The Fiscal Policy Mix: UI Extensions Shape Fiscal Multipliers

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Abstract

Government consumption stimulus is often implemented alongside other fiscal measures that shape its effectiveness. This paper studies the interaction between government spending multipliers and unemployment insurance (UI) extensions. Using state-level military spending shocks and cross-state variation in UI duration, we show that longer pre-existing UI significantly lowers spending multipliers. To interpret these findings, we develop a small open economy model with search-and-matching frictions and heterogeneous households. The model highlights two channels: a *level effect* that reduces precautionary savings, and an *endogenous UI-duration effect* whereby higher spending lowers unemployment and shortens UI extensions. Quantitatively, the latter mechanism dominates.

Keywords: Fiscal Policy, Fiscal Multipliers, Unemployment Insurance, Heterogeneous Agents
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1 Introduction

Government spending stimulus is often not a fiscal measure taken in isolation. Instead, it typically forms part of a larger fiscal policy mix that simultaneously deploys other fiscal instruments. In the US, government spending together with unemployment insurance (UI) extensions constitutes a prime example of such a fiscal policy mix: the duration of UI benefits is systematically extended as unemployment rates rise during recessions, precisely the times when government spending is intended to be most effective. The experience of the Great Financial Crisis provides a good example: large stimulus spending was implemented through the American Recovery and Reinvestment Act, while UI duration simultaneously reached unprecedented levels. This paper investigates the consequences of such a policy mix by examining how UI extensions shape the effects of government spending, thereby affecting the size of the fiscal multiplier.

We first document empirically that government spending multipliers are smaller when UI duration has been previously extended. Our empirical strategy exploits state-level variation in military spending to identify government spending shocks, and cross-state as well as time variation in UI duration to identify the additional effect of UI extensions on government consumption multipliers. The baseline specification uses the raw variation in UI duration, which we sequentially refine through a series of "horse races" and an instrumental-variables strategy to isolate exogenous changes in UI duration. These exercises confirm that the relationship between UI extensions and fiscal multipliers is not driven by other competing factors that may be correlated with UI duration. Across specifications, the evidence consistently indicates that UI extensions significantly affect the size of the fiscal multiplier.

We then rationalize this result using a small open economy New Keynesian model with equilibrium unemployment and heterogeneous households. The model provides two competing and related explanations for why extended UI duration can reduce the size of the fiscal multiplier: (i) a *level effect*, whereby longer UI duration reduces households' precautionary savings and thus lowers the fiscal multiplier; and (ii) an *endogenous UI duration effect*, whereby higher government spending lowers unemployment, leading to an earlier expiration of UI extensions. A series of counterfactual exercises that isolate these channels shows that the endogenous-duration effect accounts for most of the dampening of the fiscal multiplier. Finally, we use the model to infer the union-wide effects of UI extensions on multipliers from our state-level estimates.

In more detail, our empirical analysis uses a quarterly panel dataset at the US state level. To identify government spending shocks, we build on the existing literature on state-level fiscal multipliers (Nakamura and Steinsson, 2014; Auerbach *et al.*, 2024; Demyanyk *et al.*, 2019) and rely on state-level military spending measured using Department of Defense contract data. Following Nakamura and Steinsson (2014), we employ a Bartik-type identification strategy that exploits heterogeneous sensitivity to national military spending across states.

We supplement these identified government spending shocks with a measure of UI extensions across states and over time. The institutional design of UI extensions in the US provides rich variation in UI duration, which we use to examine how it interacts with the size of the government spending multiplier. More specifically, UI duration is set at a regular level of about 26 weeks in most states during normal times, and this regular level is set independently of the business cycle. In addition, UI policies such as the Extended Benefits program or the Emergency Unemployment Compensation program enacted during the financial crisis allow states to extend UI duration beyond this regular level when unemployment rates exceed predefined thresholds. In practice, this design implies substantial heterogeneity in UI duration across US states and over time.

Our main empirical finding is as follows: when fiscal shocks hit a state with pre-existing UI extensions, the fiscal multiplier falls significantly. We obtain this result by computing state-level government spending multipliers for unemployment and earnings, conditioning on *pre-existing* UI extensions using state-dependent local projections (Jordà, 2005).

The interpretation that extended UI duration causally leads to a lower fiscal multiplier implicitly assumes that no other state-level characteristic correlated with UI duration would also lead to a lower fiscal multiplier. We take two further steps to verify that this assumption holds in the data.

First, we augment our baseline specification by considering a series of "horse races" between UI duration and alternative competing state-level variables. The first accounts for state-level economic slack, addressing the possibility that fiscal multipliers vary over the business cycle (Auerbach and Gorodnichenko, 2012; Bernardini *et al.*, 2020). The second considers the fraction of unemployed workers receiving UI benefits, allowing us to control for the possibility that the degree of insurability against unemployment affects the size of the fiscal multiplier (Albertini *et al.*, 2021). The third accounts for state-level political orientation, since more progressive states tend to have longer UI duration and political orientation may affect the effects of fiscal policy (Carlino *et al.*, 2023).

