Unemployment, Partial Insurance, and the Multiplier Effects of Government Spending

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Abstract

I interpret the empirical evidence on government spending multipliers using an equilibrium model of unemployment in which workers are not fully insured against the risk of job loss. Consumption of resources by the government affects aggregate spending along two margins: (*i*) an *intensive* margin owing to a fall in household wealth and (*ii*) an *extensive* margin that accounts for growth in the working population. At insurance levels below a certain threshold, the positive effects of (*ii*) dominate the negative effects of (*i*), leading to multipliers for private consumption and output that exceed zero and one. Similar results appear in a quantitative version of the model scaled to match estimates from micro data on the consumption cost of unemployment.

Keywords: Government Spending Multipliers, Unemployment Insurance, Shirking Models

JEL Classification: E13, E24, E32, E62, H50, J41

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1 Introduction

There is no shortage of research on the subject of government spending multipliers. For the U.S., plausible estimates linking government purchases to real GDP are anywhere from around 0.8 to 1.5 (e.g., Ramey, 2011b). But whether a given estimate falls on the high or low end of this range often depends on the contemporaneous response of private consumption. Many studies document a sizable increase in consumption, which alongside the rise in public spending, usually delivers a GDP multiplier well above one (e.g., Blanchard and Perotti, 2002; Galí, López-Salido, and Vallés, 2007; Fisher and Peters, 2010; Mertens and Ravn, 2010; Ben Zeev and Pappa, 2017). Others report weak or even slightly negative effects that in either case are not far from zero (e.g., Burnside, Eichenbaum, and Fisher, 2004; Mountford and Uhlig, 2009; Barro and Redlick, 2011; Ramey, 2011a). What none of these studies find, however, is any clear-cut evidence of a large drop in consumption, which is why estimates of the GDP multiplier are unlikely to be a lot lower than one.

Conclusions like these drawn from macroeconomic data have long posed a challenge to neoclassical theory. As explained in Baxter and King (1993), absorption of resources by the government creates a negative wealth effect that causes people to cut back on consumption and leisure. Longer work hours mitigate some of the consumption loss, but the downward pressure this exerts on wages serves only to reinforce the crowding out of private spending. As a result, output multipliers for a temporary increase in government purchases tend to be substantially below unity.

In this paper I argue that the mismatch between theory and evidence may be illusory. Strictly speaking, observed multipliers need not be inconsistent with the neoclassical dynamic at all. This can happen if the wealth effects, which operate at the household level, are being obscured in the data by factors not normally present in fiscal policy models. Here I focus on two: unemployment in the labor market and a risk-sharing arrangement that departs from the usual assumption of full insurance. How they make detection of any crowding-out effects harder can be illustrated with a simple thought experiment. Consider an increase in government purchases that lifts output by raising the number of employed persons. If all workers are fully insured against the risk of job loss, a shift in the composition of the labor force out of unemployment will not affect the aggregate level of consumption in the economy. But if workers are only partially insured, this composition effect will push up aggregate consumption at the same time the wealth effects push it down. To be clear, the former describes an *extensive* rather than *intensive* margin of adjustment. And should it outweigh the latter, efforts to identify a negative response in the data could fail.[1]

I formalize this idea using the shirking, efficiency-wage model developed by Alexopoulos (2004). In this setup unemployment arises endogenously from firms' inability to monitor effort. Unemployment insurance, on the other hand, enters exogenously by means of an income-pooling device that can accommodate a continuum of risk-sharing options from partial to full insurance. An advantage of the model is that it is simple enough for the effects of government spending to be evaluated analytically. That way the policy consequences of varying the degree of unemployment insurance are completely transparent.

The main theoretical result is summarized by a proposition showing that multipliers for aggregate consumption and output will be greater than zero and one if the amount of unemployment insurance is below some critical value. What's more, the shirking model doesn't need stickiness in the price level to be effective. Nor do multipliers suddenly become smaller when allowing for investment dynamics. This is because government spending affects the economy through a labor supply mechanism that functions the same when prices are flexible or sticky and when capital is fixed or variable. That mechanism, it turns out, is closely related to others in the literature that transmit policy shocks through an inversion of the labor supply curve. The equivalent reduced-form concept here is the "no-shirking condition" originating from the incentive compatibility constraint on effort (e.g., Shapiro and Stiglitz, 1984; Kimball, 1994). One can show that the wage-employment locus implied by this condition is horizontal under full insurance but slopes down under partial insurance.

Just because the shirking model can explain observed multipliers in theory does not mean the results themselves should be taken seriously. How convincing they are depends instead on the empirical validity of two features central to its interpretation of the data. First and foremost is that increases in government spending lead to more workers and fewer nonworkers in the short run. Unfortunately, studies that probe aggregate data for evidence of this dynamic often have little to say.[2] For this reason, I present some evidence of my own on the extensive-margin effects of a shock to government purchases. Identification is carried out in the context of a vector autoregression (VAR) estimated on quarterly U.S. data. But because there is no consensus on how best to achieve identification, I report estimates from a few different specifications. One imposes contemporaneous restrictions in the spirit

[1] This line of argument implicitly assumes that the labor force is fixed in the short run and that consumption of individuals not in the labor force is more or less invariant to spending shocks.

[2] Notable exceptions include Ravn and Simonelli (2007) and Monacelli, Perotti, and Trigari (2010). Both sets of authors find that in the U.S., unemployment falls significantly after a positive shock to government spending. Brückner and Pappa (2012) report similar results in a subsample covering the period 1968-1980.

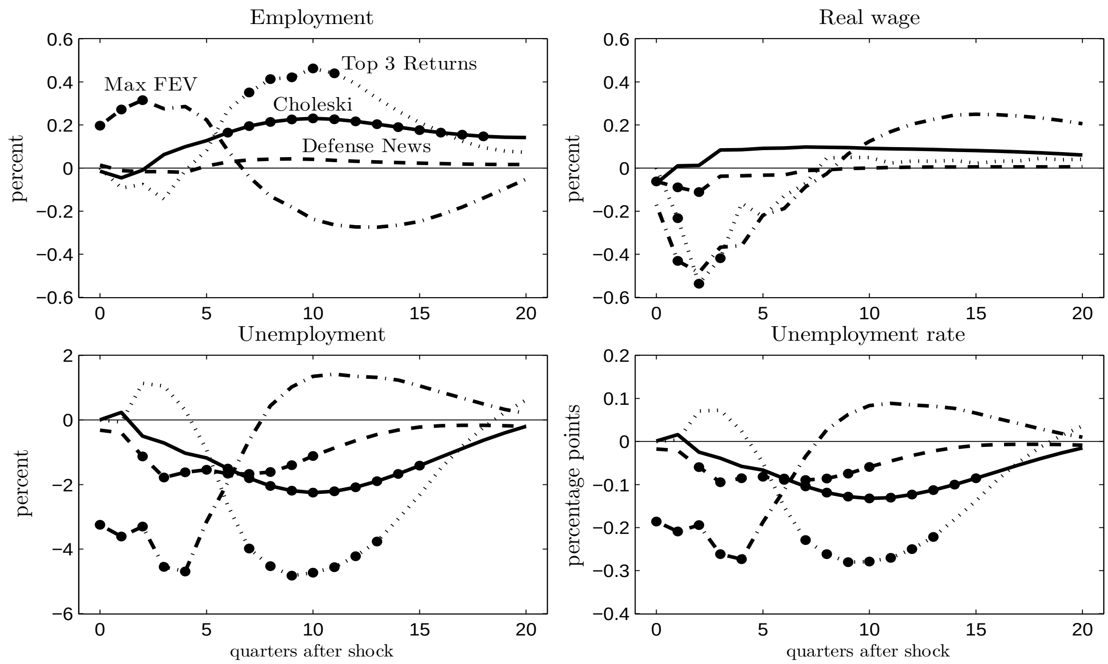

Fig. 1. Labor market effects of a government spending shock

Notes: The figure plots VAR-based impulse responses to a government spending shock using four identification procedures: contemporaneous restrictions via the Choleski decomposition (solid lines), innovations to the Ramey (2011a) defense news series (dashed lines), innovations to the Fisher and Peters (2010) "Top 3" excess returns data (dotted lines), and the Ben Zeev and Pappa (2017) maximum forecast error variance methodology (dash-dotted lines). Bullets indicate point estimates that are significantly different from zero at a 90-percent confidence level.

of Blanchard and Perotti (2002). Another uses the narrative approach as implemented in Ramey (2011a). The third follows Fisher and Peters (2010) in identifying spending shocks as innovations to the excess stock returns of military contractors. The last incorporates historical shocks recovered by Ben Zeev and Pappa (2017) that maximize contributions to the forecast error variance of defense spending over a five-year horizon.

Figure 1 graphs impulse responses for the logs of total civilian employment and unemployment (both divided by the population) as well as the unemployment rate and the real wage. For each regression, the initial shock is normalized so that growth in per capita government consumption expenditures (not shown) reaches one percent at its peak.[3] Results confirm that spending shocks increase the size of the working population and, at the same

[3] The online appendix (`https://gegivens.weebly.com/research.html`) provides details about the variables, lag structure, sample period, and identification strategy for each VAR. Also included is a description of the method for obtaining confidence bands.

Table 1
Survey data estimates of the average consumption drop at unemployment

study	sample period	data source	category	loss (%)
Burgess, Kingston, St. Louis, and Sloane (1981)	1975 - 1978	ABAS	total	15.2
Gruber (1997)	1968 - 1987	PSID	food	6.8
Dynarski, Gruber, Moffitt, and Burtless (1997)	1980 - 1993	CEX	total	24.1
Stephens (2001)	1968 - 1992	PSID	food	8.5
Browning and Crossley (2001)	1993 - 1995	COEP	total	14.0
Stephens (2004)	1992 - 1996	HRS	food	16.0
Aguiar and Hurst (2005)	1989 - 1996	CSFII	food	19.0
Chetty and Szeidl (2007)	1968 - 1997	PSID	food	6.6
East and Kuka (2015)	1968 - 2011	PSID	food	7.0
Kroft and Notowidigdo (2016)	1968 - 1997	PSID	food	6.9
Chodorow-Reich and Karabarbounis (2016)	1983 - 2012	CEX	total	20.7
Hendren (2017)	1992 - 2013	PSID	food	7.0
Ganong and Noel (2019)	2014 - 2016	JPMCI	food	6.2

Notes: ABAS - Arizona Benefit Adequacy Study; PSID - University of Michigan Panel Study of Income Dynamics; CEX - Consumer Expenditure Survey of the Bureau of Labor Statistics; COEP - Canadian Out of Employment Panel of Human Resources Development Canada; HRS - University of Michigan Health and Retirement Study; CSFII - Continuing Survey of Food Intake of Individuals of the Department of Agriculture; JPMCI - JPMorgan Chase Institute de-identified account data.

time, reduce the number of people who are unemployed. With one exception, the change in the composition of the labor force is statistically significant at conventional levels.[4] A similar pattern emerges for the unemployment rate, which depending on identification, falls anywhere from 0.1 to 0.3 percentage points in the first few years after a spending increase. Finally, note that the real wage also declines on impact, and in all but one case, remains firmly negative for a period of about one year. The significance of this result should not be overlooked. As will become clear in the next section, a lower real wage is ultimately what prompts the rise in employment demand after a spending shock.

While consistency with Figure 1 is important, the credibility of the shirking model also depends very much on the notion that consumption declines for people who become unemployed. Assessing the validity of this dynamic, however, is complicated by the fact that measures of aggregate spending aren't broken down demographically by labor force status. So instead, I look to papers from the micro literature on the household-level consumption effects of involuntary job loss. Table 1 displays a number of published estimates along with data sources, sample periods, and spending categories for each. While results vary, the data generally agree on what matters most. The typical worker does not appear to be fully insured against employment risk. Averaging across all the estimates points to a consumption drop at unemployment of around 12 percent. For the subset that use a measure of total

[4]Only when spending shocks are identified as innovations to the Ramey (2011a) defense news variable is the observed increase in employment not statistically different from zero.

expenditure (rather than food), the mean is actually closer to 18 percent.

