Is There a Fiscal Free Lunch in a Liquidity Trap?

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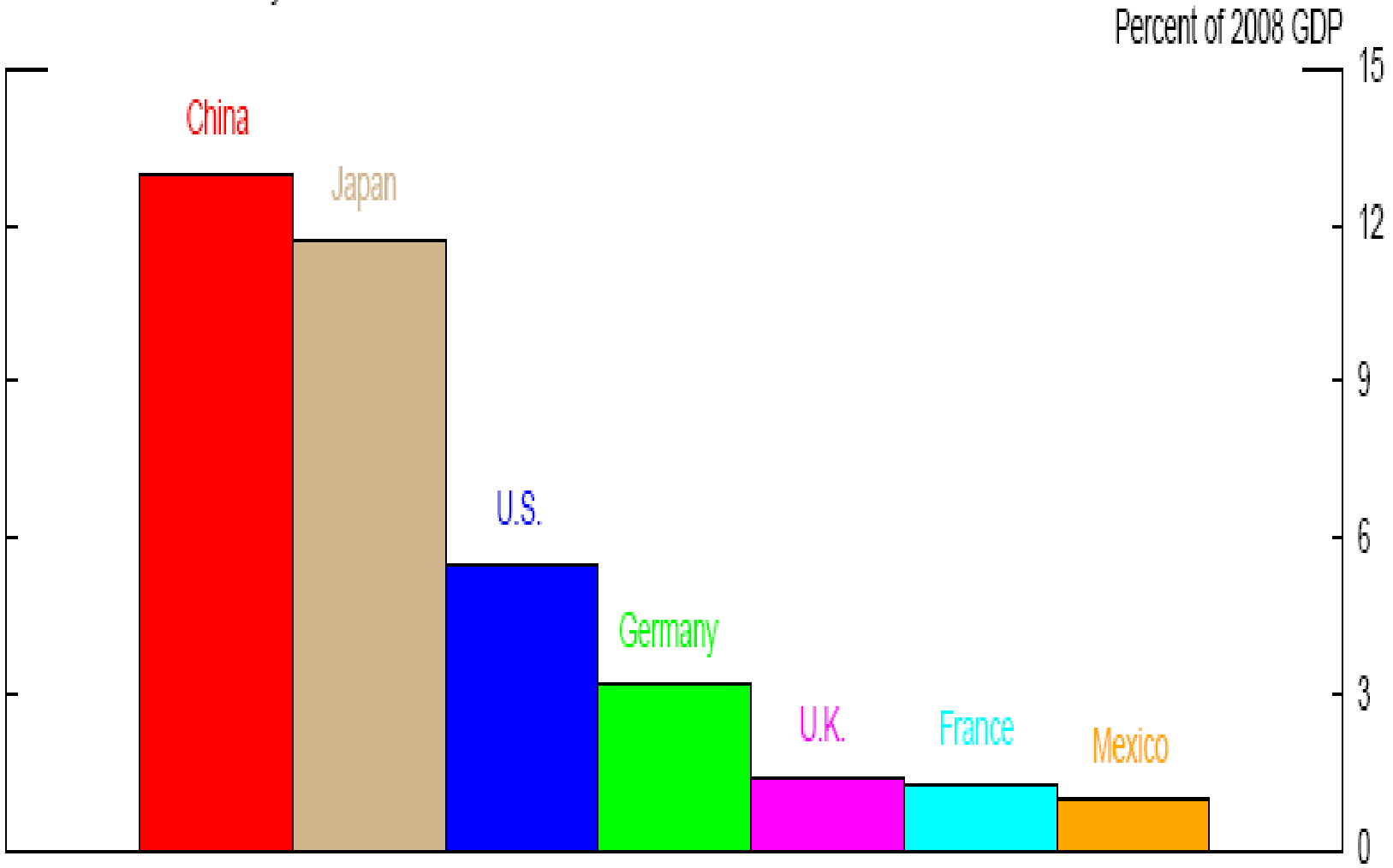
Motivation

- Many countries have announced large fiscal expansions to offset sharp declines in economic activity
  - Fiscal stimulus typically consists of both tax cuts and increases in government spending
  - Part of fiscal expansion most likely of discretionary character

Headline Fiscal Policy Announcements



- Key question: size of the fiscal spending multiplier
  - How much does GDP rise when government spending rises by 1 percent of GDP?

- Textbook economic theory suggests a multiplier less than unity at medium-term horizons
  - In a normal situation, higher demand by the government drains resources from the private sector
  - Private demand falls due to;
    * higher real interest rates ("crowding out" effect), monetary policy important
    * higher expected taxes, which reduces permanent income

- Hence, $G \uparrow\uparrow \Rightarrow C \downarrow I \downarrow \Rightarrow Y \uparrow$

- Empirical evidence on goverment spending multipliers
  - Most empirical evidence suggests that higher government spending raises output
  - But, major disagreement on the size and persistence of government spending multiplier

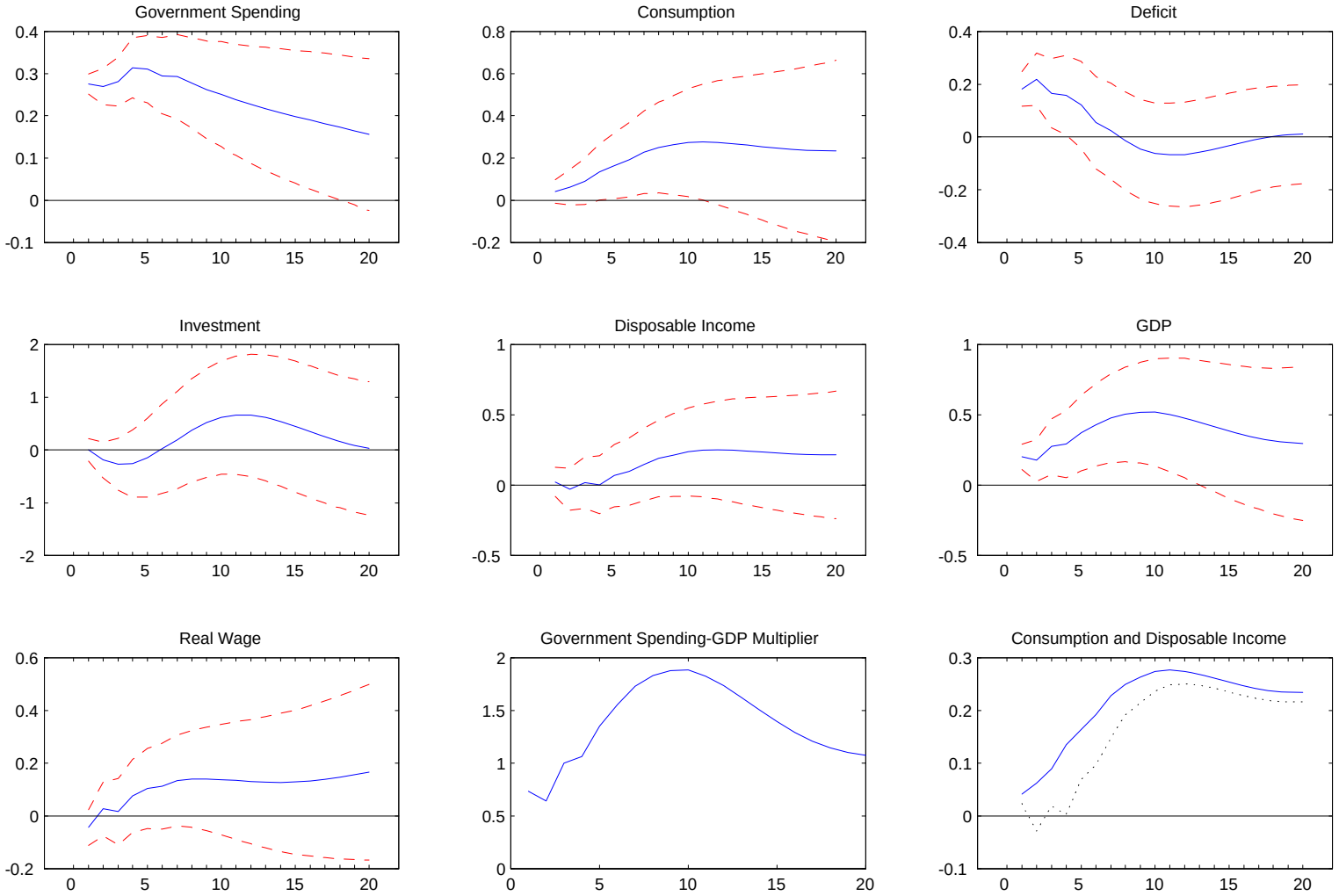
- Two dominant empirical approaches
  - Narrative approach (e.g. Ramey and Shapiro, 1988): Define dummy variables capturing episodes of military buildups (arguably exogenous and unforcastable); Korea, Vietnam, Carter-Reagan, Post 9/11
  - Structural vector autoregressions (SVARs) (Blanchard and Perotti, 2002, Perotti, 2004, Galí, Lopes-Salido and Vallés, 2007)

- Both empirical approaches subject to criticism:
  - Narrative approach:
    * Lumps together periods with very different characteristics
    * Subjective and not applicable to other countries
    * Sharp increases in military spending presumably have different effects relative to other types of government expenditures (e.g. infrastructure investments)
  - SVARs
    * Arbitrary identification assumptions (e.g. Quarterly data, assume G does not respond contemporaneously to variations in Y, $\alpha_{gy} = 0$)
    * Identified shocks a mixture of anticipated and unanticipated shocks to G, creating problems to retrieve the true impulse response functions (Leeper, Walker and Yang, 2009)

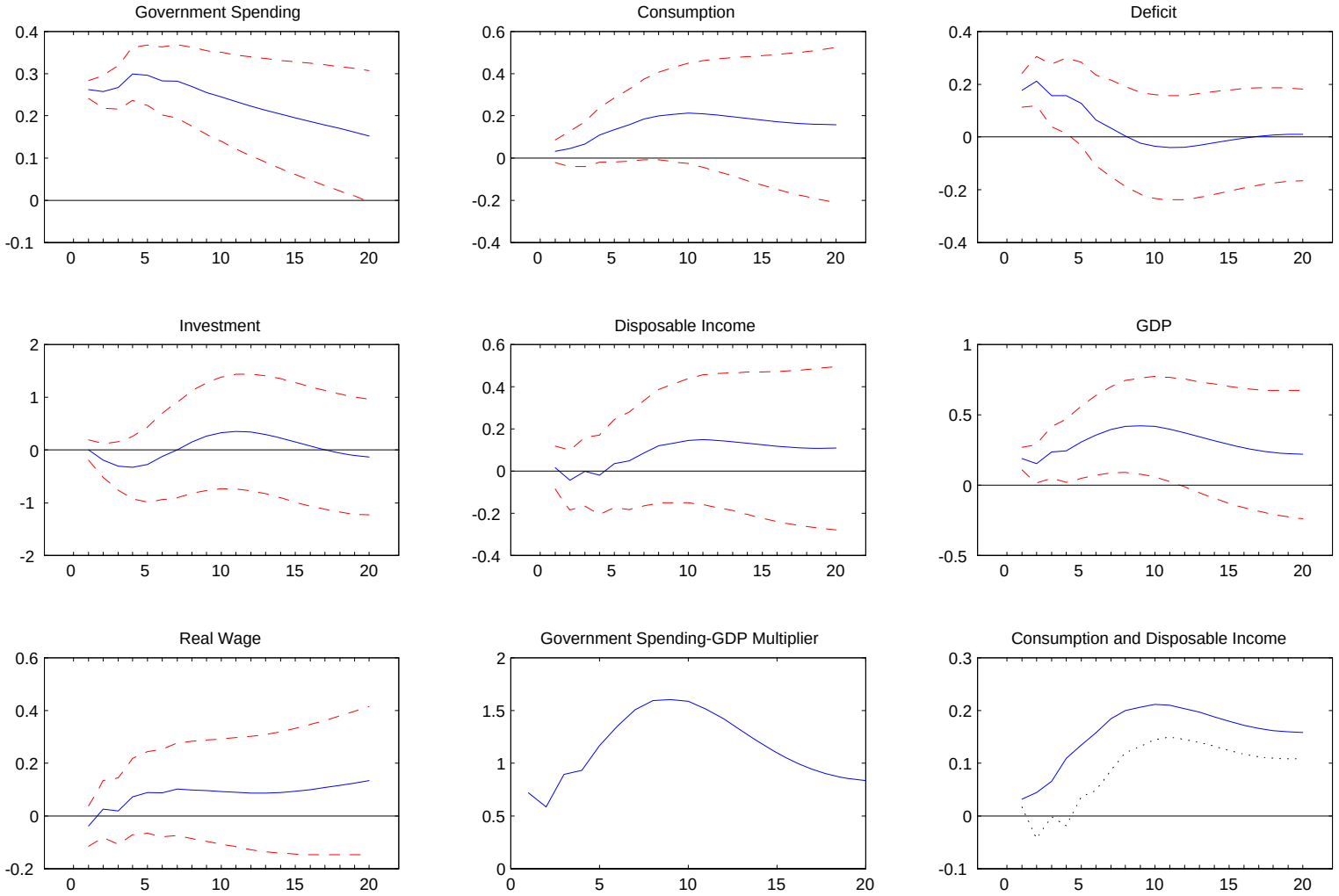
* Omitting goverment debt creates invertibility problems (Chung and Leeper, 2007)