Second, we expand our baseline specification to show that our results are not driven by unobserved covariates that jointly determine UI duration and the size of the fiscal multiplier. For example, a state could have temporarily higher unemployment, and hence extended UI duration, because wages are more rigid than average. Such region-specific characteristics could also affect the fiscal multiplier. We first note that even if this mechanism were operative, it would tend to raise the multiplier, which is the opposite of what we find. Nonetheless, we address this concern by instrumenting actual UI duration with UI extensions induced by measurement error in real-time unemployment, as constructed by Chodorow-Reich *et al.* (2018). This extension of our baseline specification links cross-state differences in UI duration to plausibly exogenous variation, rather than to differences in unobserved characteristics.

The estimates we obtain under these extensions corroborate our baseline finding, both quantitatively and qualitatively, that UI extensions reduce the responses of state-level unemployment and earnings to government spending shocks.

We next present a model of a small open economy within a monetary union (Galí and Monacelli, 2005), which mimics our empirical setting, to interpret our empirical findings. We introduce search-and-matching frictions, together with household heterogeneity in the Imrohoroğlu–Bewley–Huggett–Aiyagari tradition. This heterogeneity allows for a realistic quantitative assessment of the effects of both government spending (Galí *et al.*, 2007; Auclert *et al.*, 2018) and unemployment benefits (Kekre, 2022; McKay and Reis, 2021). The local fiscal authority provides federally financed UI benefits with limited duration, which we model through stochastic expiration (Mitman and Rabinovich, 2024). We consider a UI rule that extends benefits when the local unemployment rate exceeds a pre-defined threshold, thereby matching the policy rule in the data to a first-order approximation.

We calibrate the model to an average US region. We first show that the model is largely consistent with micro evidence on household behavior, such as the consumption patterns during unemployment spells documented in Ganong and Noel (2019). We then demonstrate that the model captures our empirical findings both quantitatively and qualitatively, despite not being targeted: the government spending multiplier is markedly lower when the duration of UI benefits is extended.

In the model, the transmission of a government spending shock operates through the usual channels present in representative-agent economies (see, for example, Woodford 2011), coupled with a precautionary-savings channel: government spending expansions reduce the unemployment rate, shortening the duration of unemployment spells and hence the need for precautionary saving, which further stimulates consumption.

Regarding the fiscal policy mix, the model provides two competing and related explanations for why extended UI duration could reduce the size of the fiscal multiplier. First, there is a *level effect*. When UI duration is longer, the idiosyncratic risk associated with unemployment spells is dampened. As a result, the precautionary-saving channel of government spending is less relevant, reducing the size of the multiplier. Second, there is an *endogenous UI duration effect*. Because UI duration is endogenously determined by the state-level unemployment rate, a government spending shock that reduces unemployment leads to an earlier phase-out of UI extensions. In the model, this reduction in UI duration raises precautionary saving and restrains household consumption, dampening the expansionary effects of government spending. Importantly, this endogenous response is present only when UI duration has been previously extended. The reason is that when UI is at its regular duration level, UI duration cannot be reduced further even if the unemployment rate falls. In other words, the institutional design of UI extensions implies a differential response of UI duration to the unemployment decline that follows a government spending shock across pre-existing levels of UI duration, the state variable in our empirical setting.

We build a series of counterfactuals in the model to understand which of the competing explanations drives our finding that the fiscal multiplier is smaller when UI has been previously extended. We find that the level effect has relatively small consequences for the size of the multiplier, with the endogenous-duration effect accounting for the bulk of the difference in fiscal multipliers that we document.

We conclude by using the model to study the fiscal policy mix at the union-wide level. As in Nakamura and Steinsson (2014), our state-level empirical estimates cannot be extrapolated to the aggregate, since they difference out the monetary policy response to fiscal measures. Our findings indicate that while the monetary policy response tends to mitigate the effects of UI extensions on the fiscal multiplier, the channels we highlight in this paper remain operative and quantitatively relevant at the aggregate level.

Literature Review In studying how the fiscal policy mix formed by UI extensions and government spending interacts, we contribute to several strands of the literature.

First, our paper belongs to the literature recognizing that the size of the government spending multiplier is not a single invariable statistic, but is instead shaped by economic characteristics. Among these, attention has been paid to how multipliers differ in expansions versus recessions (Auerbach and Gorodnichenko, 2012; Ramey and Zubairy, 2018; Bernardini *et al.*, 2020), the exchange rate response (Born *et al.*, 2021), the demographic characteristics of the population (Basso and Rachedi, 2021), the sign of the shocks (Barnichon *et al.*, Forthcoming), and nominal wage rigidity (Jo and Zubairy, 2025). Our paper instead shifts the focus from these economic characteristics to the fiscal policy mix itself as a determinant of the fiscal multiplier.

