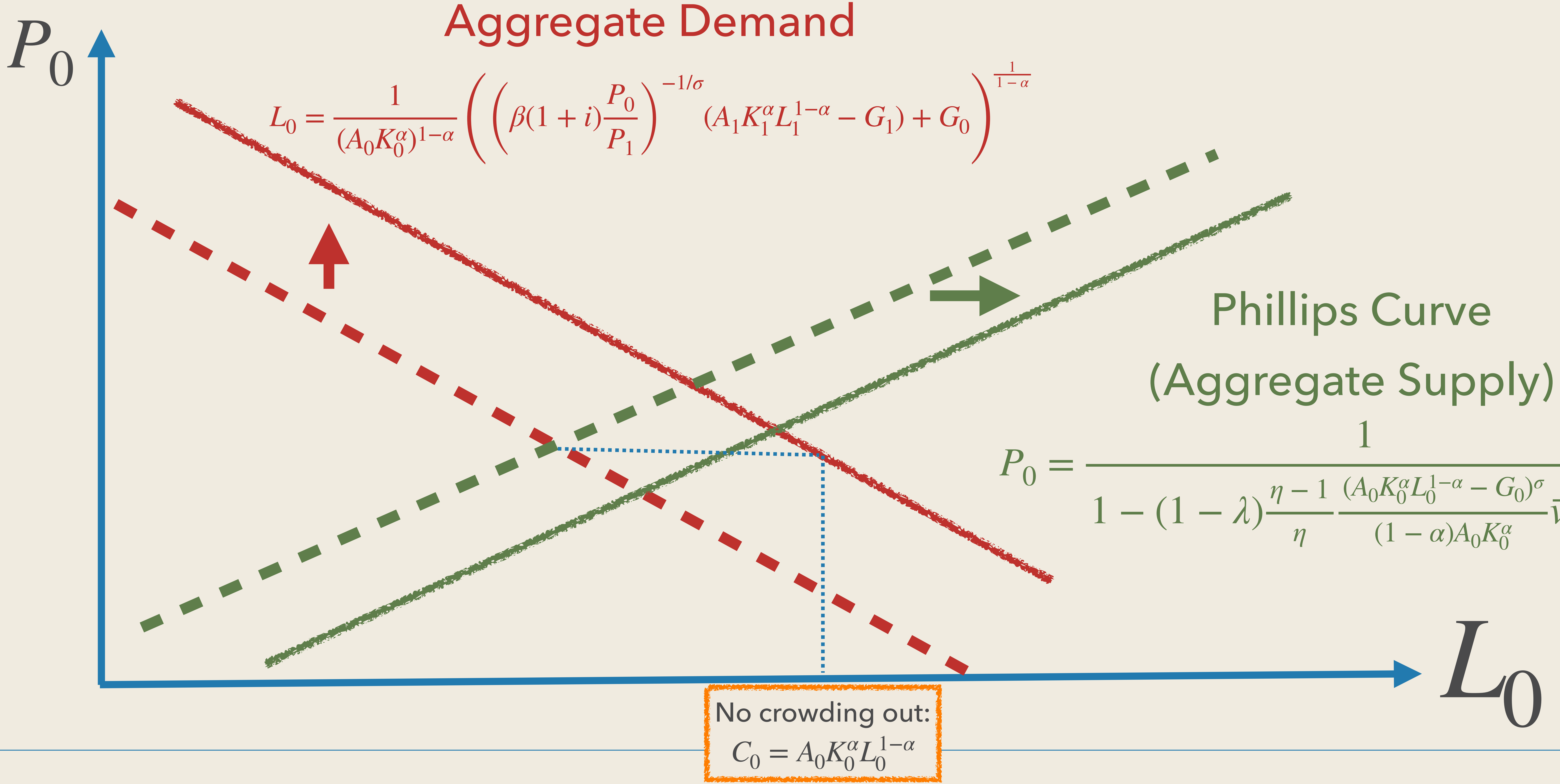


An Increase in G_0 under Rigid Price

- When prices are flexible, $G_0 \uparrow$ increases employment
- Why? What happens to consumption $C_0 = A_0 K_0^\alpha L_0^{1-\alpha} - G_0$?
- Consumption does not change (recall $C_0^{-\sigma} = \beta(1+i)P_0/P_1 C_1^{-\sigma}$)
- Output increases one-for-one with G_0:

$$\frac{dY_0}{dG_0} = \underbrace{\frac{dC_0}{dG_0}}_{=0} + 1 = 1$$

In-Between $\lambda \in (0,1)$



$$L_0 = \frac{1}{(A_0K_0^\alpha)^{1-\alpha}}\left(\left(\beta(1+i)\frac{P_0}{P_1}\right)^{-1/\sigma}(A_1K_1^\alpha L_1^{1-\alpha} - G_1) + G_0\right)^{\frac{1}{1-\alpha}}$$

$$P_0 = \frac{1}{1-(1-\lambda)\frac{\eta-1}{\eta}\frac{(A_0K_0^\alpha L_0^{1-\alpha}-G_0)^\sigma}{(1-\alpha)A_0K_0^\alpha}\bar{v}L_0^{\nu+\alpha}}$$

$$C_0 = A_0K_0^\alpha L_0^{1-\alpha}$$

Multiplier in a General Case

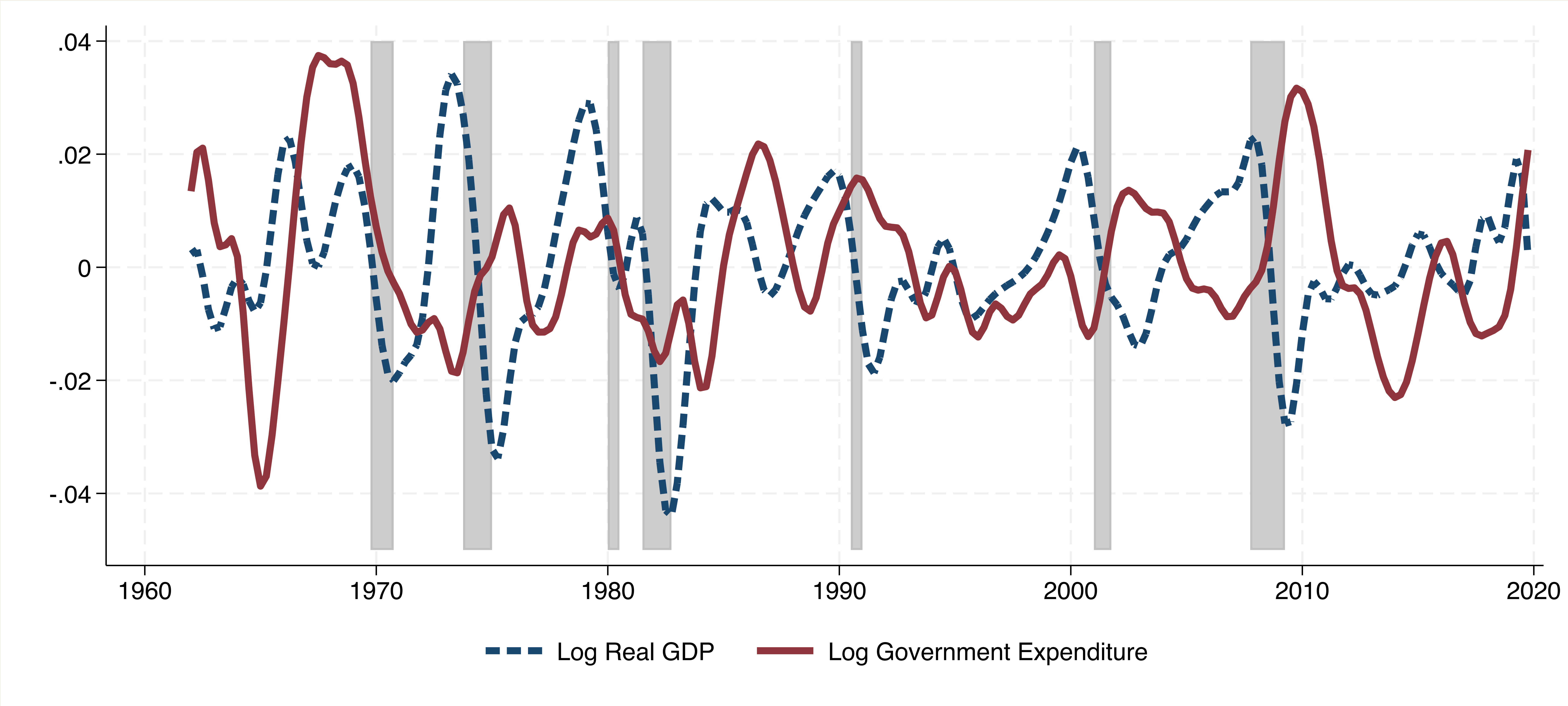
- When prices are partially flexible $P_0 \uparrow$ both because
  - income effect
  - higher aggregate demand

- Therefore,

$$\frac{dY_0}{dG_0} = \underbrace{\frac{dC_0}{dG_0}}_{\leq 0} + 1 \leq 1$$

Government Spending: Evidence

Log Government Expenditure



- Obviously, we cannot conclude from this figure that $G_0 \uparrow$ caused $Y_0 \downarrow$
- Can we identify the ***causal*** effect of G_0?

Identifcation

- We will cover three approaches:
  1. Narrative approach (Ramey-Shapiro, 1998)
  2. Forecast error approach (Ramey, 2011)
  3. Cross-sectional identification approach (Nakamura-Steinsson, 2011, Serrato-Wingender, 2016)

Focus on Defense Spending

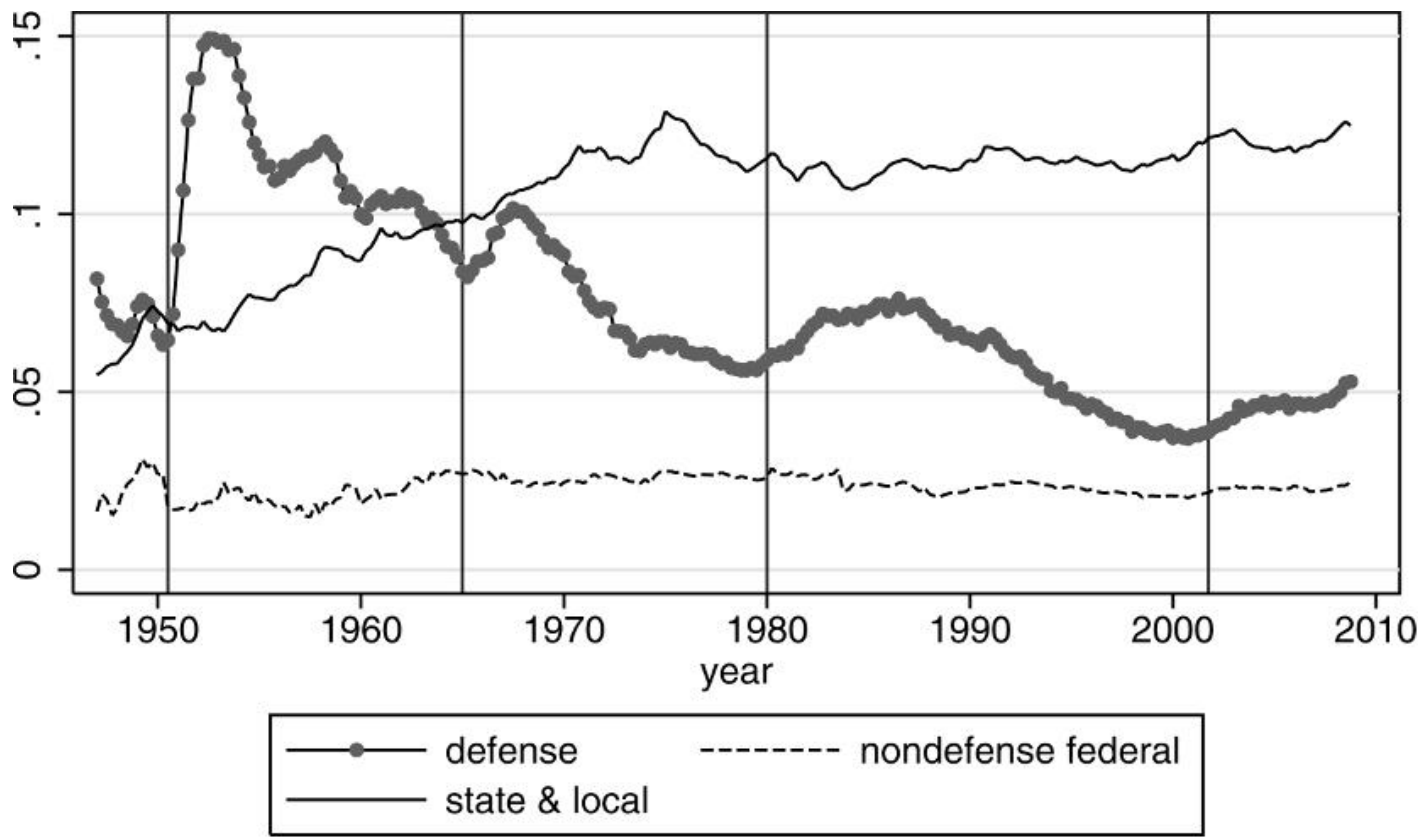


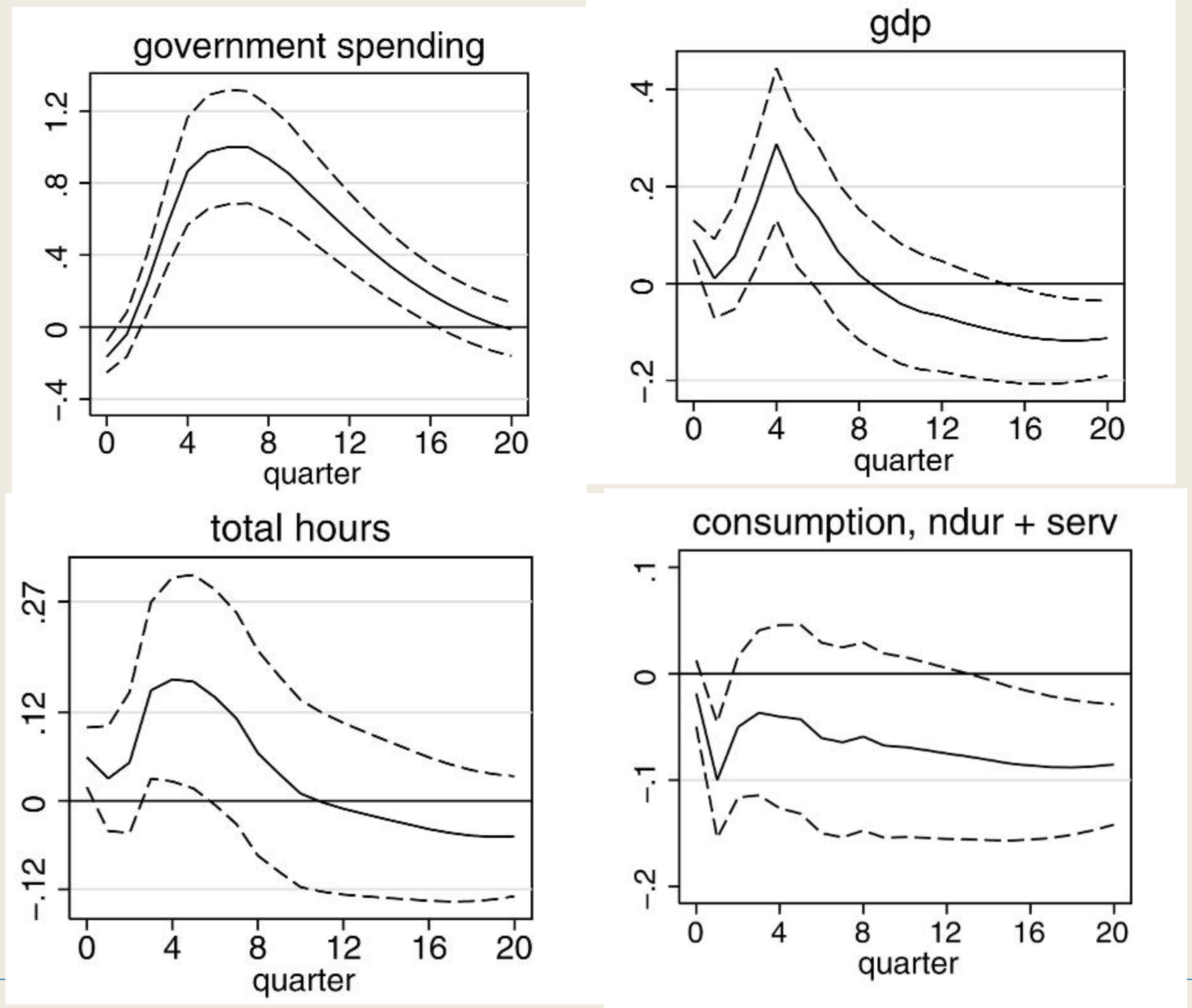
FIGURE III
Components of Government Spending Fraction of Nominal GDP

