Appendix to

"Technology Shocks and Labor Market Dynamics: Some Evidence and Theory"

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In this appendix, we examine the robustness of the results in the paper "Technology Shocks and Labor Market Dynamics: Some Evidence and Theory."

1 The Baseline Model

The economy is populated by a large number of households, each endowed with a differentiated labor skill indexed by $i \in [0,1]$; a large number of firms, each producing a differentiated product indexed by $j \in [0,1]$; and a monetary authority. Households each derives utility from consumption, real money balances, and leisure time. The consumption basket is a composite of differentiated products. Production of each type of good requires a composite of differentiated labor skills as input and is subject to a productivity shock that is common to all firms.

Denote by N_t a composite of differentiated labor skills $N_t(i)$ for $i \in [0,1]$ such that $N_t = \left[\int_0^1 N_t(i)^{(\varepsilon_w-1)/\varepsilon_w} di\right]^{\varepsilon_w/(\varepsilon_w-1)}$, and by Y_t a composite of differentiated goods $Y_t(j)$ for $j \in [0,1]$ so that $Y_t = \left[\int_0^1 Y_t(j)^{(\varepsilon_p-1)/\varepsilon_p} dj\right]^{\varepsilon_p/(\varepsilon_p-1)}$, where $\varepsilon_w \in (1,\infty)$ is the elasticity of substitution between differentiated skills and $\varepsilon_p \in (1,\infty)$ is that between differentiated goods. The composite skill and the composite good are both produced in an aggregation sector that is perfectly competitive. The demand functions for labor skill i and for good j are given by

$$N_t^d(i) = \left[\frac{W_t(i)}{W_t}\right]^{-\varepsilon_w} N_t, \quad Y_t^d(j) = \left[\frac{P_t(j)}{P_t}\right]^{-\varepsilon_p} Y_t, \tag{1}$$

where the wage rate W_t of the composite skill is related to the wage rates $\{W_t(i)\}_{i\in[0,1]}$ of the differentiated skills by $W_t = \left[\int_0^1 W_t(i)^{1-\varepsilon_w} di\right]^{1/(1-\varepsilon_w)}$ and the price P_t of the composite good is related to the prices $\{P_t(j)\}_{j\in[0,1]}$ of the differentiated goods by $P_t = \left[\int_0^1 P_t(j)^{1-\varepsilon_p} dj\right]^{1/(1-\varepsilon_p)}$.

Household $i \in [0,1]$ has a utility function

$$\mathrm{E}\sum_{t=0}^{\infty}\beta^t\left[\log(C_t(i) - bC_{t-1}) + \Phi\log\left(\frac{M_t(i)}{P_t}\right) - v(N_t^d(i))\right], \tag{2}$$

where E is an expectations operator, $\beta \in (0,1)$ is a subjective discount factor, $C_t(i)$ is individual consumption, C_{t-1} is past-period aggregate consumption (i.e., habit), $b > 0$ measures the relative importance of habit, $M_t(i)/P_t$ is real money balances, $N_t^d(i)$ is the demand schedule for the household's labor skills given by (1), and $v(N)$ is a strictly increasing and strictly convex function that measures the disutility of working. The preference representation here features "catching up with the Joneses" in the spirit of Abel (1990) and Campbell and Cochrane (1999).[1]

The household faces a budget constraint

$$P_tC_t(i) + M_t(i) + \mathrm{E}_tD_{t,t+1}B_{t+1}(i) \leq W_t(i)N_t^d(i) + \Pi_t(i) + M_{t-1}(i) + B_t(i) + T_t(i), \tag{3}$$

where $B_{t+1}(i)$ denotes the household's holdings of a one-period state-contingent nominal bond that pays off one dollar in period $t+1$ if a particular event is realized, $D_{t,t+1}$ is the period-t price of such bonds divided by the probability of the appropriate state, $\Pi_t(i)$ is the household's claim to firms' profits, and $T_t(i)$ is a lump-sum transfer from the monetary authority.

Each household maximizes (2) subject to (3) and a borrowing constraint $B_{t+1}(i) \geq -\underline{B}$, for some large positive number $\underline{B}$. The initial conditions on bonds and money are given. Households are price takers in the goods market and monopolistic competitors in the labor market, where they set nominal wages, taking the demand schedule in (1) as given. Wage-setting decisions are staggered in the spirit of Calvo (1983). In particular, in period t, all households observe an i.i.d. random signal that determines whether or not they can set a new wage rate. The probability that a household can set a new wage rate is $1-\alpha_w$. By the law of large numbers, a fraction $1-\alpha_w$ of all households can set new wages in a given period. At date t, if a household i can set a new wage, then the optimal choice of its nominal wage is given by

$$W_t^*(i) = \mu_w\frac{\mathrm{E}_t\sum_{\tau=t}^{\infty}\alpha_w^{\tau-t}D_{t,\tau}MRS_\tau(i)N_\tau^d(i)}{\mathrm{E}_t\sum_{\tau=t}^{\infty}\alpha_w^{\tau-t}D_{t,\tau}N_\tau^d(i)}, \tag{4}$$

where $\mu_w = \varepsilon_w/(\varepsilon_w - 1)$ is the steady-state wage markup, and MRS denotes the marginal rate of substitution between leisure and income. The optimal wage is thus a constant markup over