Second, we complement the literature investigating the interaction of government spending with other policies. Related to our paper, Ferriere and Navarro (2024) show, both empirically and in a model-based analysis, that a fiscal stimulus financed with more progressive taxation leads to higher fiscal multipliers. Similarly, Broner *et al.* (2021) document that a fiscal stimulus financed via external debt might be more effective, as it diverts fewer resources from the domestic economy. Additionally, Hack *et al.* (2023) and Miyamoto *et al.* (2018) show that the central bank response is a key determinant of the fiscal multiplier, as indicated by restrictions imposed by the effective lower bound on nominal interest rates and by the systematic component of monetary policy. Our work complements these papers by focusing instead on the spending-side fiscal policy mix that is actively deployed during recessions.

Finally, we contribute to an emerging literature that explores the consequences of household heterogeneity in open-economy models (de Ferra *et al.*, 2020; Auclert *et al.*, 2021; Bayer *et al.*, 2024; Guo *et al.*, 2020), as well as to the literature studying the transmission of government spending (Albertini *et al.*, 2021; Hagedorn *et al.*, 2019; Auclert *et al.*, 2018; Brinca *et al.*, 2019) and unemployment insurance benefits (Gorn and Trigari, 2024; Kekre, 2022; McKay and Reis, 2021) in economies with household heterogeneity and nominal rigidities.[1] We complement this literature by extending existing frameworks to incorporate search-and-matching frictions in the labor market within an open-economy setting. This extension allows us to study the interaction between government spending and UI extensions and to assess the relative importance of the channels highlighted in this paper.

The remainder of the paper is structured as follows. Section 2 describes UI policy in the US and the data we use to implement our identification strategy. Section 3 presents our main empirical results. Section 4 outlines the model, which we calibrate to the US

[1]For other papers examining the consequences of UI benefits with flexible prices, see, for example, Landais *et al.* (2018), Birinci and See (2023), Mitman and Rabinovich (2015), and Krusell *et al.* (2010).

economy in Section 5. Section 6 presents the model results. A final section concludes.

2 UI Background and Data

To understand and estimate the effects of UI extensions on the size of the government spending multiplier, two key ingredients are required: identified government spending shocks and sufficient variation in UI duration. Section 2.1 discusses the institutional background of UI policy that generates such variation across states and over time. Section 2.2 then describes our source of identified government spending shocks and the remaining data used in the empirical analysis.

2.1 Unemployment Insurance in the United States: Background

In the United States, most states offer a regular UI benefit duration of 26 weeks. This regular duration is set irrespective of the regional unemployment rate. During downturns, however, states can extend UI benefit duration when unemployment exceeds a predetermined threshold. The Extended Benefits program (EB), for example, allows states to provide up to 20 additional weeks of UI benefits, depending on the unemployment rate. In addition, the Emergency Unemployment Compensation program activated during the Great Recession allowed states to extend UI duration by up to 53 weeks beyond existing extensions. Similarly, the Temporary Extended Unemployment Compensation program enacted in 2002 allowed for additional extensions as unemployment increased following the dot-com bust.

The various UI programs have generated substantial variability in the duration of UI benefits, both over time and across states. Figure 1 illustrates this heterogeneity using UI duration data from Chodorow-Reich *et al.* (2018). The dashed red line represents the average duration of UI extensions across US states, while the solid blue and black lines indicate the maximum and minimum duration in the cross-section, respectively. The figure shows that between the early-2000s downturn and the financial crisis, most states did not offer additional UI extensions. However, the average UI extension duration increased markedly from 2008 onward and between 2002 and 2004. Importantly, this increase was not uniform across states, as evidenced by the disparity between the maximum and minimum durations of UI benefits.

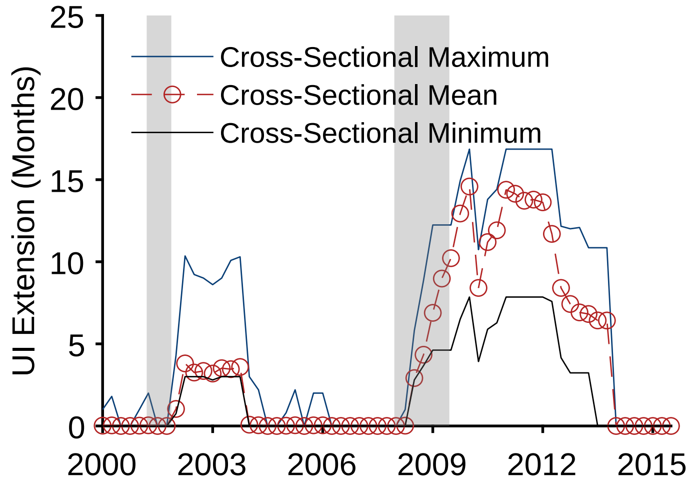


Figure 1: Duration of UI extensions

Notes: UI benefit duration extensions in US states. The dashed red line with circles shows the cross-sectional average duration of UI benefits. The solid blue (black) line indicates the maximum (minimum) duration of UI benefits across states.

2.2 Data

To implement our identification strategy, we construct a quarterly panel dataset for US states covering 2000–2015. We obtain measures of actual UI duration and the state-level unemployment rate from Chodorow-Reich *et al.* (2018). From the same source, we also obtain a state-level time series for the fraction of unemployed workers receiving UI payments. In addition, we obtain state-level earnings from the Bureau of Economic Analysis Regional Economic Accounts. Earnings are defined as pre-tax wages and salaries, which we use as a proxy for state-level economic activity. We complement these variables with the political dataset of Carlino *et al.* (2023), which contains the vote distribution in gubernatorial elections for each state.