Although survey data clearly reject the full insurance hypothesis, estimates of the consumption drop turn out to be somewhat smaller that what is needed to generate multipliers in the shirking model on the high side of the empirical range. To reach these levels while respecting the boundaries of Table 1 requires help from other mechanisms capable of transmitting fiscal shocks. I take up this task in the final section by adding to the efficiency-wage apparatus capital utilization along with Edgeworth complementarity between private and public consumption. Simulations reveal that large multipliers can be reconciled with the micro evidence on partial insurance while preserving the dominant role of the composition effect. This extended version also happens to yield credible predictions regarding the quantitative effects of two contemporary stimulus programs, namely, the American Recovery and Reinvestment Act of 2009 and the multi-year interest rate peg that was put in place soon thereafter. The same cannot be said of the full insurance model, where among other things, the abrupt rise in inflation forecasted under both programs produces multipliers sharply at odds with reality. Partial insurance, on the other hand, blunts the inflation response, which leads to more conservative multipliers, particularly in the case of a nominal interest rate peg.

2 A Simple Model with Fixed Capital

In this section I present an efficiency-wage model similar to Alexopoulos (2004). It is simple enough to work out analytical solutions showing the exact relationship between government spending multipliers and the amount of unemployment insurance held by individuals.

A. *The Model*

Families. There is a representative family with a $[0, 1]$ continuum of members. In any period a random fraction N_t get job offers. The other $1 - N_t$ are unemployed. To preserve the representative agent framework with positive unemployment, I assume the family owns all the assets and makes all saving decisions.

The family enters date t with capital $\overline{K}$ and one-period riskless bonds worth $r_{t-1}b_{t-1}$, where r_{t-1} is the gross real return from $t-1$ to t. It then leases $\overline{K}$ to firms at a rate of r_t^k per unit, pays taxes T_t to the government, and buys new bonds b_t. All remaining resources are used to purchase consumption goods in the amount C_t^f for each member. The family distributes these goods equally *before* it observes individual employment outcomes, making

C_t^f a lower bound on the quantity of consumption available to members.[5] The budget constraint implied by this arrangement is

$$C_t^f + b_t \leq r_{t-1} b_{t-1} + r_t^k \overline{K} - T_t. \tag{1}$$

Family members can increase their consumption by working. Firms offer job contracts that specify a fixed number of hours h and an effort level e_t for an hourly real wage w_t. But because effort cannot be perfectly observed, employees have an incentive to shirk. As in Alexopoulos (2004), I assume workers are paid a fraction s of their wages up front. The final installment $(1-s)hw_t$ is paid out at the end of the period only if shirking goes undetected.[6] Shirkers are caught with probability $d \in (0,1)$.

The family also manages a fully funded insurance program whereby workers contribute F_t units of consumption into a pool that is redistributed equally to the unemployed at the end of each period. Let C_t^e be the consumption of those not punished for shirking. Detected shirkers and unemployed members consume C_t^s and C_t^u. It follows that

$$C_t^e = C_t^f + hw_t - F_t, \tag{2}$$

$$C_t^s = C_t^f + shw_t - F_t, \tag{3}$$

$$C_t^u = C_t^f + N_t F_t/(1-N_t). \tag{4}$$

As in Givens (2011), insurance premiums take the form $F_t \equiv \sigma(1-N_t)hw_t$, where $\sigma \in [0,1]$ determines the replacement rate. Notice here that σ is exogenous by design. Specifying the insurance scheme in this way nests a continuum of risk-sharing options and makes it easier to sort out the role of unemployment insurance in the transmission of government spending shocks.[7] Full insurance can be analyzed by setting $\sigma = 1$ since $C_t^e = C_t^u$ in this case. Any value less than one and the model delivers partial insurance, with $C_t^u < C_t^e$ in equilibrium.[8]

[5] The precise timing of family distributions within each period ensures that the model will have an equilibrium with positive effort. Suppose instead that the decision for C_t^f was made *after* firms hire employees. Given risk-averse preferences and assuming no eligibility restrictions, families would contrive to fully insure members by allocating goods differently by job status. Workers would effectively be taxed while everyone else (including shirkers) would be subsidized. Supplying effort would never be individually rational as it would only result in a drop in leisure with no gain in consumption.

[6] Firms often punish shirkers by withholding bonuses or denying promotions rather than termination. See Alexopoulos (2007) and references therein.

[7] As σ increases, so does the incentive to lie about not having received an offer. To prevent voluntary unemployment, I assume the family sees which members receive offers and denies benefits to any who reject.

[8] If given a choice, families will always select $\sigma = 1$. Endogenizing the coverage amount, however, would preclude any discussion of the relationship between the insurance regime and the size of fiscal multipliers.

Following Burnside and Eichenbaum (1996), the preferences of family member j with consumption C_t^j are

$$U(C_t^j, e_t) = \ln C_t^j + \theta \ln(H - \nu_t[he_t + \xi]), \tag{5}$$

where $\theta > 0$, H is the time endowment, and ξ represents fixed costs of supplying effort. The function ν_t equals one if employed and exerting effort but zero otherwise. According to (5) family members care about effective hours of labor he_t. In other words, showing up to work for h hours is only costly if one is providing the mandatory effort along the way. Should any member choose to shirk ($\nu_t = 0$), the full time endowment would be consumed as leisure.[9]

The inability to monitor effort leads to moral hazard in the labor market. Alexopoulos (2006) shows that workers will uphold their end of the bargain as long as the terms of employment satisfy an *incentive compatibility* constraint

$$U(C_t^e, e_t) \geq dU(C_t^s, 0) + (1 - d)U(C_t^e, 0). \tag{6}$$

The right-hand-side reveals that members who elect to shirk always choose zero effort. This happens because the wage penalty is the same for any effort level below e_t, and utility is strictly decreasing in effort.

The family maximizes the present value of the average utility of its members, weighted by the employment probability of each type. But because they produce no output, it will never be profitable to hire shirkers. This means average utility can be written as

$$E_0 \sum_{t=0}^{\infty} \beta^t \{N_t U(C_t^e, e_t) + (1 - N_t)U(C_t^u, 0)\}, \tag{7}$$

where $\beta \in (0, 1)$ is the discount factor. Formally, sequences $\{C_t^f, b_t\}_{t=0}^{\infty}$ are chosen to maximize (7) subject to (1), (2), and (4).

Firms. A $[0, 1]$ continuum of firms produce homogeneous goods $y_t(i)$ according to

$$y_t(i) = k_t(i)^\alpha \left[(n_t(i) - n_t^s(i))e_t(i)h\right]^{1-\alpha}, \tag{8}$$

with $\alpha \in (0, 1)$. Inputs $\{k_t(i), n_t(i), n_t^s(i), e_t(i)\}$ denote capital, number of employees, shirkers, and effort levels hired by firm i. Because it wants to prevent shirking, the firm designs

[9]Think of effort here as a units-free concept that scales the number of assigned work hours h. The product he_t therefore has the same units as the time endowment H and fixed costs ξ.

labor contracts that satisfy (6), ensuring $n_t^s(i) = 0$ in equilibrium. Its profit-maximization problem then becomes

$$\max_{\{k_t(i),n_t(i),w_t(i),e_t(i)\}} \quad k_t(i)^\alpha (n_t(i)e_t(i)h)^{1-\alpha} - r_t^k k_t(i) - w_t(i)hn_t(i)$$

subject to (6), which holds with equality since the firm wishes to compensate employees no more than what is required to induce effort. A binding incentive compatibility constraint implies that effort can be written in terms of the real wage as

$$e_t(i) = \frac{H-\xi}{h} - \frac{H}{h}\left(\frac{C_t^f + hw_t(i) - F_t}{C_t^f + shw_t(i) - F_t}\right)^{-d/\theta} \equiv e(w_t(i); C_t^f, F_t). \tag{9}$$

Using (9) in place of $e_t(i)$ and taking $\{r_t^k, C_t^f, F_t\}$ as given, the optimality conditions are

$$\begin{aligned} r_t^k &= \alpha\left(\frac{y_t(i)}{k_t(i)}\right), \\ w_t(i)h &= (1-\alpha)\left(\frac{y_t(i)}{n_t(i)}\right), \\ \frac{e'(w_t(i))w_t(i)}{e(w_t(i))} &= 1. \end{aligned} \tag{10}$$

The first two equations are standard. Equation (10) is the Solow (1979) condition directing firms to pay an *efficiency wage* that minimizes labor costs per unit of effort. This quantity exceeds the Walrasian market-clearing wage, creating positive unemployment in equilibrium.

As shown by Alexopoulos (2004), one implication of (10) is that the consumption ratio C_t^e/C_t^s is constant and determined implicitly by

$$H\left(\frac{d}{\theta}\right)(1-s\tilde{C})(\tilde{C}-1) = (1-s)\left[(H-\xi)\tilde{C}^{1+d/\theta} - H\tilde{C}\right],$$

with $\tilde{C} \equiv C_t^e/C_t^s$. Inserting this ratio into (9) reveals that effort is also fixed, as

$$e_t(i) = \frac{H-\xi}{h} - \frac{H}{h}\tilde{C}^{-d/\theta} \equiv e. \tag{11}$$

With constant effort, real wages are identical across firms, so $w_t(i) = w_t$ for all $i \in [0,1]$.

No-shirking condition. In efficiency-wage models of the moral hazard variety, the labor market is characterized by a no-shirking condition derived from workers' incentive compatibility constraint. This condition replaces the neoclassical labor supply curve seen in most business cycle models. Using (2), (3), and $C_t^e/C_t^s = \tilde{C}$, the no-shirking condition can be expressed as

$$hw_t = \frac{1}{1-s}\left(\frac{\tilde{C}-1}{\tilde{C}}\right)C_t^e. \tag{12}$$

The incentive compatibility requirement also implies a constant ratio between the consumption of employed and unemployed workers. Combining (2) and (4) while substituting for w_t using (12) gives

$$\frac{C_t^u}{C_t^e} = 1 - \frac{1-\sigma}{1-s}\left(\frac{\tilde{C}-1}{\tilde{C}}\right) \equiv \mu(\sigma). \tag{13}$$

The function μ is bounded above by one and increasing in σ. So for a given s and $\tilde{C}$, the value of μ defines the scope of insurance. With full insurance, $\mu(1) = 1$, and (13) reduces to $C_t^u = C_t^e$. With partial insurance, $\mu(\sigma) < 1$, and (13) becomes $C_t^u = \mu C_t^e$.

Fiscal policy. Every period the government consumes G_t units of the final good, which it fully finances by collecting lump-sum taxes T_t. I assume government consumption evolves exogenously according to

$$G_t = (1-\rho)G + \rho G_{t-1} + \varepsilon_t,$$

where $\rho \in (0,1)$ and ε_t is a mean-zero i.i.d. shock with constant variance.

Equilibrium. All market-clearing conditions are satisfied in a competitive equilibrium. Balancing supply and demand for capital and labor means $\int_0^1 k_t(i)di \equiv \overline{K}$ and $\int_0^1 n_t(i)di \equiv N_t$ for $t \geq 0$. In product markets the supply of final goods, $\int_0^1 y_t(i)di \equiv Y_t$, balances the demand from private and public consumption, so that

$$Y_t = C_t + G_t$$

each period. The term C_t refers to aggregate private consumption and is defined as

$$C_t \equiv N_t C_t^e + (1-N_t)C_t^u, \tag{14}$$

the sum total of the consumption levels of employed and unemployed family members.