1. Narrative Approach

- Isolate events that
  A. *BusinessWeek* suddenly began to forecast large rises in defense spending
  B. induced by political events that were unrelated to the state of the U.S. economy

- Ramey-Shapiro (2011) identifies four government spending “shocks”:
  1. Korean War: June 1950
  2. Vietnam War: November 1963
  3. Cater-Reagan Buildup: December 1979
  4. 9/11: September 2001

Impulse Response: Narrative Approach



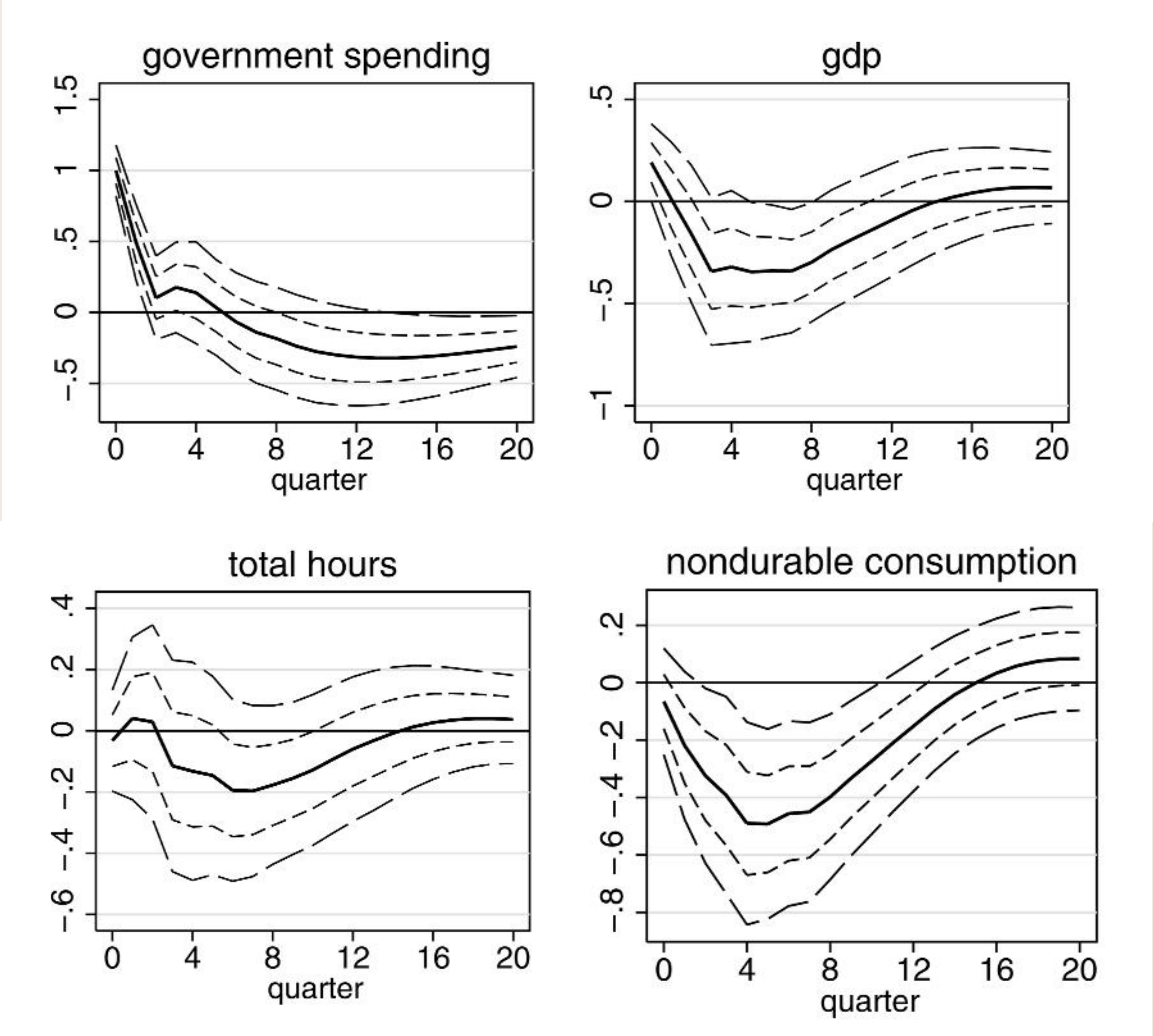
2. Forecast Error Approach

- Construct forecast error of government spending:

$$\epsilon_t^G = \Delta G_t - \mathbb{E}_{t-1}\Delta G_t$$

- Measure $\mathbb{E}_{t-1}\Delta G_t$ from survey of professional forecasters
- Changes in government spending that is not anticipated by the public

Impulse Response: Forecast Error Approach



3. Cross-sectional Identification Approach

- The previous two approaches rely on strong assumptions
- The narrative approach requires "shocks" to affect the US economy only through G_t
  - Presumably, Korean War, Vietnam War or 9/11 affected many other things
- The forecast error approach also requires their only effect to be through G_t
  - Why forecast errors? Presumably, something happened in that quarter.
- Can we achieve a better identification?

Serrato-Wingender (2016)

- Ideally, we want a random change in G_t
- Federal spending to local areas (counties) depends on population estimates
- These estimates exhibit a large measurement error from "true" population counts
- Population estimates are updated using the decimal census
  - Decimal census provides physical counts of the population in 1980, 1990, 2000
- The changes in federal spending coming from updates likely to be random
  - Measurement errors are presumably unrelated to the underlying economy

Empirical Implementation

- The decimal census provides physical counts of the population in each county:
  - 1980, 1990, 2000
- The population counts become available after 3 years
- Federal spending in 1980, 1990, 2000 are allocated based on pop estimates
  - Start basing on the most recent Census counts in 1983, 1993, 2003
- Census "shock":

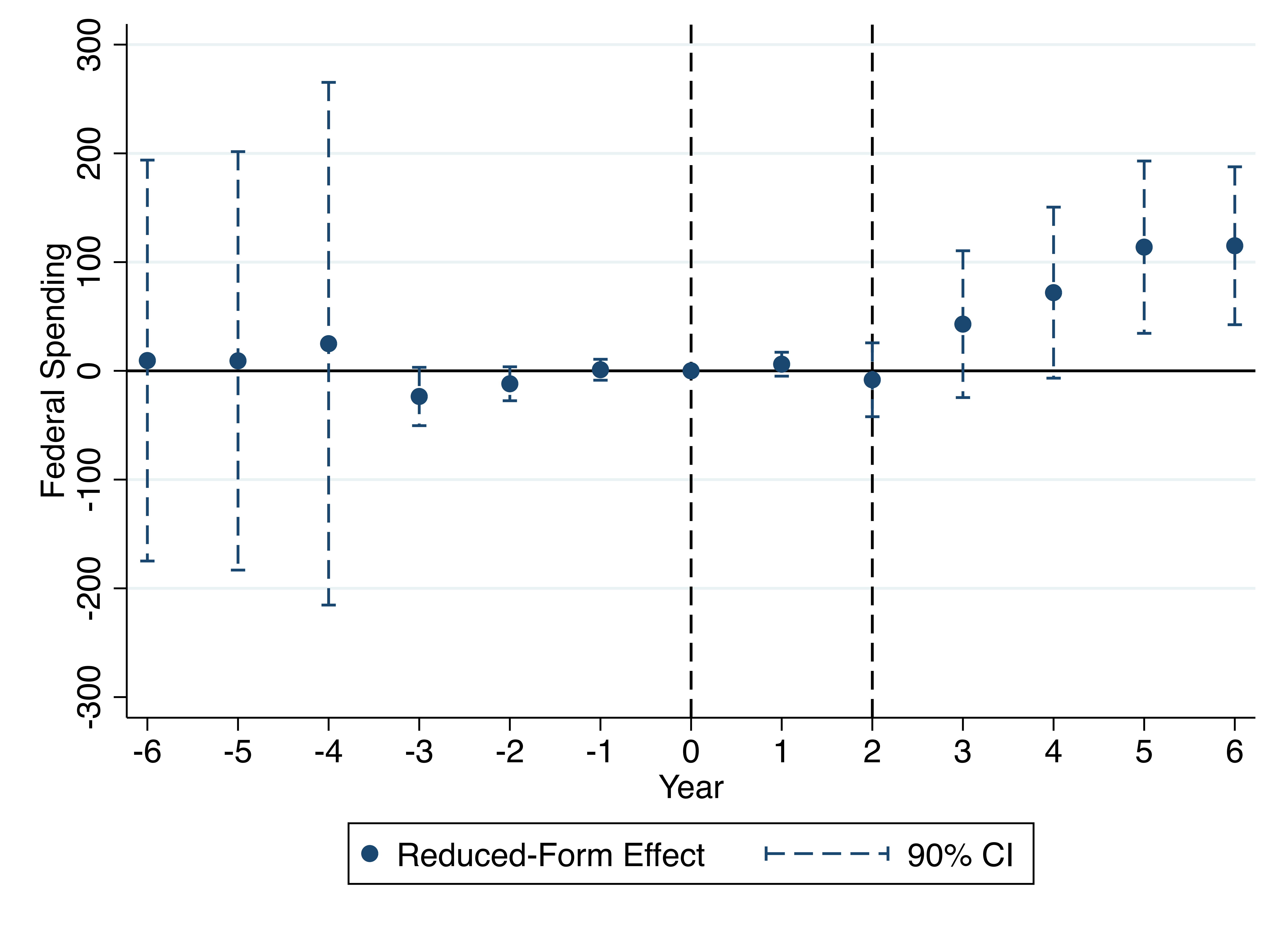
$$CS_{c,t} = \log(Pop^{count}_{c,t}) - \log(Pop^{est}_{c,t}) \qquad \text{for } t = 1980,1990,2000$$

- Estimate the following regression

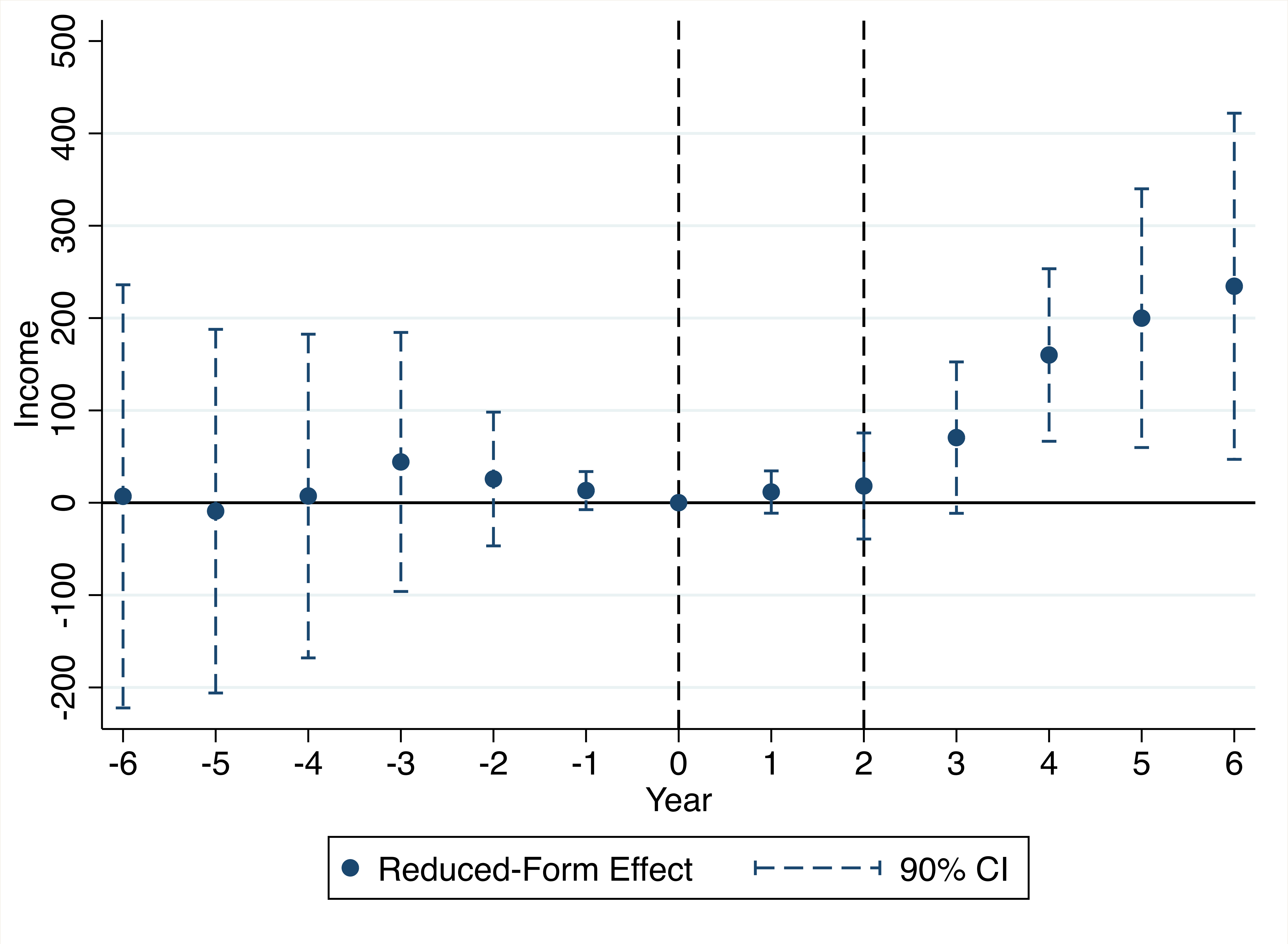
$$y_{c,t+h} - y_{c,t-1} = \beta_h CS_{c,t} + \alpha_t + \mathbf{X}'_{c,t}\gamma + \epsilon_{c,t}$$