Our identification strategy requires measures of fiscal expenditure shocks at the state level. To obtain these shocks, we build on the literature on state-level fiscal multipliers (Nakamura and Steinsson, 2014; Auerbach *et al.*, 2024; Demyanyk *et al.*, 2019) and rely on state-level military spending.

More specifically, our measure of state-level government spending is constructed using Department of Defense (DOD) contract data available on *USASpending.gov*.[2] This source provides comprehensive details on contracts signed since 2000. It supplies infor-

[2] In the context of fiscal multipliers, these data have been used previously in, for example, Auerbach *et al.* (2020, 2024) and Demyanyk *et al.* (2019).

mation on the name and location (ZIP code) of the primary contractor, the total contracted amount (obligated funds), and the contract duration. In most instances, it also reports the primary ZIP code where the contracted work was carried out. The dataset's detailed geographic and timing structure makes it well suited for our analysis.

The information on contract duration allows us to construct a proxy for spending outflows over time by allocating the obligated amount evenly over the contract's duration (Auerbach *et al.*, 2024). We then aggregate spending across contracts by location at each point in time, yielding a quarterly state-level panel of military spending.

In addition to new contract obligations, the dataset also contains modifications to existing contracts, including downward revisions to contract amounts (de-obligations) that appear as negative entries. Many of these de-obligations are very large and occur after obligations of similar magnitude. Following Auerbach *et al.*, 2020, 2024, when consecutive obligations and de-obligations have magnitudes within 0.5% of each other, we treat both as null and void. This restriction removes 2.8% of contracts from the sample.

3 Empirical Results

This section presents our main empirical results. We first show that extended UI duration significantly mitigates the unemployment and earnings responses to government spending shocks, resulting in a smaller fiscal multiplier. We next show that our results are robust to alternative specifications that address potential threats to identification, including the use of an instrumental-variables strategy.

3.1 Fiscal Multipliers and UI Duration

Throughout our analysis, we use local projections (Jordà, 2005) to infer the effects of UI extensions on government spending multipliers. Local projections provide a flexible alternative to structural vector autoregressions, allowing for direct estimation of impulse response functions without imposing dynamic restrictions. Furthermore, local projections can be readily extended to study state-dependent responses, making them well suited to our analysis.

More precisely, we estimate the additional effect of extended UI on the impulse response of the outcome variable $Y_{i,t+h}$ to the impulse variable $X_{i,t+h}$ at horizon h by estimating regressions of the following form:

$$\sum_{j=0}^{h} Y_{i,t+j} = \alpha_{i,h} + \delta_{t,h} + \beta_h \sum_{j=0}^{h} X_{i,t+j} + \gamma_h(L) Z_{i,t-1} + T^*_{i,t-1}\left(\beta_h^{UI} \sum_{j=0}^{h} X_{i,t+j} + \gamma_h^{UI}(L) Z_{i,t-1}\right) + \eta_h T^*_{i,t-1} + \varepsilon_{i,t+h}, \quad h \geq 0, \qquad (1)$$

where $T^*_{i,t-1}$ is the additional duration of UI benefits, expressed in months, in US state i at time $t-1$. $\alpha_{i,h}$ denotes state fixed effects that control for time-invariant state characteristics. $\delta_{t,h}$ denotes time fixed effects that control for aggregate shocks and nationwide policy changes (such as the monetary stance) that affect the US as a whole at a particular point in time. As a consequence, identification comes exclusively from cross-state variation within a given period. $Z_{i,t-1}$ is a set of control variables, discussed in more detail below.

Regression (1) allows us to compute the response of $Y_{i,t+h}$ to a given change in $X_{i,t+h}$ during *normal times* by estimating β_h, and the additional response of $Y_{i,t+h}$ when UI has been *previously extended* by estimating β_h^{UI}. That is, β_h^{UI} is our main object of interest.

We consider two outcome variables to estimate cumulative fiscal multipliers: the cumulative change in the state unemployment rate, $\sum_{j=0}^{h} \frac{(U_{i,t+j} - U_{i,t-1})}{U_{i,t-1}}$, and the cumulative change in state-level earnings, $\sum_{j=0}^{h} \frac{(E_{i,t+j} - E_{i,t-1})}{E_{i,t-1}}$. In both cases, the impulse variable is the change in state military spending normalized by state-level earnings, $\sum_{j=0}^{h} \frac{(G_{i,t+j} - G_{i,t-1})}{E_{i,t-1}}$.

To establish the causal effects of government spending, we require a strategy that identifies exogenous government spending shocks. We do so using a Bartik-type identification strategy that exploits heterogeneous sensitivity to national military spending across states (see, for example, Nakamura and Steinsson 2014 or Auerbach *et al.* 2020). Specifically, we instrument the cumulative changes in $X_{i,t+j}$ using cumulative changes in total national military spending interacted with state dummies.[3] The first-stage interpretation of this instrumental-variables strategy is that we regress changes in state-level spending on changes in aggregate military spending, controlling for fixed effects and other covariates. This first stage isolates systematic state-level sensitivity to national military spending from endogenous changes in state-level spending that may arise from political factors or regional business-cycle conditions.