* Effects unstable over time, e.g. the results in Galí, Lopez-Salido and Vallés (2007, JEEA), effects dependent on the monetary policy response

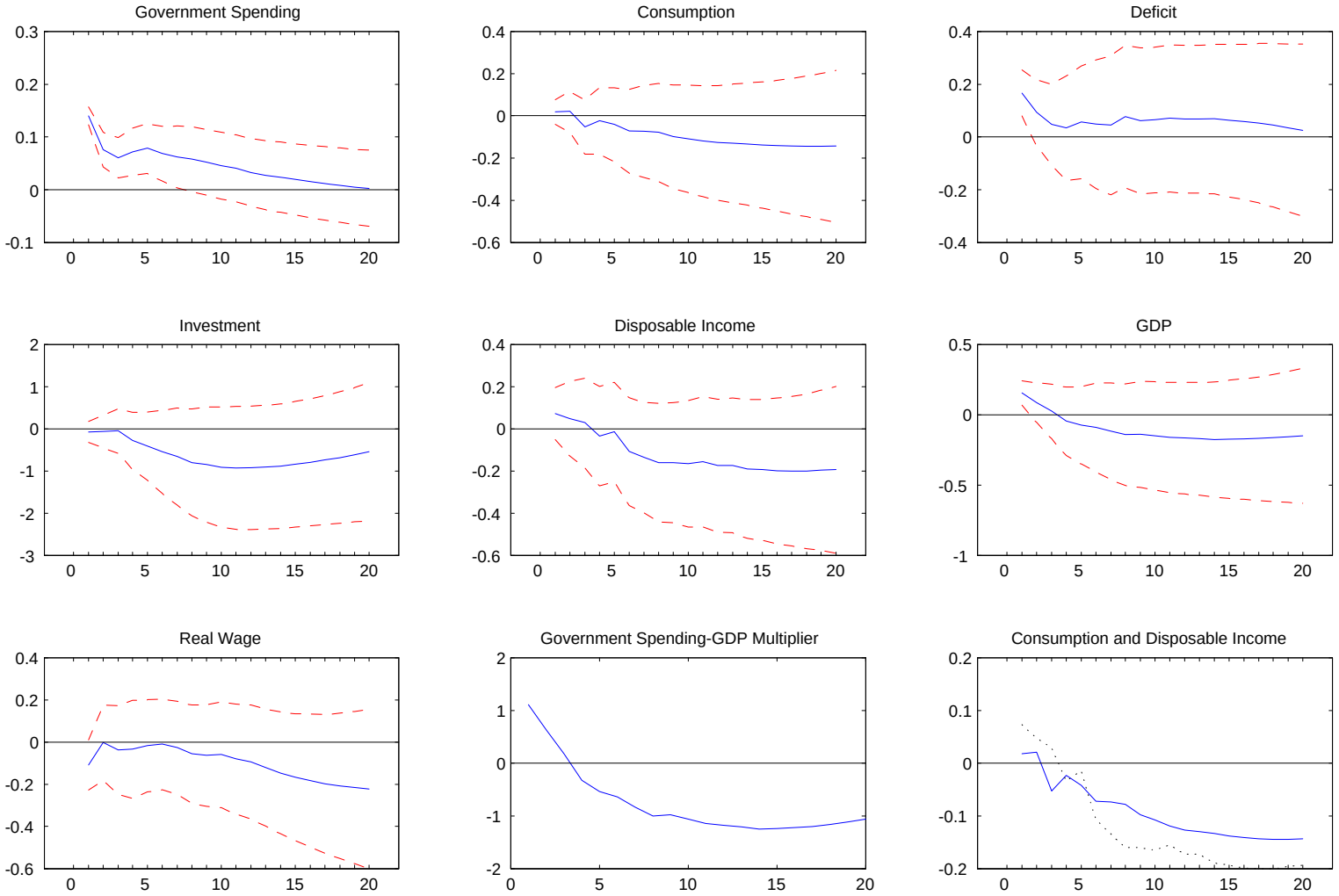
VAR Impulses to Government Spending Shock 1954:1 - 2003:4



VAR Impulses to Government Spending Shock 1954:1 - 2009:1



VAR Impulses to Government Spending Shock 1982:1 - 2009:1



- The notion that monetary policy affects the propagation of fiscal impulses, makes empirical estimates less relevant for assessing the effects of fiscal stimulus packages in a liquidity trap
  - Plausible that fiscal policy has larger effects in a liquidity trap given that monetary policy is not expected to raise nominal interest rates for some time
  - Need structural models to assess how the government spending multiplier is affected, limited historical experience with liquidity traps makes VAR evidence less relevant

What we do

- Use standard New-Keynesian type of models to investigate how the government spending mulitiplier is affected by liquidity trap. Compare two different environments:
  - "Normal conditions" in which monetary policy reacts to higher inflation and output gaps by raising nominal and real interest rates (simple rule)
  - "Liquidity trap" in which the private sector expects interest rates to remain constant for a protracted period. Assume that liqudity trap arises due to a severe aggregate-demand induced recession

- Study three variants of the New Keynesian model:
  - Simple model without capital and sticky prices only
  - Christiano, Eichenbaum and Evans (2005), Smets-Wouters (2003, 2007) (CEE-SW) type of model with capital
  - CEE-SW type of model augmented with financial frictions (BGG/CMR) and Keynesian households (Erceg et al., 2005)

- So far, all models are calibrated, currently working on estimation of the extended model where an informative dataset is used and we allow for both anticipated and unanticipated policy shocks (to cope with the critique by Chung and Leeper, 2007, and Leeper, Walker and Yang, 2009)

Key findings

- In accordance with Christiano, Eichenbaum and Rebelo (2009), we find that fiscal spending multipliers can be substantially higher in a liquidity trap relative to a normal situation. Mechanisms:
  - Nominal interest rates rise by less in a liquidity trap that under normal conditions
  - Expected inflation rises by more
  - Goverment debt to GDP does not rise much, so less need to raise taxes

- Key factors increasing the fiscal spending multiplier in a liquidity trap
  - Longer duration of the liquidity trap
  - Moderate implementation lags
  - Lump-sum tax financing
  - Increases in goverment expenditures transient (keeps p.d.v. of taxes down)
  - Increase in goverment outlay not to large
  - Less aggressive future monetary policy (announced policy behavior after exiting the liquidity trap is important)
  - High sensitivity of expected inflation to output gap/marginal costs (i.e. prices are not too sticky)

- If these "conditions" are not met, multipliers can shrink considerably
  - So no evident fiscal policy free lunch in a liquidity trap

Agenda

1. The stylized model
2. Results in the stylized model
3. Results in the CEE/SW model
4. Results in the CEE/SW model with fin. fric. and Keynesian HH
5. Concluding remarks

1. The Stylized model

- The model is a variation on the New Keynesian trinity model
  - Phillips curve

$$\pi_t = \beta \pi_{t+1|t} + \kappa_p x_t \tag{1}$$

  - Output gap equation

$$x_t = x_{t+1|t} - \sigma(1 - g_y)(i_t - \pi_{t+1|t} - r_t^{pot}) \tag{2}$$

  - Potential real interest rate

$$r_t^{pot} = \psi_g(g_t - g_{t+1|t}) + \psi_v(\nu_t - \nu_{t+1|t}) \tag{3}$$

- Monetary policy. Simple rule. If unconstrained (normal conditions), then

$$i_t = (1 - \gamma_i)(\gamma_\pi \pi_t + \gamma_x x_t) + \gamma_i i_{t-1}$$

- Under the zero lower bound constraint, we instead have

$$i_t = \max\left[-i, (1 - \gamma_i)(\gamma_\pi \pi_t + \gamma_x x_t) + \gamma_i i_{t-1}\right], \tag{4}$$

  where i is the steady state interest rate and i_t denotes the devation of the nominal interest rate from i

  - Use the technique described in Lindé and Svensson (2009) to impose (4), assuming perfect foresight

- Processes for the demand shock ν_t and government expenditures

$$\Delta g_{y,t} = \rho_{g,1}\Delta g_{y,t-1} - \rho_{g,2}\left(g_{y,t-1} - g_y\right) + \varepsilon_{g,t},$$

$$\Delta \nu_t = \rho_{c,1}\Delta \nu_{t-1} - \rho_{c,2}\left(\nu_{t-1} - 1\right) + \varepsilon_{\nu,t}.$$

- In the version of the model with distortionary labor income taxes, the evolution for public debt is given by

$$B_{G,t} = (1 + i_t)B_{G,t-1} + P_t G_t - T_t - \tau_{N,t} W_t L_t,$$

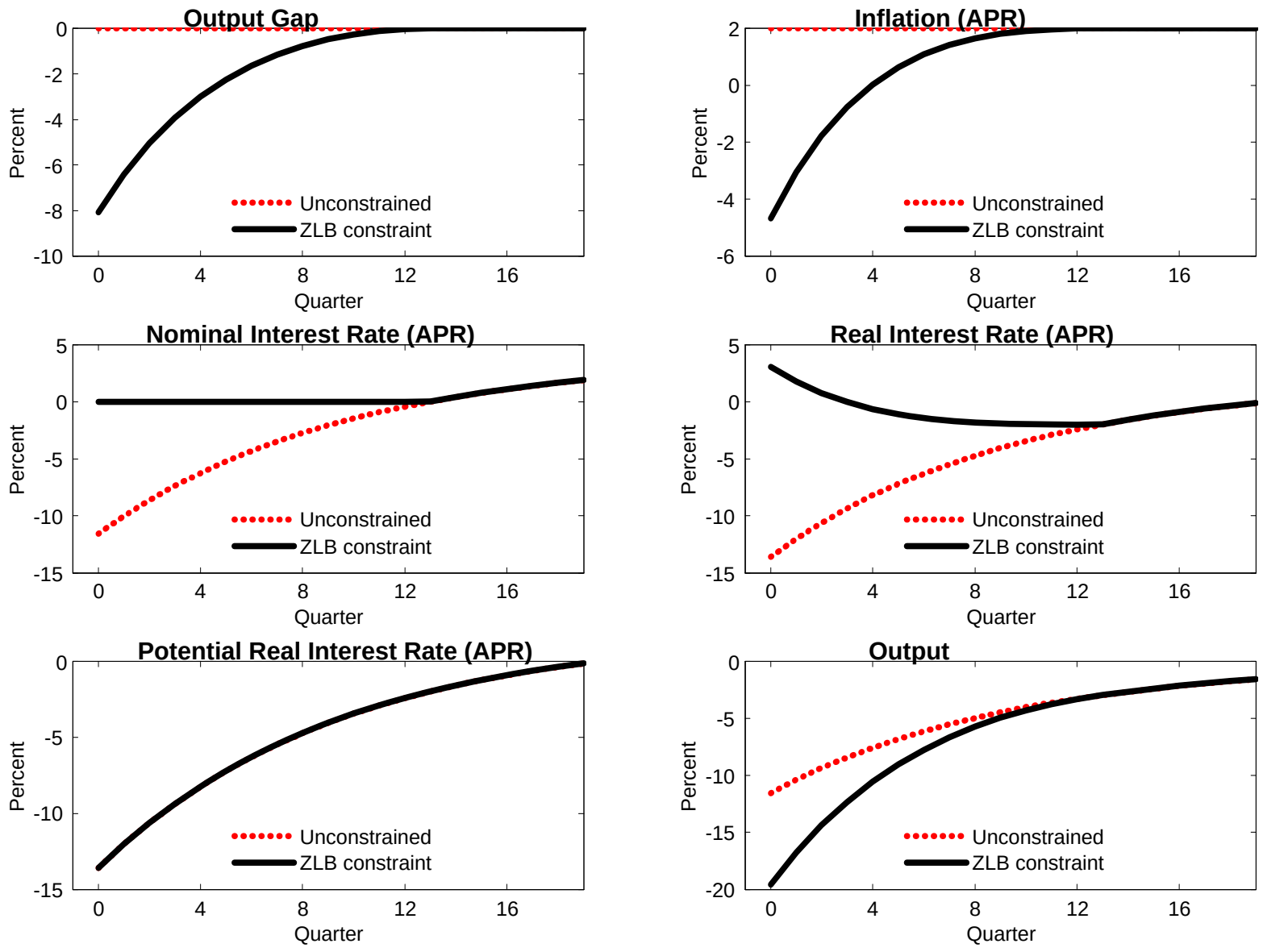
and we assume that

$$\tau_{N,t} - \tau_N = \phi_\tau\left(\tau_{N,t} - \tau_N\right) + \phi_b\left(b_{G,t} - b_G\right) + \phi_d\left(b_{G,t} - b_{G,t-1}\right) \tag{5}$$

where we have defined $b_{G,t} \equiv \frac{B_{G,t}}{P_t \bar{Y}_t}$ and τ_N is labor income tax rate

