UNDERSTANDING THE EFFECTS OF GOVERNMENT SPENDING ON CONSUMPTION

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Abstract
Recent evidence suggests that consumption rises in response to an increase in government spending. That finding cannot be easily reconciled with existing optimizing business cycle models. We extend the standard new Keynesian model to allow for the presence of rule-of-thumb consumers. We show how the interaction of the latter with sticky prices and deficit financing can account for the existing evidence on the effects of government spending. (JEL: E32, E62)

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Introduction

Effect of an ↑ G

- **Neoclassical Models**

  ↑ output ↑ hours ↓consumption ↓ real wages ↓ or ↑ investment

- **Traditional Keynesian models**

  ↑ output ↑ hours ↑ consumption ↑ real wages ↓ investment

- **New Keynesian Models with a Representative Agent ("RANK"), standard monetary policy**

↑ output ↑ hours ↓consumption ↓ real wages ↓ or ↑ investment

- **Question Asked by this Paper**

  What does a model need to produce a rise in consumption in response to a rise in government spending?

- **Answers**

  - Sticky prices alone are not enough, rule-of-thumb consumers alone are not enough.

  - Necessary features are:

    1. Rule-of-thumb consumers (Campbell-Mankiw (1989) NBER MA).
    2. Variations in the **labor market wedge** (Gali, Gertler, Lopez-Salido (2007), ReStat)

What is the Labor Market Wedge?

In general competitive equilibrium, it should be the case that:

Marginal Product of Labor (MPN) = Marginal Rate of Substitution (MRS)

In logs, the labor wedge is the μ_t such that:

$$mpn_t = \mu_t + mrs_t$$

Using a representative agent utility function, log in consumption, in logs:

$mrs_t = c_t + \varphi n_t$ (up to a constant), where $\varphi > 0$ is the curvature of the disutility of labor.

Using Cobb-Douglas production function, $mpn_t = y_t - n_t$ (up to a constant). So:

$$\mu_t = y_t - n_t - c_t - \varphi n_t$$

Can also decompose the labor wedge into the price markup and the wage markup:

$\mu_t = mpn_t - mrs_t = mpn_t - w_t + (w_t - mrs_t)$ = log price markup + log wage markup

The Labor Market Wedge

$$mpn_t = \mu_t + c_t + \varphi n_t$$

Now, we know that ↑ G → ↑ n → ↓mpn

Thus, left hand side of equation falls.

But the ↑ n causes the right hand side to rise. If μ_t is constant, then c must ↓.

The only way to get both ↑ n and ↑ c is for ↓ μ.

Note: If ↑ G → ↑ n → ↑ mpn because of increasing returns, then you could get ↑ n and ↑ c without a ↓ μ. (Devereux, Head, Lapham JMCB (1996)).

Empirical Motivation

They use the Blanchard-Perotti identification to estimate the effects of government spending shocks.

Issues with their empirical work.

1. Incorrect way of computing multipliers.
2. Claim significance based on standard deviation confidence intervals.
3. Disposable income doesn’t line up with consumption.