[3]Naturally, for the interaction term $T^*_{i,t-1} \cdot X_{i,t+j}$, we also interact total national military spending with state dummies and pre-existing UI duration, $T^*_{i,t-1}$.

Our set of controls, $Z_{i,t-1}$, always includes eight lags of the outcome variable $Y_{i,t+j}$, the impulse variable $X_{i,t+j}$, and lags of state-level changes in unemployment, earnings, and military spending. In addition, we include lags of two further controls that account for time-varying state characteristics that may be correlated with both fiscal multipliers and pre-existing UI duration. First, Carlino *et al.* (2023) shows that the partisanship of state governors affects the efficacy of fiscal policy, and we observe that more progressive states tend to have longer UI durations. We therefore include lags of a political-leadership dummy that equals one if the Republican vote share in the most recent gubernatorial election exceeded 50 percent. Second, we include the fraction of unemployed workers who receive UI benefits to control for the possibility that the degree of insurability against unemployment affects the size of the fiscal multiplier, as illustrated in Albertini *et al.* (2021). That paper shows that the fiscal multiplier is shaped by a precautionary-saving motive and by a composition effect that depends on the consumption gap between employed and unemployed workers.

Fiscal Multipliers Table 1 reports estimated cumulative unemployment and earnings multipliers in columns 1 and 2, respectively. Driscoll–Kraay standard errors (Driscoll and Kraay, 1998) are reported in parentheses; these allow for cross-sectional dependence across states and for serial correlation and heteroskedasticity over time. In what follows, we focus on 8-quarter-ahead ($h = 8$) cumulative responses as a summary statistic of the dynamic effects. Appendix A reports cumulative responses at alternative horizons.

Across outcome variables, we find that fiscal multipliers are systematically smaller when UI duration has been previously extended. In column 1, the estimate of β implies that a relative increase in military spending lowers the unemployment rate in a given state relative to other states when UI is at its regular level, with an associated multiplier of about -5.53. More precisely, this number means that if military spending increases by 1% of state-wide earnings (relative to other states), then state-level unemployment rate declines by 5.53% in cumulative terms. Evaluated at an average unemployment rate of 6%, this corresponds to a cumulative decline of about 0.33 percentage points.

Extended UI dampens this effect, as indicated by β^{UI}: a one-month longer UI duration at time $t-1$ increases the unemployment multiplier by 0.73 (about 14% of 5.53), implying a smaller reduction in unemployment. More specifically, when cumulative relative military spending increases by 1% of state earnings, the implied cumulative decline in the

	Dependent variable	
	Unemployment	Earnings
β	-5.53^{***}	1.47^{**}
	(1.71)	(0.60)
β^{UI}	0.73^{**}	-0.29^{***}
	(0.32)	(0.05)
First-stage F-statistic	10,527.75	10,527.75
Observations	2,300	2,300

Notes: Entries report cumulative 8-quarter-ahead ($h = 8$) responses of unemployment and earnings in normal times (β) and the additional effects when UI is extended (β^{UI}) by one additional month at time $t-1$. Driscoll–Kraay standard errors (Driscoll and Kraay, 1998) are in parentheses. All regressions include state and time fixed effects and are estimated by two-stage least squares. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 1: Fiscal Multipliers and UI Extensions

unemployment rate is about 0.29 percentage points rather than 0.33 percentage points.[4]

Similarly, column 2 shows that the earnings multiplier is 1.47 during normal times (captured by β) and is lower by about 0.29 in states with longer UI duration (captured by β^{UI}). These estimates can be interpreted as the cumulative increase in earnings (in dollars) per dollar of military spending. All effects are statistically different from zero at least at the 5% level.

3.2 Addressing Threats to Identification

The causal interpretation that extended UI duration lowers fiscal multipliers implicitly assumes that no other state-level characteristic correlated with UI duration also leads to a lower fiscal multiplier. In this section, we enrich specification (1) along several dimensions to assess whether this assumption holds in the data, and we employ an instrumental-variables (IV) strategy to address potential threats. We begin by formally defining the relevant threats to identification.

[4]One might be tempted to extrapolate these estimates to the larger UI extensions documented in Figure 1. We refrain from doing so. As the model counterfactuals in Section 4 suggest, what matters most is the *endogenous* response of UI duration to the fiscal shock, rather than the *level* of UI duration per se.