2. Results in the stylized model

- Construct baseline scenario, assume a sharp drop in consumption demand
  - Assume very aggressive policy, set $\gamma_i = 0$, $\gamma_\pi = 300$ and $\gamma_y = 500$. Assume $\pi = 2$ and $i = 4$
  - Persistence of underlying consumption demand shock equals 0.9
  - Unconstrained policy $\Rightarrow$ecomplete stabilization (i.e. output gap $= 0$, but output $\downarrow$) . Under ZLB constraint, output gap and output contracts, sharp decline in inflation
  - Under the zero lower bound constraint, the economy enters into a liquidity trap that lasts for 13 quarters, see Figure 1

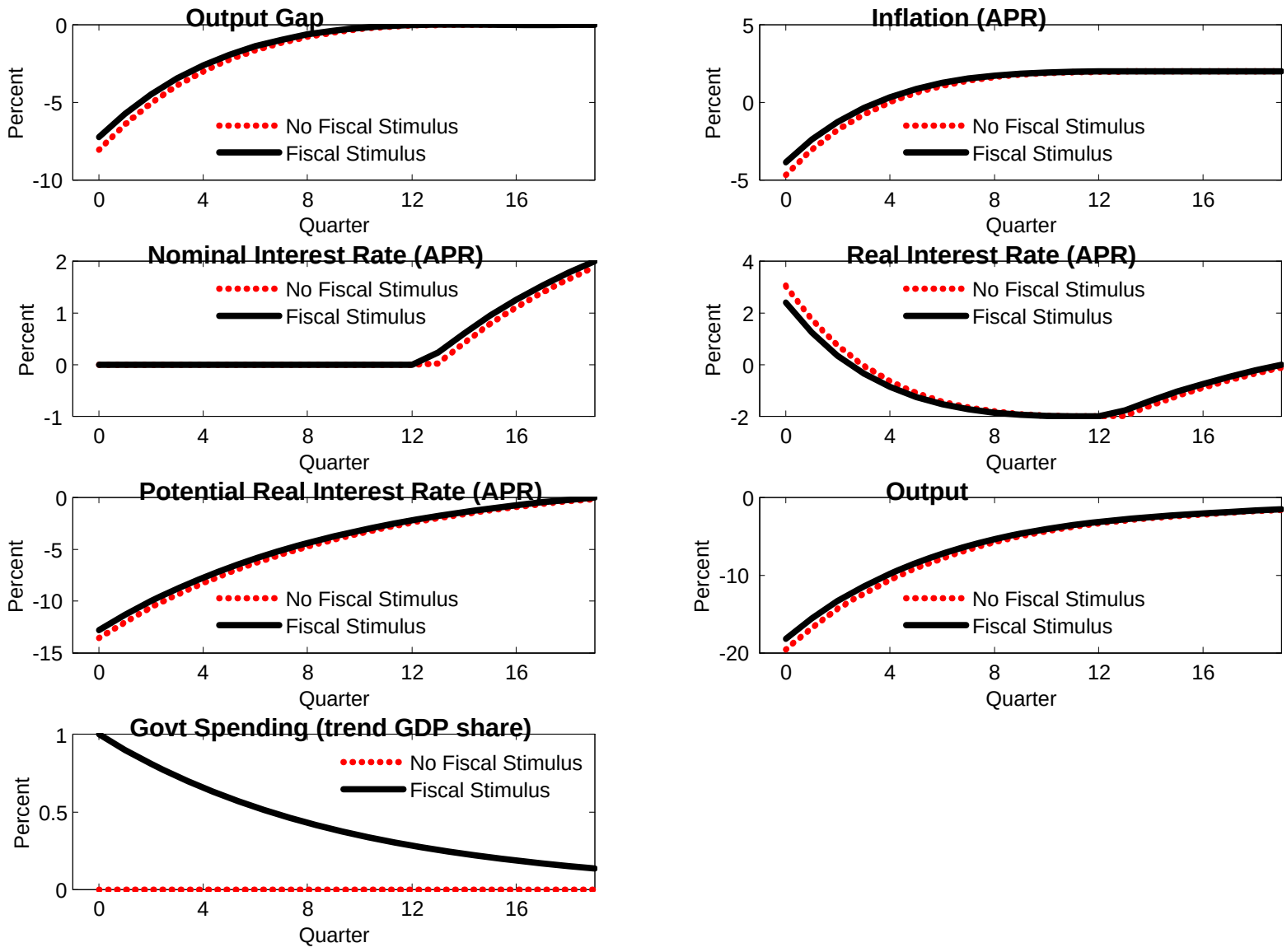

Output Gap
Percent
Quarter
Unconstrained
ZLB constraint
Inflation (APR)
Percent
Quarter
Unconstrained
ZLB constraint
Nominal Interest Rate (APR)
Percent
Quarter
Unconstrained
ZLB constraint
Real Interest Rate (APR)
Percent
Quarter
Unconstrained
ZLB constraint
Potential Real Interest Rate (APR)
Percent
Quarter
Unconstrained
ZLB constraint
Output
Percent
Quarter
Unconstrained
ZLB constraint

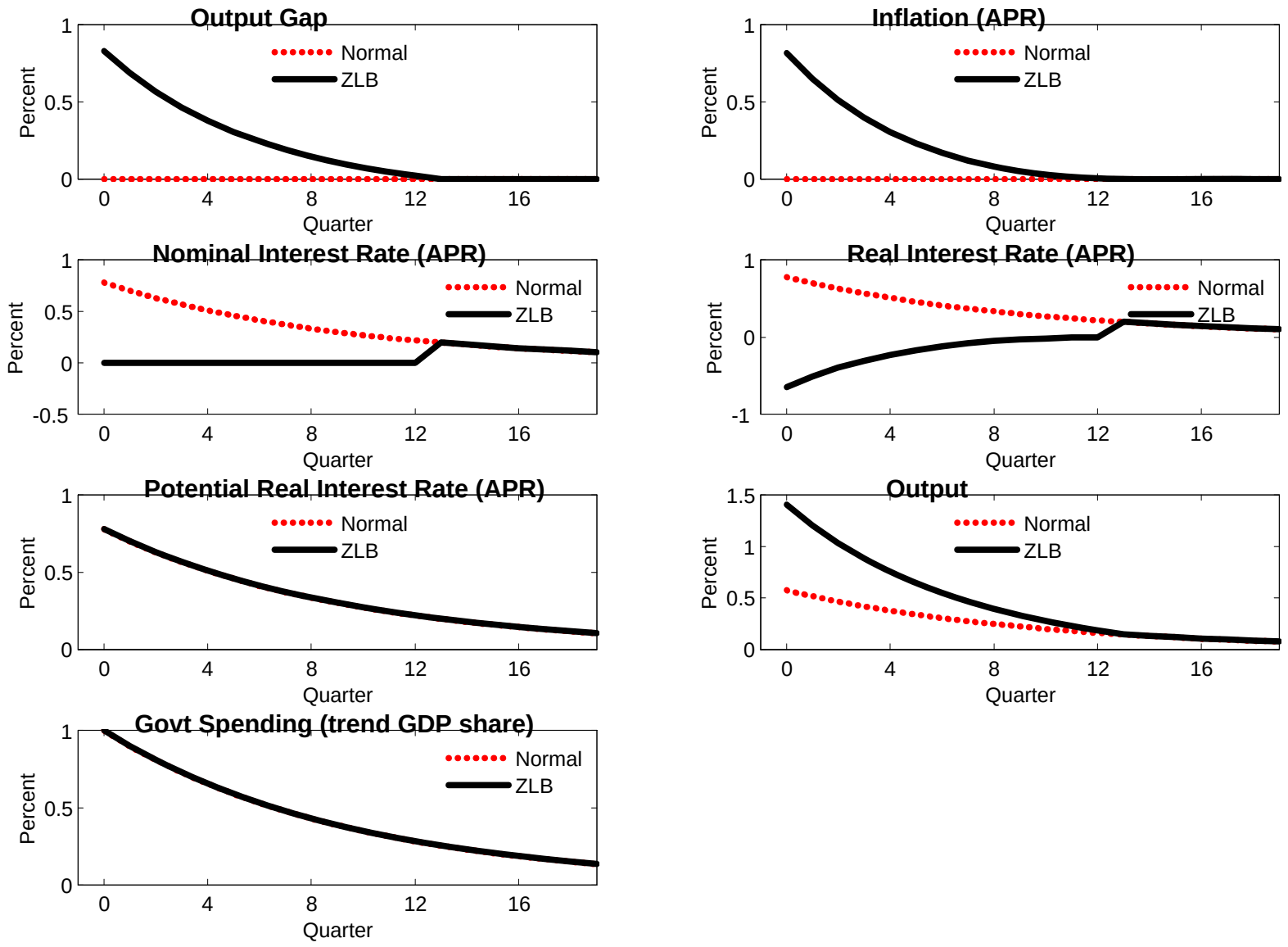
Fiscal stimulus: The favorable case

- Assume government spending rises by 1 percent of baseline GDP
  - Front-loaded increase, announced the same period as the underlying drop in consumption demand occurs
  - Same persistence as the underlying consumption demand shock
  - Assume that fiscal intervention can be financed by lump-sum taxes

- Compare the effects of a front-loaded increase in government spending in two different environments
  - "Normal conditions", in which policy response to demand shock by raising interest rates
  - "Liquidity trap/ZLB", in which private sector expects interest rates to remain low for a protracted period

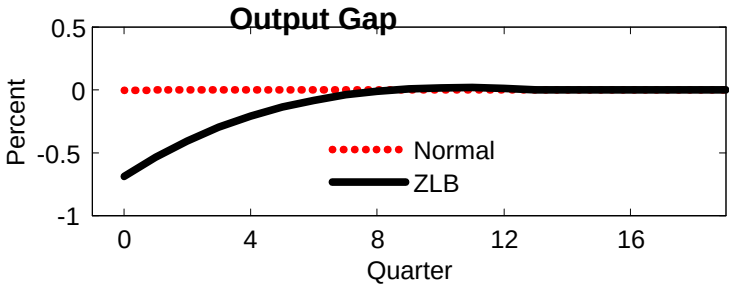
- The fiscal intervention causes the economy to exit the liquidity trap only one period earlier, so multipliers in Figure 3 essentially as high as possible

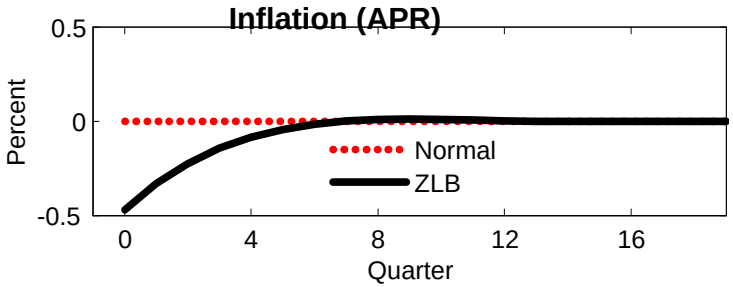

Output Gap
Percent
Quarter
No Fiscal Stimulus
Fiscal Stimulus
Inflation (APR)
Nominal Interest Rate (APR)
Real Interest Rate (APR)
Potential Real Interest Rate (APR)
Output
Govt Spending (trend GDP share)

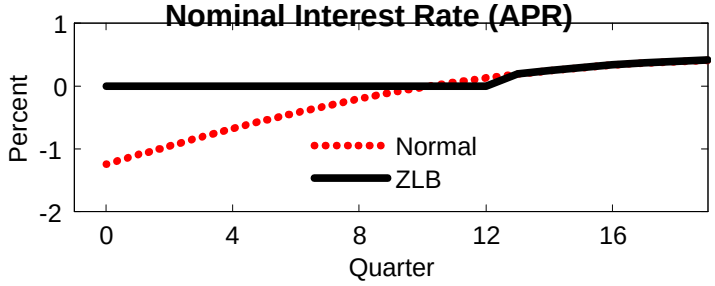

Output Gap
Normal
ZLB
Percent
Quarter
Inflation (APR)
Nominal Interest Rate (APR)
Real Interest Rate (APR)
Potential Real Interest Rate (APR)
Output
Govt Spending (trend GDP share)

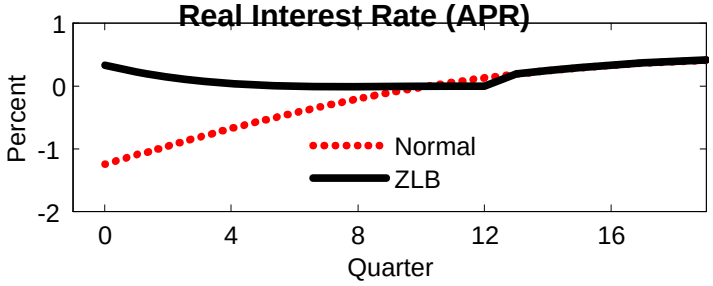
Fiscal stimulus plagued by implemenation lags