B. *Government Spending Multipliers*

I measure the effects of an unanticipated increase in government purchases using the familiar *impact multiplier*. With capital fixed, quantities for both output and consumption can be derived analytically. In discussing the results, I focus on the range of insurance options needed to guarantee a positive consumption multiplier and thus an output multiplier in excess of one.

PROPOSITION 1: *In the shirking model with fixed capital,*

(*i*) *the impact multipliers for output and consumption are*

$$\tfrac{dY_t}{dG_t} \equiv \Gamma_y = \left[1 + \tfrac{1-g}{1-\alpha}\left(\alpha - \tfrac{(1-\mu)N}{(1-\mu)N+\mu}\right)\right]^{-1} \qquad \tfrac{dC_t}{dG_t} \equiv \Gamma_c = \Gamma_y - 1,$$

(*ii*) Γ_y *and* Γ_c *are strictly decreasing functions of* μ, *and*

(*iii*) $\Gamma_y > 1$ *and* $\Gamma_c > 0$ *if and only if*

$$\alpha < \tfrac{(1-\mu)N}{(1-\mu)N+\mu} \quad \Leftrightarrow \quad \mu < \tfrac{(1-\alpha)N}{(1-\alpha)N+\alpha} \equiv \mu_1.$$

PROOF:

See Appendix.

Part (*i*) makes clear that the multipliers, denoted Γ_y and Γ_c, are determined by four factors. Two of those factors are the steady-state levels of employment N and the share of government spending in output $g \equiv G/Y$. The other two are the capital income share α and the degree of unemployment insurance μ.

The second part demonstrates that Γ_y and Γ_c are decreasing in the insurance coefficient. So as μ gets smaller, or as risk sharing among family members declines, the expansionary effects of a shock to government spending get bigger. By how much depends on the size of the other parameters. Figure 2 plots Γ_y (solid line) and Γ_c (dashed line) as functions of μ, holding fixed the values of N, g, and α.[10] In the case of full insurance ($\mu = 1$), consumption is negative and output less than one. But as unemployment insurance drops, the multipliers begin to rise at an increasing rate. For small enough values of μ, spending shocks "crowd-in" private consumption, ensuring an output multiplier greater than one. In the extreme case of zero insurance, for which $\mu(0) = 0.19$, Γ_y reaches a maximum of 2.41.

[10] Values of N and g are chosen to match the average civilian employment rate and the ratio of government consumption expenditures to GDP in the U.S. from 1948 to 2018.

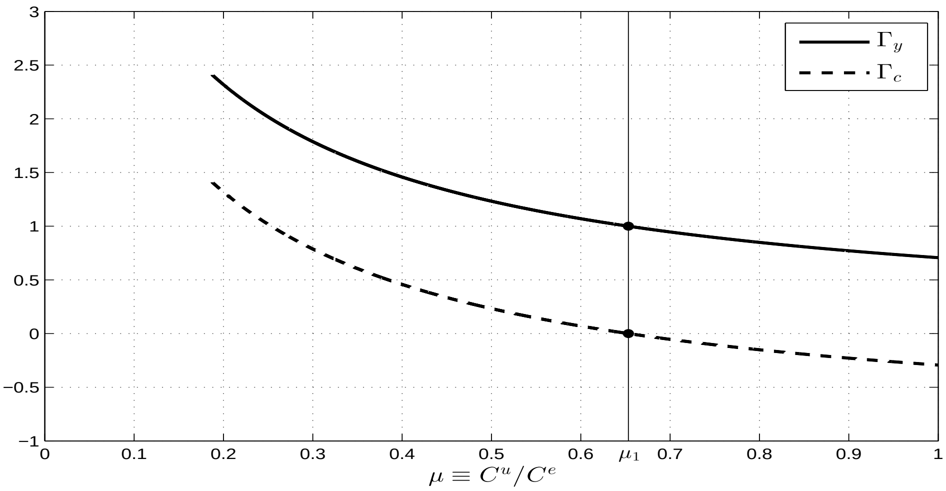

Fig. 2. Impact multipliers

Notes: Impact multipliers for output (Γ_y) and consumption (Γ_c) are shown as functions of the insurance coefficient μ. Computations are based on the following calibration: $g = 0.17$, $N = 0.942$, $\alpha = 1/3$.

Part (*iii*) of the proposition identifies the critical value of μ, call it μ_1, for which $\Gamma_c = 0$ and $\Gamma_y = 1$. In the figure μ_1 is about 0.65. At this level of risk sharing, consumption falls by 35 percent for members who become unemployed. Of course any value below μ_1, given part (*ii*), is consistent with $\Gamma_c > 0$ and $\Gamma_y > 1$.

This last finding is notable because it goes against the neoclassical view of fiscal policy. As shown by Woodford (2011), government purchases necessarily crowd out private consumption in standard optimizing models with flexible prices and wages. In fact if one were to replace the labor market described above with a purely neoclassical structure, the multipliers for output ($\tilde{\Gamma}_y$) and consumption ($\tilde{\Gamma}_c$) would be

$$\tilde{\Gamma}_y = \left[1 + \frac{1-g}{1-\alpha}\left(\alpha + \varphi\right)\right]^{-1} \qquad \text{and} \qquad \tilde{\Gamma}_c = \tilde{\Gamma}_y - 1,$$

where $1/\varphi \geq 0$ is the Frisch labor supply elasticity.[11] Clearly $\tilde{\Gamma}_y \in (0, 1)$ and $\tilde{\Gamma}_c < 0$ for any permissable value of φ. And should labor supply be inelastic, $\tilde{\Gamma}_y$ may be close to zero.

Now the reasons why multiplier effects are mostly absent in the neoclassical model are well known (e.g., Aiyagari, Christiano, and Eichenbaum, 1992; Baxter and King, 1993). The goal of this paper is not to rehash these old arguments, but rather to explain how unemployment

[11] $\tilde{\Gamma}_y$ and $\tilde{\Gamma}_c$ are derived from a one-sector business cycle model with divisible labor, constant-returns-to-scale production, and preferences of the form $\ln C + \theta \frac{h^{1+\varphi}}{1+\varphi}$.

and partial insurance alter the conventional narrative. As a starting point, I rewrite dC_t/dG_t as the sum of its intensive and extensive margin adjustments. The former refers to changes in the consumption of individual members and, as explained below, is heavily influenced by the usual wealth effects of government spending. The latter describes movements in the size of the working population, what I henceforth call the *composition effect*. The math is easy. Just differentiate (14) with respect to G_t and collect terms. The result when evaluated at the steady state is

$$\frac{dC_t}{dG_t} = \underbrace{N\frac{dC_t^e}{dG_t} + (1-N)\frac{dC_t^u}{dG_t}}_{\textit{intensive margin } (<0)} \quad + \quad \underbrace{(1-\mu)C^e\frac{dN_t}{dG_t}}_{\textit{extensive margin } (\geq 0)}.$$

The first bracketed term captures the effect on C_t of changes in individual consumption triggered by a decline in family wealth. It is similar, but not identical to, the effect that runs through the neoclassical analysis. Here an increase in government spending (taxes) tightens the budget constraint (1), prompting an immediate withdrawal of family consumption C_t^f. As explained in Alexopoulos (2004), this pushes up the ratio C_t^e/C_t^s, which effectively increases the penalty associated with shirking. Now employees will strictly prefer effort. To make workers indifferent between the two, firms scale back the real wage until $C_t^e/C_t^s = \tilde{C}$ is restored, or until the incentive compatibility constraint re-balances. Facing cuts to both wages and family consumption, employed and unemployed workers alike have to reduce C_t^e and C_t^u. This crowding out of individual consumption, assuming for the moment no change in employment, forces aggregate consumption lower.

Obviously employment will not remain constant for long. As the real wage goes down (see also Fig. 1), firms have an incentive to hire more workers. This results in a larger share of the family consuming C_t^e and a smaller share consuming C_t^u. What the second bracketed term captures is the effect on C_t of this shift in the composition of the workforce between employed and unemployed members. Under full insurance ($\mu = 1$), the effect vanishes since consumption is the same for everyone. But if $\mu < 1$, or $C_t^u < C_t^e$, rising employment drives up aggregate consumption even as individual consumption levels fall. Should the degree of insurance be sufficiently small ($\mu \leq \mu_1$), the composition effect will dominate, and aggregate consumption will respond positively to an increase in government purchases.

C. *The Labor Market*

While the composition effect may be responsible for any increase in aggregate consumption, it is still unclear how this effect can be large enough to offset the crowding out of individual consumption. To answer this question, I take a closer look at how the insurance arrangement affects key properties of the no-shirking condition, which serves as the relevant labor supply concept in the model. I also discuss the findings in relation to a different transmission mechanism that turns out to have similar reduced-form implications.

My focus on the labor market is motivated by analyses of government spending in Linnemann (2006), Bilbiie (2009), and Bilbiie (2011). Each demonstrates that an increase in consumption is attainable in a one-sector model with flexible prices if and only if the *constant-consumption* labor supply curve is both downward sloping and steeper than labor demand. To be clear, what gives the supply curve its unusual shape is the use of a nonseparable preference structure that makes consumption and work hours Edgeworth complements. But as Bilbiie (2009) rightly points out, the conditions required for this result violate strict concavity of the utility function, a feature he argues should be avoided in business cycle models because it implies that consumption will be an inferior good.

An advantage of the present model is that it yields the same reduced-form description of the labor market while preserving standard assumptions on preferences (i.e., log separability). This result is made possible by the fact that the relevant wage-employment locus characterizing the supply side of the market is the *constant-consumption* no-shirking condition (NSC). As discussed earlier, this condition replaces the ordinary neoclassical relationship linking the real wage to the marginal rate of substitution. But unlike the latter, it will be negatively sloped should one relax the traditional assumption of full insurance.

To develop this point, I log-linearize the no-shirking equation (12) along with the risk-sharing condition (13) and the aggregate consumption identity (14). Substituting all three into a single expression produces a constant-consumption NSC

$$\hat{w}_t = -\frac{(1-\mu)N}{(1-\mu)N+\mu}\hat{N}_t + \hat{C}_t, \tag{15}$$

where hatted variables denote log deviations from the nonstochastic steady state.

Clearly the insurance coefficient μ affects the slope of (15). With full insurance the slope is zero, and employment variations have no effect on the incentive-compatible real wage. But under partial insurance, it is both negative and increasing in μ, meaning the curve gets steeper (more negative) as unemployment benefits shrink. To understand why this inversion occurs, note that an increase in employment reduces the average marginal utility of consumption since utility is concave and $C_t^e > C_t^u$. Re-balancing marginal utility with the

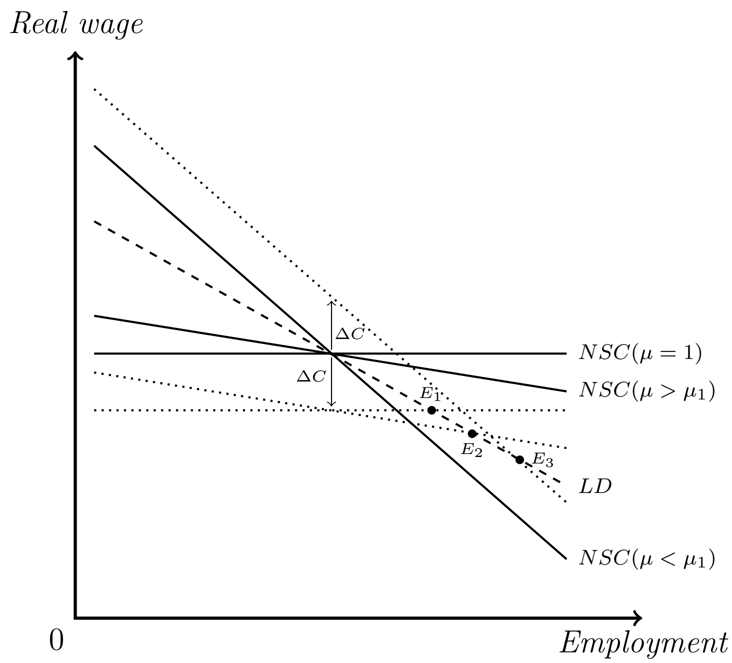

Fig. 3. Labor market equilibrium

Notes: The diagram illustrates the labor market effects of an increase in government spending under (*i*) full insurance ($\mu = 1$), (*ii*) partial insurance with $\mu > \mu_1$, and (*iii*) partial insurance with $\mu < \mu_1$. Equilibrium occurs at the intersection of labor demand (LD) and the constant-consumption no-shirking condition (NSC). In each case the increase in government spending shifts NSC by an amount equal to the eventual change in aggregate consumption (ΔC).

shadow value of wealth requires lowering individual consumption through cutbacks in the real wage. Exactly how far wages must fall for a given increase in employment depends on the initial drop in average marginal utility. This magnitude will be bigger when consumption inequality is high, or when unemployment insurance is low.