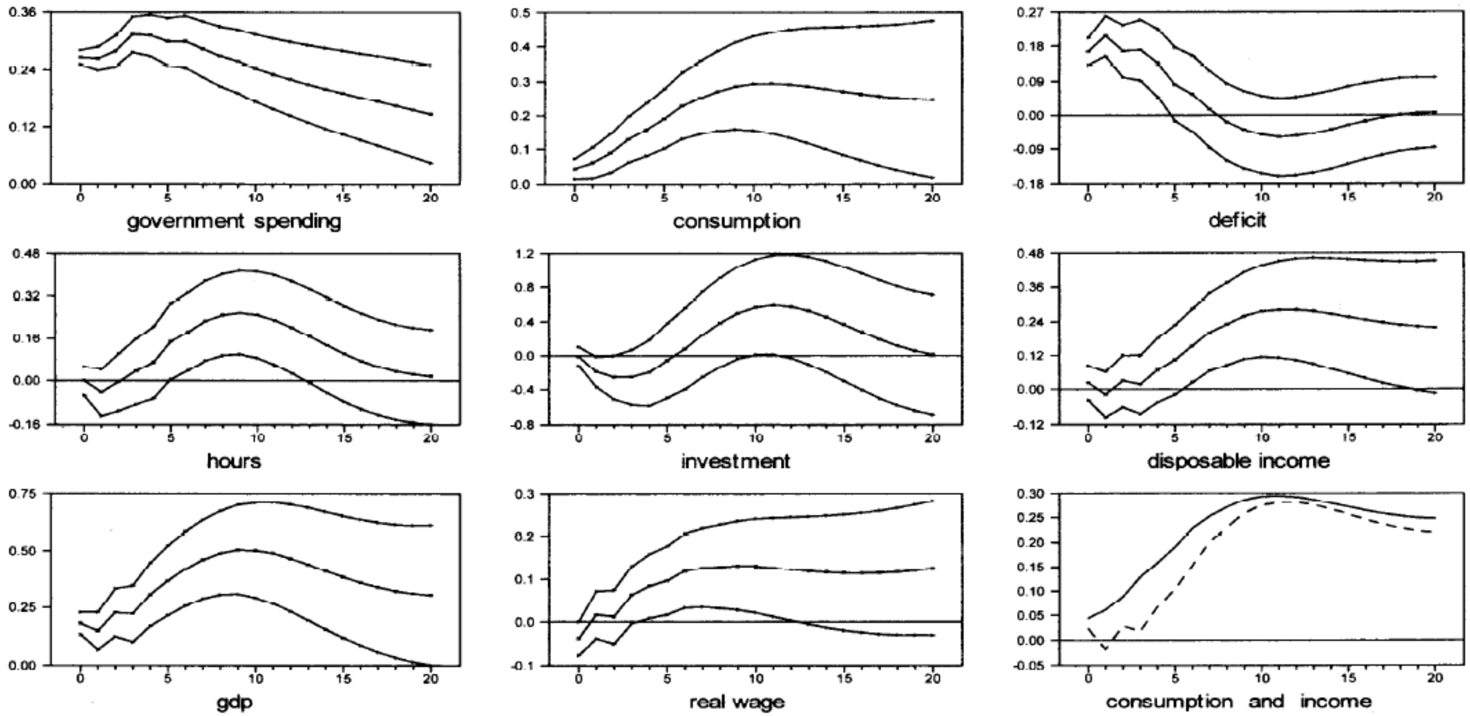


FIGURE 1. The dynamic effects of a government spending shock.

Note: Estimated impulse responses to a government spending shock in the large VAR. Sample Period 1954:I–2003:IV. The horizontal axis represents quarters after the shock. Confidence intervals correspond ±1 standard deviations of empirical distributions, based on 1,000 Monte Carlo replications. The right bottom panel plots the point estimates of both consumption (solid line) and disposable income (dashed line).

TABLE 1. Estimated effects of government spending shocks.

	Estimated Fiscal Multipliers						Implied Fiscal Parameters		
	Output			Consumption					
	1stQ	4thQ	8thQ	1stQ	4thQ	8thQ	ρ_g	ϕ_g	ϕ_b
				1948:I–2003:IV					
Baseline spending									
Small VAR	0.51	0.31	0.28	0.04	0.09	0.19	0.85	0.10	0.10
Larger VAR	0.41	0.31	0.68	0.07	0.11	0.49	0.80	0.06	0.06
Excluding military									
Small VAR	0.15	-0.12	0.34	-0.11	0.24	0.32	0.95	0.005	0.60
Larger VAR	0.36	0.62	1.53	0.03	0.51	0.68	0.94	0.005	0.60
				1954:I–2003:IV					
Baseline spending									
Small VAR	0.74	0.75	1.22	0.14	0.46	0.73	0.95	0.13	0.20
Larger VAR	0.68	0.70	1.74	0.17	0.29	0.95	0.95	0.10	0.30
Excluding military									
Small VAR	0.63	1.95	2.60	0.25	1.41	1.12	0.95	0.05	0.50
Larger VAR	0.74	2.37	3.50	0.37	1.39	1.76	0.95	0.01	0.50
				1960:I–2003:IV					
Baseline spending									
Small VAR	0.91	1.05	1.32	0.19	0.59	0.84	0.95	0.13	0.20
Larger VAR	0.81	0.44	0.76	0.20	0.25	0.45	0.95	0.08	0.20
Excluding military									
Small VAR	0.72	1.14	1.19	0.17	0.78	0.68	0.94	0.03	0.50
Larger VAR	1.13	1.89	2.08	0.40	1.14	1.07	0.98	0.01	0.55

Note: Large VAR corresponds to the 8-variable VAR described in the text; Small VAR estimates are based on a 4-variable VAR including government spending, output, consumption, and the deficit. Government spending excluding military was obtained as GFNEH + GSEH + GFNIH + GSIH. For each specification ρ_g is the AR(1) coefficient that matches the half-life of the estimated government spending response. Parameter ϕ_g is obtained as the difference of the VAR-estimated impact effects of government spending and deficit, respectively. Finally, given ρ_g and ϕ_g, we calibrate the parameter ϕ_b such that the dynamics of government spending (21) and debt (37) are consistent with the horizon at which the deficit is back to steady state, matching our empirical VAR responses of the fiscal deficit.