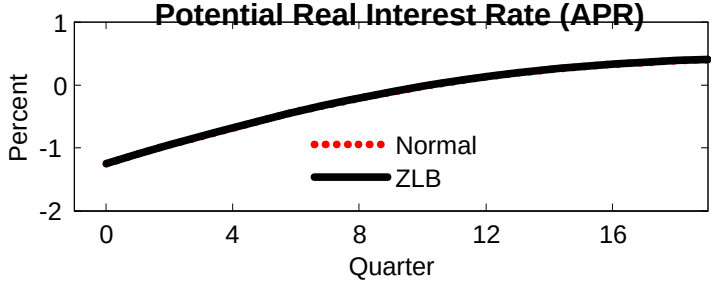
- In Figure 4, we report results where we assume that the government intervention is plagued by implementation lags
  - Announed in period 0, but assume the maximum increase in G occurs in the third year

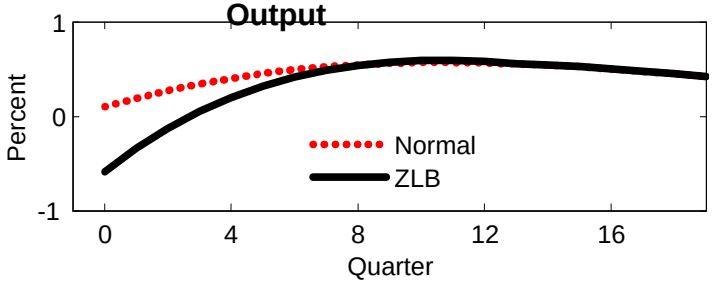

Output Gap
Percent
0.5
0
-0.5
-1
0
4
8
12
16
Quarter
Normal
ZLB

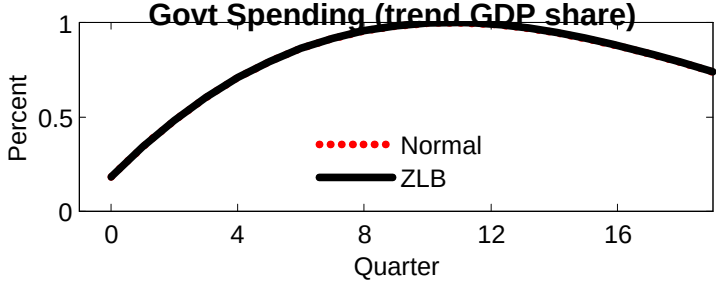

Inflation (APR)
Percent
0.5
0
-0.5
0
4
8
12
16
Quarter
Normal
ZLB


Nominal Interest Rate (APR)
Percent
1
0
-1
-2
0
4
8
12
16
Quarter
Normal
ZLB


Real Interest Rate (APR)
Percent
1
0
-1
-2
0
4
8
12
16
Quarter
Normal
ZLB

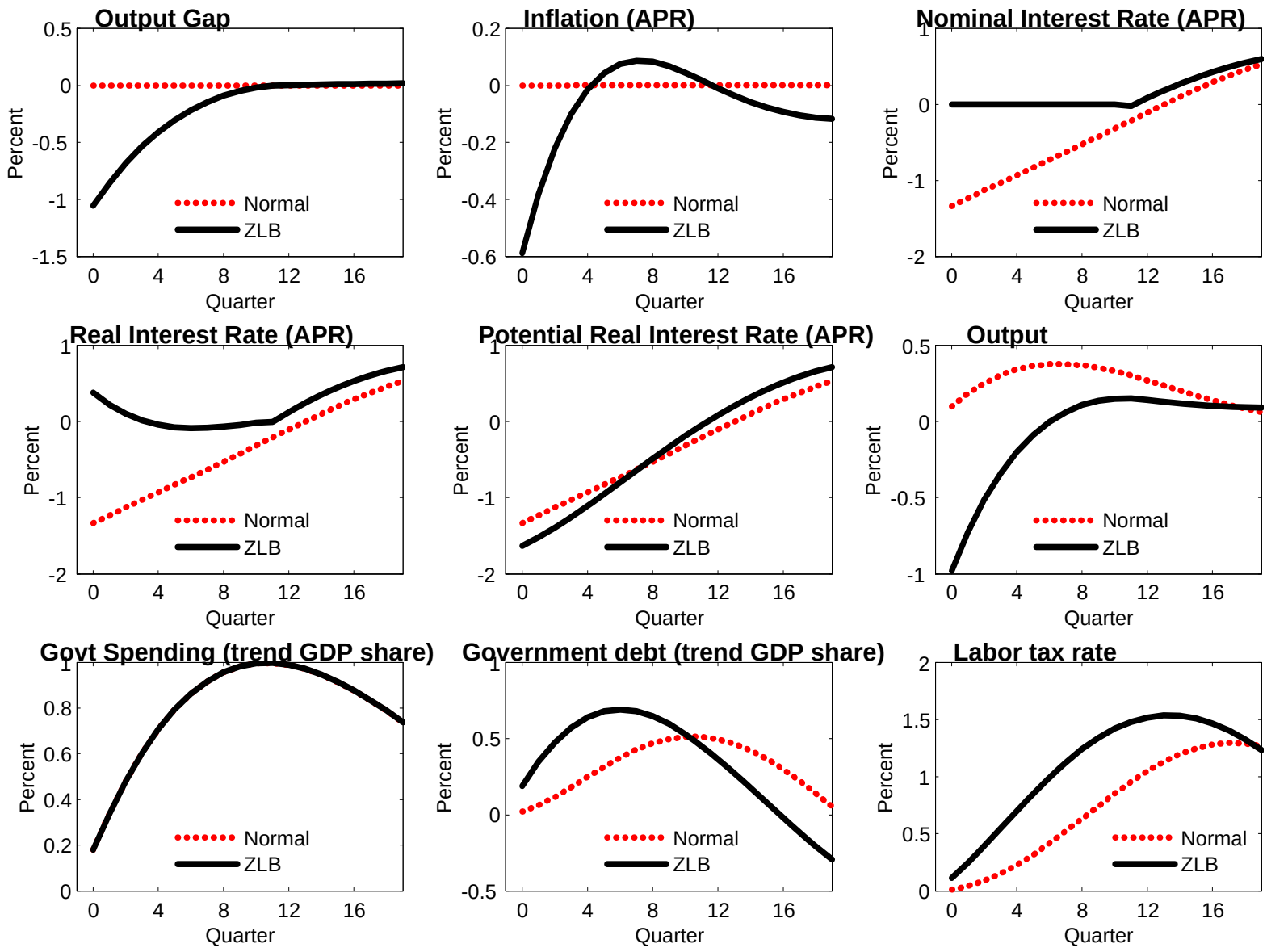

Potential Real Interest Rate (APR)
Percent
1
0
-1
-2
0
4
8
12
16
Quarter
Normal
ZLB


Output
Percent
1
0
-1
0
4
8
12
16
Quarter
Normal
ZLB


Govt Spending (trend GDP share)
Percent
1
0.5
0
0
4
8
12
16
Quarter
Normal
ZLB

Fiscal stimulus: Implemenation lags and distortionary taxes

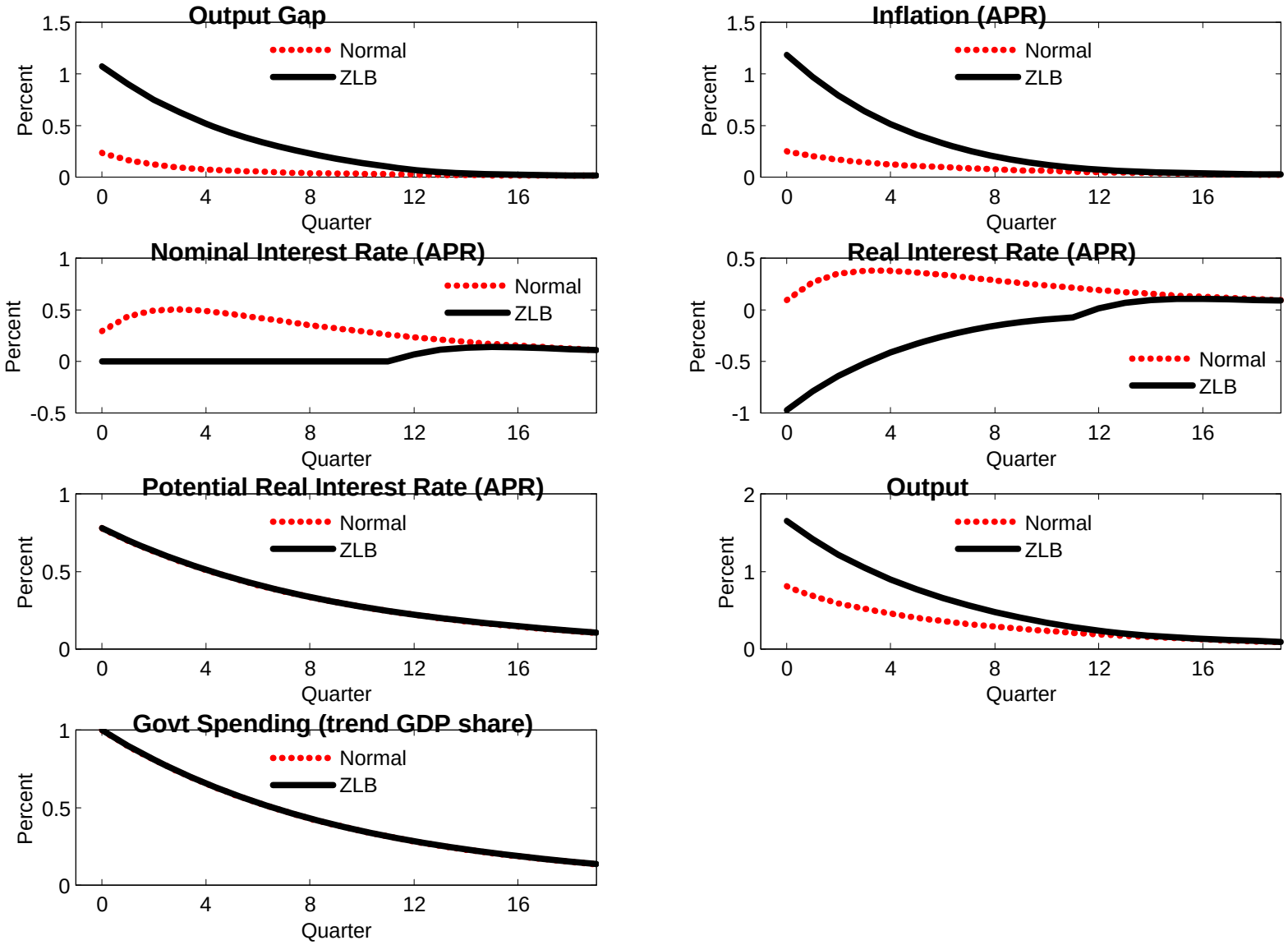
- Finally, we drop the assumption of lump-sum tax financing, maintain assumption of implentation lags
  - Assume that expansion in G must be via labor income taxes


Output Gap
Percent
Quarter
Normal
ZLB
Inflation (APR)
Nominal Interest Rate (APR)
Real Interest Rate (APR)
Potential Real Interest Rate (APR)
Output
Govt Spending (trend GDP share)
Government debt (trend GDP share)
Labor tax rate