Threats to Identification Suppose the true data-generating process (DGP) is:

$$\sum_{j=0}^{h} Y_{i,t+j} = \alpha_{i,h} + \delta_{t,h} + \beta_h \sum_{j=0}^{h} X_{i,t+j} + \gamma_h (L) Z_{i,t-1} + T^*_{i,t-1} \left(\beta_h^{UI} \sum_{j=0}^{h} X_{i,t+j} + \gamma_h^{UI} (L) Z_{i,t-1} \right)$$
$$+ \eta_h T^*_{i,t-1} + R_{i,t-1} \left(\beta_h^{R} \sum_{j=0}^{h} X_{i,t+j} + \gamma_h^{R} (L) Z_{i,t-1} \right) + \nu_h R_{i,t-1} + \varepsilon_{i,t+h}, \quad h \geq 0. \qquad (2)$$

Relative to the baseline model in (1), this DGP allows the fiscal multiplier to depend on an alternative state variable $R_{i,t-1}$. If the true DGP is (2) but we estimate (1), then the error term includes the omitted component $R_{i,t-1} \left(\beta_h^R \sum_{j=0}^{h} X_{i,t+j} + \gamma_h^R (L) Z_{i,t-1} \right)$. As a result, estimates of β_h^{UI} are biased if $T^*_{i,t-1}$ is correlated with the unobserved state variable $R_{i,t-1}$—the threat to identification.

We address this concern using two strategies. First, we consider plausible candidates for $R_{i,t-1}$ and estimate horse-race regressions based on (2). Second, we instrument $T^*_{i,t-1}$ with a variable that is correlated with $T^*_{i,t-1}$ (relevance) but unlikely to be correlated with the unobserved $R_{i,t-1}$ (exclusion).

Horse Races We implement a series of "horse races" between UI duration, $T^*_{i,t-1}$, and alternative state-level variables by estimating versions of (2).

The coefficient β_h^R captures the additional effect associated with the competing variable $R_{i,t-1}$, while β_h^{UI} measures the additional effect of extended UI conditional on $R_{i,t-1}$. We consider three competing explanatory variables, discussed next.

The first competing variable we consider is a measure of state-level economic slack that mimics a recession indicator. Specifically, we construct a dummy variable that equals one if state-level unemployment has been increasing for at least two consecutive quarters.

This horse race accounts for the fact that economic slack and UI extensions are naturally correlated. This correlation could bias our results if fiscal multipliers vary over the business cycle. In particular, our finding that longer UI duration reduces state-level fiscal multipliers could instead reflect lower sensitivity to demand shocks when local slack is higher. Note, however, that the existing literature typically finds the opposite: government spending multipliers are larger during recessions (Auerbach and Gorodnichenko, 2012; Bernardini *et al.*, 2020).

The second competing variable we consider is the deviation of the fraction of unemployed workers receiving UI from its average. Although we already include the UI recipiency rate among our controls, treating it as a competing "horse" allows us to formally assess whether variation in the pool of UI recipients affects the fiscal multiplier. For example, as illustrated in Albertini *et al.* (2021), changes in recipiency can alter the consumption gap between employed and unemployed workers, thereby affecting the fiscal multiplier.

The third competing explanatory variable is the state's political orientation, measured by our political-leadership dummy, included among the baseline controls, that equals one if the Republican vote share in the most recent gubernatorial election exceeded 50 percent. Including this variable as a competing "horse" in (2) accounts for the possibility that political orientation affects the efficacy of fiscal policy (Carlino *et al.*, 2023) and for the fact that more progressive states tend to have longer UI duration.

Accounting for Unobserved Covariates: Instrumental Variables Second, beyond the competing explanatory variables discussed above, we introduce an additional instrument for pre-existing UI duration, $T^*_{i,t-1}$, to address the more general concern that an unobserved covariate may jointly drive UI extensions and the size of the fiscal multiplier when UI is extended.

For example, two states could have different UI durations at a given point in time not because they have faced different histories of shocks, but because they have faced similar shocks that are amplified in the state with longer UI duration. Common sources of shock amplification include differences in wage rigidity (Hall, 2005) and financial constraints (Bernanke *et al.*, 1999). We first note that this type of amplification is likely to bias our estimates of the effect of UI duration on the fiscal multiplier toward zero. For example, if a state has temporarily higher unemployment, and hence longer UI duration, because local wages are more rigid, then fiscal shocks should also be more strongly amplified in that state, leading to larger fiscal multipliers when UI is extended.

Nevertheless, we address this concern by using the measurement-error approach of Chodorow-Reich *et al.* (2018). These authors identify variation in UI benefit duration driven by unemployment measurement error. Specifically, Chodorow-Reich *et al.* (2018) uses revisions to the unemployment rate to decompose variation in UI benefit duration, $T^*_{i,t-1}$, into two components. The first component reflects differences in economic conditions. The second arises from measurement error in the real-time unemployment data used to determine UI benefit extensions and is therefore orthogonal to economic conditions and region-specific characteristics. Following their notation, we denote the compo-

	Baseline	Horse Races			
		Slackness	Slackness and $\widehat{T}$ Instrument	UI Receip. and $\widehat{T}$ Instrument	Political and $\widehat{T}$ Instrument
Earnings (β^{UI})	-0.29***	-0.36***	-0.44***	-0.31**	-0.30***
	(0.05)	(0.08)	(0.13)	(0.15)	(0.11)
Unemployment (β^{UI})	0.73**	0.88***	0.74***	0.54**	0.76**
	(0.32)	(0.30)	(0.25)	(0.26)	(0.30)
First-stage F-statistic	10,527.75	2,365.46	102.86	127.90	164.94
Observations	2,300	2,300	2,300	2,300	2,300