3. A New Keynesian Model with Rule-of-Thumb Consumers

The economy consists of two types of households, a continuum of firms producing differentiated intermediate goods, a perfectly competitive firm producing a final good, a central bank in charge of monetary policy, and a fiscal authority. Next we describe the objectives and constraints of the different agents. Except for the presence of rule-of-thumb consumers, our framework consists of a standard dynamic stochastic general equilibrium model with staggered price setting à la Calvo.[19]

3.1. Households

We assume a continuum of infinitely lived households, indexed by $i \in [0, 1]$. A fraction $1 - \lambda$ of households have access to capital markets where they can trade a full set of contingent securities, and buy and sell physical capital (which they accumulate and rent out to firms). We use the term *optimizing* or *Ricardian* to refer to that subset of households. The remaining fraction λ of households do not own any assets nor have any liabilities, and just consume their current labor income. We refer to them as *rule-of-thumb* households. Different interpretations for that behavior include myopia, lack of access to capital markets, fear of saving, ignorance of intertemporal trading opportunities, and so forth. Our assumptions imply an admittedly extreme form of *non-Ricardian* behavior among *rule-of-thumb* households, but one that captures in a simple and parsimonious way some of the existing evidence, without invoking a specific explanation. Campbell

Optimizing households. Let C_t^o, and L_t^o represent consumption and leisure for optimizing households. Preferences are defined by the discount factor $\beta \in (0, 1)$ and the period utility $U(C_t^o, L_t^o)$. A typical household of this type seeks to maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t U(C_t^o, N_t^o), \tag{1}$$

subject to the sequence of budget constraints

$$P_t(C_t^o + I_t^o) + R_t^{-1} B_{t+1}^o = W_t P_t N_t^o + R_t^k P_t K_t^o + B_t^o + D_t^o - P_t T_t^o \tag{2}$$

and the capital accumulation equation

$$K_{t+1}^o = (1 - \delta) K_t^o + \phi\left(\frac{I_t^o}{K_t^o}\right) K_t^o. \tag{3}$$

At the beginning of the period the consumer receives labor income $W_t P_t N_t^o$, where W_t is the real wage, P_t is the price level, and N_t^o denotes hours of work. He also receives income from renting his capital holdings K_t^o to firms at the (real) rental cost R_t^k. B_t^o is the quantity of nominally riskless one-period bonds carried over from period $t-1$, and paying one unit of the numéraire in period t. R_t denotes the gross nominal return on bonds purchased in period t. D_t^o are dividends from ownership of firms, T_t^o denotes lump-sum taxes (or transfers, if negative) paid by these consumers. C_t^o and I_t^o denote, respectively, consumption and investment expenditures, in real terms. P_t is the price of the final good. Capital adjustment costs are introduced through the term $\phi(I_t^o/K_t^o)K_t^o$, which determines the change in the capital stock induced by investment spending I_t^o. We assume $\phi' > 0$, and $\phi'' \leq 0$, with $\phi'(\delta) = 1$, and $\phi(\delta) = \delta$.

In what follows we specialize the period utility—common to *all* households—to take the form

$$U(C, L) \equiv \log C - \frac{N^{1+\varphi}}{1+\varphi},$$

where $\varphi \geq 0$.

We consider two alternative labor market structures. First we assume a competitive labor market, with each household choosing the quantity of hours supplied given the market wage. In that case the optimality conditions must be supplemented with the first-order condition

$$W_t = C_t^o (N_t^o)^{\varphi}. \tag{8}$$

Under our second labor market structure wages are set in a centralized manner by an economy-wide union. In that case hours are assumed to be determined by firms (instead of being chosen optimally by households), given the wage set by the union. Households are willing to meet the demand from firms, under the assumption that wages always remain above all households' marginal rate of substitution. In that case condition (8) no longer applies. We refer the reader to Section 3.6 and Appendix A for a detailed description of the labor market under this alternative assumption.

Rule-of-thumb households. Rule-of-thumb households are assumed to behave in a "hand-to-mouth" fashion, fully consuming their current labor income. They do not smooth their consumption path in the face of fluctuations in labor income, nor do they intertemporally substitute in response to changes in interest rates. As noted we do not take a stand on the sources of that behavior, though one may possibly attribute it to a combination of myopia, lack of access to financial markets, or (continuously) binding borrowing constraints.