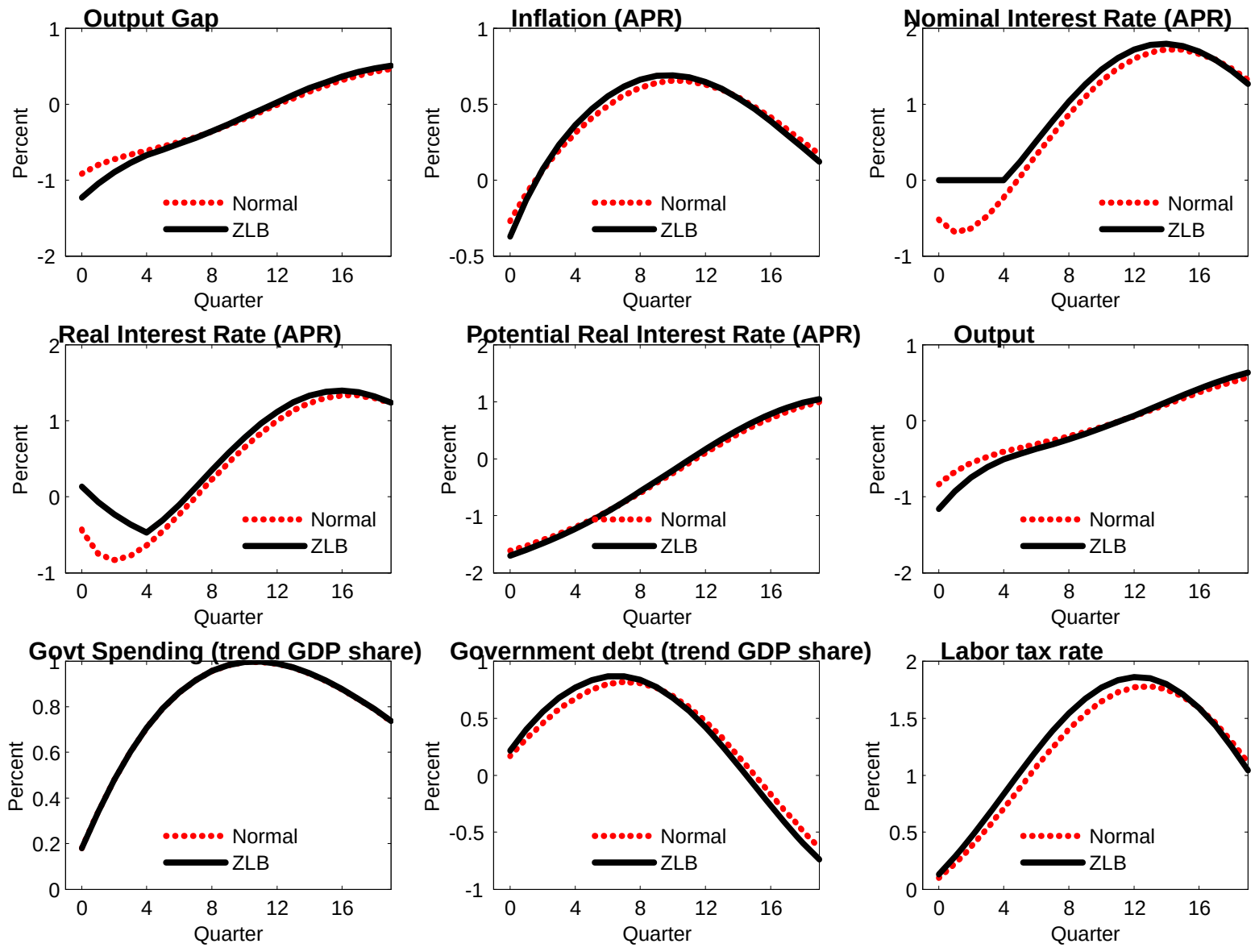
Role of monetary policy

- Assume less aggressive policy, set $\gamma_i = 0.7$, $\gamma_\pi = 3$ and $\gamma_y = 0.25$

- This leads to somewhat more expansionary effects of the fiscal stimulus, in particular at medium and long horizons



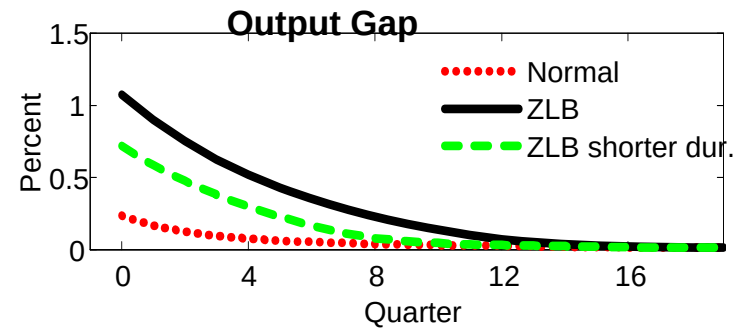
Front-loaded expansion, financing with lump-sum taxes

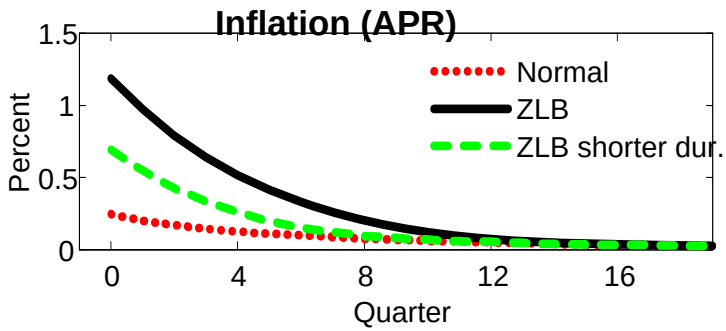


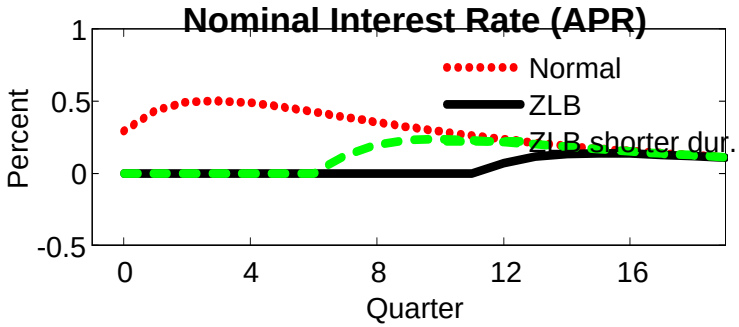
Implementation lags, financing with distortionary taxes

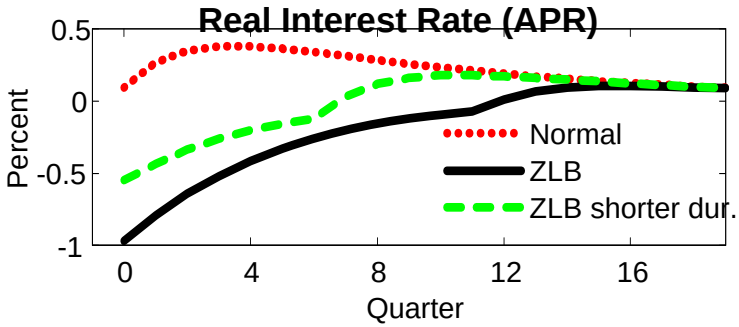
Role of persistence of liquidity trap

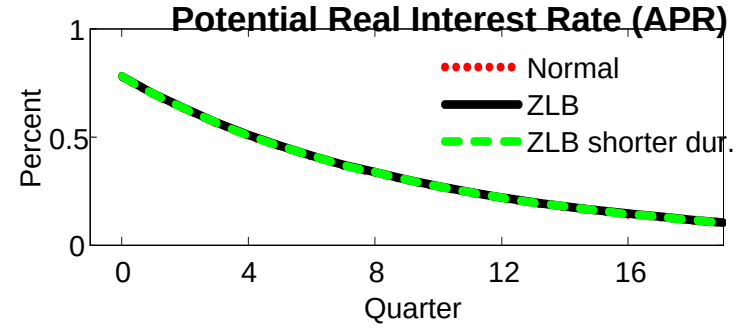
- Now assume that the duration of the liquidity trap is substantially shortened
  - Assume duration of 8 quarters instead of the previous 12 quarters
  - Show results for front-loaded intervention, lump-sum taxes, standard policy rule

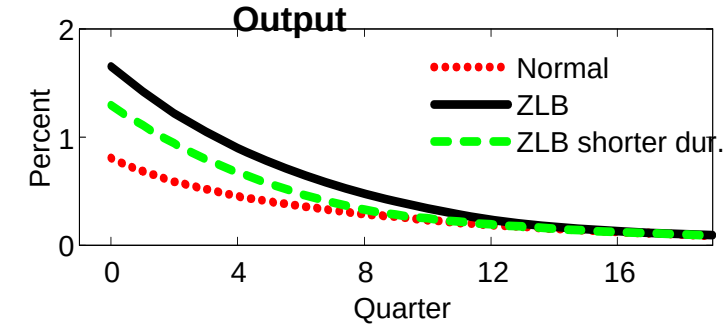

Output Gap
Normal
ZLB
ZLB shorter dur.
Percent
Quarter
1.5
1
0.5
0
0
4
8
12
16

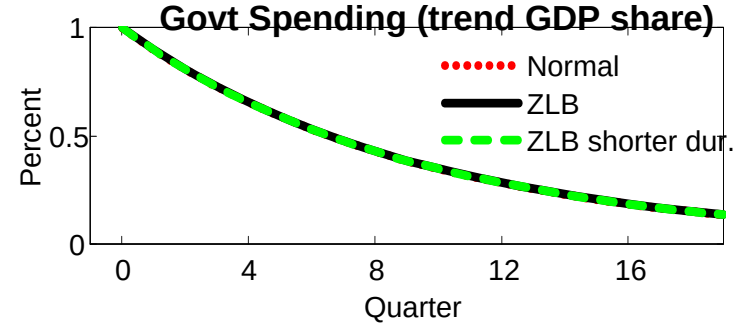

Inflation (APR)
Normal
ZLB
ZLB shorter dur.
Percent
Quarter
1.5
1
0.5
0
0
4
8
12
16


Nominal Interest Rate (APR)
Normal
ZLB
ZLB shorter dur.
Percent
Quarter
1
0.5
0
-0.5
0
4
8
12
16


Real Interest Rate (APR)
Normal
ZLB
ZLB shorter dur.
Percent
Quarter
0.5
0
-0.5
-1
0
4
8
12
16

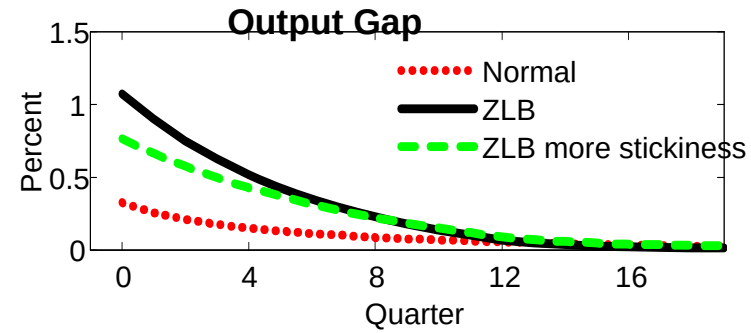

Potential Real Interest Rate (APR)
Normal
ZLB
ZLB shorter dur.
Percent
Quarter
1
0.5
0
0
4
8
12
16

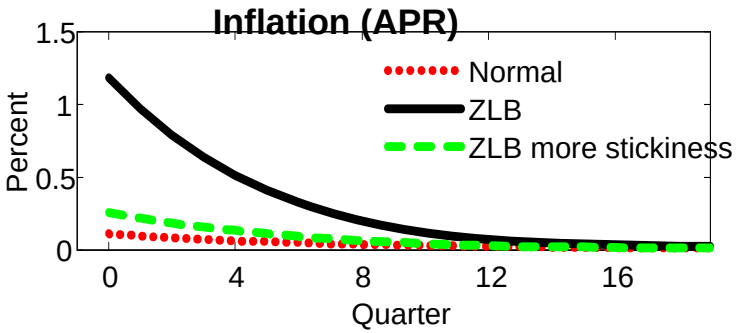

Output
Normal
ZLB
ZLB shorter dur.
Percent
Quarter
2
1
0
0
4
8
12
16

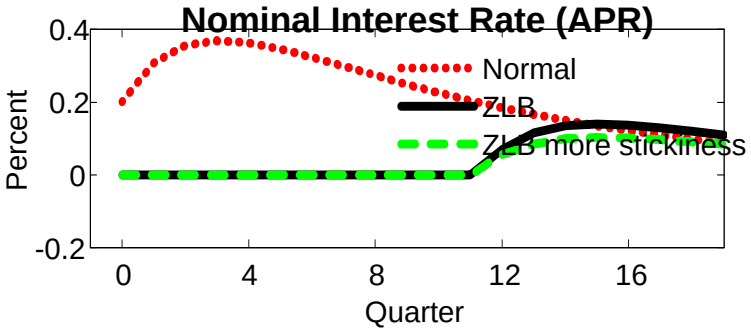

Govt Spending (trend GDP share)
Normal
ZLB
ZLB shorter dur.
Percent
Quarter
1
0.5
0
0
4
8
12
16

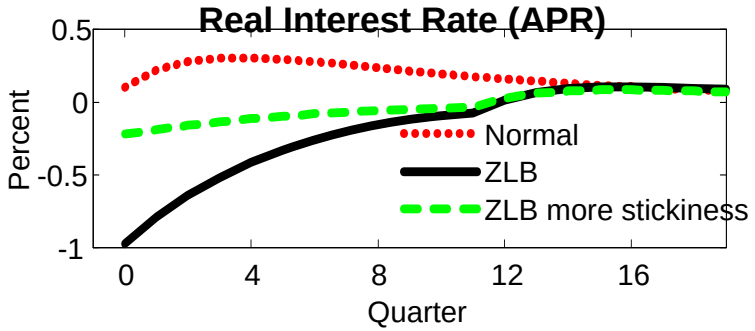
Role of sticky prices

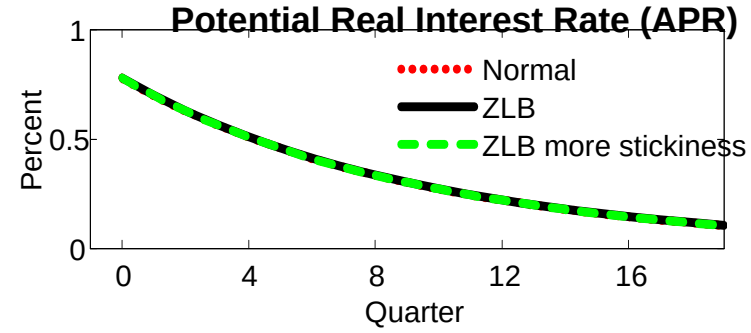
- Now assume that the degree of price stickiness increase substantially
  - ξ_p increased to 0.95 (ξ_p =0.90 in baseline), duration of liquidity trap unchanged (underlying demand shock down even more)
  - Show results for front-loaded intervention, lump-sum taxes, standard policy rule