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[1] Alternatively, one could postulate internal habit formation by replacing past aggregate consumption by past individual consumption. Our quantitative results are not sensitive to this alternative formulation. We prefer the external-habit specification here since it is analytically simpler.

a weighted average of the MRS's in the current and future periods during which the wage is expected to remain in effect.

Production of a type-j good requires the composite labor as input, with a constant-returns production function described by

$$Y_t(j) = A_t N_t(j), \tag{5}$$

where A_t denotes a productivity shock that is common to all firms, and $N_t(j)$ is the composite labor used by firm j. The shock follows a random-walk process given by $A_t = A_{t-1}\exp(\varepsilon_t)$, where ε_t is an i.i.d. normal process, with a zero mean and a finite variance.

Firms are price-takers in the input markets and monopolistic competitors in the product markets, where they set prices for their differentiated products, taking the demand schedules in (1) as given. Similar to households' wage-setting decisions, firms' price-setting decisions are staggered in the spirit of Calvo (1983), with the probability for each firm to set a new price given by $1-\alpha_p$. If a firm j can set a new price in period t, it chooses $P_t(j)$ to maximize an expected present value of its profits $\mathrm{E}_t \sum_{\tau=t}^{\infty} \alpha_p^{\tau-t} D_{t,\tau}[P_t(j) - V_\tau] Y_\tau^d(j)$, where $V_\tau = W_\tau / A_\tau$ is the unit production cost, and $Y_\tau^d(j)$ is the demand schedule described in (1). Solving the profit maximizing problem results in an optimal pricing decision rule

$$P_t^*(j) = \mu_p \frac{\mathrm{E}_t \sum_{\tau=t}^{\infty} \alpha_p^{\tau-t} D_{t,\tau} V_\tau Y_\tau^d(j)}{\mathrm{E}_t \sum_{\tau=t}^{\infty} \alpha_p^{\tau-t} D_{t,\tau} Y_\tau^d(j)}, \tag{6}$$

where $\mu_p = \varepsilon_p/(\varepsilon_p - 1)$ measures the steady-state markup. The optimal price is thus a markup over a weighted average of the marginal costs in the current and future periods during which the price is expected to remain in effect.

Regardless of whether or not they can set new prices, all firms solve their cost-minimizing problems, taking the input price (i.e., the wage rate) as given. The solution to firms' cost-minimizing problems yields aggregate demand for the composite labor

$$N_t^d = \frac{1}{A_t}\int_0^1 Y_t^d(j)dj = \frac{G_t Y_t}{A_t}, \tag{7}$$

where $G_t = \int_0^1 [P_t(j)/P_t]^{-\varepsilon_p} dj$ measures price dispersion. Thus, to a first-order approximation, if the rise in aggregate demand does not match productivity improvements, the demand for labor will fall.

We close the model by specifying a monetary policy. We assume that the monetary authority follows a Taylor rule, under which the nominal interest rate is adjusted to respond to inflation and aggregate output. Specifically, we consider a Taylor rule of the form

$$i_t = \rho_i i_{t-1} + (1-\rho_i)[\phi_\pi \pi_t + \phi_y g_{yt}], \tag{8}$$

where $i_t = \log[(\mathrm{E}_t D_{t,t+1})^{-1}]$ denotes the nominal interest rate, $\pi_t = \log(P_t/P_{t-1})$ denotes the inflation rate, and $g_{yt} = \log(Y_t/Y_{t-1})$ denotes the output growth rate. We consider such a Taylor rule for two reasons. First, the literature suggests that a simple Taylor rule seems to be a reasonable description of U.S. monetary policy (e.g., Taylor, 1993). Second, and more related to our discussion, there is an interesting debate in the literature about whether technology shocks drive hours up or down in a sticky-price model under a Taylor rule (e.g., Basu, 1998, Dotsey, 1999, and Gali and Rabanal, 2004).[2] As the monetary authority adjusts the nominal interest rate, money supply becomes endogenous and is channeled to the households via lump-sum transfers.