Holding $\hat{C}_t$ fixed, equation (15) and the log-linearized demand schedule, $\hat{w}_t = -\alpha\hat{N}_t$, jointly determine the real wage and employment levels. Both curves will be negatively sloped absent full insurance. What's more, if the degree of insurance is small enough, NSC will be steeper than labor demand in a manner isomorphic to Bilbiie (2011) and others. It should come as no surprise then that values of μ satisfying $\alpha < (1-\mu)N/[(1-\mu)N+\mu]$ are precisely the same values under Proposition 1 that give $\Gamma_c > 0$ and $\Gamma_y > 1$.

Figure 3 depicts the situation in the labor market under (*i*) full insurance, (*ii*) partial insurance with $\mu > \mu_1$, and (*iii*) partial insurance with $\mu < \mu_1$. Equilibrium occurs where labor demand (LD) intersects NSC. As for (*i*) and (*ii*), an increase in government spending has no effect on demand but shifts down NSC since the policy ultimately reduces aggregate consumption. Notice that for a given drop in consumption, the increase in employment is greater under partial insurance (E_2) than under full insurance (E_1). Though in neither case is the expansion large enough to generate an output multiplier bigger than one. Case (*iii*) is different. Now government spending lifts aggregate consumption, causing (15) to shift up instead. The decrease in the wage (see also Fig. 1) and the ensuing increase in employment (E_3) is sufficient to raise output by more than the spending shock.

D. *The Role of Efficiency Wages*

Two aspects of the shirking model that distinguish it from the neoclassical framework are moral hazard in the labor market and partial rather than full income insurance. What this paper demonstrates is that positive consumption multipliers are unattainable without the latter. What it hasn't yet established is the significance of moral hazard and the efficiency wage component *per se*. Surely this feature, irrespective of insurance, has implications on the strength of the intensive and extensive margins for consumption. And if so, what role does it have in affecting fiscal policy outcomes?

To disentangle the composition effects of partial insurance from the general equilibrium effects of efficiency wages, I recompute impact multipliers using two alternative models of unemployment. One is a standard indivisible labor model in which families trade in employment lotteries (e.g., Hansen, 1985; Rogerson, 1988). The other is an off-the-shelf labor search model in the spirit of Mortensen and Pissarides (1994). Onto each of these I graft the insurance specification described earlier and rerun the same policy experiment illustrated in Figure 2. Before commenting on the results, I go over some of the main parts of each model. Details I leave for the appendix.

Employment lotteries. Labor is still an indivisible commodity. But this time effort is perfectly observable, so employees face no temptation to shirk. Wages are therefore competitive as opposed to incentive compatible, and families, instead of taking employment as given, choose labor supply optimally to maximize expected utility. To "convexify" the commodity space, families select the probability, call it N_t, that members get hired in period t. A lottery then determines who works and who doesn't. According to (2) and (4), workers again earn wages hw_t while unemployed members receive benefits $\sigma N_t hw_t$. What's different now is that families internalize their choice of N_t on the insurance premium F_t. Recall in the shirking model, where firms alone pick N_t, families treat F_t parametrically in the course of optimization. As shown by Alexopoulos (2004), the two models are observationally equiva-

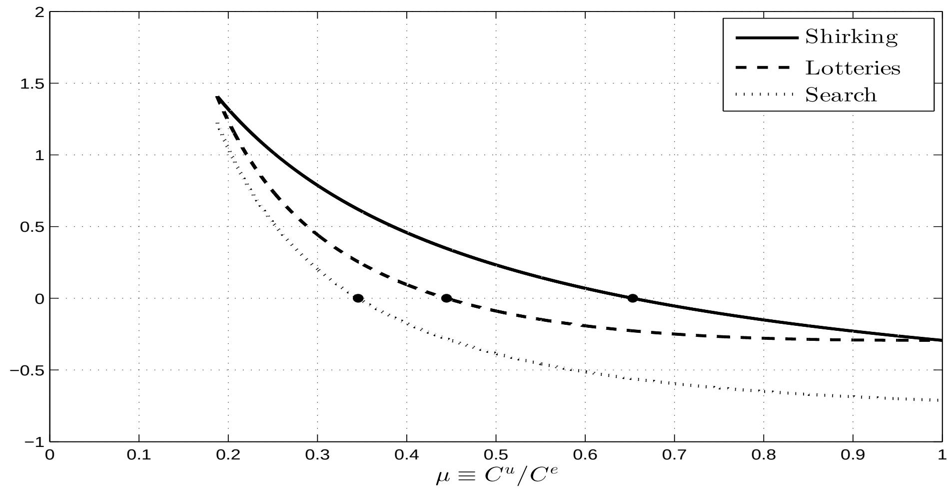

Fig. 4. Consumption multipliers

Notes: Impact multipliers for consumption are shown as functions of the insurance coefficient μ for the shirking model (solid line), the indivisible labor model with employment lotteries (dashed line), and the search-and-matching model (dotted line). All computations are based on the following joint calibration: $\beta = 0.99$, $g = 0.17$, $\rho = 0.90$, $N = 0.942$, $\alpha = 1/3$.

lent in the special case of full insurance but imply separate dynamics under partial insurance.

Search and matching. A $[0, 1]$ continuum of firms employ N_t family members at date t. To attract workers, they post vacancies v_t at a constant flow cost c_p. Once matched, workers and firms separate exogenously with probability $1 - \lambda_p$ per period. The number of unemployed members who search for jobs is given by $u_t = 1 - N_{t-1}$. Following convention, I assume that the aggregate flow of new hires is determined by a constant returns to scale matching function $m_t = m(u_t, v_t)$. The probability that firms fill vacancies, m_t/v_t, and unemployed members find jobs, m_t/u_t, can then be expressed as functions of market tightness v_t/u_t. Both firms and workers take these probabilities as given when negotiating wages w_t. Equilibrium outcomes correspond to a generalized Nash bargaining solution in which workers and firms split the joint surplus of the marginal match.[12] Most of the parameter values chosen for this model are taken from Monacelli *et al.* (2010). The key exception is the parameter governing the relative value of nonwork to work activity. I use a fairly high value for this ratio as suggested by Hagedorn and Manovskii (2008).

Results. Figure 4 plots impact multipliers for consumption over values of μ in the shirking

[12]The number of individuals who receive unemployment benefits in any given period is the sum of all unmatched job searchers $u_t - m_t$ and newly separated workers $(1 - \lambda_p)N_{t-1}$.

model (solid line), the lottery model (dashed line), and the search model (dotted line). When comparing each one side by side, two main conclusions emerge. First, the basic *qualitative* findings described earlier do not hinge on a strict efficiency-wage view of labor markets. In all three models of unemployment, partial insurance is a necessary but not sufficient condition for generating positive multipliers. Indeed with full insurance the consumption response is always negative. But as μ falls, the multipliers get bigger and eventually hit critical points at which the composition effects rather than the wealth effects become the dominant force.

The second major takeaway is that unobservable effort, in and of itself, has significant *quantitative* effects on the private response to government spending. For any feasible value of μ, the consumption multiplier is larger in the shirking model than in the other two. This property enables the shirking model to overturn the crowding-out effects of fiscal policy at higher insurance levels. In the lottery and search models, the critical values of μ imply a consumption drop at unemployment of around 56 and 65 percent compared to only 35 percent in the shirking model.[13]

3 A Model with Capital Accumulation

In this section I reexamine the policy consequences of unemployment insurance while allowing for capital accumulation. One problem with extending the model in this direction, however, is the emergence of equilibrium indeterminacy. In a continuous-time version of the shirking model, Nakajima (2006) proves that indeterminacies will occur if unemployment insurance falls below a certain threshold. What complicates matters here is that this boundary turns out to be above the point at which positive consumption multipliers show up in the baseline model. Should Nakajima's result carry over to discrete time, any amount of insurance small enough to increase consumption after a spending shock will also lead to indeterminacy.

With this in mind, I evaluate the multipliers under two assumptions about capital. One is the standard textbook case in which a unit of investment at time t is costlessly transformed into a unit of productive capital at $t + 1$. While this assumption indeed rules out a large area of the insurance space as indeterminate, I find that output multipliers can still exceed one under partial insurance on account of a positive investment response. In the second case, a share of the family's investment each period gets absorbed by adjustment costs. This feature dramatically shrinks the indeterminacy region, allowing scrutiny of a wider range of

[13] The comparatively weak response of consumption under labor search illustrates the difficulty this class of models has in producing large government spending multipliers. See Monacelli *et al.* (2010) for a discussion.

insurance options, including ones consistent with a positive consumption multiplier.

A. *The Model*

Aside from investment, the only feature that differs from the previous setup is monopolistic competition in the goods market with Calvo-Yun price stickiness. I incorporate these elements here partly in anticipation of the quantitative models discussed later and partly for reasons germane to this section alone. As shown below, nominal rigidities affect the determinacy properties of the shirking model vis-à-vis unemployment insurance. The results in Nakajima (2006) are limited in this regard as they only apply to the case of flexible prices.[14]

Families. Let K_t denote the period-t stock of capital, B_{t-1} the predetermined quantity of one-period nominal bonds with gross return R_{t-1}, and $\int_0^1 D_t(i)di$ the flow of dividends received from ownership of firms. Rental income $r_t^k K_t$ along with dividend and bond wealth is used for purchasing new bonds B_t, family consumption C_t^f, and investment I_t. It follows that the budget constraint takes the form

$$C_t^f + I_t + \frac{B_t}{P_t} \leq \frac{R_{t-1}B_{t-1}}{P_t} + r_t^k K_t - T_t + \frac{1}{P_t}\int_0^1 D_t(i)di.$$

The economy's finished good, priced at P_t per unit, can be either consumed or invested.

The law of motion for capital is given by

$$K_{t+1} = (1-\delta)K_t + \phi\left(\frac{I_t}{K_t}\right)K_t,$$

where the depreciation rate $\delta \in (0,1)$ and $\phi\left(I_t/K_t\right)$ is an adjustment cost function. Following Abel and Blanchard (1983), I assume $\phi' > 0$ and $\phi'' \leq 0$, with $\phi(\delta) = \delta$ and $\phi'(\delta) = 1$. The cost function is assumed to be only weakly concave in order to accommodate the two cases described above. The first one assumes adjustment costs have no effect on investment dynamics and is obtained by restricting $\phi'' = 0$. The second relaxes this assumption by allowing $\phi'' < 0$. In choosing the size of adjustment costs, I copy King and Watson (1996) and Galí *et al.* (2007) by fixing ϕ'' so that the model delivers a unitary elasticity of investment

[14] The appendix contains a full and independent analysis of a version of the model with sticky prices and fixed capital. The results generalize those of the previous section to account for shifts in labor demand arising from cyclical variations in the markup.

with respect to q (i.e., the shadow value of installed capital).[15]

Finished good firms. A competitive firm produces finished goods Y_t by assembling a continuum of intermediate goods $\{y_t(i)\}$ using the Dixit-Stiglitz aggregator $Y_t^{1-1/\eta} = \int_0^1 y_t(i)^{1-1/\eta} di$. Its derived demand for good i takes the form $y_t(i) = (P_t(i)/P_t)^{-\eta} Y_t$, where $P_t(i)$ is the unit price of $y_t(i)$ and $\eta > 1$ is the substitution elasticity across varieties. The zero-profit condition ensures that the finished good price satisfies $P_t^{1-\eta} = \int_0^1 P_t(i)^{1-\eta} di$.