Their period utility is given by

$$U(C_t^r, L_t^r), \tag{9}$$

and they are subject to the budget constraint

$$P_t C_t^r = W_t P_t N_t^r - P_t T_t^r. \tag{10}$$

Accordingly, the level of consumption will equate labor income net of taxes:

$$C_t^r = W_t N_t^r - T_t^r. \tag{11}$$

Notice that we allow taxes paid by rule-of-thumb households (T_t^r) to differ from those of the optimizing households (T_t^o). Under the assumption of a competitive labor market, the labor supply of rule-of-thumb households must satisfy

$$W_t = C_t^r (N_t^r)^{\varphi}. \tag{12}$$

Alternatively, when the wage is set by a union, hours are determined by firms' labor demand, and (8) does not apply. Again we refer the reader to the subsequent discussion.

A.2. *Wage-Setting by Unions*

Consider a model with a continuum of unions, each of which represents workers of a certain type. Effective labor input hired by firm j is a CES function of the quantities of the different labor types employed,

$$N_t(j) = \left(\int_0^1 N_t(j,i)^{\frac{\varepsilon_w - 1}{\varepsilon_w}} di \right)^{\frac{\varepsilon_w}{\varepsilon_w - 1}},$$

where ε_w is the elasticity of substitution across different types of households. The fraction of rule-of-thumb and Ricardian consumers is uniformly distributed across worker types (and hence across unions). Each period, a typical union (say, representing worker of type z) sets the wage for its workers in order to maximize the objective function

$$\lambda\left[\frac{1}{C_t^r(z)} W_t(z) N_t(z) - \frac{N_t^{1+\varphi}(z)}{1+\varphi}\right] + (1-\lambda)\left[\frac{1}{C_t^o(z)} W_t(z) N_t(z) - \frac{N_t^{1+\varphi}(z)}{1+\varphi}\right],$$

subject to a labor demand schedule

$$N_t(z) = \left(\frac{W_t(z)}{W_t}\right)^{-\varepsilon_w} N_t .$$

Because consumption will generally differ between the two types of consumers, the union weighs labor income with their respective marginal utility of consumption (i.e., $1/C_t^r$ and $1/C_t^o$). Notice that, in writing down the problem, we have assumed that the union takes into account the fact that firms allocate labor demand uniformly across different workers of type z, independently of their household type. It follows that, in the aggregate, we will have $N_t^r = N_t^o = N_t$ for all t.

Aggregation. Aggregate consumption and hours are given by a weighted average of the corresponding variables for each consumer type. Formally,

$$C_t \equiv \lambda C_t^r + (1-\lambda) C_t^o \tag{13}$$

and

$$N_t \equiv \lambda N_t^r + (1-\lambda) N_t^o. \tag{14}$$

Similarly, aggregate investment and the capital stock are given by

$$I_t \equiv (1-\lambda) I_t^o$$

and

$$K_t \equiv (1-\lambda) K_t^o.$$

3.2. Firms

We assume a continuum of monopolistically competitive firms producing differentiated intermediate goods. The latter are used as inputs by a (perfectly competitive) firm producing a single final good.

Price setting. Intermediate firms are assumed to set nominal prices in a staggered fashion, according to the stochastic time dependent rule proposed by Calvo (1983). Each firm resets its price with probability $1-\theta$ each period, independently of the time elapsed since the last adjustment. Thus, each period a measure $1-\theta$ of producers reset their prices, while a fraction θ keep their prices unchanged.

3.3. Monetary Policy

In our baseline model the central bank is assumed to set the nominal interest rate $r_t \equiv R_t - 1$ every period according to a simple linear interest rate rule:

$$r_t = r + \phi_\pi \pi_t, \tag{18}$$

where $\phi_\pi \geq 0$ and r is the steady state nominal interest rate. An interest rate rule of the form (18) is the simplest specification in which the conditions for indeterminacy and their connection to the Taylor principle can be analyzed. Notice that it is a particular case of the celebrated Taylor rule (1993), corresponding to a zero coefficient on the output gap, and a zero inflation target. Rule (18) is said to satisfy the Taylor principle if and only if $\phi_\pi > 1$. As is well known, in the absence of rule-of-thumb consumers, that condition is necessary and sufficient to guarantee the uniqueness of equilibrium.[23]

3.4. Fiscal Policy

The government budget constraint is

$$P_t T_t + R_t^{-1} B_{t+1} = B_t + P_t G_t, \tag{19}$$

where $T_t \equiv \lambda\, T_t^r + (1-\lambda)\, T_t^o$. Letting $g_t \equiv (G_t - G)/Y$, $t_t \equiv (T_t - T)/Y$, and $b_t \equiv ((B_t/P_{t-1}) - (B/P))/Y$, we henceforth assume a fiscal policy rule of the form

$$t_t = \phi_b b_t + \phi_g g_t, \tag{20}$$

where ϕ_b and ϕ_g are positive constants.