An *equilibrium* consists of allocations $C_t(i)$, $B_{t+1}(i)$, $M_t(i)$, and a wage $W_t(i)$ for household i, for all $i \in [0,1]$; an allocation $N_t(j)$ and a price $P_t(j)$ for firm j, for all $j \in [0,1]$; together with prices $D_{t,t+1}$, P_t, and a wage W_t, that satisfy the following conditions: (i) taking prices and all wages but its own as given, each household's allocations and wage solve its utility maximizing problem; (ii) taking wages and all prices but its own as given, each firm's allocation and price solve its profit maximizing problem; (iii) markets for bonds, money, the composite labor, and the composite goods clear; and (iv) monetary policy is described by a Taylor rule in (8).

To simplify analysis, we assume the existence of some implicit financial arrangements that enables households to pool their idiosyncratic income risks that may arise from staggered wage setting (e.g., Rotemberg and Woodford 1997). Under such financial arrangements, equilibrium consumption and holdings of real money balances would be identical across households even though wages and hours worked may differ.[3] It follows that the market clearing condition for the composite good is given by $C_t = Y_t$; and the market clearing condition for the composite labor, in light of (7), is given by $N_t = G_t C_t / A_t$.

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[2] In the online appendix, we also examine a money growth rule in the spirit of Gali (1999), but generalized to allow the money growth rate to respond to technology shocks. Under our estimated money growth rule, we obtain similar labor market dynamics as we obtain here under the Taylor rule.

[3] The existence of such implicit financial arrangements is sufficient, but not necessary to insure the households against idiosyncratic income risks in the presence of staggered wage setting. As shown by Huang, Liu, and Phaneuf (2004), we can interpret the model as one with a representative household that consists of a large number of workers, each endowed with a different skill. In this alternative setup with a representative household (and thus perfect risk sharing), we can obtain identical wage and price dynamics as in the baseline model presented here.

2 Equilibrium Dynamics

We focus on a stationary equilibrium. To induce stationarity, we divide aggregation consumption (or output), the real wage, and the real money balances by the productivity A_t. We denote the transformed variables by $\tilde{C}_t = C(t)/A(t)$, $\tilde{W}_t = W(t)/[A(t)P(t)]$, and $\tilde{M}_t = M(t)/[A(t)P(t)]$. We further denote log-deviations of a stationary variable $\tilde{X}_t$ from its steady-state value by $\tilde{x}_t = \log(\tilde{X}_t/\tilde{X})$. The equilibrium dynamics can be summarized by the following equations:

$$\pi_t = \beta \mathrm{E}_t \pi_{t+1} + \lambda_p \tilde{\omega}_t, \tag{9}$$

$$\pi_{wt} = \beta \mathrm{E}_t \pi_{w,t+1} + \frac{\lambda_w}{1+\eta\varepsilon_w}\left[(\frac{1}{1-b}+\eta)\tilde{c}_t - \tilde{\omega}_t - \frac{b}{1-b}(\tilde{c}_{t-1} - \Delta a_t)\right], \tag{10}$$

$$\tilde{\omega}_t = \tilde{\omega}_{t-1} + \pi_{wt} - \pi_t - \Delta a_t, \tag{11}$$

$$\frac{1}{1-b}\left[\mathrm{E}_t \tilde{c}_{t+1} - (1+b)\tilde{c}_t + b\tilde{c}_{t-1} - b\Delta a_t\right] = i_t - \mathrm{E}_t \pi_{t+1}, \tag{12}$$

$$(1-\beta)\left[\frac{1}{1-b}(\tilde{c}_t - b\tilde{c}_{t-1}) - \tilde{m}_t + \frac{b}{1-b}\Delta a_t\right] = \beta \mathrm{E}_t\left[\pi_{t+1} + \frac{1}{1-b}(\Delta\tilde{c}_{t+1} - b\Delta\tilde{c}_t)\right], \tag{13}$$

$$\Delta\tilde{m}_t = \mu_t - \pi_t - \Delta a_t. \tag{14}$$

$$i_t = \rho_i i_{t-1} + (1-\rho_i)[\phi_\pi \pi_t + \phi_y(\Delta\tilde{c}_t - \Delta a_t)]. \tag{15}$$

Equations (9) is derived from optimal pricing decisions, where $\tilde{\omega}_t$ is deviations of the real wage from its steady state (i.e., a real-wage gap) and $\lambda_p = \frac{(1-\beta)(1-\alpha_p)}{\alpha_p}$ measures the extent of price-level rigidity that arises from staggered price setting. Equation (10) is derived from optimal wage-setting decisions, where $\pi_{wt} = \log\left(\frac{W_t}{W_{t-1}}\right)$ is nominal wage inflation, $\tilde{c}_t$ is deviations of consumption (or output) from its steady state (i.e., an output gap), $\eta = \frac{Nv''(N)}{v'(N)}$ is an inverse Frisch elasticity of labor hours (evaluated at the steady-state hours), and $\lambda_w = \frac{(1-\beta)(1-\alpha_w)}{\alpha_w}$ measures the extent of nominal wage rigidity that arises from staggered wage setting. Equation (11) describes the law of motion of the real-wage gap. Equation (12) is an intertemporal Euler equation. Equation (13) is derived from the money demand relation. Equation (14) describes the law of motion for the real money balances. Finally, Equation (15) is the Taylor rule.