Intermediate good firms. A $[0, 1]$ continuum of firms manufacture the economy's intermediate goods. Each period firms minimize variable costs subject to the production technology (8) and incentive compatibility condition (6). Constant returns guarantee that real marginal cost is the same across firms and given by $mc_t = \Phi \left(r_t^k\right)^{\alpha} (w_t/e)^{1-\alpha}$, where $\Phi \equiv \alpha^{-\alpha}(1-\alpha)^{\alpha-1}$ and e is the optimal effort level in (11).

Although wages are renegotiated every period, prices may now be fixed for several periods. Following Calvo (1983) and Yun (1996), a fraction $1-\chi$ of randomly selected firms adjust their price optimally each period. The other χ firms keep their price unchanged. Adjusting firms all choose a common price $\tilde{P}_t$ to maximize the present discounted value of dividend payments. Optimization leads to the usual reset price equation that balances marginal cost with marginal revenue in a dynamic context. Substituting $\tilde{P}_t$ into the finished good price index implied by the Calvo technology gives $\chi\pi_t^{\eta-1} + (1-\chi)(\tilde{P}_t/P_t)^{1-\eta} = 1$, where $\pi_t \equiv P_t/P_{t-1}$.

Monetary policy. When prices are sticky, the effects of government spending depend on monetary policy. In this model the central bank sets the nominal return on one-period bonds according to

$$\ln R_t = \ln R + \phi_\pi \ln \pi_t, \tag{16}$$

where R is the steady-state value of R_t and the response coefficient $\phi_\pi > 1$.[16]

Equilibrium. For intermediate goods, market-clearing conditions imply

$$K_t^{\alpha} \left(N_t e h\right)^{1-\alpha} = \Delta_t Y_t,$$

where $K_t \equiv \int_0^1 k_t(i) di$ and $\Delta_t \equiv \int_0^1 \left(P_t(i)/P_t\right)^{-\eta} di$. For finished goods, balancing supply and

[15]The (steady-state) elasticity of the investment-capital ratio with respect to q is given by $-1/\delta\phi''(\delta)$.

[16]The nonstochastic steady state corresponds to the one with zero inflation.

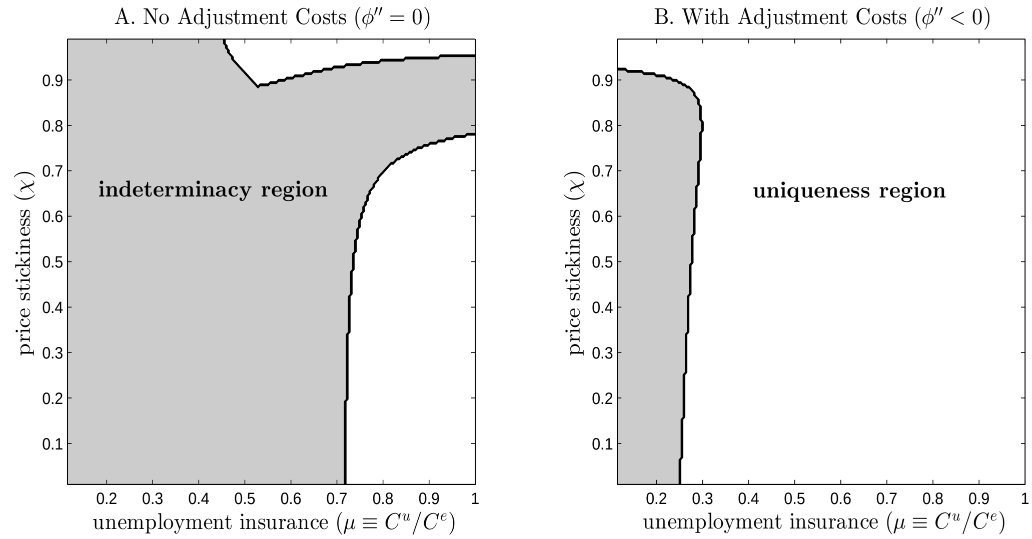

Fig. 5. Determinacy analysis

Notes: Regions of the parameter space (μ, χ) consistent with a unique equilibrium (light area) or indeterminacy (dark area) are shown for the models without capital adjustment costs (A) and with adjustment costs included (B). Computations are based on the following calibration: $\beta = 0.99$, $g = 0.17$, $\rho = 0.90$, $N = 0.942$, $\alpha = 1/3$, $\eta = 6$, $\phi_\pi = 1.50$, $\delta = 0.025$, $\phi''(\delta) = \{0, -40\}$.

demand each period requires

$$Y_t = C_t + I_t + G_t.$$

B. *Indeterminacy and Government Spending Multipliers*

I search for the range of insurance options that produce a determinate equilibrium along with a bigger-than-one output multiplier. To be clear, by determinate I mean that the model has a locally unique (bounded) rational expectations equilibrium. This requires that the number of unstable eigenvalues implied by the full system of log-linear equations match the number of expectational variables (e.g., Klein, 2000). In what follows, I use numerical methods to compute multipliers and to evaluate the roots condition for all feasible values of μ.[17]

First consider the case without adjustment costs ($\phi'' = 0$). Panel A of Figure 5 shows regions of the parameter space (μ, χ) associated with equilibrium uniqueness or indeterminacy, holding the other parameters fixed at baseline values. As anticipated, capital renders much of the insurance space indeterminate. And this is true regardless of the degree of price fixity. Under flexible prices ($\chi = 0$), indeterminacy arises whenever $\mu < 0.72$, which is close to the

[17]The appendix contains additional details on the specific eigenvalue conditions that must be satisfied in order for the shirking model with capital to be locally determinate.

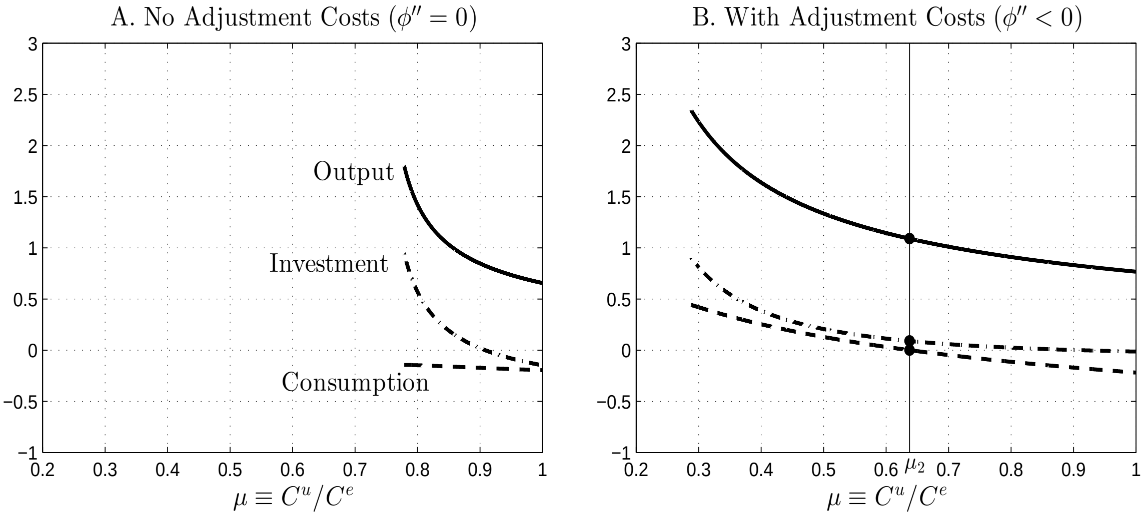

Fig. 6. Impact multipliers

Notes: Impact multipliers for output, consumption, and investment as functions of the insurance coefficient μ are shown for the models without capital adjustment costs (A) and with adjustment costs included (B). Computations are based on the following calibration: $\beta = 0.99$, $g = 0.17$, $\rho = 0.90$, $N = 0.942$, $\alpha = 1/3$, $\chi = 2/3$, $\eta = 6$, $\phi_\pi = 1.50$, $\delta = 0.025$, $\phi''(\delta) = \{0, -40\}$.

threshold value reported in Nakajima (2006). Under sticky prices, the threshold is generally higher and increasing in χ. Regarding fiscal policy, the main takeaway is that insurance levels found earlier to be consistent with positive consumption now lead to indeterminacy for any plausible value of χ. It's also worth noting that indeterminacies abound even though the interest rate rule (16) satisfies the well-known Taylor principle, expressed here as $\phi_\pi > 1$. In a broad class of sticky price models, adherence to the Taylor principle is often cited as a sufficient condition for determinacy (e.g., Woodford, 2003).

Figure 6 plots output, consumption, and investment multipliers for vales of μ consistent with a unique equilibrium. Results confirm that without adjustment costs (panel A), a positive response of consumption is no longer possible. Output multipliers, on the other hand, can still exceed one should investment be sufficiently large. This happens whenever $\mu < 0.86$, with investment increasing rapidly the closer μ gets to its threshold value.

Panel B of Figure 5 shows regions of (μ, χ) space associated with (in)determinacy, this time with $\phi'' < 0$. As is clear from the figure, adjustment costs greatly expand the range of permissable insurance options. Now any value of μ above 0.3 is enough to ensure determinacy regardless of the degree of price stickiness. How these changes affect the multipliers can be seen in Figure 6 (panel B). Overall the results are similar to the baseline model. Output and consumption are less than one and zero under full insurance. And as unemployment benefits drop, both quantities along with the multiplier for investment get bigger. Like before, there exists a critical value, call it μ_2, at which consumption is zero. For insurance levels below μ_2, which in the figure is about 0.64, the composition effect becomes large enough to turn the consumption multiplier positive.

4 Some Extensions and Quantitative Examples

As a strictly empirical matter, the composition effect by itself is probably not strong enough to deliver the kinds of robust multipliers often found in macro-econometric studies of fiscal policy. For output to rise by more than government purchases, my results indicate that consumption has to fall in excess of 30 percent for workers who become unemployed. A decline of this magnitude though seems large in comparison to estimates from the micro literature reviewed earlier. Recall these studies typically report consumption losses in the neighborhood of 5 to 25 percent. Yet even at the high end of this range, the simple models used thus far have little hope of matching the empirical evidence absent other transmission channels capable of boosting the economy's response to a spending increase.

In this section I extend the shirking model to include propagation mechanisms that have been used before to study the effects of fiscal policy. The aims are twofold. The first is to see if large multipliers can even be reconciled with an empirically plausible degree of unemployment insurance. The second is to assess the credibility of the insurance mechanism by conducting a set of quantitative experiments that speak directly to some leading issues in the policy debate. One issue concerns the effects of large and prolonged increases in government spending of the sort recently associated with the American Recovery and Reinvestment Act. Another deals with the idea that multipliers may be larger and more persistent when monetary policy is expected to peg the interest rate for a known length of time, perhaps as a consequence of the zero bound. In both experiments I find that the extended model yields insights similar to those found in related work on the effectiveness of these types of programs. By contrast, imposing full insurance generates policy outcomes more at odds with mainstream views.