  - β_h: Impact of Census shock on the outcome y after h years

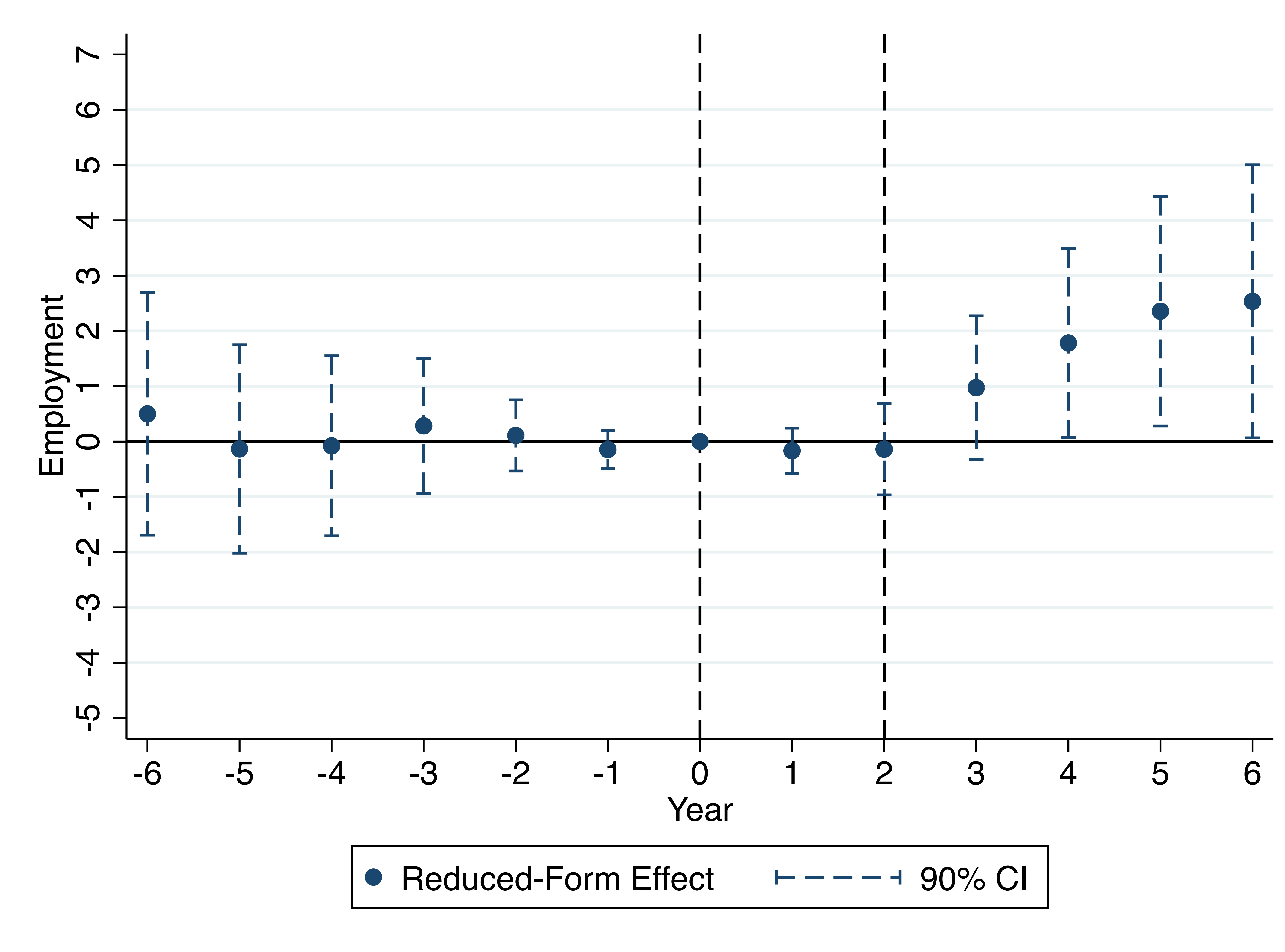
Impact on Federal Spending



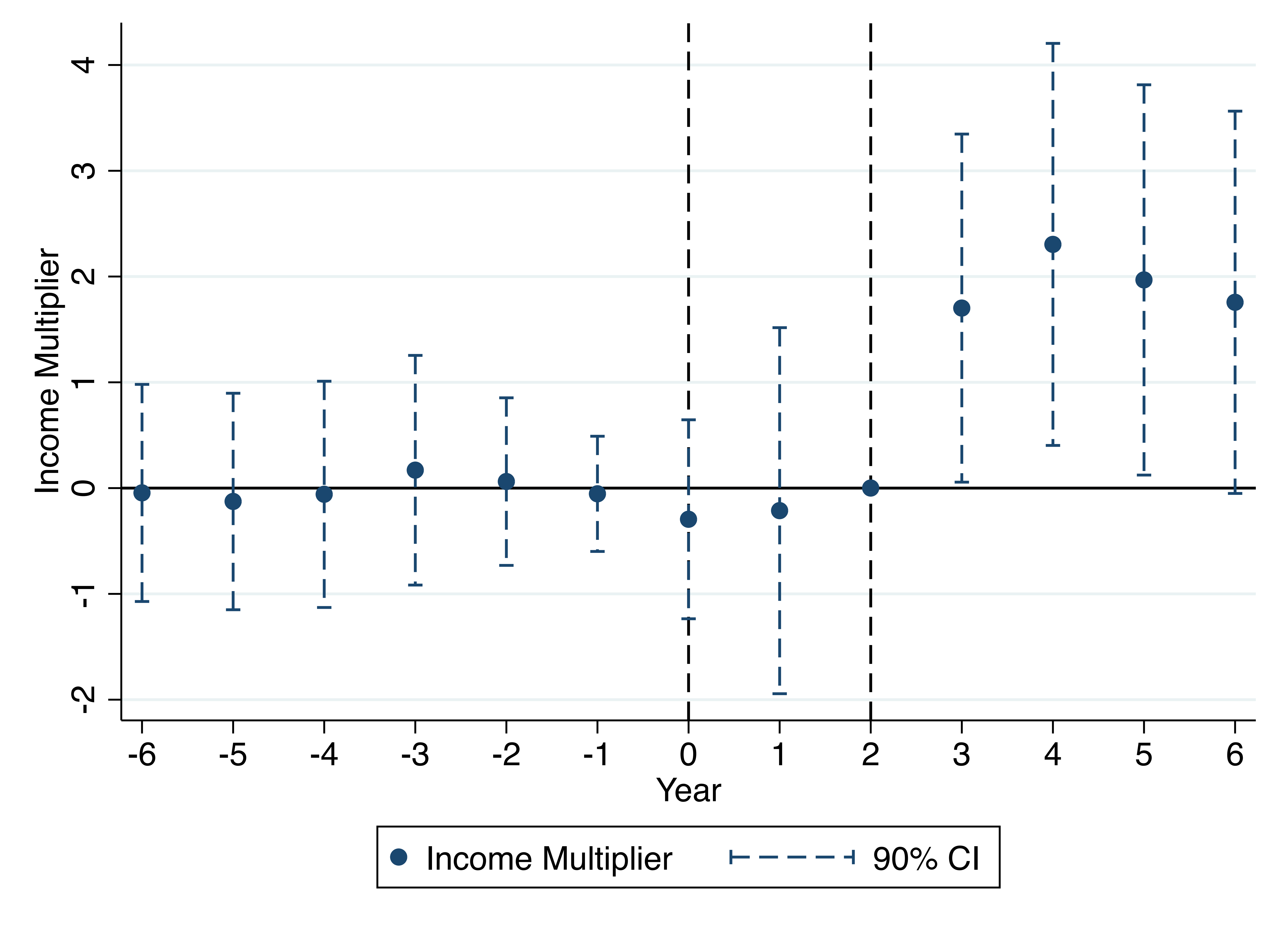
Impact on Income



Impact on Employment



Fiscal Multiplier



Government Spending with Deficit Financing

Fiscal Multiplier Above One?

- Can fiscal multipliers be above one?
  - This is what we saw with the cross-sectional identification
- Why was it below one in our model?
  - Households face higher taxes and, as a result, cut consumption
- Households budget constraints:

$$P_0 C_0 + A_0 = W_0 l_0 + D_0 - T_0$$

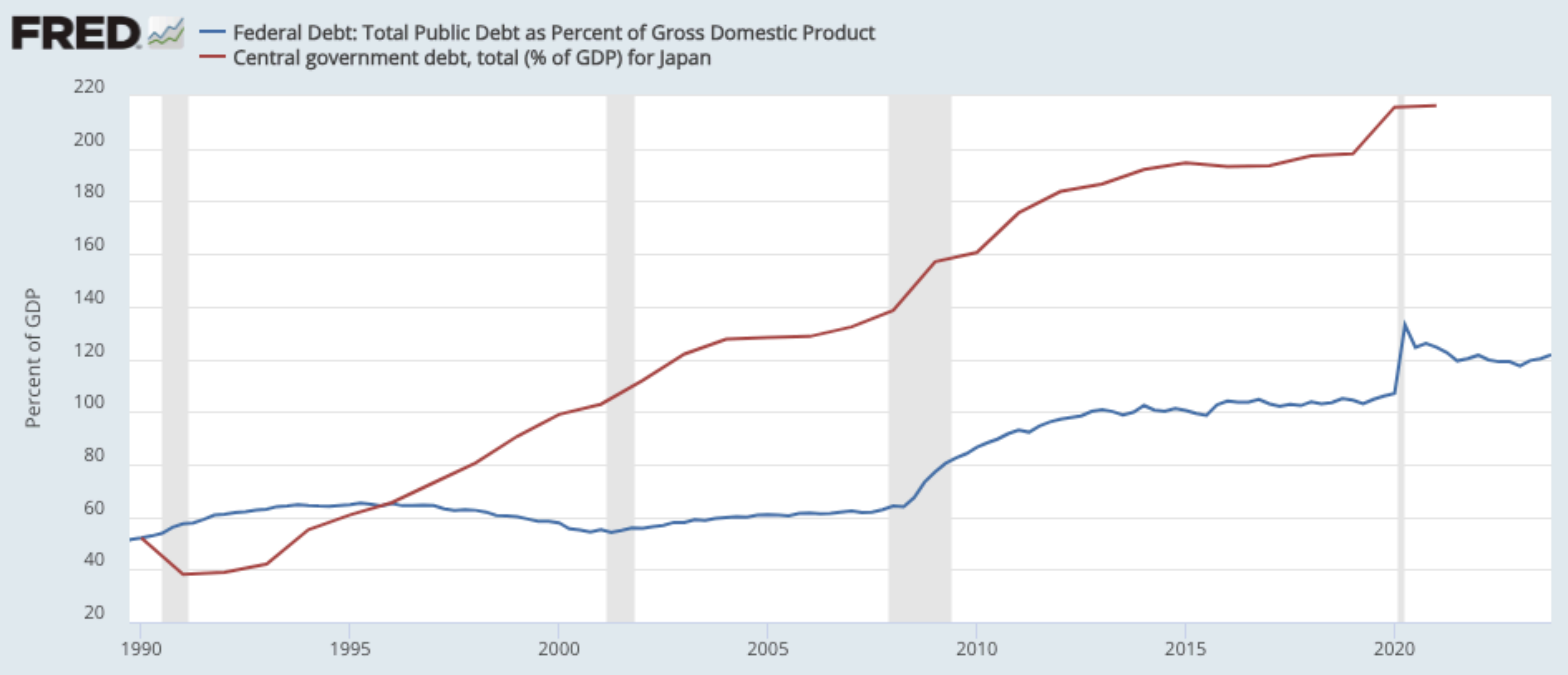
$$P_1 C_1 = (1+i)A_0 + W_1 l_1 + D_1 - T_1$$

- Using the government budget $T_t = P_t G_t$,

$$P_0 C_0 + \frac{1}{1+i} P_1 C_1 = \left[W_0 l_0 + D_0 - P_0 G_0\right] + \frac{1}{1+i}\left[W_1 l_1 + D_1 - P_1 G_1\right]$$

Debt to GDP Ratio

- What if the government doesn't tax immediately by issuing debt?



Deficit Financing

- The government now issues debt to finance spending:

$$P_0 G_0 = B_0$$

$$P_1 G_1 + (1+i) B_0 = T_1$$

- Households budget constraint:

$$P_0 C_0 + A_0 = W_0 l_0 + D_0$$

$$P_1 C_1 = (1+i) A_0 + W_1 l_1 + D_1 - T_1$$

- These are the only modifications

Same as Before

- Eliminating B_0 and solve for T_1:

$$T_1 = P_1 G_1 + (1+i) P_0 G_0$$

- Plug the above expression into the household budget and eliminate A_0:

$$P_0 C_0 + \frac{1}{1+i} P_1 C_1 = \left[W_0 l_0 + D_0 - P_0 G_0\right] + \frac{1}{1+i}\left[W_1 l_1 + D_1 - P_1 G_1\right]$$

- This is exactly the same budget constraint as before
- This implies equilibrium conditions remain completely unchanged
- Government spending still crowds out consumption and fiscal multiplier ≤ 1

Ricardian Equivalence

- The previous result is called Ricardian Equivalence
- The timing of taxes is irrelevant for equilibrium outcomes
  - The government can tax immediately to finance G
  - …or the government can issue debts to finance G

  Regardless, we have the same allocation
- Why?
- Even if gov doesn't tax today, households know gov taxes more heavily tomorrow
- They save more and consume less today even if they don't face taxes today
- Consumption is crowded out

Government Spending with Borrowing Constrained Households

Borrowing Constraint

- The previous argument relied on households' ability to smooth consumption
- So, if households cannot smooth C, Ricardian equivalence might fail
- In fact, as we saw in the consumption lecture, households are not smoothing C
- We now assume certain fraction of households are borrowing constrained