Finally, government purchases (in deviations from steady state, and normalized by steady state output) are assumed to evolve exogenously according to a first order autoregressive process

$$g_t = \rho_g g_{t-1} + \varepsilon_t, \tag{21}$$

5. The Effects of Government Spending Shocks

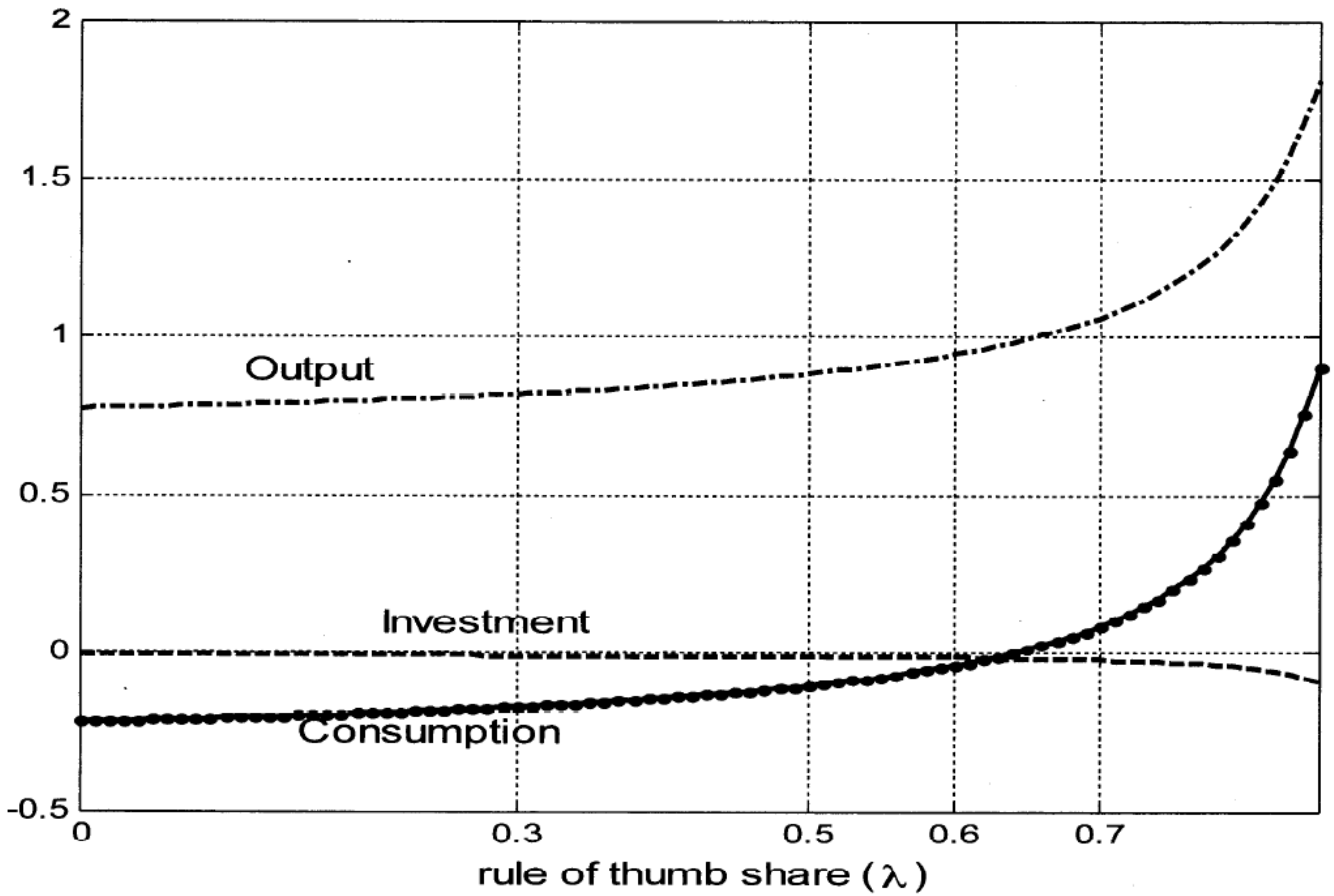
In the present section we analyze the effects of shocks to government spending in the model economy described above. In particular, we focus on the conditions under which an exogenous increase in government spending has a positive effect on consumption, as found in much of the existing evidence. Throughout we restrict ourselves to configurations of parameter values for which the equilibrium is unique.