A. *Extensions*

To the model presented in section 3 I add endogenous capital utilization and government consumption valued as a public good. Below I outline how each one fits into the basic framework developed by Alexopoulos (2004).[18]

Capital utilization. The family selects the rate z_t at which capital is to be utilized. Leasing K_t brings in $r^k_t z_t K_t$ units of rental income, but it also entails a cost in terms of finished goods equal to $\Psi(z_t)K_t$.[19] Updating the budget constraint to account for these resource flows gives

$$C^f_t + I_t + \Psi(z_t)K_t + \frac{B_t}{P_t} \leq \frac{R_{t-1}B_{t-1}}{P_t} + r^k_t z_t K_t - T_t + \frac{1}{P_t}\int_0^1 D_t(i)di. \tag{17}$$

Imposing market-clearing requirements on (17) produces the aggregate resource constraint

$$Y_t = C_t + I_t + G_t + \Psi(z_t)K_t.$$

To see why utilization is helpful, consider how z_t adjusts after a spending increase. Higher employment drives up the returns to capital, which the family captures in part by raising its utilization rate. For a given capital stock, increases in z_t increase the marginal product of labor, to which firms respond by hiring even more workers. This demand-side momentum in the labor market strengthens the expansionary effects of policy already operating through the no-shirking condition. The effect gets bigger the less costly it is to change z_t.[20]

Public goods. I incorporate public goods by reformulating utility as

$$U(C^j_t + bG_t, e_t) = \ln(C^j_t + bG_t) + \theta \ln(H - \nu_t[he_t + \xi]). \tag{18}$$

Preferences of member j now depend on C^j_t and G_t, and the sign of b determines whether they are viewed as substitutes or complements. As explained by Fève, Matheron, and Sahuc (2013), $b < 0$ implies that private and government consumption are Edgeworth complements in that higher values of the latter increase the marginal utility of the former, inducing families to consume more. Should the complementarity effect be sufficiently strong, the incentive to raise C^j_t may offset the negative wealth effect of higher taxes.[21]

[18] The appendix contains results from a version of the model that adds rule-of-thumb families along the lines of Campbell and Mankiw (1989) and Galí *et al.* (2007). This feature renders the model non-Ricardian, which makes the financing of government spending (taxes or debt) relevant for the effects of fiscal policy. By contrast, versions of the shirking model analyzed here all satisfy Ricardian equivalence.

[19] I impose $z = 1$ and $\Psi(1) = 0$ and assume $\Psi'(1)/\Psi''(1) \equiv \psi \geq 0$.

[20] The cost of adjusting z_t is governed by $\psi \equiv \Psi'(1)/\Psi''(1)$. It gets progressively larger as $\psi \to 0$, at which point the family sets $z_t = 1$ as was implicitly assumed in section 3.

[21] Studies that rely on Edgeworth complementarity include Linnemann and Schabert (2004), Bouakez and

Swapping the original utility function for (18) affects the supply side of the model in a logical way. As always, firms want to discourage shirking, which requires that job contracts satisfy an incentive compatibility constraint

$$U(C_t^e + bG_t, e_t) \geq dU(C_t^s + bG_t, 0) + (1-d)U(C_t^e + bG_t, 0). \tag{19}$$

Cost minimization proceeds exactly as before. The only difference is that the ratio implied by the Solow condition (10) now corresponds to $\tilde{C} \equiv (C_t^e + bG_t)/(C_t^s + bG_t)$.

Labor supply is again characterized by a no-shirking condition that follows directly from (19). The implied consumption ratio linking C_t^u to C_t^e also generalizes to account for public goods and is given by

$$\frac{C_t^u + bG_t}{C_t^e + bG_t} = 1 - \frac{1-\sigma}{1-s}\left(\frac{\tilde{C}-1}{\tilde{C}}\right) \equiv \mu(\sigma). \tag{20}$$

Notice how public goods alter the interpretation of μ. No longer is it equivalent to C_t^u/C_t^e, which is the relevant measure of partial insurance in the model and the same concept used in research on the consumption effects of unemployment. Rather than being constant, this ratio now varies over the cycle according to $(C_t^u/C_t^e) = \mu - (1-\mu)b(G_t/C_t^e)$.

B. *Government Spending Multipliers*

Until now, I have framed the policy discussion in terms of impact multipliers. While analytically convenient, this measure ignores the cumulative effects of a spending shock over longer horizons. Below I follow Mountford and Uhlig (2009) by reporting *present-value* multipliers, an alternative concept that takes into account the entire response path and correctly discounts future macroeconomic outcomes.

Take Gross Domestic Product, for example, defined in the model as $Z_t \equiv C_t + I_t + G_t$. Its present-value multiplier is

$$\text{present-value multiplier}(l) \equiv \frac{E_t \sum_{j=0}^{l} (1/R)^j \triangle Z_{t+j}}{E_t \sum_{j=0}^{l} (1/R)^j \triangle G_{t+j}},$$

Rebei (2007), Leeper, Traum, and Walker (2017), and Lewis and Winkler (2017). Pappa (2009) and Sims and Wolff (2018) incorporate an additional source of complementarity by having government employment and/or public capital enter directly into the production function.

which gives the discounted value (total effect) of changes in GDP over the next l periods caused by a unit shock to the present value of government spending in period t. For $l = 0$, the present-value multiplier is the same as the impact multiplier dZ_t/dG_t.

Estimates of the present-value multiplier will obviously depend on values chosen for the auxiliary parameters (ψ, b) and the insurance coefficient μ. Regarding capital utilization, I fix $\psi = 0.5$. Published estimates tend to fall between 0.1 and 0.9. My calibration is at the midpoint where utilization costs are fairly conservative.[22] As for public goods, I set $b = -0.2$. This value is close to the estimate in Leeper *et al.* (2017) and implies some degree of complementarity between private and government consumption. A modest value of b limits the impact public goods can exert on the multiplier process, which helps keep the onus on partial insurance to do most of the heavy lifting in the model.

For information on μ, I look to the estimates compiled in Table 1. These studies mostly use survey data to evaluate the drop in food consumption that occurs when a person becomes unemployed. Across this group, estimates range from 6 to 19 percent. Yet I suspect these numbers may understate the true loss experienced by displaced workers. For starters, most of the samples deliberately exclude observations that show large changes in consumption. Although this helps insulate results from problems of misreporting, it probably biases upward estimates of C^u/C^e. Second, some studies report annual declines without conditioning on the length of time spent out of work. Chodorow-Reich and Karabarbounis (2016) bring up this point and argue that affected estimates should be increased by a factor of three since the typical unemployment spell lasts only 17 weeks. Finally, restricting the analysis to food ignores spending categories that are more sensitive to job loss. The classic study by Burgess *et al.* (1981) indeed finds that where obligated or necessary expenditures fall by 12.7 percent, all other consumption categories fall by a combined 28 percent.

In what follows, I set $\mu = 0.8099$ so that the model delivers $C^u/C^e = 0.82$ in the steady state. The implied consumption drop of 18 percent is near the average of sample estimates in Table 1 that utilize a measure of total spending. While this number undoubtedly masks a great deal of heterogeneity across individuals, I view it as a useful approximation of the extent to which the typical U.S. worker is insured against unemployment risk.

Figure 7 graphs present-value multipliers for GDP, consumption, and investment out to a ten-year horizon. The benchmark results displayed in the first row come from the basic partial insurance model as described in the last section (solid lines). To this core I add

[22] Levin, Onatski, Williams, and Williams (2006), Justiniano, Primiceri, and Tambalotti (2010), and Altig, Christiano, Eichenbaum, and Lindé (2011) report values between 0.1 to 0.2. Smets and Wouters (2007) and Galí, Smets, and Wouters (2012) obtain estimates closer to 0.8.

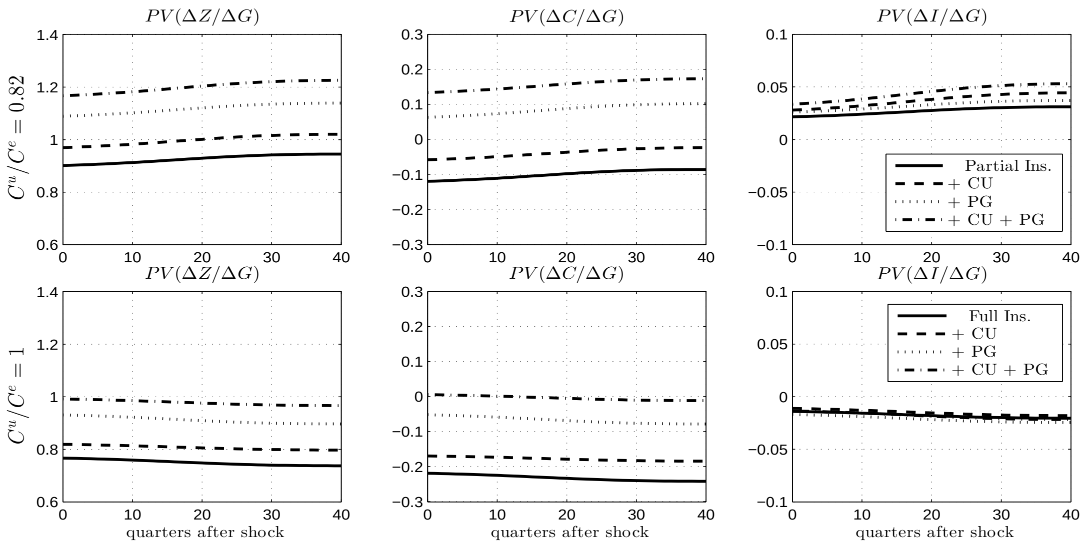

Fig. 7. Present-value multipliers

Notes: Present-value multipliers for GDP, consumption, and investment are shown for the extended model with partial (row one) and full insurance (row two). Added to each baseline (solid lines) are utilization (dashed lines), public goods (dotted lines), and utilization and public goods together (dash-dotted lines). Computations are based on the calibration: $\beta = 0.99$, $g = 0.17$, $\rho = 0.90$, $N = 0.942$, $\alpha = 1/3$, $\chi = 2/3$, $\eta = 6$, $\phi_\pi = 1.50$, $\delta = 0.025$, $\phi''(\delta) = -40$, $\psi = \{0, 0.5\}$, $b = \{0, -0.2\}$, $\mu = \{0.8099, 1\}$.

capital utilization (dashed lines), public goods (dotted lines), and then both utilization and public goods together (dash-dotted lines). Row two compares the same cases but alters the benchmark to full insurance ($C^u/C^e = 1$).

Consider the partial insurance model first. At no point are the present-value multipliers for consumption and output greater than zero and one. Though the effects are somewhat limited, adding capital utilization increases the multipliers across the board. Consumption is visibly higher but still below zero at all horizons. Yet after a few years, GDP rises slightly above one due to a modest pickup in investment. Swapping out utilization for public goods clearly strengthens the economy's response to a spending shock. Both the impact and cumulative effects on consumption and output are comfortably above zero and one in this case. Inserting utilization back into the model amplifies the effects of government spending even more. Now the multipliers are on par with those found at the upper end of the empirical range, about 0.16 for consumption and 1.2 for GDP. Investment is also at its highest in this model, settling above 0.05 in the long run.[23]

[23] Studies that report a positive response of investment to government purchases are Edelberg, Eichenbaum, and Fisher (1999), Burnside *et al.* (2004), Ben Zeev and Pappa (2017), and Lewis and Winkler (2017).

The second row illustrates just how critical partial insurance is for the transmission of government spending. Under full insurance, present-value multipliers are significantly lower and decreasing over time (compared to row one) across all permutations of the model. Even with utilization and public goods together, the declines are enough to push consumption to zero and GDP below one at any horizon. In principle, bigger multipliers could be attained with a smaller (more negative) value of b, that is, through stronger consumption complementarities. But to me, an over-reliance on this mechanism is empirically less palatable.[24]

C. *The American Recovery and Reinvestment Act of 2009*

A simple AR(1) process for government purchases is not a realistic way of describing the types of large-scale spending initiatives recently implemented in the U.S. and other advanced countries. One example is the $787 billion American Recovery and Reinvestment Act (ARRA) that was signed into law in early 2009. As documented in Cogan, Cwik, Taylor, and Wieland (2010), most of the payments authorized by this legislation were to be phased in gradually over five years. In this section I analyze the effects of the ARRA by simulating the time profile of government spending in the extended model with capital utilization and public goods included. To see what affect the insurance arrangement has on equilibrium outcomes, I run the simulation once with $C^u/C^e = 0.82$ and a second time with $C^u/C^e = 1$.