3 Robustness of Quantitative Results

We now examine the robustness of the quantitative results obtained in the baseline model by considering variations in some key parameters and in the specifications of the monetary policy rule.

4 Quantitative results in the baseline model

For ease of comparison, we first reiterate our findings in the baseline model. The parameters to be calibrated include β, the subjective discount factor; b, the habit-persistence parameter; α_p and α_w, the fractions of firms and households that do not adjust prices and nominal wages; ε_p and ε_w, the elasticities of substitution between differentiated products and between differentiated labor skills; η, the inverse Frisch elasticity; and the monetary policy parameters ρ_i, ϕ_π, and ϕ_y. The calibrated parameters are summarized in Table 1.

Since we have a quarterly model, we set $\beta = 0.99$ so that the steady state annual real interest rate is 4 percent. We set $b = 0.8$, which is in the range considered by Boldrin, et al (2001). We set $\alpha_p = 0.75$ and $\alpha_w = 0.75$, so that price and nominal wage contracts each lasts on average for 4 quarters (e.g., Taylor, 1999a). The parameter ε_p determines the steady-state price markup μ_p. Recent studies by Basu and Fernald (2002) suggest that the value-added markup is about 1.05 when factor utilization rates are controlled for; while without correction factor utilization, it is higher at about 1.12. Some other studies suggest an even higher value-added markup of about 1.2 (with no corrections for factor utilization) (e.g., Rotemberg and Woodford, 1997). Since we do not focus on variations in factor utilization, in light of these studies, we set $\varepsilon_p = 10$ so that $\mu_p = 1.1$. Following Huang and Liu (2002), we set $\varepsilon_w = 6$. We set $\eta = 5$, corresponding to a Frisch elasticity of 0.2, which is consistent with micro-evidence (e.g., Pencavel, 1986). Finally, we set $\rho_i = 0.5$, $\phi_\pi = 1.1$, and $\phi_y = 0.5$ in light of the studies by Taylor (1999b) and Clarida, et al (2000).

Figure 1 displays the impulse responses of labor market variables in the baseline model under these parameters. The model does fairly well in replicating the patterns of the VAR-responses. The model predicts that a positive technology shock leads to (i) a short-run decline in hours; (ii) a modest rise in the real wage in the short run and a permanent increase in the long run; (iii) a small decline in nominal wage inflation (basically flat); and (iv) a modest short-run decline in price inflation. These patterns of adjustments, with the exception of hours (which depends on the VAR specification), are broadly consistent with those obtained from the VAR. Quantitatively, the model's predicted impulse responses, with the minor exception of the initial response of hours, lie within the empirical confidence bands.

4.1 Alternative parameter values

Since the habit parameter b and the (inverse) Frisch elasticity parameter η both play an important role in shaping the labor market responses to technology shocks, we consider some variations in these parameters and examine to what extent our quantitative results depend on the particular values that we assign to these parameters.

We begin with the habit parameter, which has been assigned a prominent role in generating a decline in hours in an RBC model (e.g., Francis and Ramey, 2005). One notable discrepancy between the baseline model and the data is that the initial decline in hours appears too large, and lies outside of the confidence bands estimated from both specifications of the VAR. Although we have argued that one should not reply solely upon the employment effects of technology shock for evaluating competing models, we would like to know what it takes to bring the hours response in the model closer to that observed in the data. Since a larger habit parameter implies more dampened responses in aggregate demand and thereby a greater decline in hours following a positive technology shock, it is possible to obtain a better fit of hours by setting the habit parameter to a lower value. Figure 2 confirms this possibility. There, we change the habit parameter from $b = 0.8$ to $b = 0.6$, which is within a reasonable range considered in the literature, and we keep other aspects of the baseline model unchanged. The figure shows that lowering the value of b indeed helps bring the initial response of hours response closer to the empirical confidence bands. Remarkably, such a change does not have significant impacts on the quantitative fit of other labor-market variables.