Introducing Hand-to-Mouth Households

- We assume $\theta \in [0,1]$ faction of households cannot access saving/borrowing
  - denoted with superscript h (hand-to-mouth households)
- The remaining households are the same as before
  - denoted with superscript p (permanent-income households)
- We make the following simplifying assumptions:
  1. All households receive the same income, $W_t l_t + D_t - T_t$
  2. The labor supply l_0 is determined by the aggregate labor supply equation:

$$C_0^{-\sigma}\frac{W_0}{P_0} = \bar{v} l_0^{\nu}$$

where $C_t \equiv \theta C_t^h + (1-\theta)C_t^p$

Consumption of Hand-to-Mouth Households

- The hand-to-mouth households consume the entire income period-by-period:

$$P_0 C_0^h = W_0 l_0 + D_0 - T_0$$

$$P_1 C_1^h = W_1 l_1 + D_1 - T_1$$

- As a result, the consumption of hand-to-mouth households at $t = 0$ is

$$C_0^h = \frac{1}{P_0} \left[W_0 l_0 + D_0 - T_0 \right]$$

Consumption of Permanent-Income Housheolds

- The permanent-income households solve

$$\max_{C_0^p, C_1^p, A_0} u(C_0^p) + \beta u(C_1^p)$$

$$\text{s.t.} \qquad P_0 C_0^p + A_0 = W_0 l_0 + D_0 - T_0$$

$$P_1 C_1^p = (1+i)A_0 + W_1 l_1 + D_1 - T_1$$

- The solution for C_0^p is (assuming $u(C) = C^{1-\sigma}/(1-\sigma)$)

$$C_0^p = \frac{1}{1 + \frac{\left(\beta(1+i)\frac{P_0}{P_1}\right)^{1/\sigma}}{(1+i)\frac{P_0}{P_1}}} \left[\frac{1}{P_0}(W_0 l_0 + D_0 - T_0) + \frac{1}{(1+i)\frac{P_0}{P_1}} \frac{1}{P_1}(W_1 l_1 + D_1 - T_1) \right]$$

Consumption Functions

- Note that in equilibrium,

$$\frac{1}{P_t}(W_t l_t + D_t) = \frac{1}{P_t}(W_t L_t + P_t A_t K_t^{\alpha} L_t^{1-\alpha} - W_t L_t) = A_t K_t^{\alpha} L_t^{1-\alpha} \quad \text{(national income identify)}$$

$$T_1 = (P_0 G_0 - T_0)(1+i) + P_1 G_1 \quad \text{(Government budget)}$$

- Plugging these in, we have

$$C_0^h = A_0 K_0^{\alpha} L_0^{1-\alpha} - \frac{T_0}{P_0} \equiv \mathbf{C}_0^h(L_0, T_0, P_0)$$

$$C_0^p = \frac{(1+i)\frac{P_0}{P_1}}{(1+i)\frac{P_0}{P_1} + \left(\beta(1+i)\frac{P_0}{P_1}\right)^{1/\sigma}} \left[A_0 K_0^{\alpha} L_0^{1-\alpha} - G_0 + \frac{1}{(1+i)\frac{P_0}{P_1}}(A_1 K_1^{\alpha} L_1^{1-\alpha} - G_1)\right] \equiv \mathbf{C}_0^p(L_0, P_0, G_0, G_1)$$

Equilibrium Conditions

- Household labor supply is

$$C_0^{-\sigma}\frac{W_0}{P_0} = \bar{v}L_0^{\nu} \tag{6}$$

- Consumption

$$C_0^h = \mathbf{C}_0^h(L_0, T_0, P_0), \qquad C_0^p = \mathbf{C}_0^p(L_0, P_0, G_0, G_1), \qquad C_t = \theta C_0^h + (1-\theta)C_t^p \tag{7}$$

- Firm's labor demand

$$(1-\alpha)A_t K_t^{\alpha} L_t^{-\alpha} = \frac{W_t}{p_t} \tag{8}$$

- Retailer's price setting

$$P_0 = (1-\lambda)\frac{\eta-1}{\eta}p_0 + \lambda\bar{P}_0, \quad P_1 = \frac{\eta}{\eta-1}p_1 = \bar{P}_1 \tag{9}$$

- Goods market clearing

$$C_0 + G_0 = A_0 K_0^{\alpha} L_0^{1-\alpha}, \quad C_1 + G_1 = A_1 K_1^{\alpha} L_1^{1-\alpha} \tag{10}$$

- Fiscal policy chooses $\{T_0, G_0, G_1\}$

Aggregate Demand

- The goods market clearing is

$$A_0 K_0^\alpha L_0^{1-\alpha} = \theta \mathbf{C}_0^h(L_0, T_0, P_0) + (1-\theta)\mathbf{C}_0^p(L_0, P_0, G_0, G_1) + G_0$$

- Solving for L_0 gives

$$L_0 = \frac{1}{\left(A_0 K_0^\alpha\right)^{\frac{1}{1-\alpha}}} \left(-M_T \frac{T_0}{P_0} + M_G G_0 + M_C \left[A_1 K_1^\alpha L_1^{1-\alpha} - G_1 \right] \right)^{\frac{1}{1-\alpha}}$$

where

$$M_T = \frac{\theta}{1-\theta}\left[1 + \frac{1}{\beta^{1/\sigma}\left((1+i)\frac{P_0}{P_1}\right)^{\frac{1-\sigma}{\sigma}}}\right], \quad M_G = \frac{1}{1-\theta}\left(1 + \theta \frac{1}{\beta^{1/\sigma}\left((1+i)\frac{P_0}{P_1}\right)^{\frac{1-\sigma}{\sigma}}}\right), \quad M_C = \left(\beta(1+i)\frac{P_0}{P_1}\right)^{-1/\sigma}$$

Aggregate Demand when $\theta = 0$

- Note that the earlier model is nested as a special case with $\theta = 0$
- When $\theta = 0$, we have $M_T = 0$, $M_G = 1$ and $M_C = \left(\beta(1+i)\frac{P_0}{P_1}\right)^{-1/\sigma}$, so that

$$L_0 = \frac{1}{(A_0 K_0^\alpha)^{\frac{1}{1-\alpha}}}\left(\left(\beta(1+i)\frac{P_0}{P_1}\right)^{-1/\sigma}(A_1 K_1^\alpha L_1^{1-\alpha} - G_1) + G_0\right)^{\frac{1}{1-\alpha}}$$

which is exactly what we used to have

Aggregate Supply

- The Phillips curve remains the same:

$$P_0 = \frac{1}{1 - (1 - \lambda)\frac{\eta - 1}{\eta}\frac{(A_0 K_0^\alpha L_0^{1-\alpha} - G_0)^\sigma}{(1 - \alpha)A_0 K_0^\alpha}\bar{v}L_0^{\nu+\alpha}}\lambda\bar{P}_0$$

Step-by-Step Understanding of Our Model

- Let us understand our model step-by-step:

  1. How does the model behave in the absence of fiscal policy ($T_0 = G_0 = G_1 = 0$)?

  2. How does the model behave with balanced-budget fiscal policy ($P_0 G_0 = T_0$)?

  3. How does the model behave with deficit-financed fiscal policy ($G_0 > 0, T_0 = 0$)?

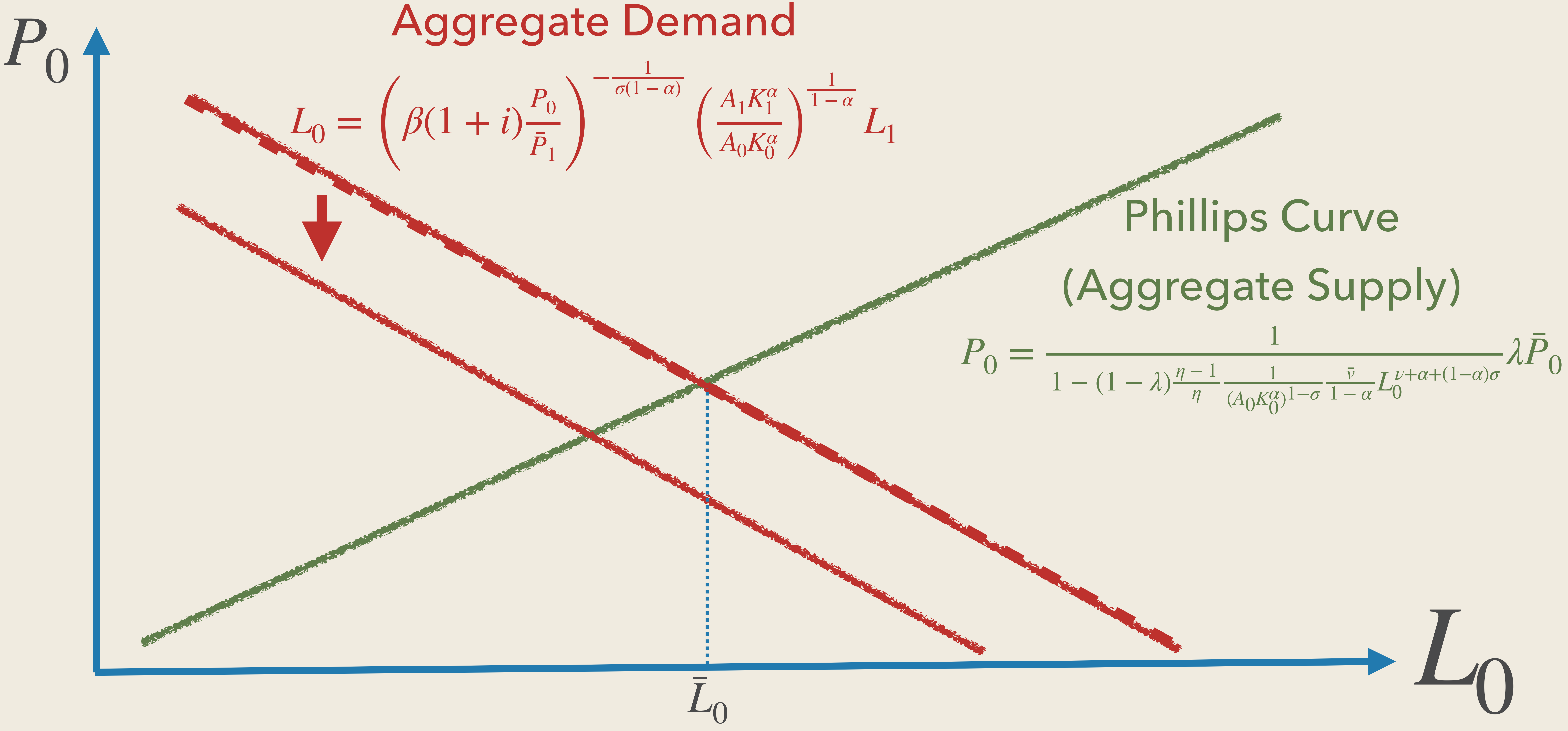
1. No Fiscal Policy

- With $T_0 = G_0 = G_1 = 0$, the aggregate demand equation collapses to

$$L_0 = \left(\beta(1+i)\frac{P_0}{\bar{P}_1} \right)^{-\frac{1}{\sigma(1-\alpha)}} \left(\frac{A_1 K_1^\alpha}{A_0 K_0^\alpha} \right)^{\frac{1}{1-\alpha}} L_1$$

- Looks familiar?
- This is exactly the same as the case without borrowing constraint ($\theta = 0$)
- What does this imply about monetary policy?