Figure 3 shows the contemporaneous response of output, consumption, and investment (all normalized by steady state output) to a positive government spending shock, as a function of λ, the fraction of rule-of-thumb consumers. The size of the shock is normalized to a 1% of steady state output. Given our normalizations, the plotted values can be interpreted as impact multipliers. We restrict the range of λ values considered to those consistent with a unique equilibrium. The remaining parameters are kept at their baseline values. Figure 3(A) corresponds to the economy with competitive labor markets, Figure 3(B) to its imperfectly competitive counterpart. In the former case, consumption declines for most values of λ con-

FIGURE 3. Impact multipliers: sensitivity to λ.

Note: Baseline calibration for remaining parameters.

A. Competitive Labor Market



B. Non-Competitive Labor Market

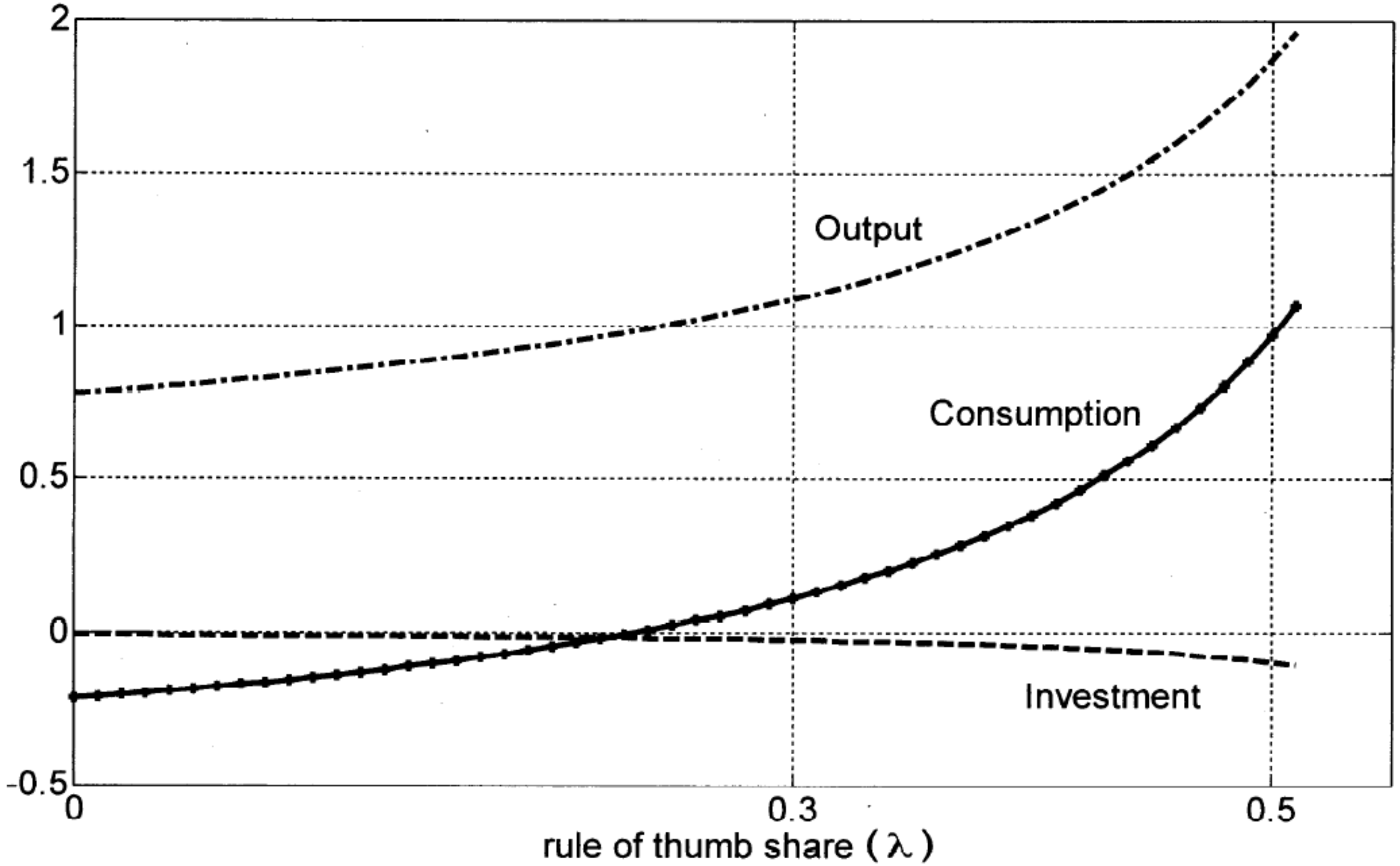


Figure 4 displays the dynamic responses of some key variables in our model to a positive government spending shock under the baseline calibration, and compares them to those generated by a neoclassical economy. The latter corresponds to a particular calibration of our model, with no price rigidities and no rule-of-thumb consumers ($\theta = \lambda = 0$). Again we consider two alternative labor market structures, competitive and non-competitive. In each case the top-left graph displays the pattern of the three fiscal variables (spending, taxes, and the deficit) in response to the shock considered. Notice that the pattern of both variables is close to the one estimated in the data (see Figure 1), consistently with our calibration of the fiscal policy rule. The figure illustrates the amplifying effects of the introduction of rule-of-thumb consumers and sticky prices: The response of output and consumption is systematically above that generated by the neoclassical model.[27]