The policy experiments carried out below are similar to ones in Uhlig (2010) and Zubairy (2014). In particular, the program of government spending under the ARRA, as identified by Cogan *et al.* (2010), is fed into the model as a sequence of anticipated shocks. So after observing the initial shock in the first quarter of 2009, households and firms have perfect foresight about future spending and incorporate that information into their expectations.

Figure 8 shows the path of government purchases through 2014 and the response to these shocks under partial (solid lines) and full insurance (dashed lines). The effects on GDP start off small but rise quickly in the first two years of operation. What's more, the additional output at this stage is larger in the partial insurance case by as much as 0.16 percentage points (from a common steady state). After 2010, the stimulus effects begin to fade and continue until the spending increases expire in 2014.

Differences in the amplitude of GDP once again trace to consumption. With full insurance, consumption falls immediately by 0.15 percent as families anticipate the inevitable run

[24] The long-run output multiplier of 1.3 obtained by Fève *et al.* (2013) requires an estimate of $b = -0.95$, indicating a high degree of complementarity between private and government consumption.

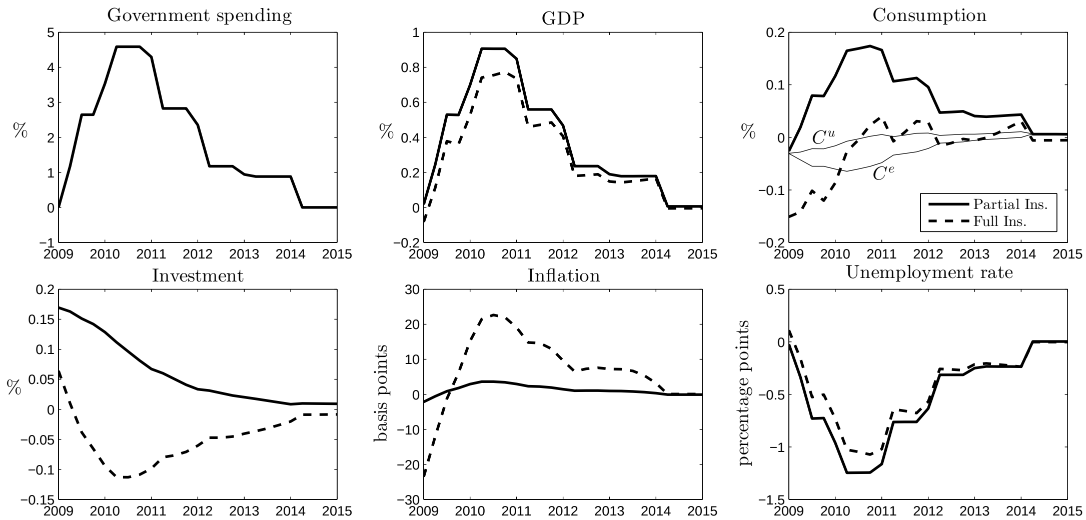

Fig. 8. ARRA: response paths

Notes: The economy's response to the path of government spending implied by the ARRA is shown for the partial (solid lines) and full insurance (dashed lines) versions of the extended model. All variables are in percent deviations from steady state except for inflation and the unemployment rate, which have been converted to annualized basis points and absolute percentage points, respectively. Simulations are based on the following calibration: $\beta = 0.99$, $g = 0.17$, $N = 0.942$, $\alpha = 1/3$, $\chi = 2/3$, $\eta = 6$, $\phi_\pi = 1.50$, $\delta = 0.025$, $\phi''(\delta) = -40$, $\psi = 0.5$, $b = -0.2$, $C^u/C^e = \{0.82, 1\}$.

up in taxes. Under partial insurance, there is only a slight drop in the initial quarter, followed by two straight years of positive growth. This increase, to be sure, occurs at the same time individual consumption is being crowded out. Notice that C_t^e and C_t^u (thin solid lines) respond negatively after 2009, although the change in C_t^e is greater and more persistent.[25] It follows that the rise in C_t must be due to positive composition effects operating along the extensive margin. These effects are clearly visible in the unemployment rate, which is a full 1.25 percentage points below its long-run average at the height of the stimulus in late 2010.

To shed light on the cumulative effects of the ARRA, Figure 9 converts the response paths into present-value multipliers. With full insurance (dashed lines), consumption and GDP are well below zero and one for all of 2009 and most of 2010. But under partial insurance (solid lines), consumption and GDP are significantly above these points the whole time. The peak effects are 0.18 and 1.24 and arrive in the second quarter of 2014.[26] The two cases also have

[25]The implication is that spending shocks may temporarily reduce the consumption inequality associated with job loss. Related findings on the distributional effects of government spending can be found in Galí *et al.* (2007), Anderson, Inoue, and Rossi (2016), and Ma (2019).

[26]In their preliminary analysis the ARRA legislation, Romer and Bernstein (2009) report medium-run

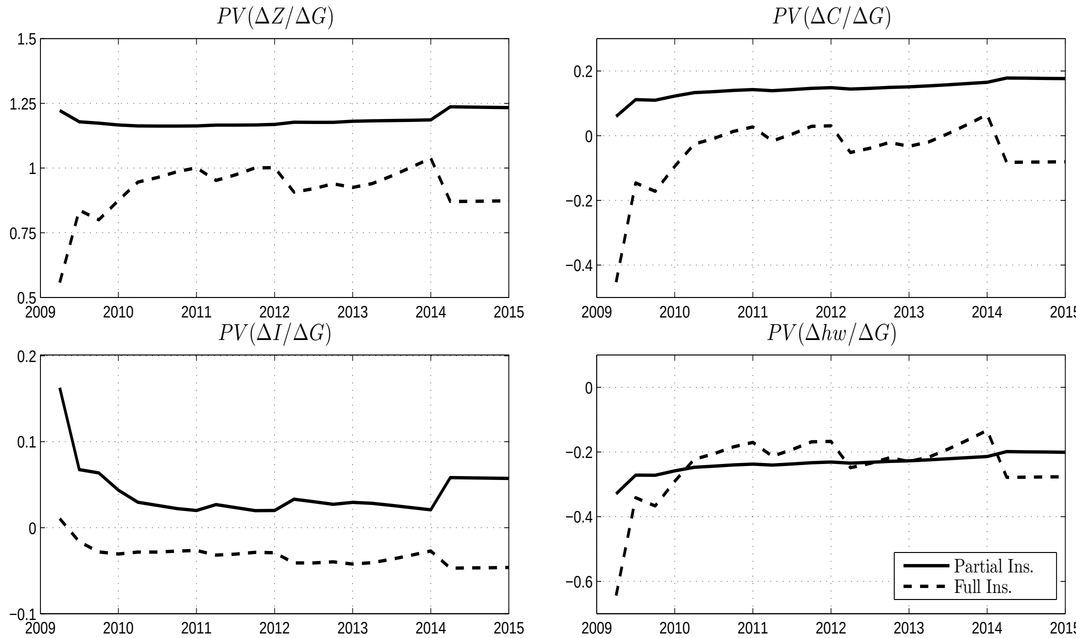

Fig. 9. ARRA: present-value multipliers

Notes: Present-value multipliers for GDP, consumption, investment, and the real wage implied by the path of the economy under the ARRA are shown for the partial (solid lines) and full insurance (dashed lines) versions of the extended model. Simulations are based on the following calibration: $\beta = 0.99$, $g = 0.17$, $N = 0.942$, $\alpha = 1/3$, $\chi = 2/3$, $\eta = 6$, $\phi_\pi = 1.50$, $\delta = 0.025$, $\phi''(\delta) = -40$, $\psi = 0.5$, $b = -0.2$, $C^u/C^e = \{0.82, 1\}$.

different implications for investment. With partial insurance, the multiplier jumps to 0.16 right after the policy announcement but diminishes rapidly from then on. The full insurance model shows investment being crowded out in all but the initial period (see also Fig. 8).

I conclude this section with some comments on the real wage and inflation. Results show that wages decline regardless of the scope of insurance, resulting in negative multipliers from start to finish. For the first year though, wage cuts are noticeably larger under full insurance. As explained in section 2, efforts to re-balance the incentive compatibility constraint after a spending shock force down the real wage and crowd out individual consumption. But as is clear from Figure 8, the consumption drop is smaller, albeit it more persistent, under partial insurance.[27] This behavior both dampens and prolongs the countercyclical adjustment of the real wage compared to the full insurance case. Of course less variation in the wage

forecasts of the GDP multiplier in the neighborhood of 1.5.

[27]The dynamics of aggregate and individual consumption are identical under full insurance.

means less variation in marginal cost, and in turn, a more stable path of inflation. Under full insurance, annualized inflation promptly falls by 25 basis points and then rises by about 50 basis points over the next six quarters. The changes observed under partial insurance over the same period are trivial by comparison.[28]

D. *A Nominal Interest Rate Peg*

Some of the latest research on fiscal policy has been motivated by the experience of near-zero interest rates that took place from 2009 to 2015. Since then, many have argued that multipliers may be larger than normal should monetary policy accommodate government spending by keeping interest rates fixed (e.g., Eggertsson, 2011; Woodford, 2011; Christiano, Eichenbaum, and Rebelo, 2011). In this section I examine the consequences of such accommodative or "passive" monetary policy. Highlighting the role of unemployment insurance is still the main focus, so I again simulate the extended model for $C^u/C^e = \{0.82, 1\}$.

The joint policy experiment I have in mind is similar to one in Leeper *et al.* (2017). The fiscal side dictates that government spending rise by 1 percent for two years before settling into its original autoregressive track, or

$$G_t = \begin{cases} 1.01G & \text{for } t = 1, 2, \ldots, 8 \\ (1-\rho)G + \rho G_{t-1} & \text{for } t > 8. \end{cases}$$

Meanwhile, the central bank sets

$$\ln R_t = \begin{cases} \ln R & \text{for } t = 1, 2, \ldots, J \\ \ln R + \phi_\pi \ln \pi_t & \text{for } t > J. \end{cases}$$

This procedure calls for pegging the nominal interest rate at a fixed value (the steady state) for J quarters but reverting to the benchmark rule (16) thereafter.[29]

Figure 10 graphs present-value multipliers implied by the policy simulation described above. The first row is for the extended model with partial insurance and considers cases in which J equals zero (solid lines), eight (dashed lines), and twelve quarters (dotted lines). The second row evaluates the same three peg lengths under full insurance.

[28] The absence of any significant inflationary effects of the ARRA echoes results in Dupor and Li (2015).

[29] I implement the interest rate peg using methods developed by Laseen and Svensson (2011). The idea is to augment the policy rule with a series of anticipated "shadow shocks" designed so that the peg holds for the desired number of periods.