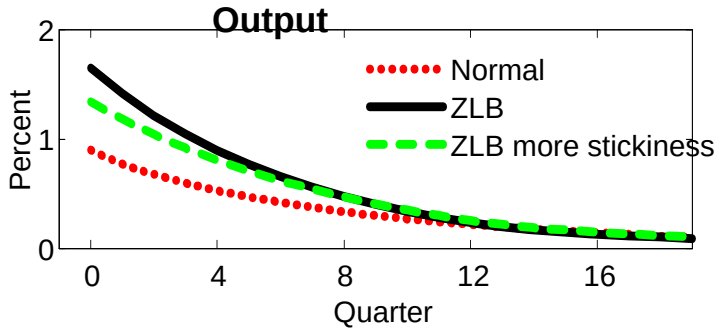

Output Gap
Normal
ZLB
ZLB more stickiness
Percent
Quarter
1.5
1
0.5
0
0
4
8
12
16

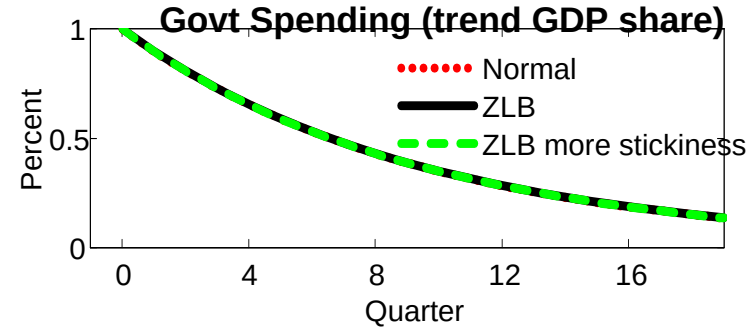

Inflation (APR)
Normal
ZLB
ZLB more stickiness
Percent
Quarter
1.5
1
0.5
0
0
4
8
12
16


Nominal Interest Rate (APR)
Normal
ZLB
ZLB more stickiness
Percent
Quarter
0.4
0.2
0
-0.2
0
4
8
12
16


Real Interest Rate (APR)
Normal
ZLB
ZLB more stickiness
Percent
Quarter
0.5
0
-0.5
-1
0
4
8
12
16


Potential Real Interest Rate (APR)
Normal
ZLB
ZLB more stickiness
Percent
Quarter
1
0.5
0
0
4
8
12
16


Output
Normal
ZLB
ZLB more stickiness
Percent
Quarter
2
1
0
0
4
8
12
16

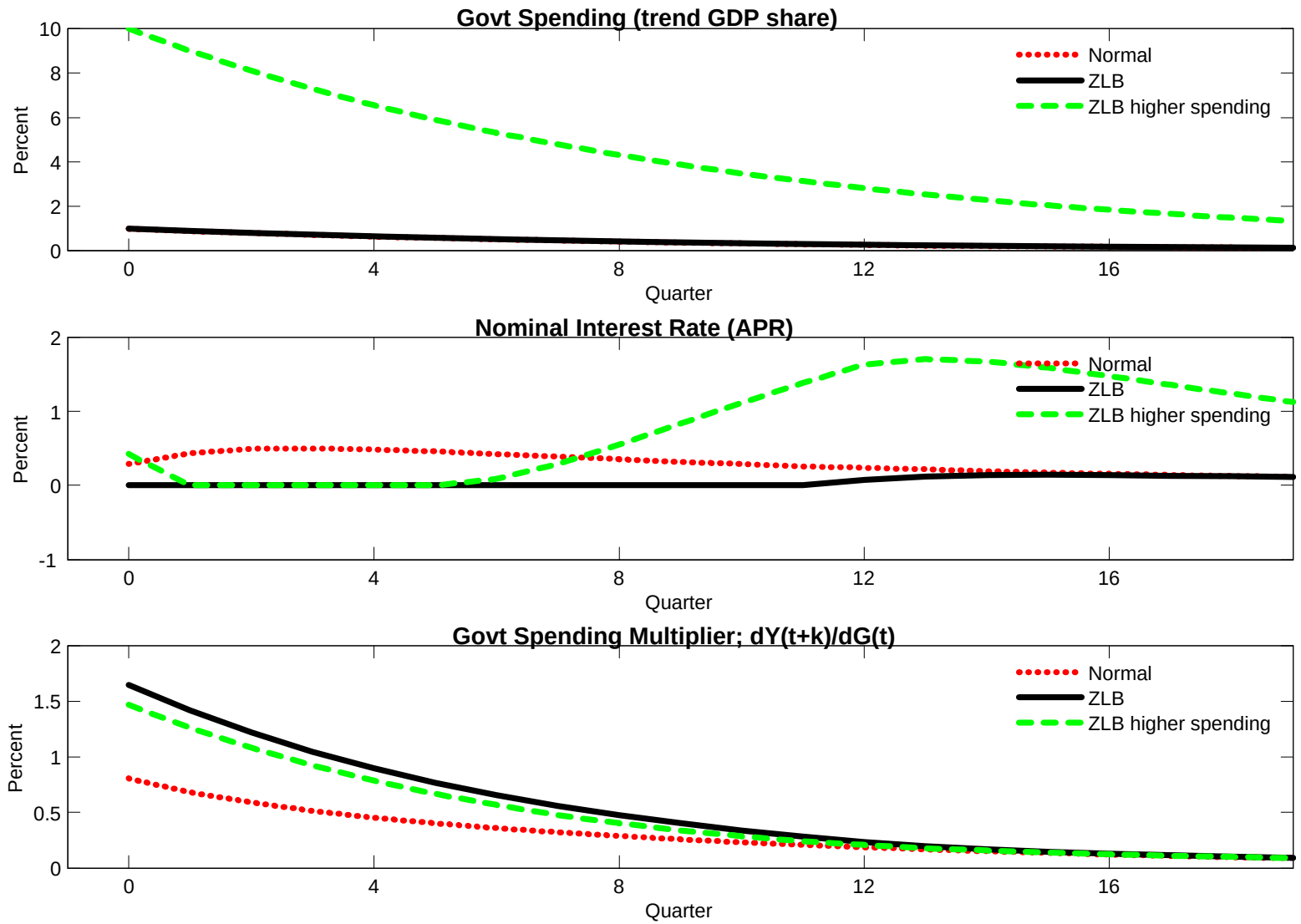

Govt Spending (trend GDP share)
Normal
ZLB
ZLB more stickiness
Percent
Quarter
1
0.5
0
0
4
8
12
16

Liquidity trap duration and size of stimulus

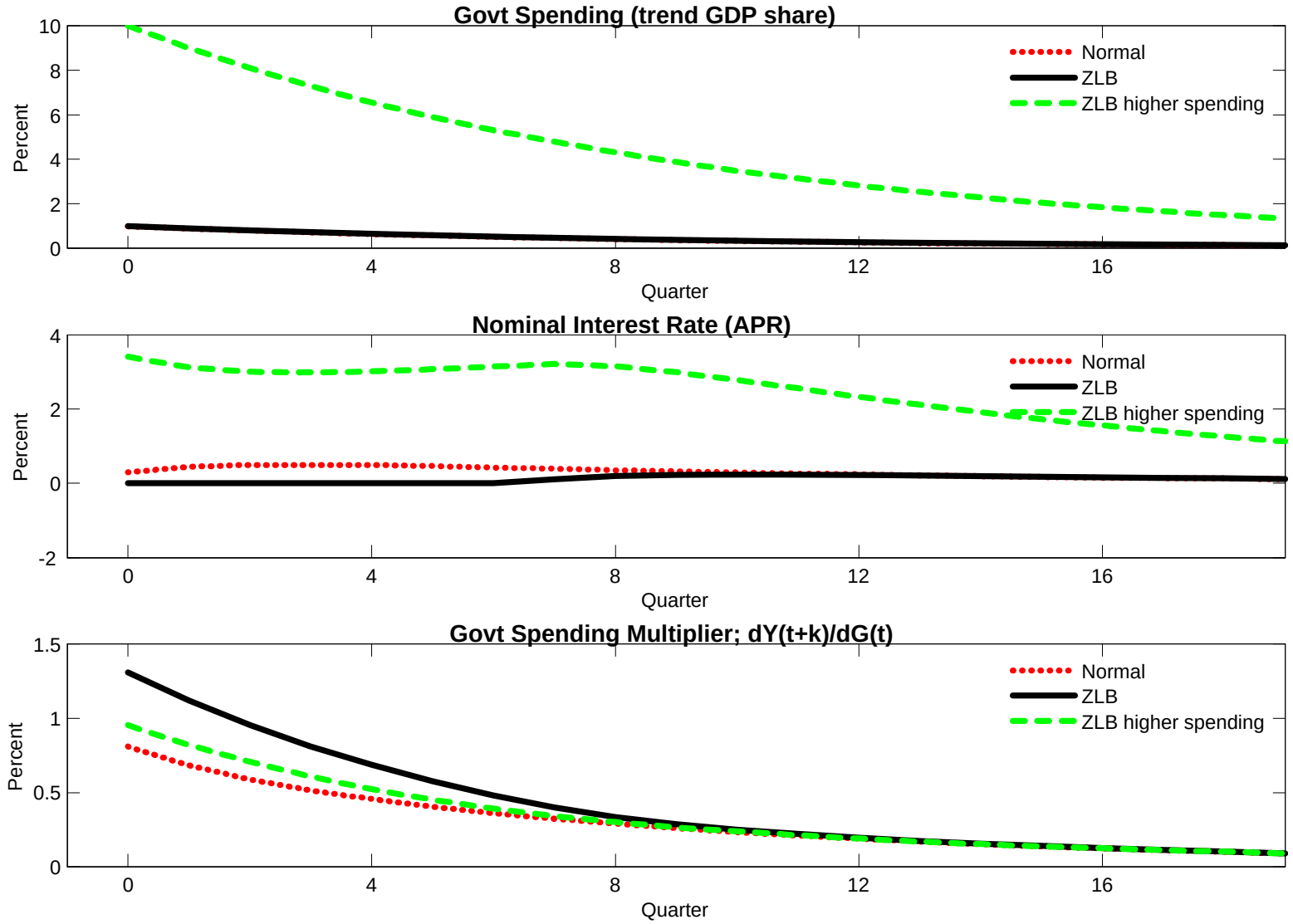
- If the liquidity trap is expected to last for a prolonged period of time, then fiscal mulipliers remain high for plausible levels of stimulus

- If the liquidity trap is expected to be of shorter duration ($\leq 4-6$ quarters), then fiscal multipliers strongly moderated if stimulus too large

- Document this in two figures below, one with benchmark liquidity trap duration (12 quarters), another with lower liquidity trap duration (8 quarters)
  - Compare multipliers for increases in $g_{y,t}$ with 1 and 10 percent
  - Show results for front-loaded intervention, lump-sum taxes, standard policy rule