A. Competitive Labor Market

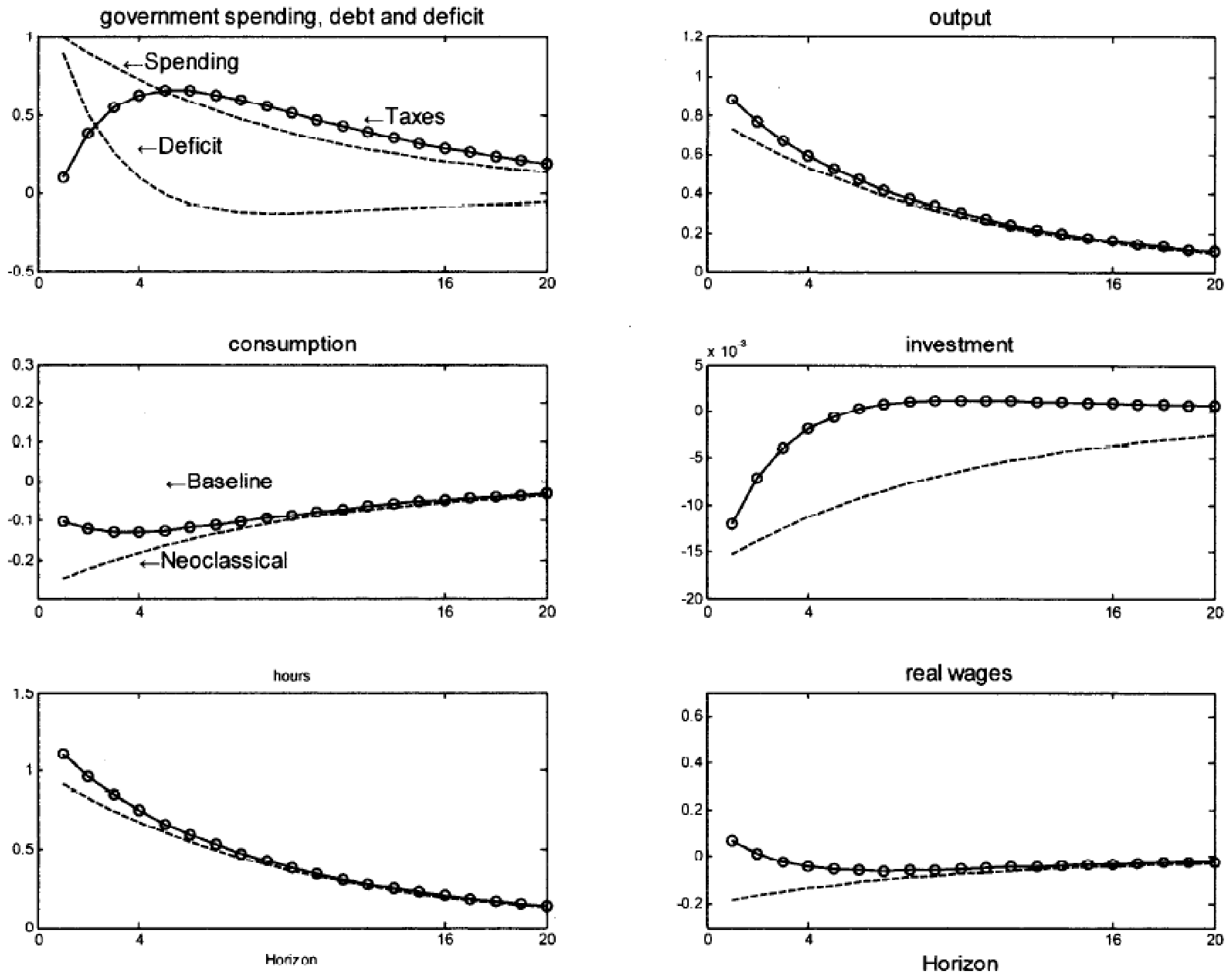
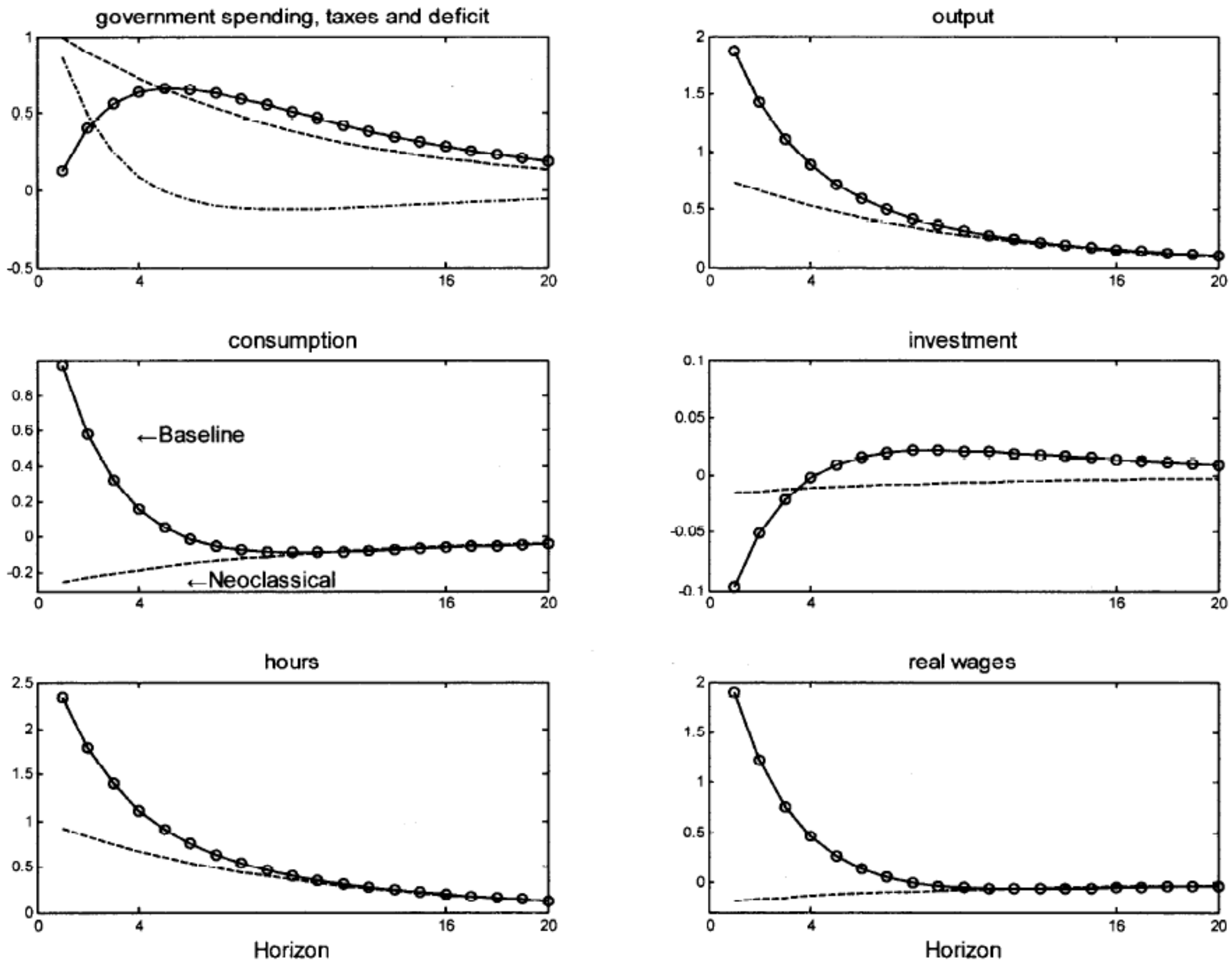


FIGURE 4. The dynamic effects of a government spending shock: baseline vs. neoclassical models.

Note: Baseline calibration (continuous), neoclassical calibration (dashed).

B. Non-Competitive Labor Market



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