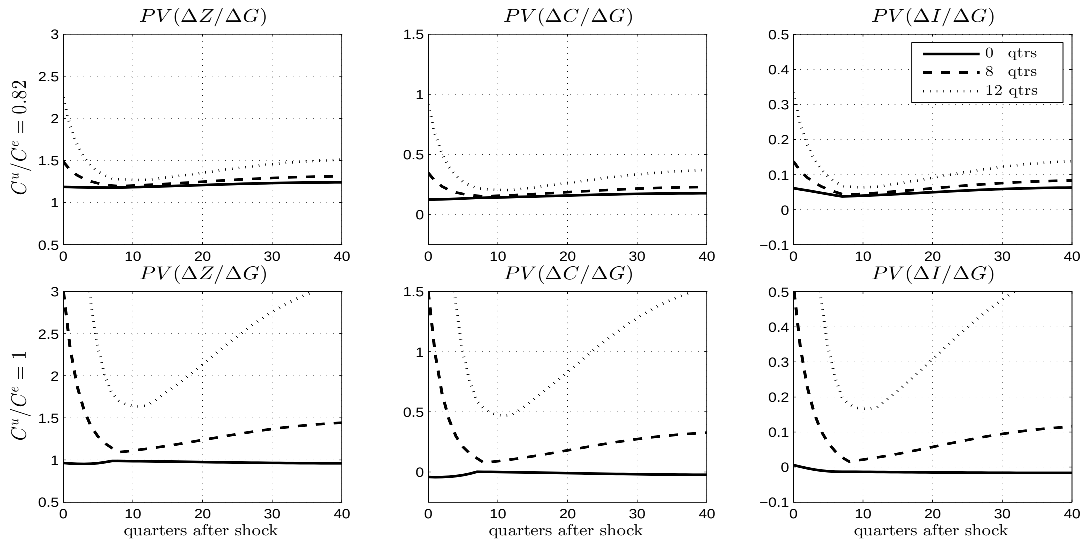

Fig. 10. Interest rate peg: present-value multipliers

Notes: Present-value multipliers for GDP, consumption, and investment are shown for versions of the extended model with a nominal interest rate peg of zero (solid lines), eight (dashed lines), and twelve-quarter (dotted lines) durations. Simulations are based on the following calibration: $\beta = 0.99$, $g = 0.17$, $\rho = 0.90$, $N = 0.942$, $\alpha = 1/3$, $\chi = 2/3$, $\eta = 6$, $\phi_\pi = 1.50$, $\delta = 0.025$, $\phi''(\delta) = -40$, $\psi = 0.5$, $b = -0.2$, $C^u/C^e = \{0.82, 1\}$.

Results from the partial insurance model appear broadly consistent with the literature. To start, multipliers for GDP, consumption, and investment are all higher when the interest rate is pegged, and the effects increase the longer it lasts (e.g., Woodford, 2011; Erceg and Lindé, 2014). A two-year peg, for example, produces an impact multiplier for GDP equal to 1.5. A three-year peg raises it to about 2.2. These quantities are close to values reported by Christiano *et al.* (2011) who run a similar experiment but in the context of an estimated medium-size DSGE model of the postwar U.S. economy.

Another familiar result is that present-value multipliers are always highest in the impact period. Leeper *et al.* (2017) attribute this finding to the well-known expected inflation channel. In short, fixing the nominal interest rate decreases the real interest rate since government spending leads to higher expected inflation. A lower real rate encourages private spending, causing a further rise in inflation and so on. The full effect can be seen in Figure 11 (row one), which graphs the response of interest rates and inflation for each case. Notice that the drop in the real rate increases with the duration of the peg. Moreover, the biggest declines occur on impact, or when monetary policy is furthest from its liftoff period.

Now contrast these results with the full insurance model (row two), where the effects are

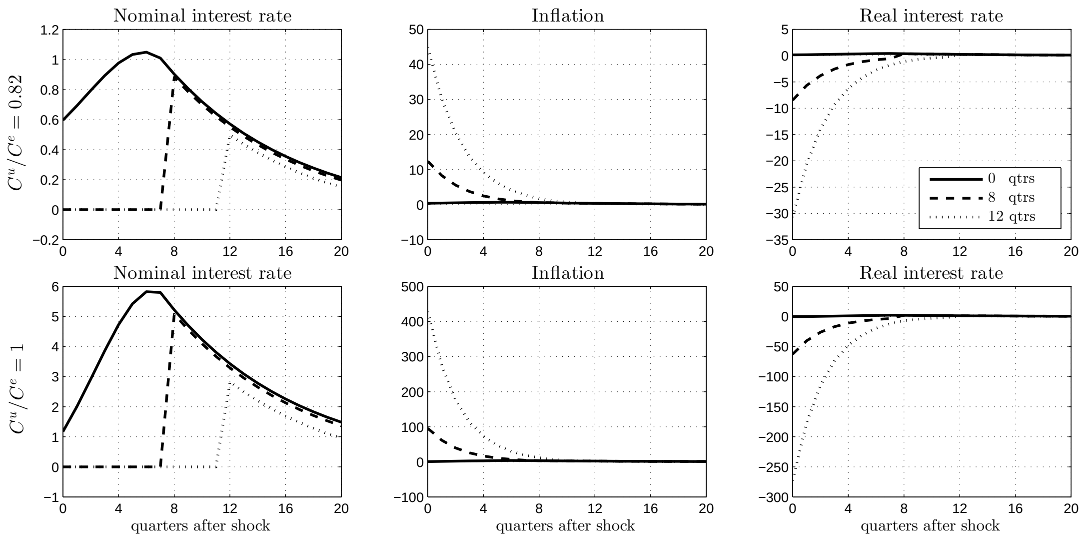

Fig. 11. Interest rate peg: response paths

Notes: The response of interest rates and inflation to the path of government spending are shown for versions of the extended model with a nominal interest rate peg of zero (solid lines), eight (dashed lines), and twelve-quarter (dotted lines) durations. All variables are in annualized basis points. Simulations are based on the following calibration: $\beta = 0.99$, $g = 0.17$, $\rho = 0.90$, $N = 0.942$, $\alpha = 1/3$, $\chi = 2/3$, $\eta = 6$, $\phi_\pi = 1.50$, $\delta = 0.025$, $\phi''(\delta) = -40$, $\psi = 0.5$, $b = -0.2$, $C^u/C^e = \{0.82, 1\}$.

literally an order of magnitude larger. Under a three-year peg, for example, inflation surges more than 400 basis points (annualized), causing the real rate to plummet by about 275 points. Such a large drop in the real rate obviously cannot happen without a significant rise in production, evidence of which is clear from Figure 10. Following the initial increase in government spending, multipliers for GDP, consumption, and investment are huge and, to my knowledge, far beyond any credible estimates of the effects of similar programs.[30]

This divergence between the two models makes sense once one recognizes that full insurance has consequences under an interest rate peg akin to increases in the degree of price flexibility. It turns out both amplify the expected inflation effect on the real interest rate. As shown by Christiano *et al.* (2011), Kiley (2016), and Leeper *et al.* (2017), spending multipliers go up–often dramatically–as price changes become more frequent. This happens because greater price flexibility leads to a larger response of inflation (assuming passive monetary policy) and hence a larger adjustment of the real interest rate.[31]

[30] Impact multipliers in this case are 10, 6.7, and 2.3. None are actually visible in the figure though because the range of values have been truncated to facilitate comparisons between partial and full insurance.

[31] This property is closely related to the more general volatility paradox of sticky price models discussed in Werning (2011) and Bhattarai, Eggertsson, and Schoenle (2018).

Moving from partial to full insurance, it seems, has similar effects on inflation. That's because partial insurance, through its influence on the wage-setting process, actually bolsters the amount of *endogenous* price rigidity in the model. So even though the frequency of price changes is the same, the magnitude of those changes are much smaller (e.g., Givens 2008; Givens, 2011). And like increases in *exogenous* rigidity, this works to moderate the impact of spending shocks on inflation (see also Fig. 8). The net result is a smaller reduction in the real interest rate and thus a smaller, but more plausible, upturn in private spending.

5 Concluding Remarks

The basic argument laid out in these pages goes something like this. The negative (individual) wealth effects of government spending predominant in most business cycle models are not necessarily inconsistent with the aggregate time-series evidence. Once one accounts for the composition of private spending between workers and nonworkers, it is possible for aggregate consumption to go up after a tax-financed rise in government purchases. But for this to happen, two conditions must be met. The spending increase must result in more workers and fewer nonworkers, and consumption levels must be higher for workers.

I flesh out these ideas in a shirking, efficiency-wage model with partial unemployment insurance. The main theoretical result shows that multipliers for consumption and output will exceed zero and one if insurance is sufficiently small. This threshold, however, lies somewhat outside the normal range of estimates from the micro literature on the consumption effects of unemployment. To strengthen the transmission channel, I add to the model capital utilization and public goods. Not only does this extended version produce sizable multipliers at insurance levels within the normal range, it also yields credible predictions regarding the effectiveness of contemporary stimulus programs like the ARRA and the Federal Reserve's accommodation of fiscal policy through a transient interest rate peg.

This research makes assumptions designed to spotlight–as openly as possible–the link between unemployment insurance and government spending multipliers. As a result, it leaves out certain details the broader policy literature suggests may be relevant. One is the financing of public consumption by means of distortionary taxes. Many studies show that multipliers will be lower if the only source of revenue is a marginal income tax (e.g., Drautzburg and Uhlig, 2015). Others argue that the expansionary effects of public spending can be preserved if accompanied by an increase in tax progressivity. Ferriere and Navarro (2020) demonstrate as much in a model with heterogeneity in households' marginal propensities to consume and labor supply elasticities. Both quantities tend to be larger for low-income earners. A policy that shifts the tax burden away from this group should therefore mitigate the crowding-out effects of higher taxes and increase the size of the spending multiplier.

Another detail left out of the shirking model is stickiness in the nominal wage. To date, there is ample evidence showing that wage changes are infrequent (e.g., Barattieri, Basu, and Gottschalk, 2014). Accounting for this type of rigidity may have nontrivial effects on the response of income and consumption to a fiscal shock (e.g., Colciago, 2011; Furlanetto, 2011; Dupor, Li, and Li, 2019). In a recent contribution, Rendahl (2016) incorporates sticky wages into a labor search model with full insurance and a binding zero bound constraint on monetary policy. As expected, higher government spending puts considerable upward pressure on prices at the zero bound. With nominal wages fixed, real wages fall and profit margins rise, which in turn, boosts hiring, lowers unemployment, and increases private spending.

An important empirical question is whether the effects of fiscal shocks vary over the business cycle. For the U.S., Auerbach and Gorodnichenko (2012) find that spending multipliers are bigger during recessions than during expansions. While this interpretation of the data has its critics (e.g., Ramey and Zubairy, 2018), subsequent research has concluded that fiscal policy is generally more effective when there is slack in the economy. Of course my results based on a purely linearized model rule out state-dependent multipliers by construction. Results from Albertini, Auray, Bouakez, and Eyquem (2021), however, may provide some guidance on what a nonlinear model would have to say about potential asymmetric effects of government spending. Their framework combines search frictions in the labor market with partially insured unemployment risk. Fiscal shocks are transmitted through composition effects similar to mine, but these get amplified during contractions by virtue of a job-finding probability that is highly concave with respect to the degree of market tightness.

Perhaps the most controversial assumption is the representative family structure, a useful modeling device that separates intertemporal decisions from the consumption choices of individuals. Relaxing this assumption would allow workers who face uninsurable job risk to smooth consumption by means of precautionary saving. Ravn and Sterk (2017) explore this idea using a labor search model with government unemployment benefits. While it contains no formal discussion of fiscal policy, their analysis does show how financial market incompleteness and sticky prices together amplify the cyclical effects of labor market shocks. Auclert, Rognlie, and Straub (2018) and Hagedorn, Manovskii, and Mitman (2019) explicitly measure the size of fiscal multipliers in the context of a New Keynesian (sticky-wage) model with incomplete markets and deficit financing. Both studies, however, omit the sort of frictions needed to generate positive unemployment in equilibrium. Using a similar framework, Auclert and Rognlie (2018) examine the aggregate demand effects of a rise in income inequality. They find that higher inequality can reduce output and consumption, but only if it derives from individual earnings risk and if monetary policy is passive along the way. Incorporating these and other aspects of the incomplete markets literature may well provide new insights on the fiscal consequences of unemployment insurance policies.

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