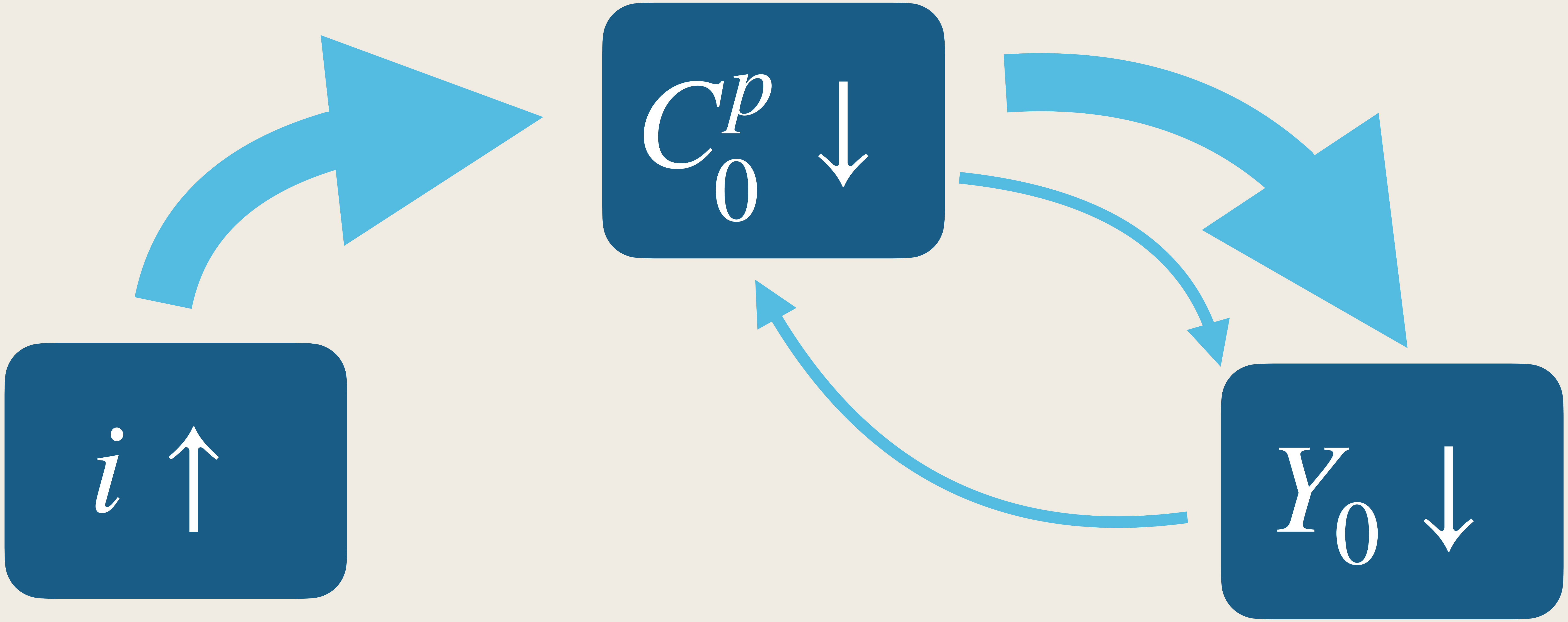
Monetary Policy Tightening



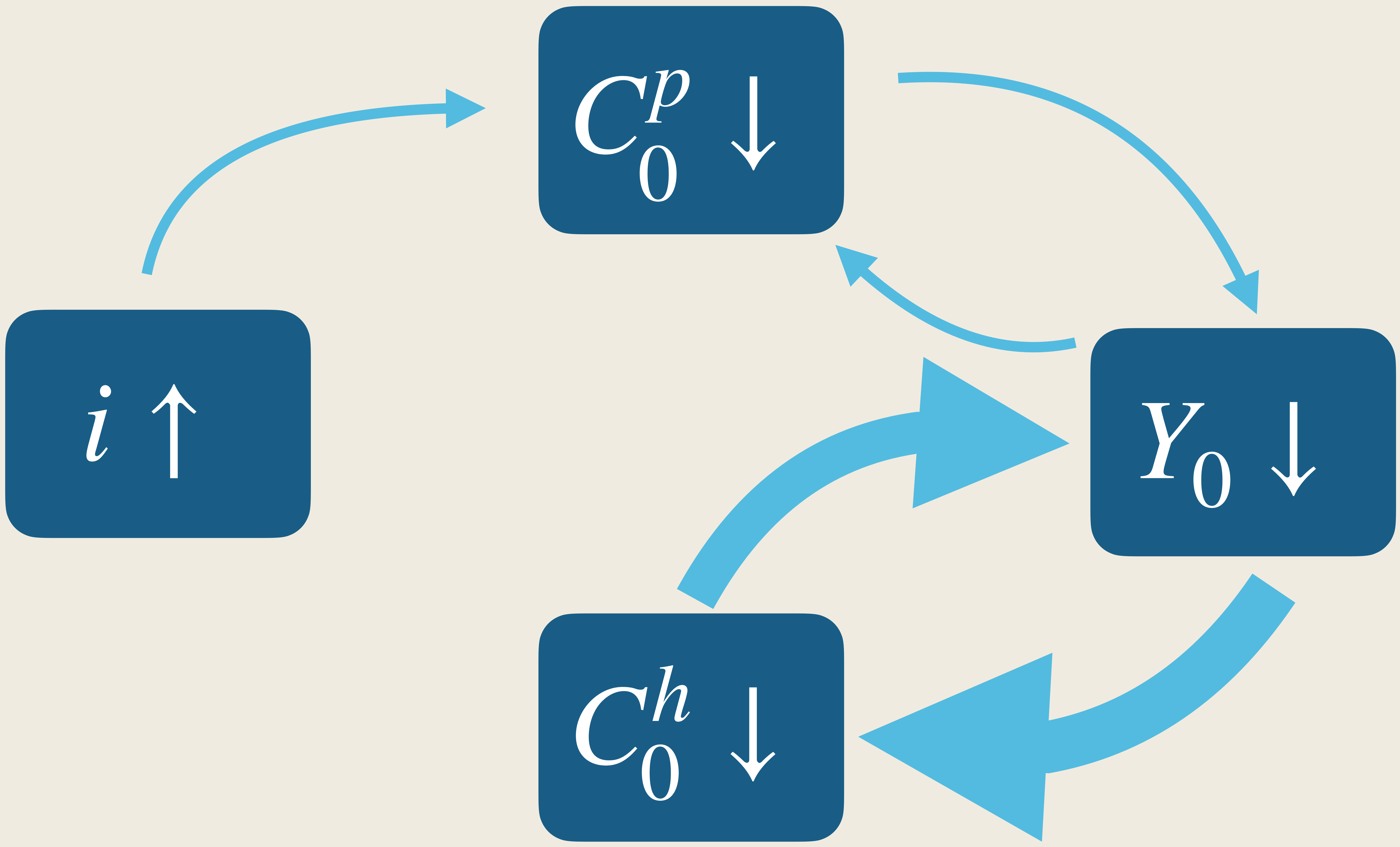
Monetary Policy with Borrowing Constraints

- Monetary policy has exactly the same effect as the model with $\theta = 0$
  - No matter how many households are borrowing constrained (θ)
- Why?
- A fraction θ of borrowing-constrained households do not respond to $i \uparrow$
  - This may dampen the effect of monetary policy
- But, they react more to a decrease in income because their $MPC = 1$
  - This may amplify the effect of monetary policy
- In our model, these two effects cancel

Monetary Policy when $\theta = 0$



Monetary Policy when $\theta \gg 0$



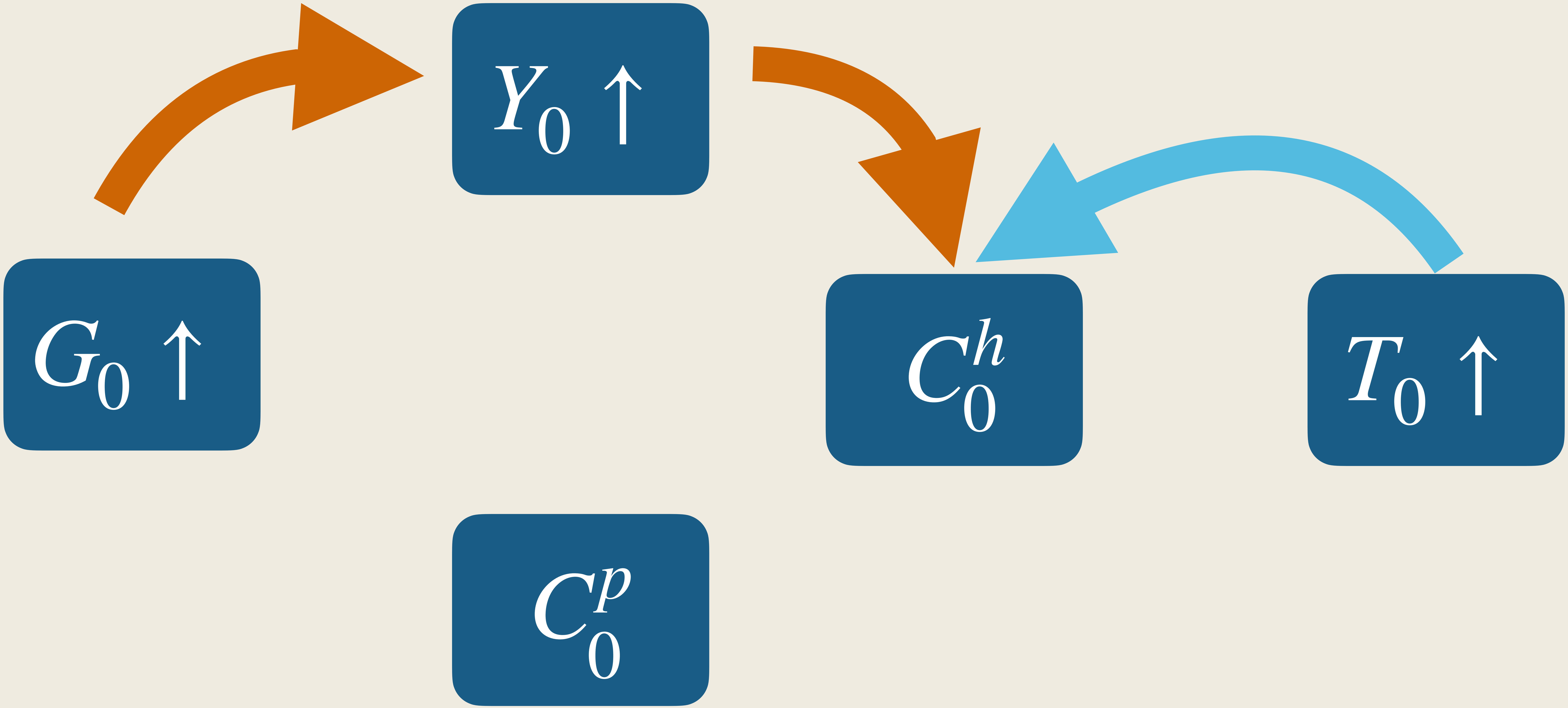
2. Balanced Budget Fiscal Policy

- With $T_0 = P_0 G_0$, the aggregate demand equation collapses to

$$L_0 = \frac{1}{(A_0 K_0^\alpha)^{\frac{1}{1-\alpha}}} \left(\left(\beta(1+i)\frac{P_0}{P_1} \right)^{-1/\sigma} (A_1 K_1^\alpha L_1^{1-\alpha} - G_1) + G_0 \right)^{\frac{1}{1-\alpha}}$$

- Again, this is exactly the same as the case without borrowing constraint ($\theta = 0$)
- Consequently, the impact of fiscal policy is unchanged.
  - Fiscal multiplier ≤ 1

Balanced Budget Fiscal Policy when $\theta \gg 0$



3. Deficit-Financed Government Spending

- With $T_0 = 0$ and $G_0 > 0$,

$$L_0 = \frac{1}{\left(A_0 K_0^\alpha\right)^{\frac{1}{1-\alpha}}} \left(M_G G_0 + M_C \left[A_1 K_1^\alpha L_1^{1-\alpha} - G_1\right]\right)^{\frac{1}{1-\alpha}}$$

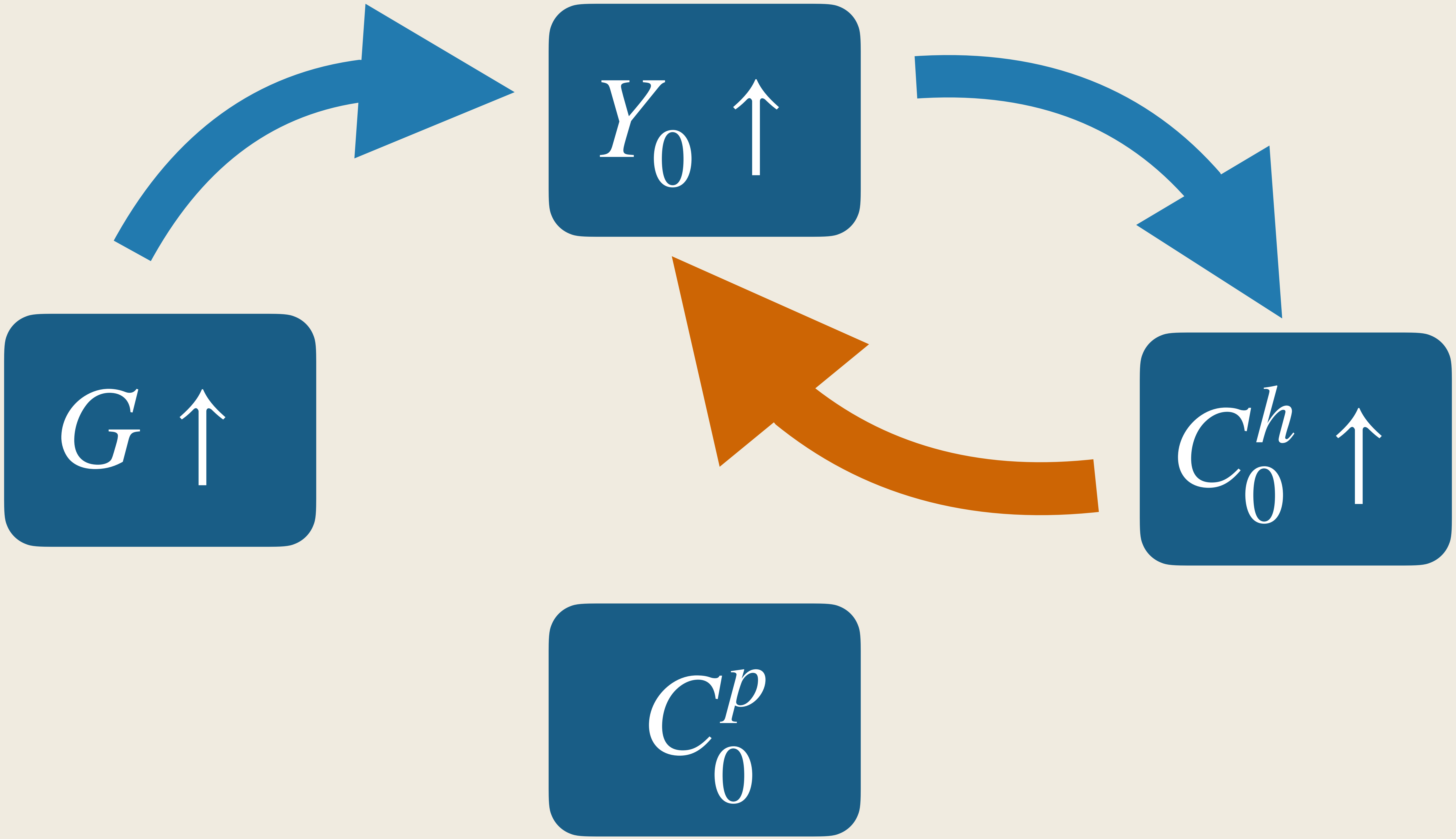
$$\text{where} \quad M_G = \frac{1}{1-\theta}\left(1 + \theta \frac{1}{\beta^{1/\sigma}\left((1+i)\frac{P_0}{P_1}\right)^{\frac{1-\sigma}{\sigma}}}\right), \quad M_C = \left(\beta(1+i)\frac{P_0}{P_1}\right)^{-1/\sigma}$$

- Suppose prices are rigid, $P_0 = \bar{P}_0$. Then

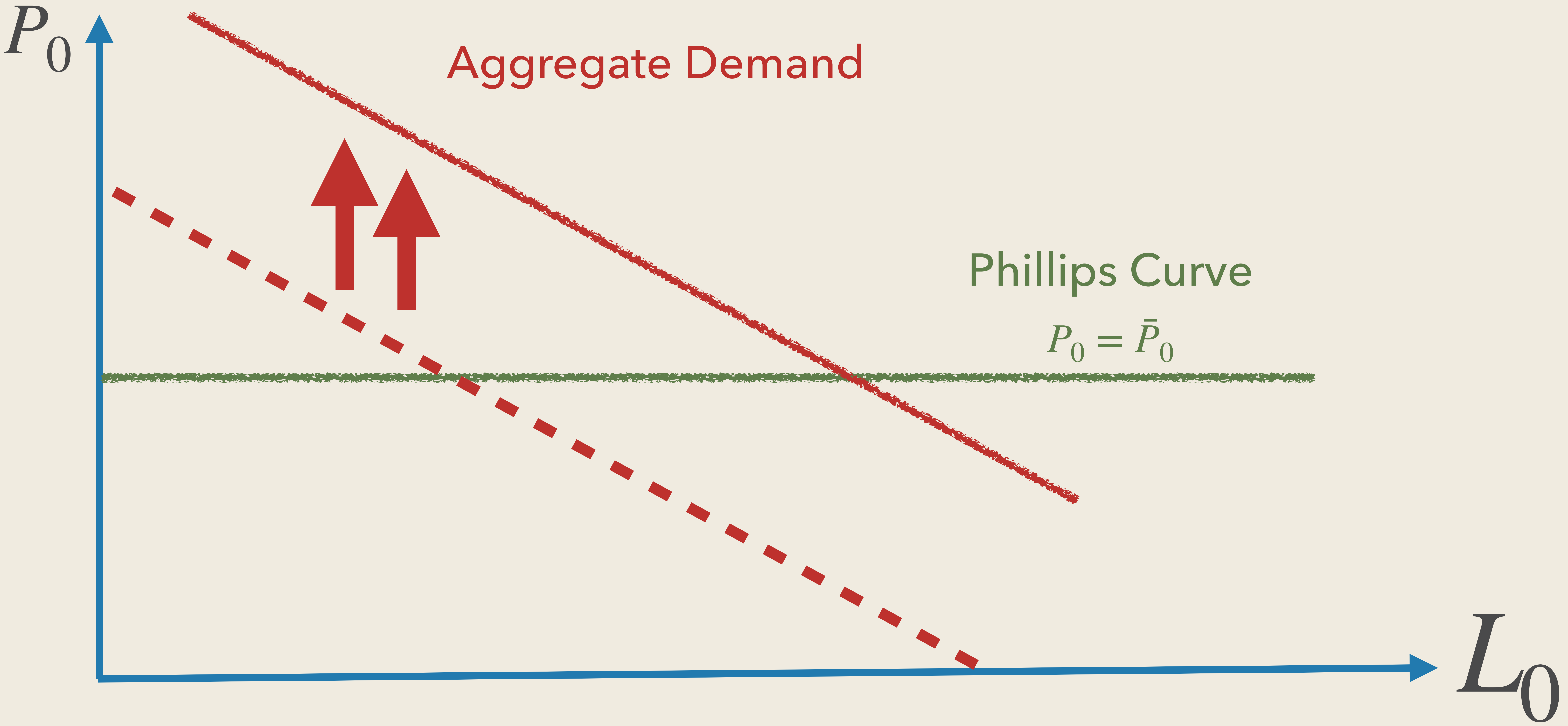
$$\frac{dY_0}{dG_0} = \frac{d(A_0 K_0^\alpha L_0^{1-\alpha})}{dG_0} = M_G > 1 \quad \text{iff } \theta > 0$$