We would also like to examine to what extent our results depend on the value of the Frisch elasticity of hours worked (given by $1/\eta$). Although much importance has been attached to this parameter in the DSGE literature, especially concerning the labor market dynamics, there is no consensus view on the value of this parameter. In the baseline model, we set $\eta = 5$, corresponding to a Frisch elasticity of 0.2. The literature suggests that higher values of the Frisch elasticity may also be plausible (e.g., Rogerson, Rupert, and Wright, 2000). Figure 3 plots the model's impulse responses when we set the Frisch elasticity to 1 instead of 0.2. Evidently, such a change does not affect the quantitative fit of the model.

4.2 Alternative monetary policy rules

We consider two alternative monetary policy rules, a Taylor rule with an output gap in place of output growth and a money-growth rule in the spirit of Gali (1999).

4.2.1 An alternative Taylor rule

In our baseline model, we assume a Taylor rule under which the nominal interest rate is set to respond to price inflation and output growth. In the literature, a popular specification of the monetary policy rule is a Taylor rule with nominal interest rate responding to variations in inflation and output gap (in place of output growth). We now consider such an alternative Taylor rule described by

$$i_t = \rho_i i_{t-1} + (1 - \rho_i)[\phi_\pi \pi_t + \phi_y \tilde{c}_t]. \tag{16}$$

Figure 4 shows that quantitative predictions of the baseline model do not change much when we replace the Taylor rule with output growth by one with an output gap. There is one subtle difference, however, between the two types of Taylor rules. Since output gap falls along with price inflation following a positive technology shock, whereas output growth rises, the Taylor rule with output gap corresponds to a more accommodative monetary policy than the rule with output growth. As such, the initial decline in hours becomes smaller than that in the baseline model, and moves closer to within the range described by the empirical confidence bands.

4.2.2 A money-growth rule

We now examine a money-growth rule in place of the Taylor rule. Specifically, we consider a money-growth rule in the spirit of Gali (1999), under which the monetary authority adjusts the growth rate of money stock in response to changes in productivity shocks. That is,

$$\mu_t = (1 - \rho)\bar{\mu} + \rho \mu_{t-1} + \gamma \varepsilon_t, \tag{17}$$

where $\mu_t = \log(M_t^s / M_{t-1}^s)$ denotes the growth rate of money supply, and $\gamma \neq 0$ implies systematic responses of monetary policy to technology shocks. It turns out that much of the insight obtained in the baseline model remains unchanged.

To solve the equilibrium dynamics, we need to calibrate the parameter γ, which measures the extent of monetary-policy accommodation. For this purpose, we run an OLS regression of the M2 growth rates on the technology shock series, where we use two alternative measures of technology shocks. The first measure is our own technology shock series constructed from the four-variable SVAR under the difference specification, which has a sample period from 1949 to 2003 (at quarterly frequency). The second measure of technology shock that we use is the "purified" technology measure constructed by BFK (2004), which has a sample period from 1949 to 1996 (at annual frequency). The point estimates in equation (17) suggest that $\hat{\rho} = 0.62(0.06)$ and $\hat{\gamma} = 0.14(0.05)$, where the numbers in parentheses are standard errors. Using the BFK measure produces point estimates of $\hat{\rho} = 0.60(0.14)$ and $\hat{\gamma} = 0.13(0.33)$. The 95 percent confidence interval for $\hat{\gamma}$ is 0.04 to 0.23 with our measure, and -0.53 to 0.79 with the BFK measure. It appears that the estimates for γ are small and may even be statistically insignificant.[4] In light of these estimates, we set $\rho = 0.62$ and $\gamma = 0.14$ as our benchmark policy parameters.

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[4] We have also used two other measures of technology shocks, one constructed from our SVAR under the level specification and the other constructed by Gali and Rabanal (2004), and we have obtained similar results.

Figure 6 displays the impulse responses from the model under the calibrated money growth rule and compares them with the SVAR-based estimates. The model here, as in the baseline model with the Taylor rule, generates empirically plausible responses of the labor market variables. Specifically, it generates a modest decline in hours, a modest short-run rise in the real wage, which continues rising until reaching a permanently higher level, a small response of nominal wage inflation, and a modest decline in price inflation. Quantitatively, most of the theoretical impulse responses lies within the empirical confidence bands, with the minor exceptions of hours and nominal wage inflation, both of which lie slightly above the confidence bands for the first several periods after the shock.