Notes: Entries report cumulative 8-quarter-ahead ($h = 8$) additional effects of extended UI duration, β^{UI}, on the responses of unemployment and earnings. Driscoll–Kraay standard errors (Driscoll and Kraay, 1998) are in parentheses. All specifications include state and time fixed effects and are estimated by two-stage least squares. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Column 1 reproduces the baseline results in Table 1. Columns 2–5 add, respectively, the slack measure, the slack measure and the measurement-error-based instrument $\widehat{T}$ (Chodorow-Reich *et al.*, 2018), the UI recipiency measure and $\widehat{T}$, and the political-orientation measure and $\widehat{T}$.

Table 2: Fiscal Multipliers and UI Extensions: Addressing Threats to Identification

nent of UI extensions due to measurement error by $\widehat{T}_{i,t-1}$.

We use this measurement-error-driven component, $\widehat{T}_{i,t-1}$, to link cross-state differences in UI duration to plausibly exogenous variation rather than to unobserved characteristics. Specifically, instead of instrumenting the interaction term $T^{*}_{i,t-1} \cdot X_{i,t+j}$ with national military spending interacted with state dummies and pre-existing actual UI duration, $T^{*}_{i,t-1}$, we instrument it with the corresponding interaction that replaces $T^{*}_{i,t-1}$ by $\widehat{T}_{i,t-1}$.[5]

Results Table 2 reports the additional effect of pre-existing extended UI duration (β^{UI}, our coefficient of interest) on unemployment and earnings. Each column corresponds to a different specification, with column 1 reproducing the baseline results from Table 1 for

[5]Formally, if $\widehat{T}_{i,t-1}$ and the national-level military spending measure interacted with state dummies, denoted $DoD_{i,t}$, are jointly exogenous—that is, $\mathbb{E}\left[\varepsilon_{i,t} \mid \widehat{T}_{i,t-1}, DoD_{i,t}\right] = 0$—then, by the law of iterated expectations, $\mathrm{Cov}\left(\widehat{T}_{i,t-1} DoD_{i,t}, \varepsilon_{i,t}\right) = 0$. Therefore, $\widehat{T}_{i,t-1} DoD_{i,t}$ is a valid instrument for the interaction term of interest.

reference.

The second column shows that our baseline results are robust to including state-level slack as a competing explanatory variable in the horse-race regression (2). In particular, when UI duration is extended, the earnings and unemployment multipliers associated with military spending are still reduced.

In the third column, we continue to control for state-level slack and, in addition, use the measurement-error-based component of UI duration, $\widehat{T}_{i,t-1}$, as an instrument for actual UI duration extensions, $T^*_{i,t-1}$. The results show that introducing this instrument does not meaningfully alter our baseline estimates. We therefore conclude that unobserved factors are unlikely to be driving our findings on the stabilization consequences of UI extensions. In particular, the earnings and unemployment multipliers remain significantly dampened.

The fourth and fifth columns continue to use $\widehat{T}_{i,t-1}$ as an instrument for actual UI duration and include state-level slack as a competing variable, but add either the UI recipiency rate or the political-leadership dummy as an additional competing variable. The estimates from these extended specifications confirm that pre-existing extended UI dampens the unemployment and earnings multipliers, in line with our baseline results.

What are the economic interpretations of the horse-race regressions and the IV estimates? The horse-race regressions can be interpreted as follows. In these specifications, β^{UI} captures the additional effect of government spending when UI is extended, holding constant the competing state variable $R_{i,t-1}$ as well as the other controls. For example, when $R_{i,t-1}$ is the UI recipiency rate, the estimate of β^{UI} compares states with the same recipiency rate (and the same fixed effects and controls) that differ only in whether UI is extended; β^{UI} then measures the resulting difference in the fiscal multiplier across these otherwise comparable states.

The interpretation of the IV estimates of β^{UI} is analogous, but relies on plausibly exogenous variation in UI duration. Consider two states, A and B, where state A has a longer pre-existing UI extension than state B due to measurement error. Holding everything else constant, the same fiscal expenditure shock generates a smaller earnings response in state A than in state B.

Overall, Table 2 shows that the findings in Section 3.1 are robust across the extensions we consider, both qualitatively and quantitatively. In particular, the evidence consistently indicates that fiscal multipliers are lower when UI duration is extended.

Finally, the results above are based on government expenditure shocks constructed using the Bartik instrument. In an earlier version of the paper, we documented a similar set of results using government value added shocks identified through the timing restrictions in Blanchard and Perotti (2002).

4 Model

Our empirical evidence shows that the fiscal policy mix matters: UI extensions significantly reduce the size of the fiscal multiplier. We next interpret these findings through the lens of a quantitative model that mimics the empirical setting. Specifically, we first show that the model matches the empirical relationship between fiscal multipliers and UI duration. We then use the model to tease out the transmission channels at work, allowing us to distinguish among alternative explanations for our empirical findings.