- Fiscal multiplier above one. Multiplier $\to \infty$ when $\theta \to 1$

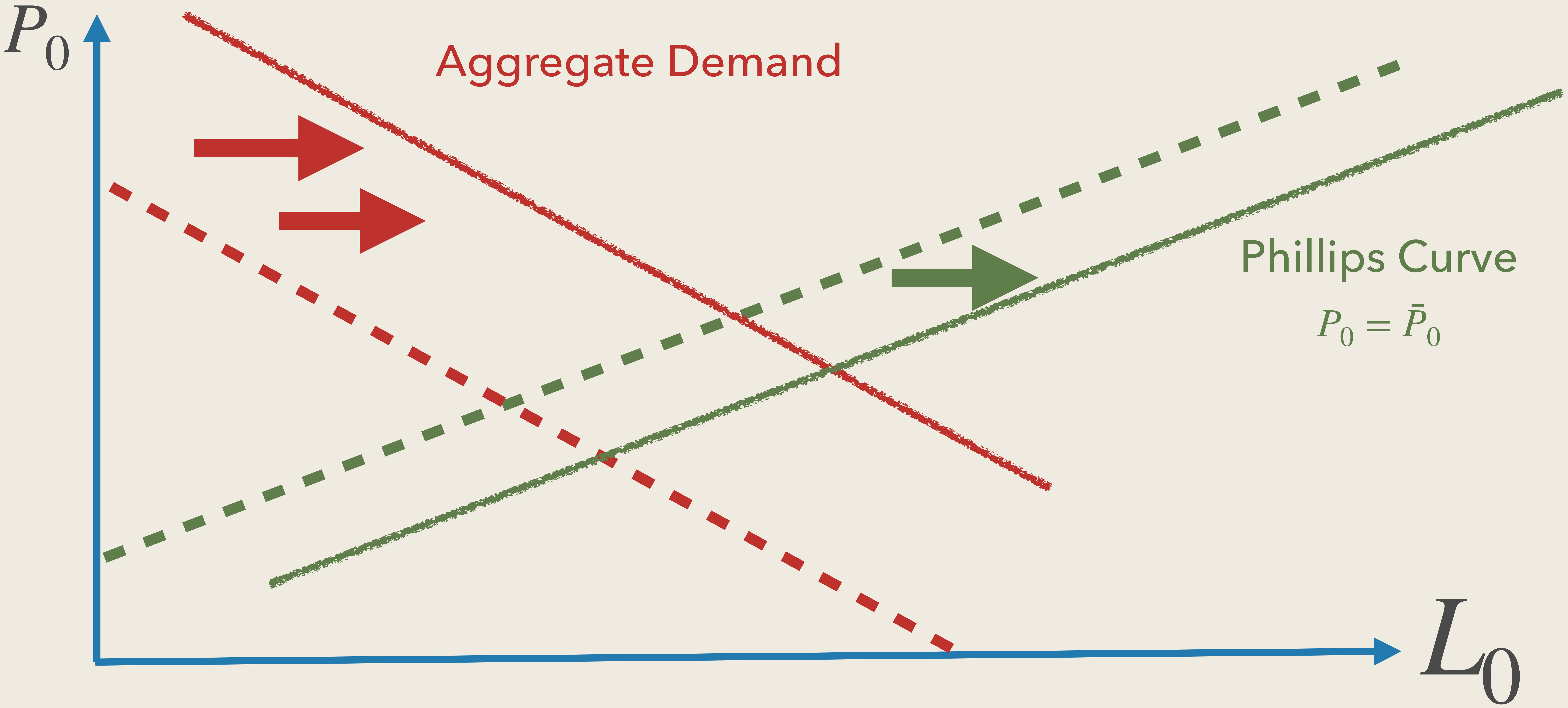
Deficit Financed Fiscal Policy when $\theta \gg 0$



Deficit Financed G_0 when $\theta > 0$



Deficit Financed G_0 when $\theta > 0$



Transfer Policies: Theory

Stimulus Checks

- Another common fiscal policy is to decrease T_0 (financed by an increase in T_1)
- Such "economic stimulus payment" has been actively used recently:
  1. \$300-\$600 tax rebates in 2001
  2. \$300-\$600 tax rebates in 2008
  3. \$500-\$1200 stimulus checks in 2020
- We saw that they were effective in stimulating individual consumption
- What are the implications for the macroeconomy?

Ricardian Equivalence, Again

- When $\theta = 0$ and $G_0 = G_1 = 0$, $\{P_0, L_0\}$ solve

$$L_0 = \frac{1}{\left(A_0 K_0^\alpha\right)^{\frac{1}{1-\alpha}}} \left(M_C A_1 K_1^\alpha L_1^{1-\alpha}\right)^{\frac{1}{1-\alpha}}, \quad \text{where } M_C = \left(\beta(1+i)\frac{P_0}{P_1}\right)^{-1/\sigma}$$

$$P_0 = \frac{1}{1-(1-\lambda)\frac{\eta-1}{\eta}\frac{(A_0 K_0^\alpha L_0^{1-\alpha} - G_0)^\sigma}{(1-\alpha)A_0 K_0^\alpha}\bar{v} L_0^{\nu+\alpha}} \lambda \bar{P}_0$$

- How do changes in $\{T_0, T_1\}$ affect L_0 or P_0? – Nothing
- Once again, this is Ricardian equivalence
- Households understand if they receive transfers today, they will be taxed tomorrow

Breaking Ricardian Equivalence

- When $\theta > 0$ and assuming $G_0 = G_1 = 0$:

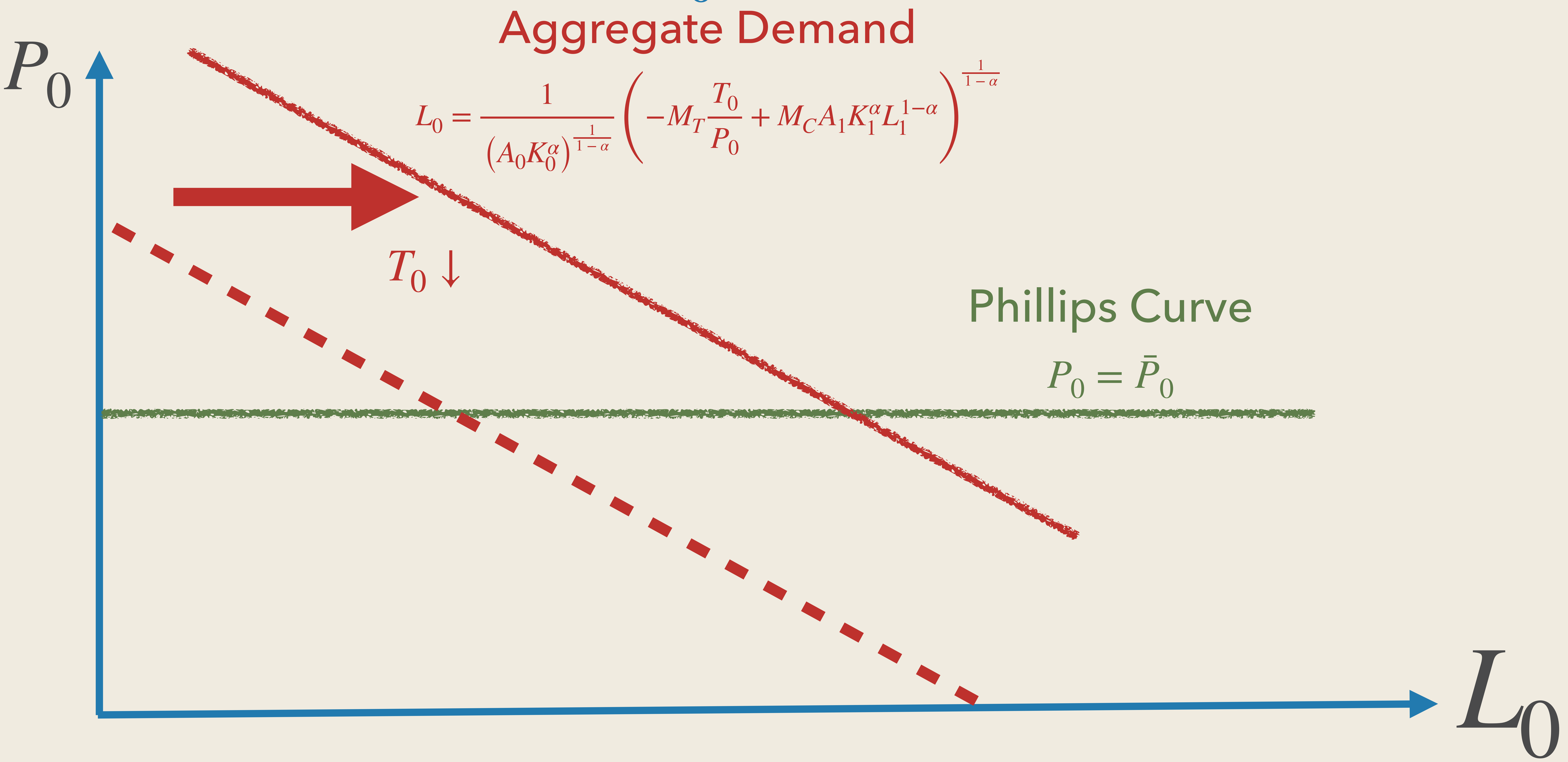
$$L_0 = \frac{1}{\left(A_0 K_0^\alpha\right)^{\frac{1}{1-\alpha}}} \left(-M_T \frac{T_0}{P_0} + M_C A_1 K_1^\alpha L_1^{1-\alpha} \right)^{\frac{1}{1-\alpha}}$$

where

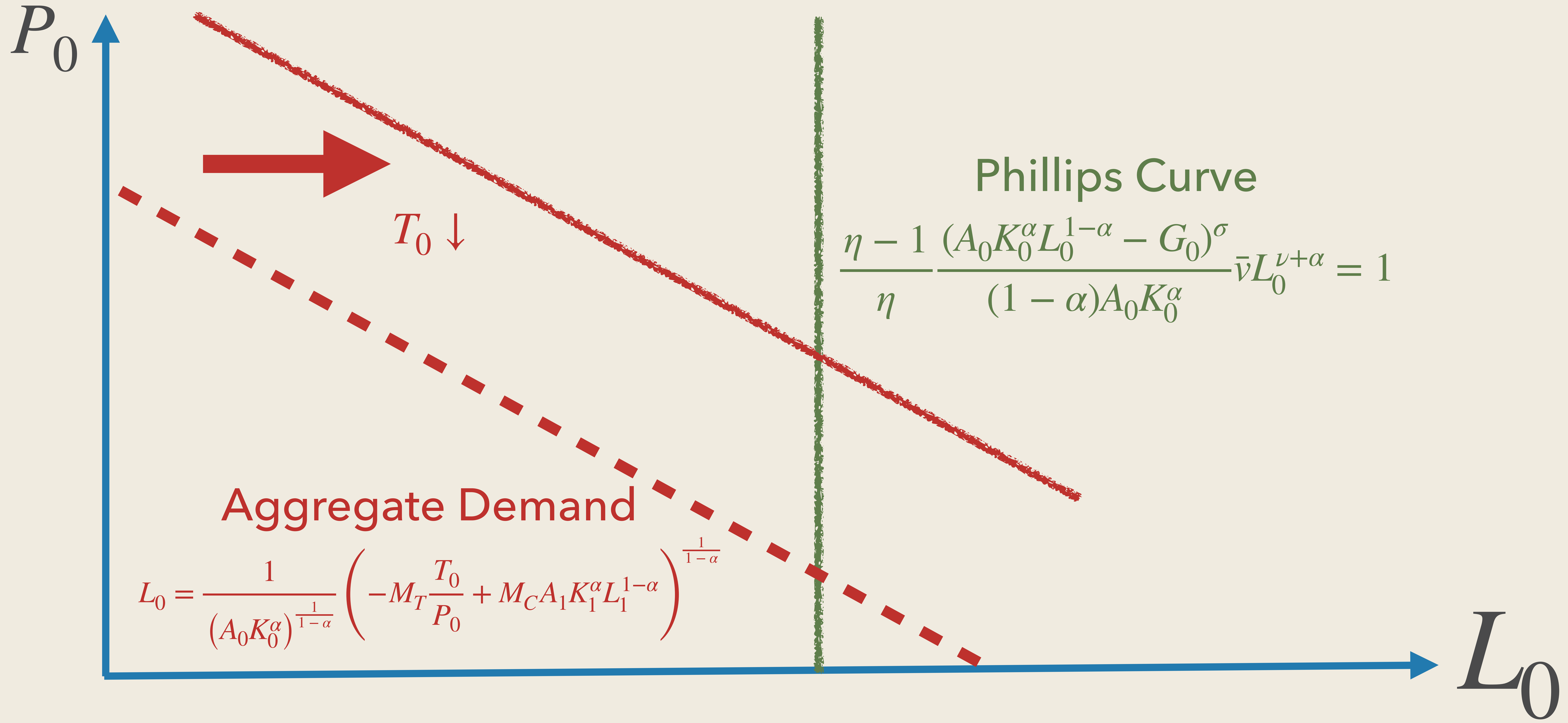
$$M_T = \frac{\theta}{1-\theta} \left[1 + \frac{1}{\beta^{1/\sigma}\left((1+i)\frac{P_0}{P_1}\right)^{\frac{1-\sigma}{\sigma}}} \right], \quad M_C = \left(\beta(1+i)\frac{P_0}{P_1} \right)^{-1/\sigma}$$

- Now T_0 does matter for aggregate demand.
- Households are constrained, so they do not save the transfers to prepare for taxes
- With rigid prices, the transfer multiplier is $\frac{dY_0}{dT_0} = M_T$