Benchmark duration case: High multipliers even for large stimulus

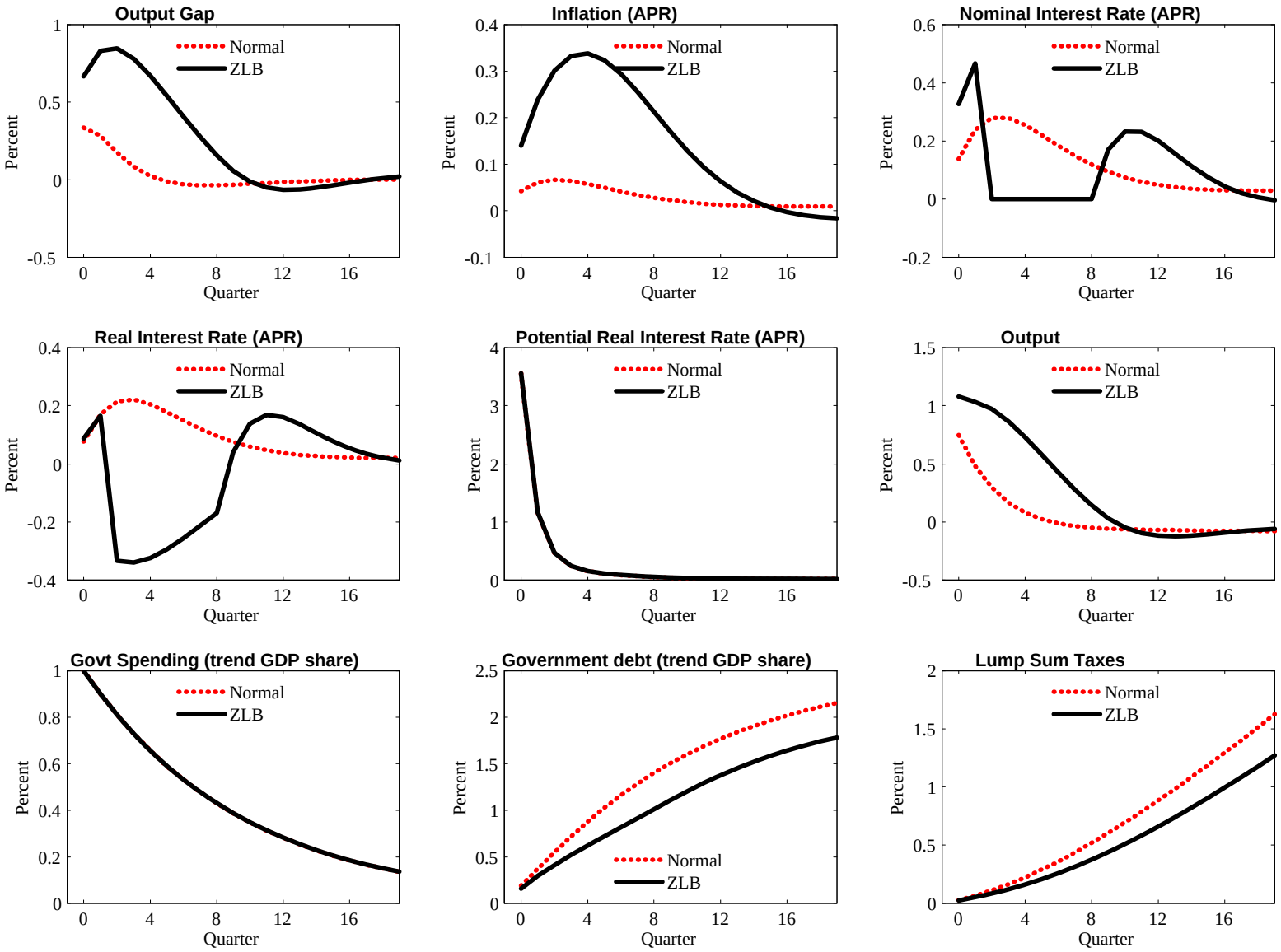


Shorter liquidity trap duration case: Moderated mulitpliers for large stimulus

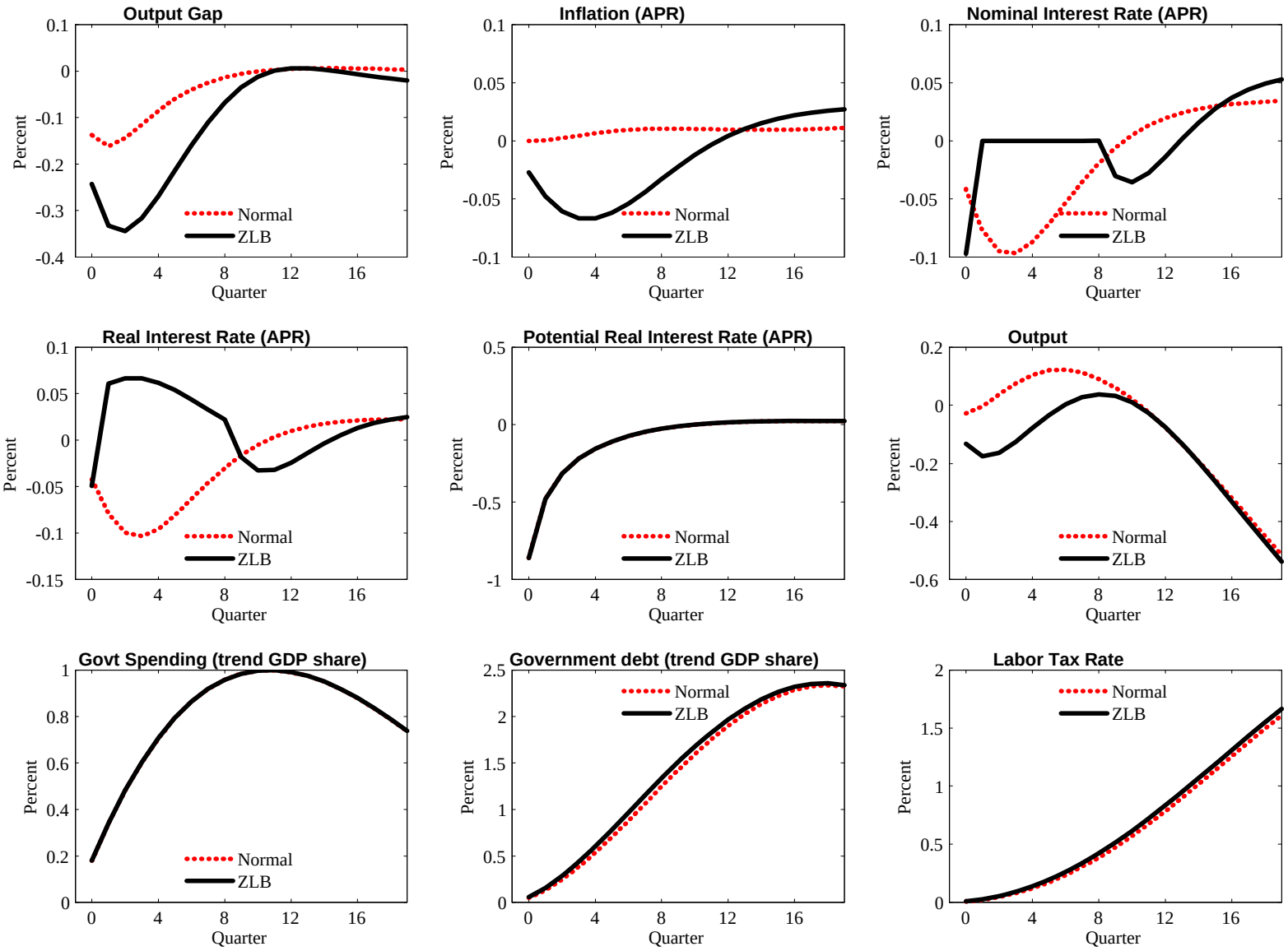
3. Results in the CEE/S-W Model

- Verify that the mechanisms outlined above holds in a a fully fledged DSGE model with capital
  - Nominal price and wage stickiness
  - Habit formation in preferences
  - Adjustment costs of changing investment

- Calibration reflects the empirical findings by CEE and SW, with the exception that the slope of the Phillips curve is lower (following e.g. ALLV and ACEL)
  - In the standard Calvo model, our slope of the Phillips curve implies $\xi_p = 0.9$
- Monetary policy follows a standard policy rule ($\gamma_i = 0.7$, $\gamma_\pi = 3$, $\gamma_x = 0.25$)
  - Assume liquidity trap to last for 8 quarters
- Results show somewhat lower multipliers in the benign case (expected inflation rise by less)
  - Driven by shorter liquidity trap duration and sticky wages


Output Gap
Normal
ZLB
Percent
Quarter
Inflation (APR)
Nominal Interest Rate (APR)
Real Interest Rate (APR)
Potential Real Interest Rate (APR)
Output
Govt Spending (trend GDP share)
Government debt (trend GDP share)
Lump Sum Taxes

- Also in this model, fiscal multipliers are negative when fiscal stimulus is plagued by implementation lags and needs to be financed by distortionary labor income taxes

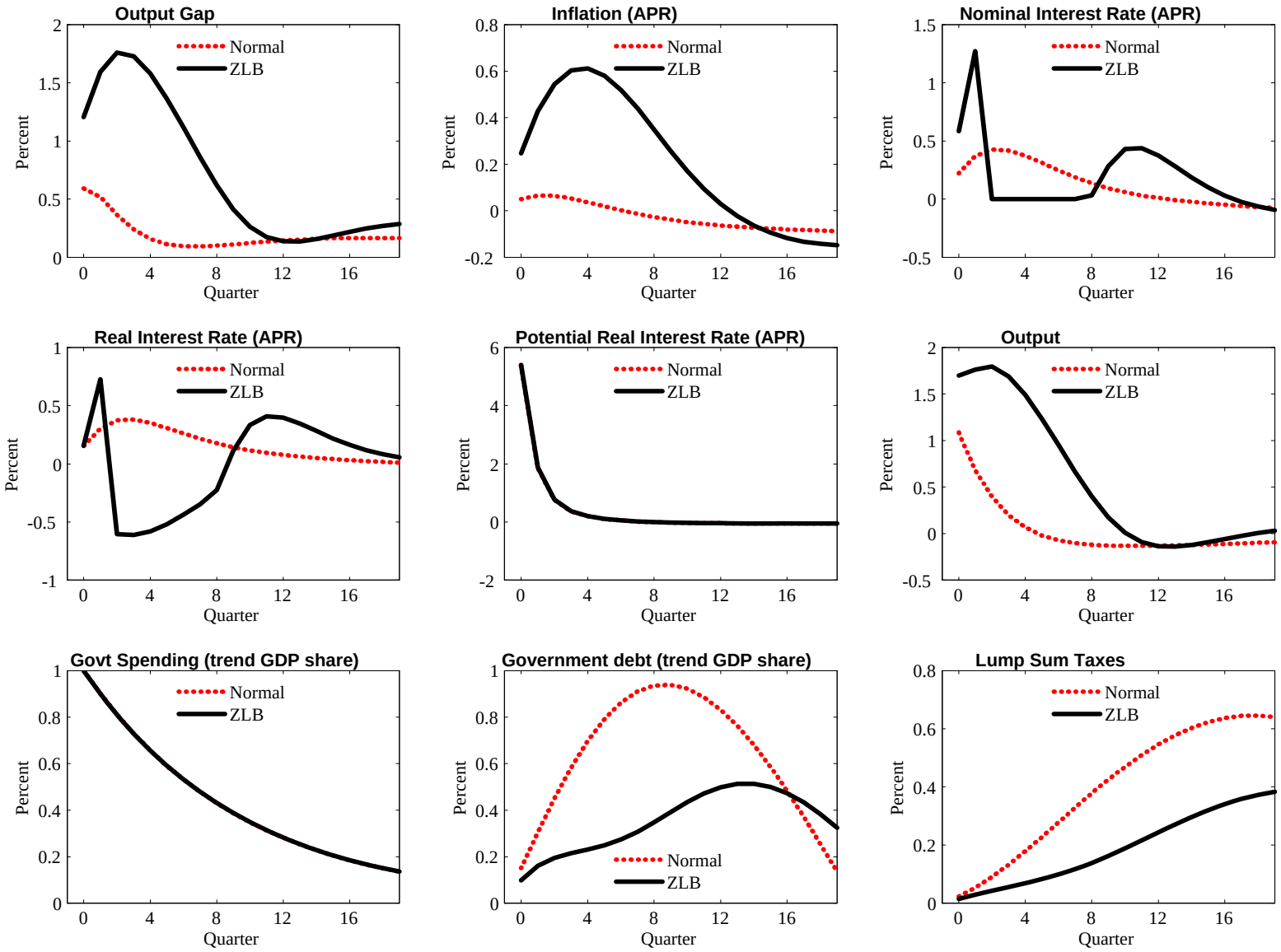

Output Gap
Inflation (APR)
Nominal Interest Rate (APR)
Real Interest Rate (APR)
Potential Real Interest Rate (APR)
Output
Govt Spending (trend GDP share)
Government debt (trend GDP share)
Labor Tax Rate
Percent
Quarter
Normal
ZLB