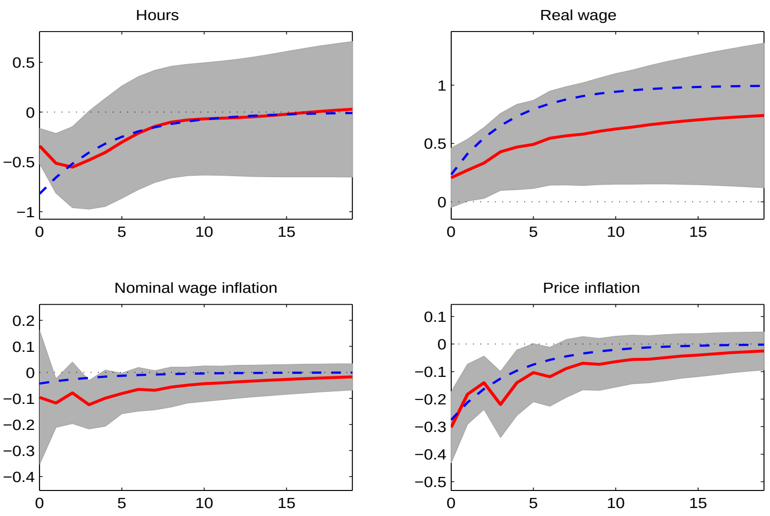
Specifically, using the technology shock series from our level specification, we obtain estimates of $\hat{\rho} = 0.62(0.06)$ and $\hat{\gamma} = 0.14(0.05)$, which appear identical to the estimates obtained under the difference specification. Using the Gali-Rabanal series, we obtain $\hat{\rho} = 0.61(0.06)$ and $\hat{\gamma} = 0.10(0.05)$. We are grateful to Susanto Basu and Jordi Gali for providing us with their data.

Table 1.

Calibrated parameter values

Preferences:	$\eta = 5$,	$\beta = 0.99$,	$b = 0.8$
Nominal contract duration:			
Basline model:	$\alpha_p = 0.75$,	$\alpha_w = 0.75$	
Sticky-price model:	$\alpha_p = 0.75$,	$\alpha_w = 0$	
Sticky-wage model:	$\alpha_p = 0$,	$\alpha_w = 0.75$	
Elasticities of substitution:	$\epsilon_p = 10$,	$\epsilon_w = 6$	
Taylor rule:			
Postwar sample:	$\rho_i = 0.5$,	$\phi_\pi = 1.1$,	$\phi_y = 0.5$
Volcker-Greenspan sample:	$\rho_i = 0.5$,	$\phi_\pi = 2.15$,	$\phi_y = 0.5$
Money-growth rule:	$\rho = 0.62$,	$\gamma = 0.14$	

Data vs. model: Difference specification in VAR



Data vs. model: Level specification in VAR

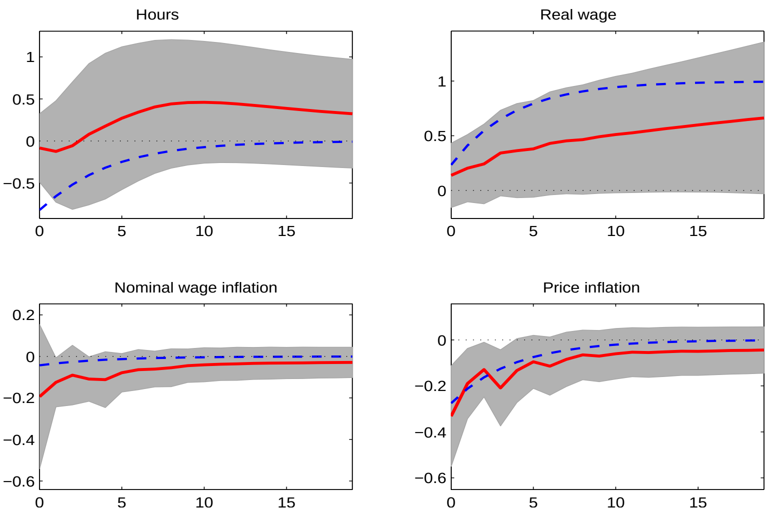
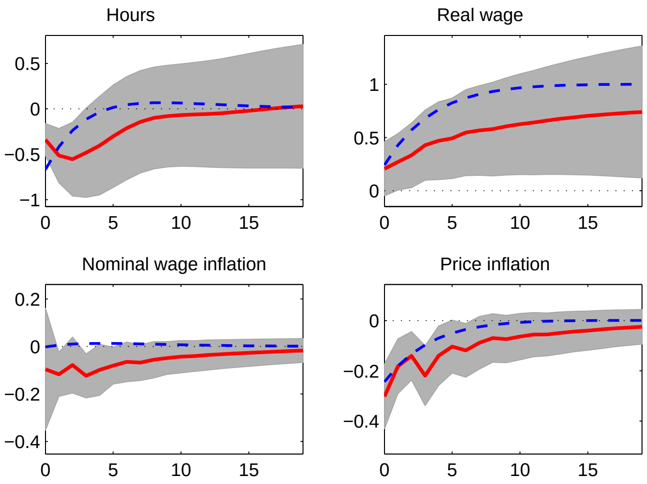