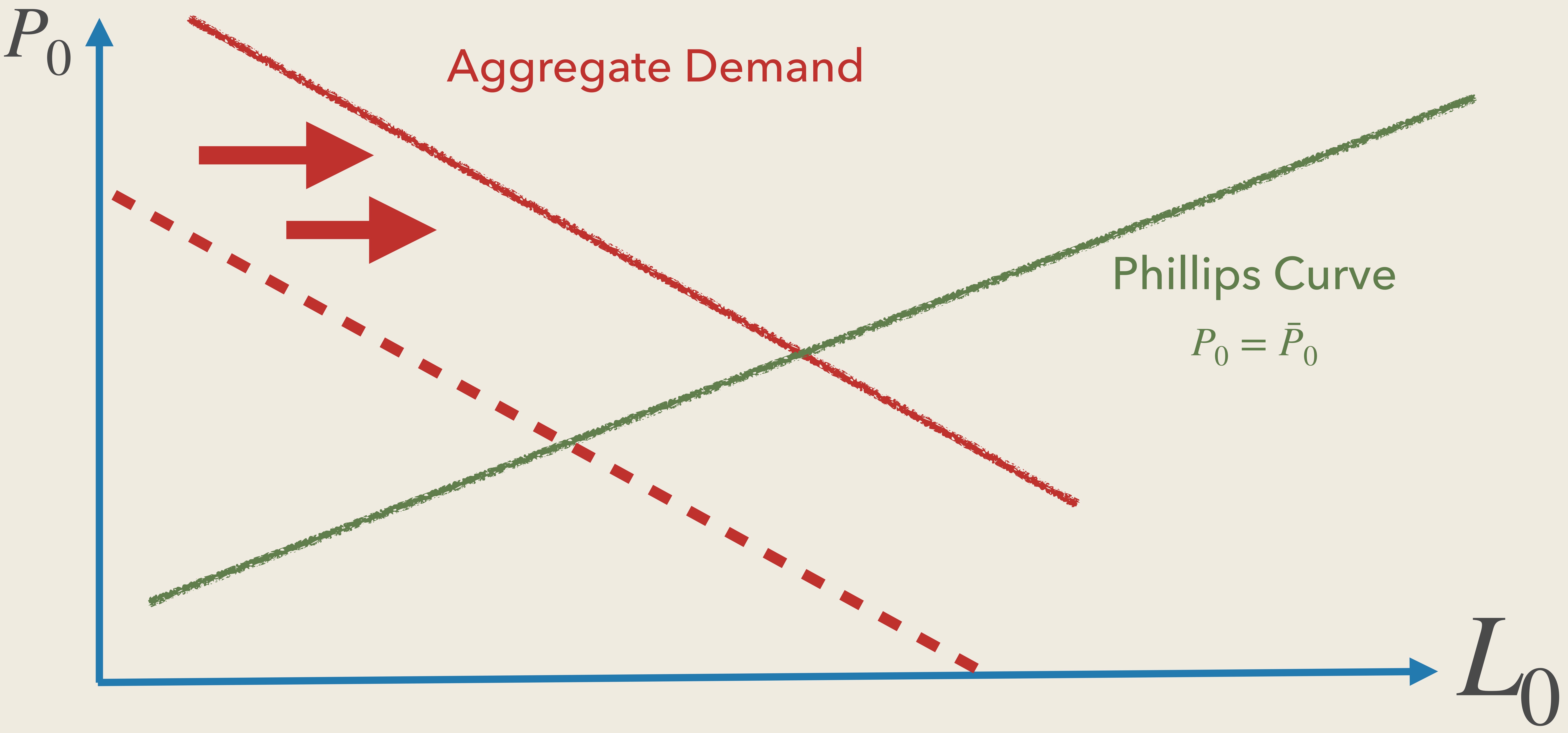
Stimulus Checks $T_0 \downarrow$ when $\theta > 0$ and $\lambda = 1$



Stimulus Checks $T_0 \downarrow$ when $\theta > 0$ and $\lambda = 0$



Stimulus Checks $T_0 \downarrow$ when $\theta > 0$



Transfer Policies: Evidence

– Egger, Haushofer, Miguel, Niehaus and Walker (2022)

Randomized Control Trials

- NGO distributed cash transfers in Kenya, 2014-2017
- One-time cash transfers of $\approx$ \$1000 to over 10,000 households in 653 villages
  - Randomized receiving households and villages
- Questions:
  1. How do households directly receiving transfers respond?
  2. How do households not directly receiving transfers but living in the receiving areas respond?
  3. How do firms in the areas receiving transfers respond?
  4. How do income and prices in the areas receiving transfers respond?

Spending Response after One Year

Recipient households increase spending by $339 (13% increase)

	(1)	(2)	(3)	(4)
	Recipient Households		Non-Recipient Households	
	𝟙(Treat Village) Reduced Form	Total Effect IV	Total Effect IV	Control, Low-Saturation Mean (SD)
Panel A: Expenditure				
Household expenditure, annualized	293.59	338.57	334.77	2536.01
	(60.11)	(109.38)	(123.20)	(1933.51)
Non-durable expenditure, annualized	187.65	227.20	317.62	2470.69
	(58.59)	(99.63)	(119.76)	(1877.23)
Food expenditure, annualized	72.04	133.84	133.30	1578.05
	(36.96)	(63.99)	(58.56)	(1072.00)
Temptation goods expenditure, annualized	6.55	5.91	−0.68	37.07
	(5.79)	(8.82)	(6.50)	(123.54)
Durable expenditure, annualized	95.09	109.01	8.44	59.41
	(12.64)	(20.24)	(12.50)	(230.83)

Spending Response after One Year

Non-recipient households increase spending by $335 (13% increase)

	(1)	(2)	(3)	(4)
	Recipient Households		Non-Recipient Households	
	𝟙(Treat Village) Reduced Form	Total Effect IV	Total Effect IV	Control, Low-Saturation Mean (SD)
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	(12.64)	(20.24)	(12.50)	(230.83)

Income Response

	(1)	(2)	(3)	(4)
	Recipient Households		Non-Recipient Households	
	$\mathbb{1}$(Treat Village) Reduced Form	Total Effect IV	Total Effect IV	Control, Low-Saturation Mean (SD)
Panel C: Household balance sheet				
Household income, annualized	79.43 (43.80)	135.70 (92.10)	224.96 (85.98)	1023.36 (1634.02)

Both recipient and non-recipient households increase income by 13-20%

Response of Firms

Large impact on firm revenue even in villages without transfers. No effect on investment or entry

	(1)	(2)	(3)	(4)
	Treatment Villages		Control Villages	
	$\mathbb{1}$(Treat Village) Reduced Form	Total Effect IV	Total Effect IV	Control, Low-Saturation Weighted Mean (SD)
Panel A: All enterprises				
Enterprise profits, annualized	−2.27	55.77	35.08	156.79
	(21.42)	(36.73)	(37.36)	(292.84)
Enterprise revenue, annualized	−29.61	322.16	237.16	494.45
	(102.74)	(138.17)	(112.72)	(1223.07)
Enterprise costs, annualized	−13.32	89.35	73.08	117.22
	(28.63)	(38.51)	(46.77)	(263.46)
Enterprise wage bill, annualized	−15.90	75.99	66.57	97.35
	(25.49)	(30.64)	(35.86)	(237.01)
Enterprise profit margin	0.01	−0.11	−0.12	0.33
	(0.02)	(0.06)	(0.05)	(0.30)
Panel B: Non-agricultural enterprises				
Enterprise inventory	11.02	34.69	16.90	50.41
	(9.14)	(13.39)	(10.66)	(131.86)
Enterprise investment, annualized	4.00	13.58	6.82	46.57
	(7.05)	(13.10)	(7.96)	(167.44)
Panel C: Village-level				
Number of enterprises	0.01	0.02	0.01	1.12
	(0.01)	(0.01)	(0.01)	(0.14)

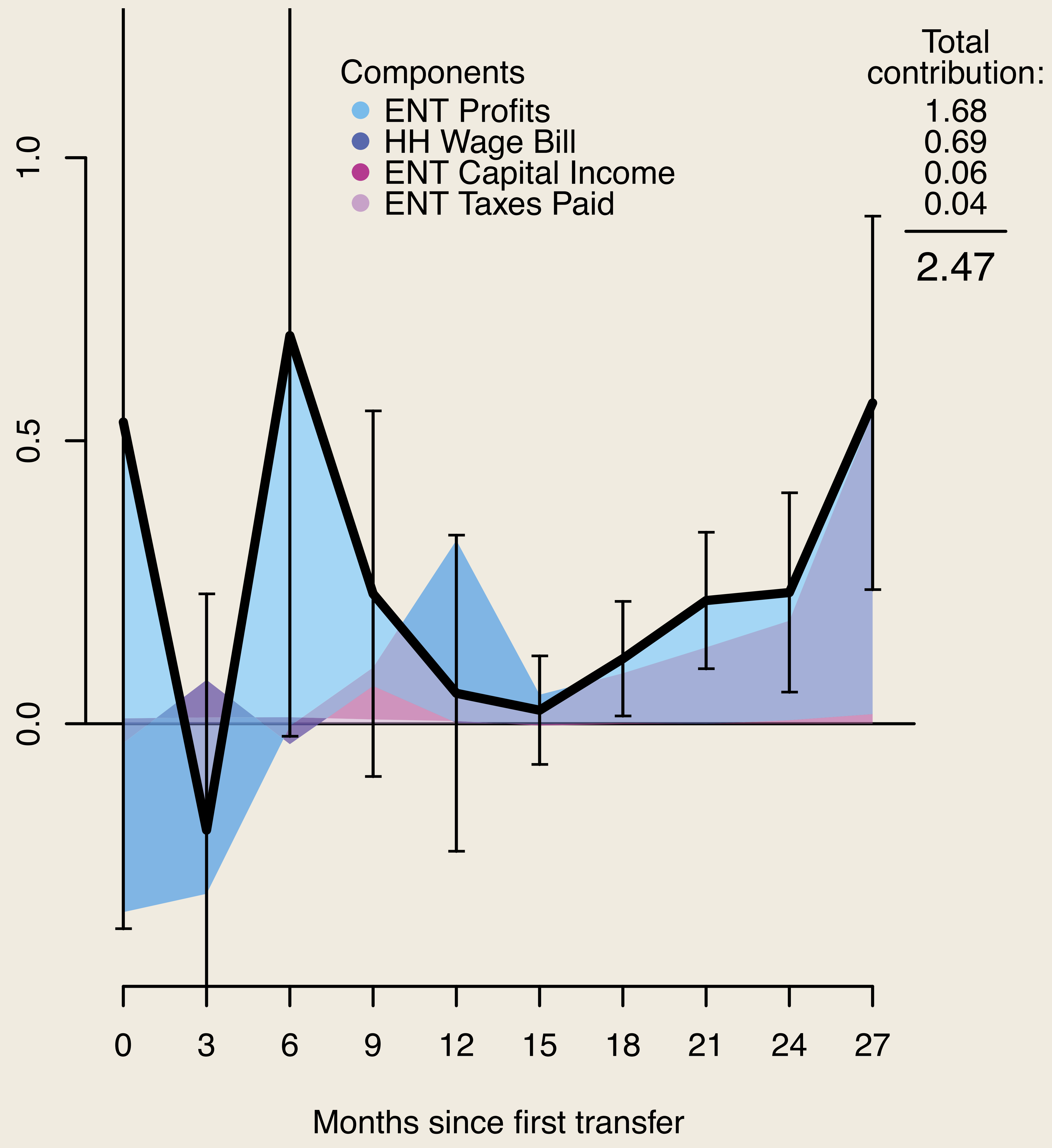
Limited Impact on Prices

Prices increased by 0.22%-1%

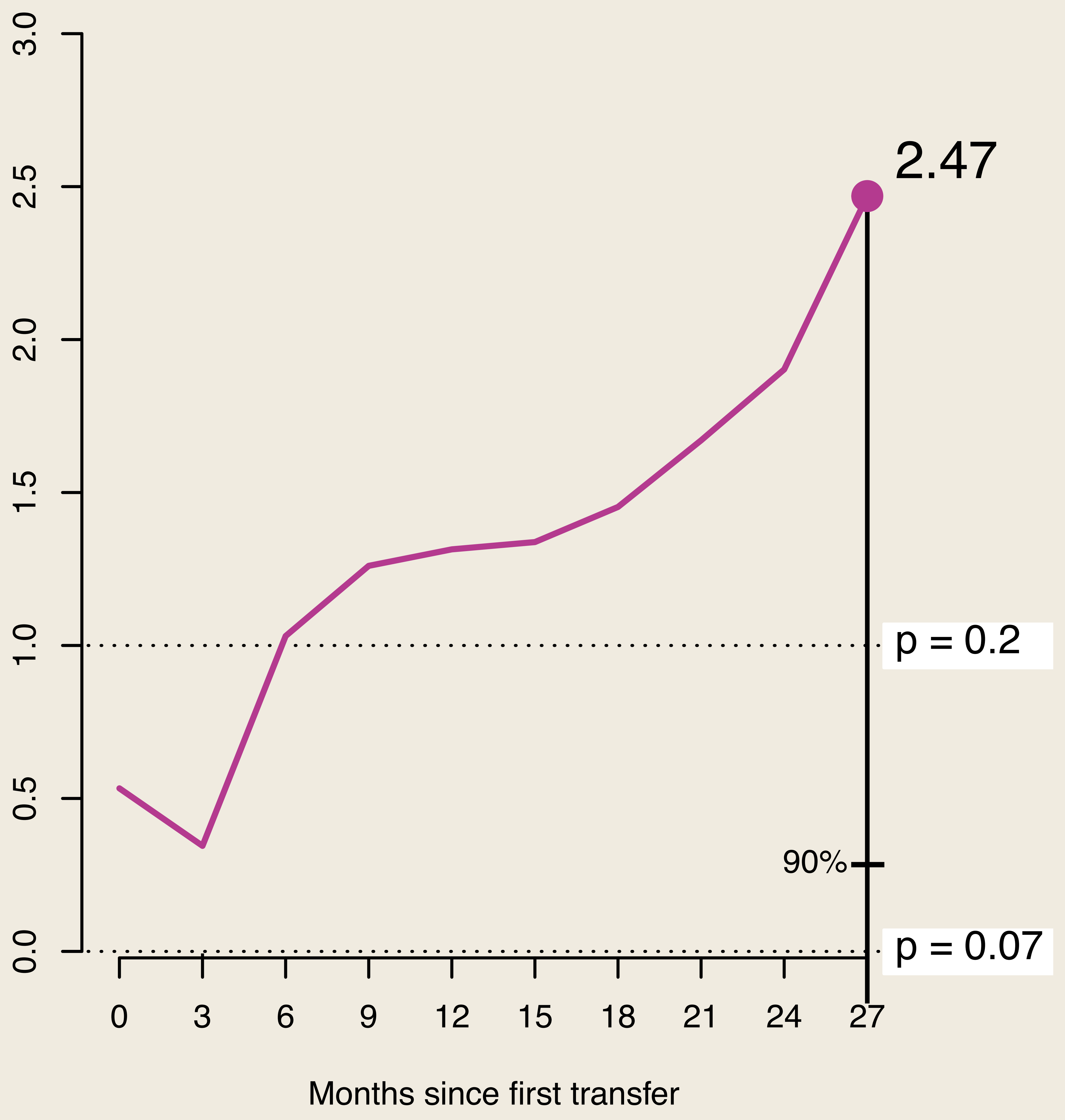
		(1)	(2)
		Overall Effects	
		ATE	Average Maximum Effect (AME)
All goods		0.0010	0.0042
		(0.0006)	(0.0031)
By tradability	More tradable	0.0014	0.0062
		(0.0015)	(0.0082)
	Less tradable	0.0009	0.0034
		(0.0006)	(0.0032)
By sector	Food items	0.0009	0.0036
		(0.0006)	(0.0033)
	Non-durables	0.0014	0.0061
		(0.0017)	(0.0089)
	Durables	0.0019	0.0070
		(0.0011)	(0.0061)
	Livestock	−0.0008	−0.0027
		(0.0010)	(0.0052)
	Temptation goods	−0.0011	−0.0112
		(0.0026)	(0.0143)