4. Results in the CEE/SW model with fin. fric. and Keynesian HH

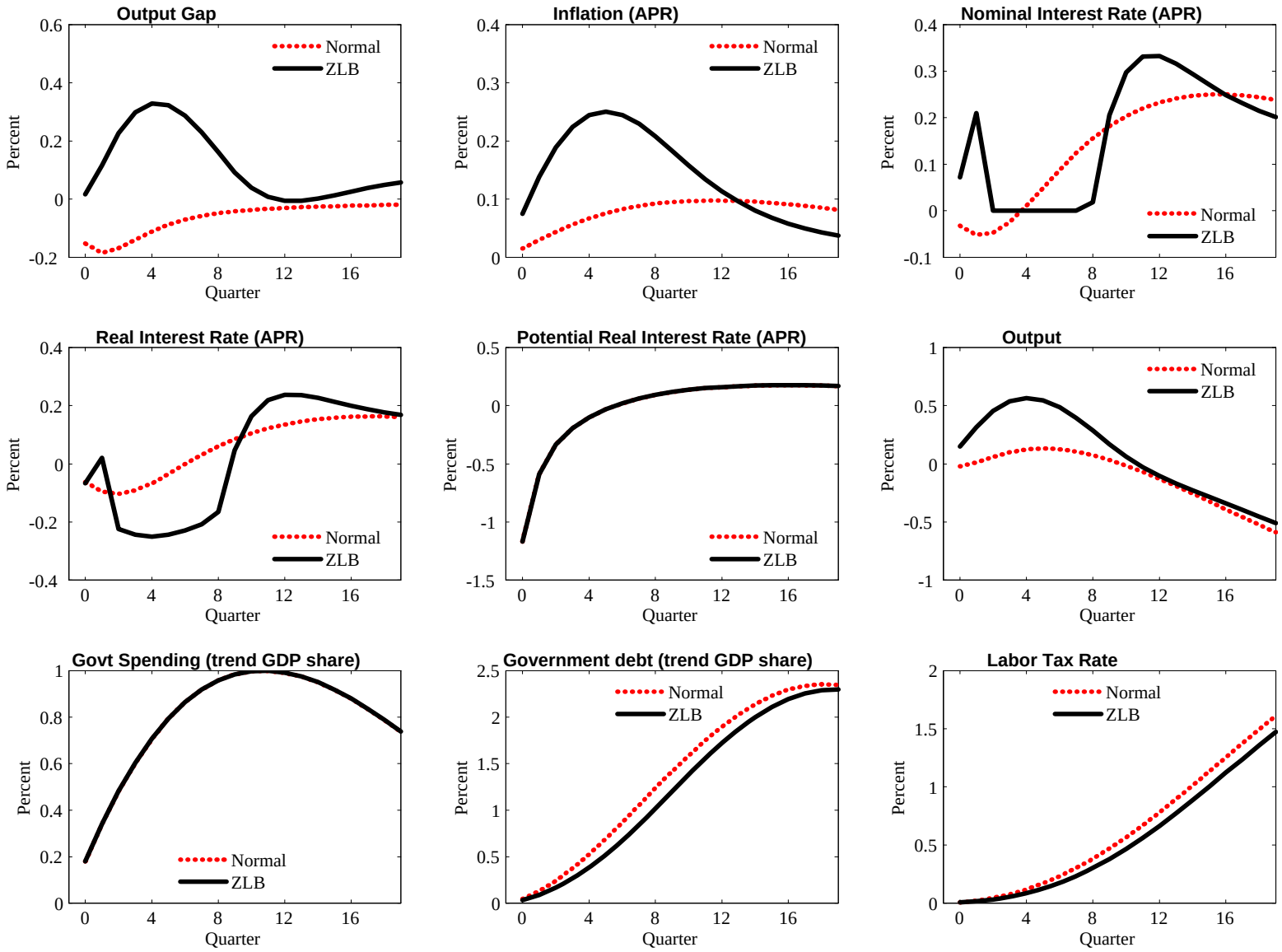
- Introduce financial frictions following Bernanke, Gertler and Gilchrist (1999) and Christiano, Motto and Rostagno (2007)
  - Debt contract between entrepreneurs and banks written in nominal terms
  - Calibration follows BGG
- Introduce Keynesian households following Galí, Lopez-Salido and Vallés (2007) and Erceg, Guerrieri and Gust (2005)
  - Consume their after tax disposal income, set their wage equal to the economy wide average, face same labor demand $=>$ works as much as the average household
  - Set fraction of Keynesian households to 0.5, implies their share of total consumption equals 0.3

- In other respects, model identical to the CEE/SW model

- Results more receptive to the idea that fiscal expansions are stimulative even under implementation lags and distortionary tax financing



Front loaded rise, lump sum taxes

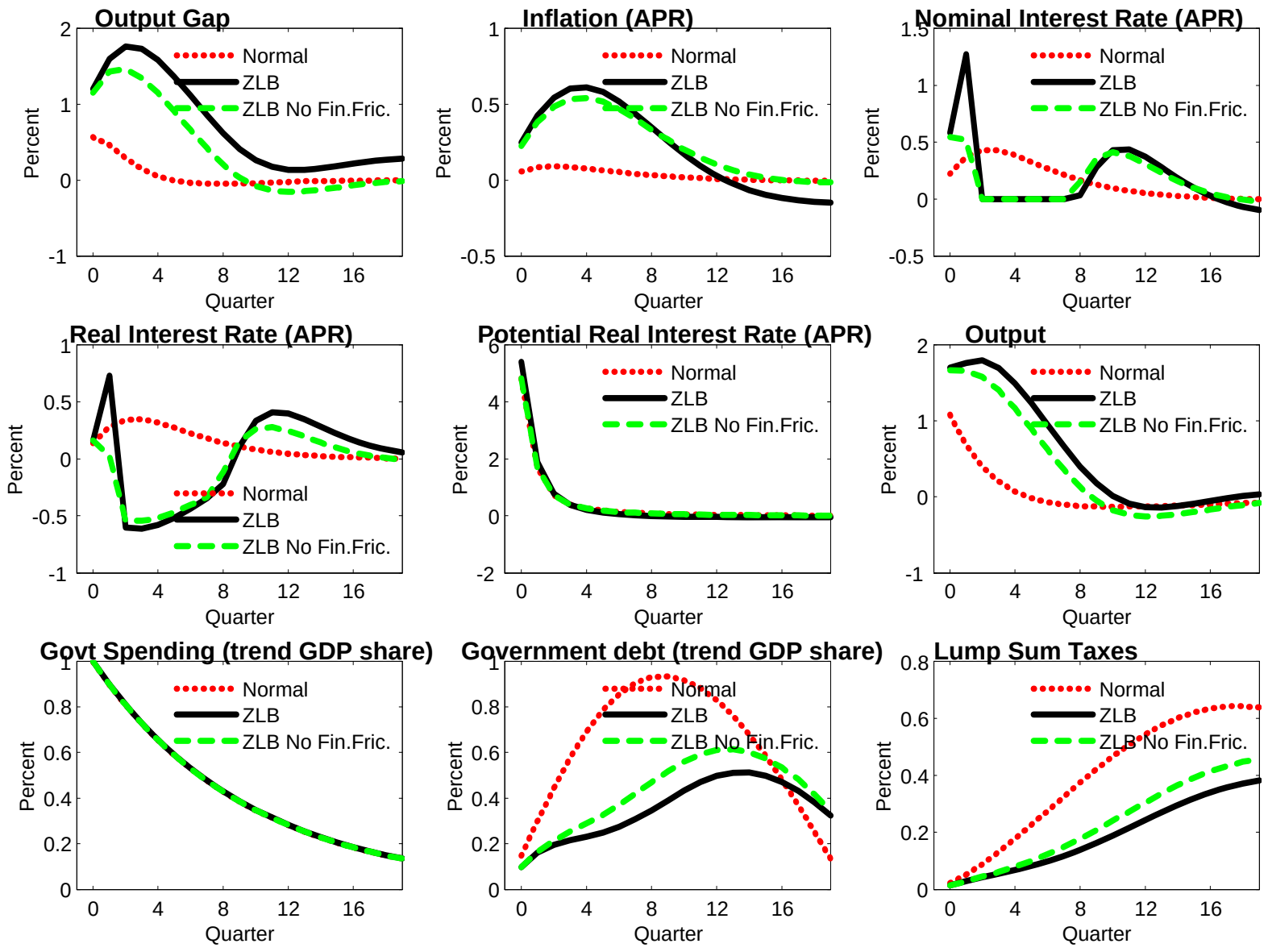


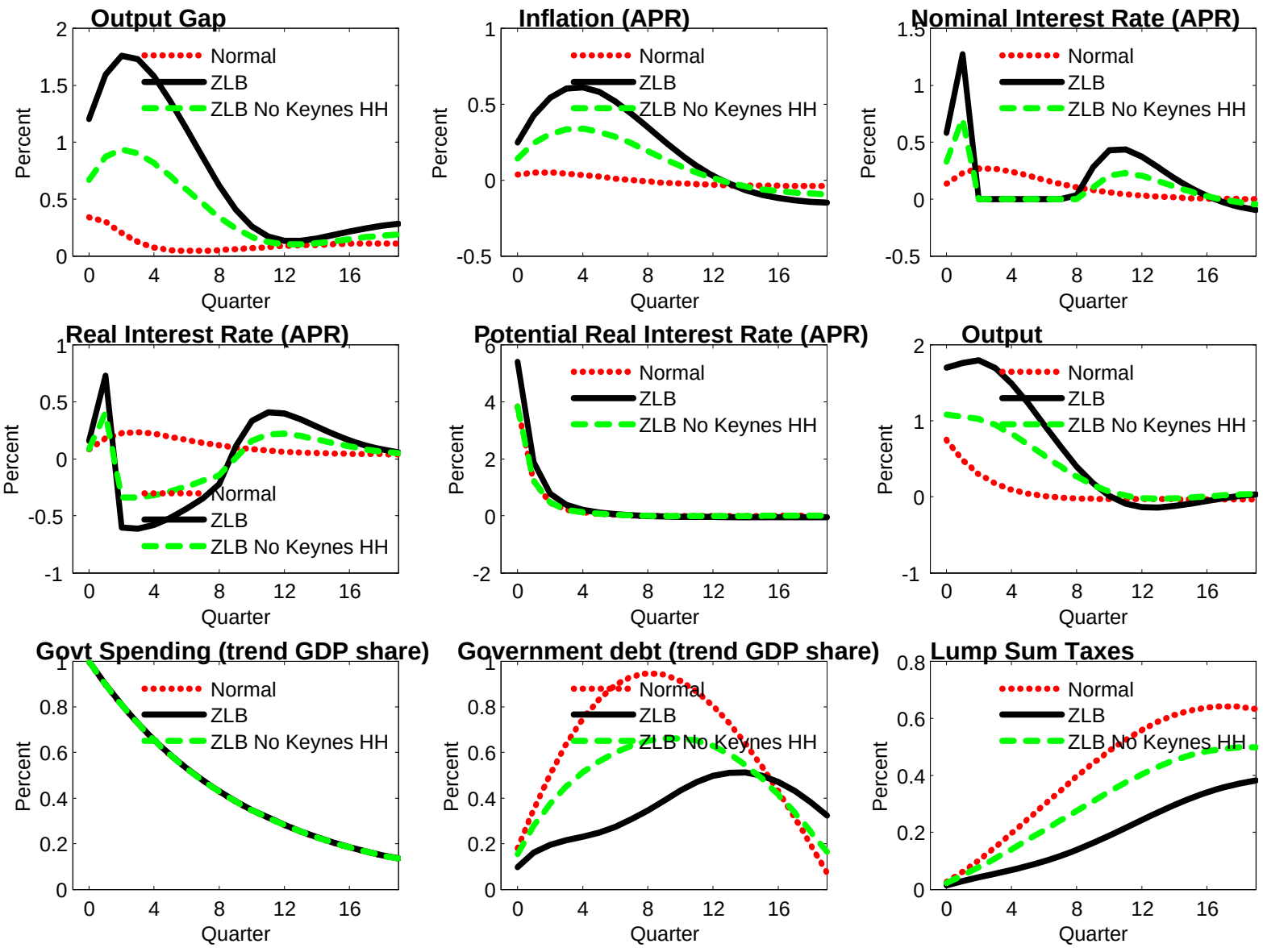
Implementation lags, financing with labor income taxes

Role of financial frictions and Keynesian households

- We now explore the role of financial frictions and Keynesian households for shaping the fiscal multipliers
  - Take out financial frictions and Keynesian households from the model, adjust underlying shock so that duration of liquidity trap is unchanged
  - Show results for front-loaded intervention, lump-sum taxes, standard policy rule

- Our results suggest that
  - For given liquity trap duration, financial frictions do not matter much
  - Keynesian households more important for given liquidity trap duration


Output Gap
Inflation (APR)
Nominal Interest Rate (APR)
Real Interest Rate (APR)
Potential Real Interest Rate (APR)
Output
Govt Spending (trend GDP share)
Government debt (trend GDP share)
Lump Sum Taxes
Normal
ZLB
ZLB No Fin.Fric.
Percent
Quarter


Output Gap
Inflation (APR)
Nominal Interest Rate (APR)
Real Interest Rate (APR)
Potential Real Interest Rate (APR)
Output
Govt Spending (trend GDP share)
Government debt (trend GDP share)
Lump Sum Taxes
Normal
ZLB
ZLB No Keynes HH
Percent
Quarter

5. Concluding remarks

- The spending multiplier can be much larger than normal if the liquidity trap is very persistent, and fiscal stimulus can be rapidly implemented
  - Budgetary costs may be minimal as the large response of output boosts tax revenues, allowing for something close to a "fiscal free lunch."

- However, we caution that the multiplier may be much smaller under plausible implementation lags for many types of public spending,and/or if the liquidity trap lasts less than two years
  - No obvious fiscal free lunch in current environment

- An interesting feature of the estimation exercise is that is will provide a multivariate assessment if expansions in government expenditures are typically front-loaded or plauged by implementation lags
  - Hard to distinguish between alternatives using data on G only