Figure 1:—Impulse responses of labor market variables: SVAR-based estimates versus the baseline model

Legend: Solid line – SVAR; Dashed line – model; Gray area – 95% *confidence band for SVAR-based estimates.*

Data vs. model: Difference specification in VAR



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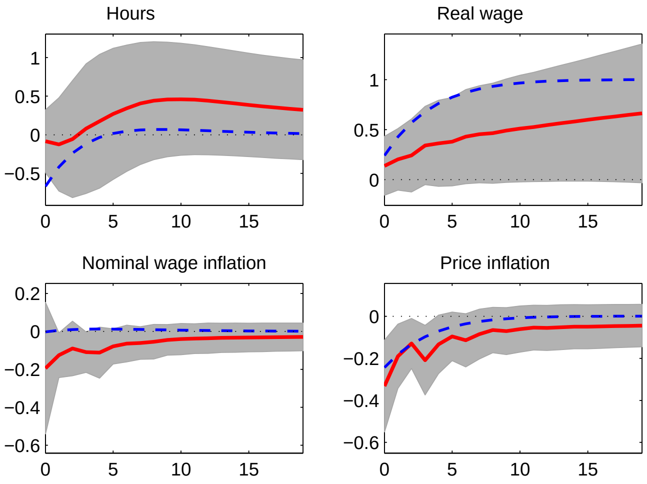
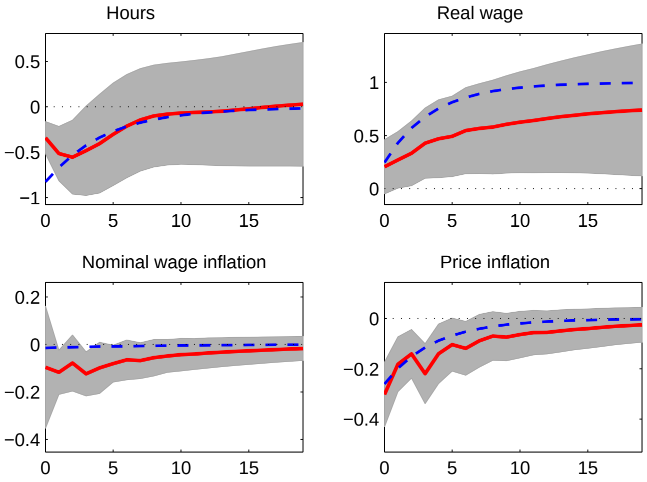


Figure 2:—Sensitivity: low habit parameter ($b = 0.6$)

Legend: Solid line – SVAR; Dashed line – model; Gray area – 95% *confidence band for SVAR-based estimates.*

Data vs. model: Difference specification in VAR



Data vs. model: Level specification in VAR

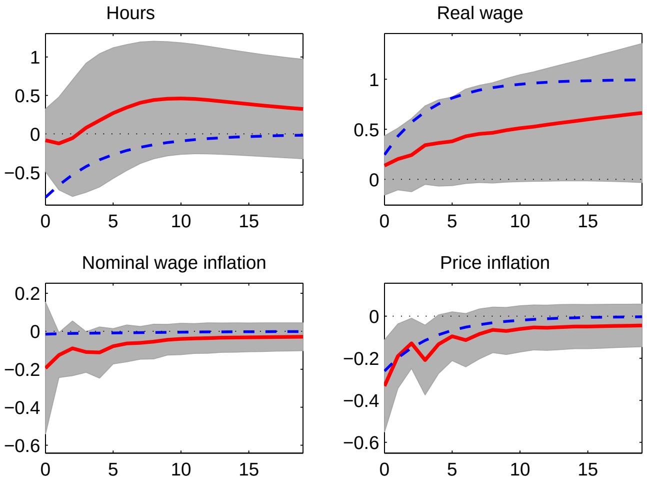
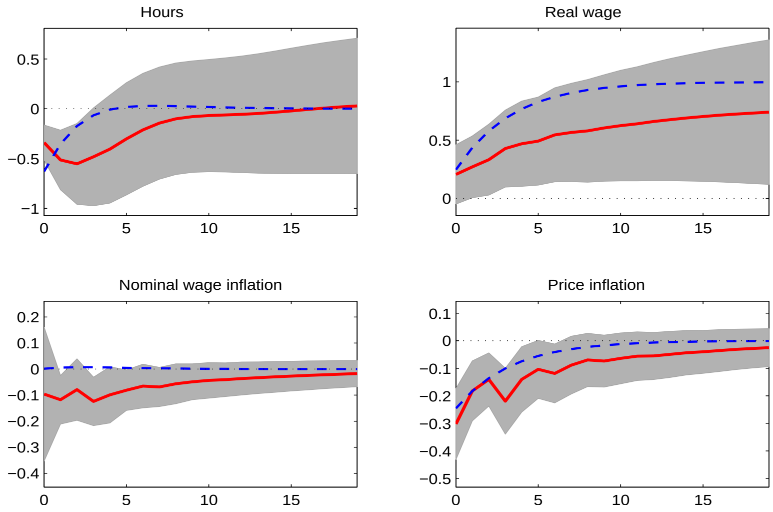