Transfer Multipliers

Quarterly



Cumulative



Fiscal Policy in Infinite Horizon New Keynesian Model

Extensions

- As in the two-period model, assume θ faction of households are hand-to-mouth

$$C_t^h = W_t l_t + D_t - T_t$$

- A fraction $1 - \theta$ of permanent-income households follows the Euler equation:

$$u'(C_t^p) = \beta(1 + r_t)u'(C_{t+1}^p)$$

- Government sets $\{G_t, T_t, B_t\}$ that satisfies

$$G_t - B_t = T_t - (1 + r_t)B_{t-1}$$

  - We assume $B_t = \rho_B(B_{t-1} + G_t)$, where ρ_B captures the degree of deficit-financing

- Calibration:
  - Set $\theta \in \{0,0.4\}$ and $\rho_B \in \{0,0.97\}$
  - Remaining parameters unchanged

Equilibrium Conditions: $\{C_t^h, C_t^p, C_t, L_t, I_t, K_{t+1}, q_t, p_t/P_t, r_t, i_t, \pi_t, G_t, B_t, T_t\}$

1. Consumption:

$$u'(C_t^p) = \beta(1+r_t)u'(C_{t+1}^p), \quad C_t^h = F(K_t, L_t) - I_t - \Phi(I_t, K_t) - T_T, \quad C_t = \theta C_t^h + (1-\theta)C_t^p$$

2. Labor demand/supply:

$$\frac{p_t}{P_t}\frac{\partial F_t(K_t, L_t)}{\partial L_t}u'(C_t) = v'(L_t)$$

3. Investment:

$$\frac{I_t}{K_t} = \frac{1}{\phi}\left[q_t - 1\right], \quad q_t = \frac{1}{1+r_t}\left[\frac{p_t}{P_t}\frac{\partial F_{t+1}(L_{t+1}, K_{t+1})}{\partial K_{t+1}} - \frac{I_{t+1}}{K_{t+1}} - \frac{\phi}{2}\left(\frac{I_{t+1}}{K_{t+1}}\right)^2 + \left(\frac{I_{t+1}}{K_{t+1}} + (1-\delta)\right)q_{t+1}\right]$$

4. Capital stock evolution: $K_{t+1} = (1-\delta)K_t + I_t$

5. Goods market clearing: $C_t + I_t + \Phi(I_t, K_t) + G_t = F_t(K_t, L_t)$

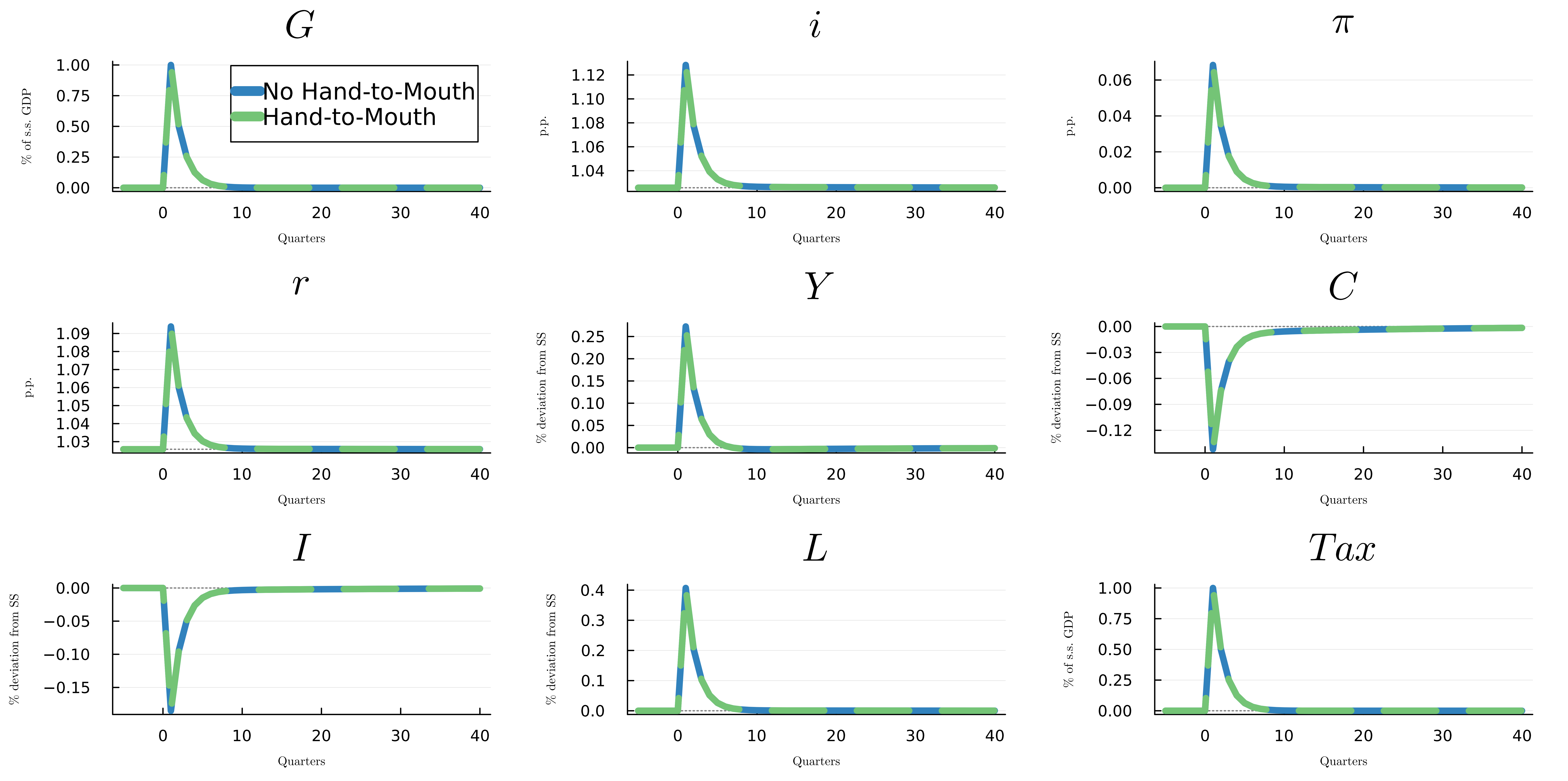
6. New Keynesian Phillips curve: $\pi_t = \kappa\left[\frac{\eta-1}{\eta}\frac{p_t}{P_t} - 1\right] + \beta\pi_{t+1}$

7. Monetary and fiscal policy:

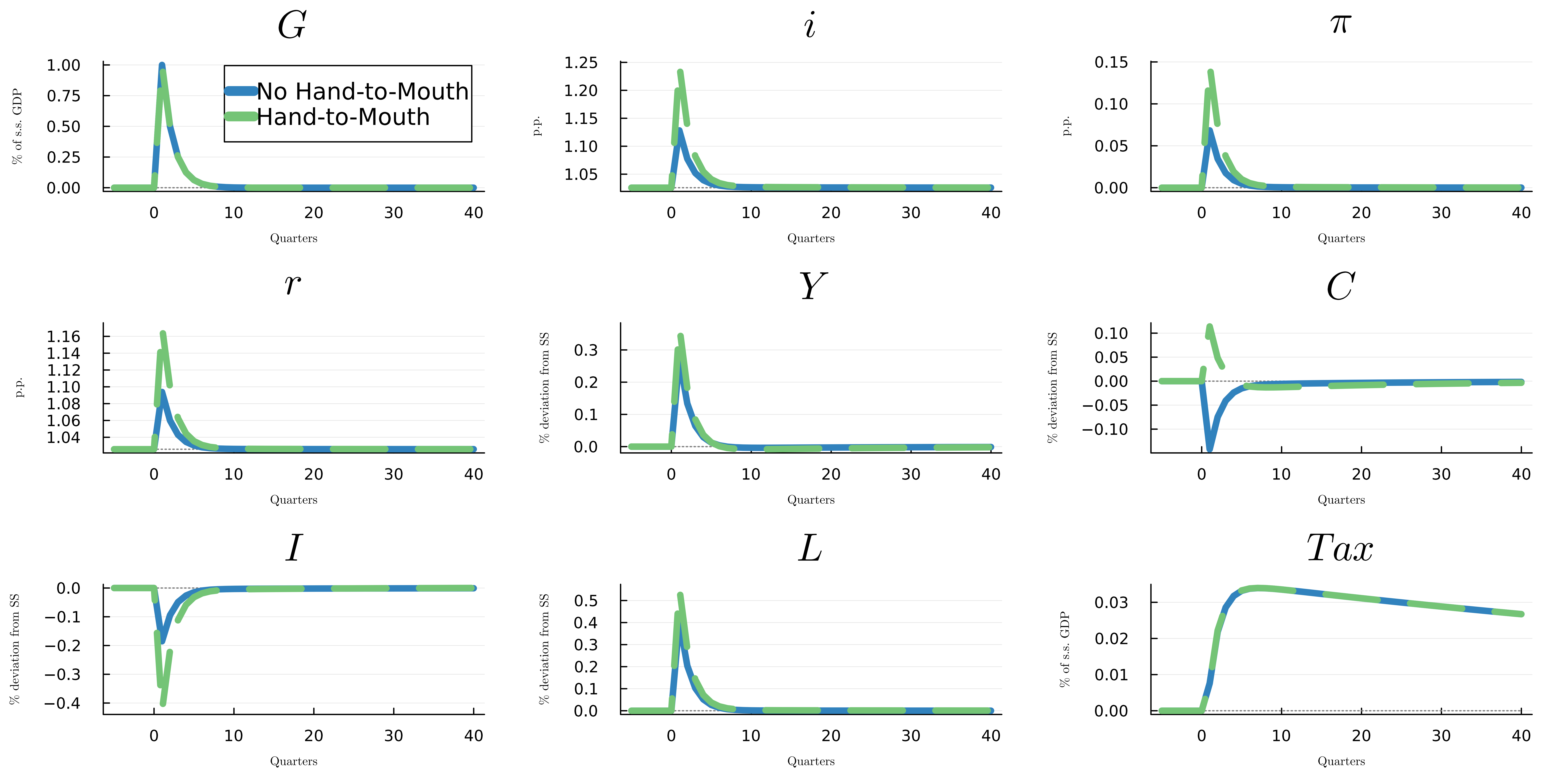
$$i_t = \bar{i} + \phi_\pi \pi_t + \epsilon_t, \quad G_t - B_t = T_t - (1+r_t)B_{t-1}, \quad B_t = \rho_B(B_{t-1} + G_t)$$

8. Fisher equation: $r_t = i_t - \pi_{t+1}$

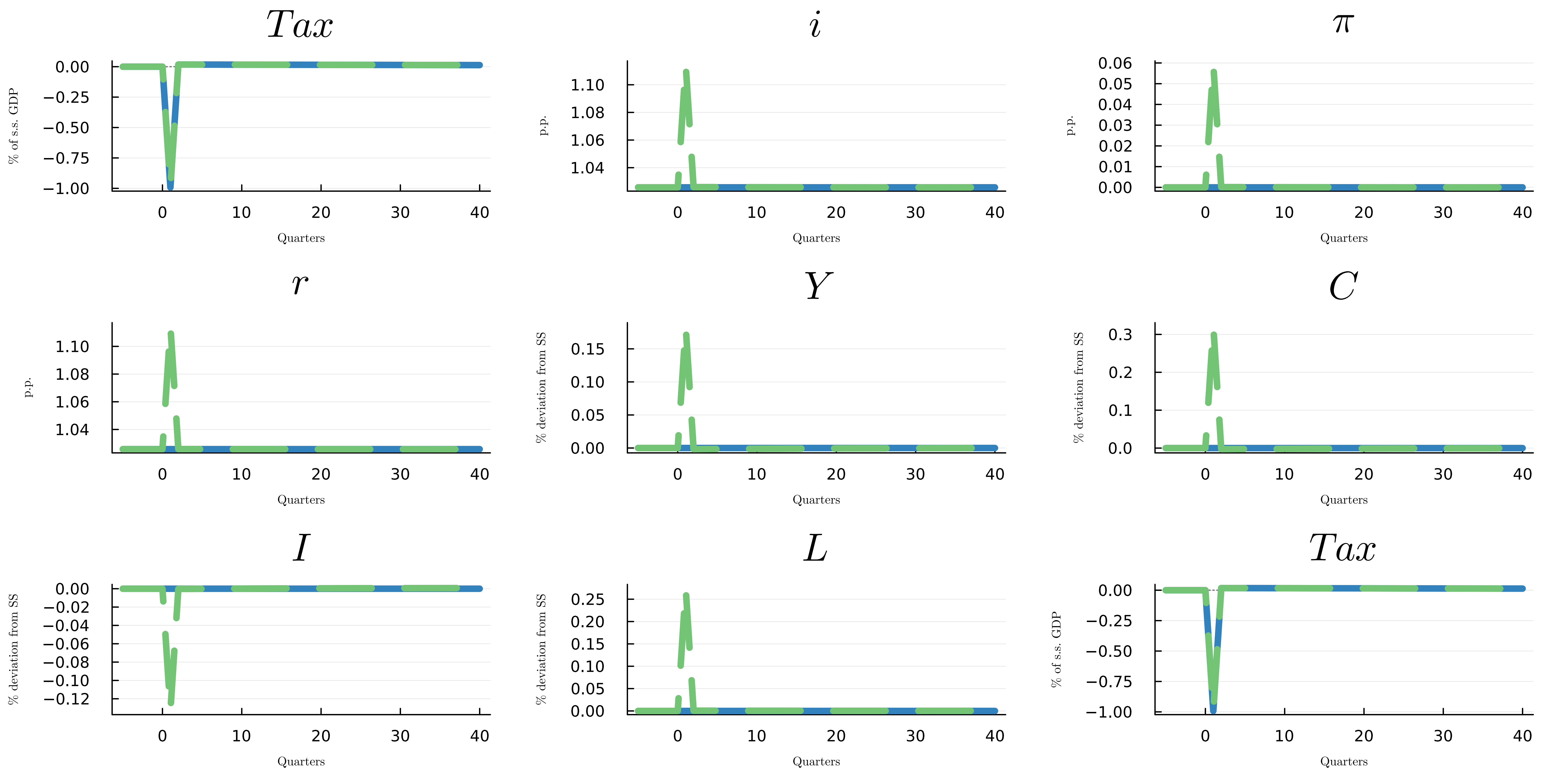
Balanced Budget Government Spending



Deficit-Financed Government Spending



Stimulus Checks



Summary

- Fiscal policy is widely considered an important stabilization tool
- Standard New Keynesian model features Ricaridan equivalence
  - Government spending multiplier is less than 1
  - Transfer policy is neutral
- Empirical evidence refutes both of the predictions
- We extended NK model to include borrowing-constrained households
  - Fiscal multiplier can be larger than 1 if deficit-financed
  - Transfer payment is expansionary