Figure 3:—Sensitivity: high Frisch elasticity ($\eta = 1$)

Legend: Solid line – SVAR; Dashed line – model; Gray area – 95% *confidence band for SVAR-based estimates.*

Difference specification in VAR



Level specification in VAR

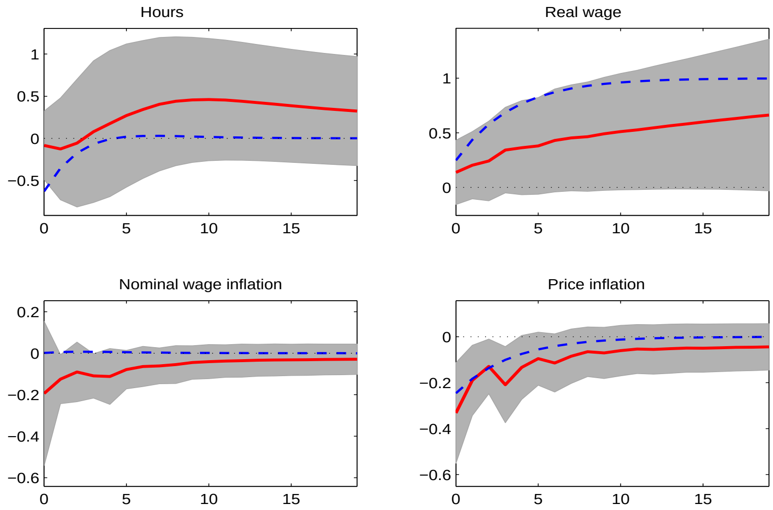
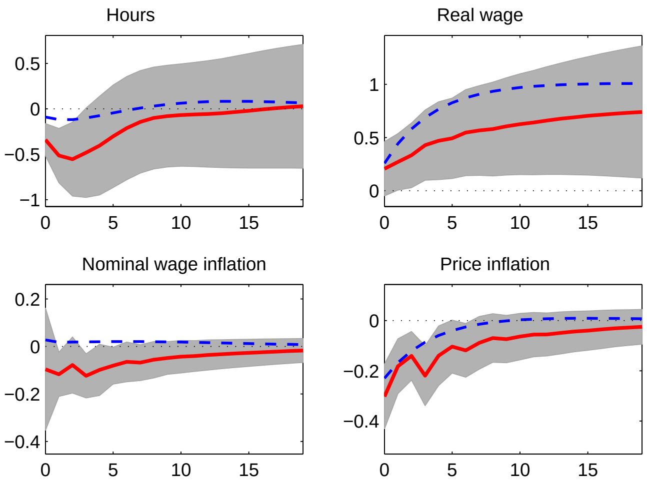


Figure 4:—Sensitivity: alternative Taylor rule (output gap in place of output growth)

Legend: Solid line – SVAR; Dashed line – model; Gray area – 95% *confidence band for SVAR-based estimates.*

Difference specification in VAR



Level specification in VAR

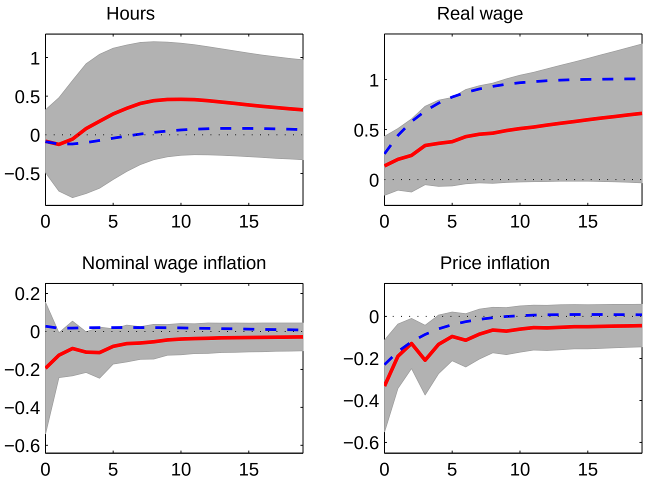


Figure 5:—Sensitivity: a money growth rule in place of the Taylor rule

Legend: Solid line – SVAR; Dashed line – model; Gray area – 95% *confidence band for SVAR-based estimates.*