To this end, we extend the New Keynesian small-open-economy model of Galí and Monacelli (2005) to incorporate heterogeneous agents (Aiyagari, 1994; Huggett, 1993; Bewley, 1983) and equilibrium unemployment (Mortensen and Pissarides, 1994). The economy is composed of two regions, Home and Foreign. We model Home as a small open economy and Foreign as the rest of the economy. Because Home is negligible in size relative to the overall economy, economy-wide variables are exogenous from Home's perspective. In line with our empirical setting, we assume that the monetary authority in Home adopts a fixed exchange rate vis-à-vis Foreign, allowing us to interpret Home as a region within the US economy. Financial markets are incomplete both domestically and internationally, and households in Home can save only in domestic and foreign bonds through assets issued by a representative mutual fund. We use subscripts H and F to denote Home and Foreign variables, respectively.

4.1 Labor Market Transitions and UI Eligibility

Employment transitions are determined in a frictional labor market. At the end of period $t-1$, a mass N_{t-1} of households is employed, and a mass $U_{t-1} = 1 - N_{t-1}$ is unemployed. At the start of period t, an exogenous fraction δ of employed households separates from firms and instantaneously joins the pool of unemployed households. Unemployment at the beginning of the period is therefore given by $1 - (1-\delta)N_{t-1}$. Firms must post vacancies V_t to be matched with currently unemployed workers. New matches M_t are formed according to

$$M_t = \chi V_t^{\gamma} \left(1 - (1-\delta) N_{t-1}\right)^{1-\gamma}, \tag{3}$$

where $\gamma \in (0,1)$ and χ denotes matching efficiency.

We define labor-market tightness as the ratio of vacancies to unemployment, $\theta_t := V_t/(1-(1-\delta)N_{t-1})$. An unemployed household finds a job with probability $f_t := M_t/(1-(1-\delta)N_{t-1})$, and a firm fills a vacancy with probability $q_t := M_t/V_t$. The law of motion for employment is given by:

$$N_t = (1-\delta) N_{t-1} + M_t. \tag{4}$$

UI Eligibility. Households can be either eligible or ineligible to receive unemployment benefits. We assume that transitions between eligibility states are stochastic (Chodorow-Reich *et al.*, 2018; Mitman and Rabinovich, 2024). The probability of losing eligibility is set endogenously by the government and is described in more detail below. Policy therefore influences the idiosyncratic risk faced by households, since the UI system provides direct insurance against income losses during unemployment spells.

More precisely, consider a household that is unemployed and eligible to receive unemployment benefits at the end of period $t-1$. In period t, conditional on remaining unemployed, the household remains eligible with time-varying probability $1 - pe_t$. With the complementary probability pe_t, the household loses eligibility for the remainder of the unemployment spell. The expected duration of UI benefits is therefore pe_t^{-1}. This stochastic expiration captures, in a parsimonious way, the limited duration of unemployment benefits in the US UI system. Once an ineligible unemployed household finds a job, it regains eligibility with constant probability pr for the remainder of the employment spell. This assumption captures the fact that it takes several months for a newly hired worker to regain UI eligibility. We denote by $\{N_t^e, N_t^{ne}\}$ the masses of employed households that are eligible and ineligible, respectively, at the end of the period, and define $\{U_t^e, U_t^{ne}\}$ analogously for unemployed households. The laws of motion for these states are provided in Appendix B.1.

4.2 Households

There is a continuum of infinitely lived households of measure one, indexed by i. We summarize a household's idiosyncratic state by $s = \{a, h, n, e, \beta\}$. A household can be either employed or unemployed, denoted by $n \in \{1, 0\}$, respectively. If a household becomes unemployed, it can be either eligible or ineligible to receive unemployment benefits, $e \in \{1, 0\}$. Households also differ in their idiosyncratic labor productivity h, which follows an exogenous AR(1) process in logs.[6] In addition, we allow for permanent heterogeneity in discount factors, $\beta \in \{\beta_1, \beta_2\}$, a standard device used to match the high degree of wealth inequality and the large marginal propensities to consume observed in the data (Carroll *et al.*, 2017). Finally, a denotes households' asset holdings in claims issued by a representative mutual fund.

A household with idiosyncratic state vector s at time t chooses consumption c_t and next-period asset holdings a_{t+1} to solve:

$$V_t(s) = \max_{c_{Ht}, c_{Ft}, a_t} \frac{c\left(c_{Ht}, c_{Ft}\right)^{1-\sigma}}{1-\sigma} + \beta \mathbb{E}_t V_{t+1}\left(s'\right) \tag{5}$$

$$\text{s.t.} \quad \frac{P_{Ht}}{P_t} c_{Ht} + \frac{P_{Ft}}{P_t} c_{Ft} + a_t = (1-\tau_t)\, h_t \left(d_t + \mathbb{I}_{n=1} w_t + \mathbb{I}_{(n=0,e=1)} b_t + \mathbb{I}_{(n=0,e=0)} \tilde{b}_t\right) + (1 + r_t^a) a_{t-1}, \quad a_t \geq 0,$$

where $\sigma > 0$ is the inverse of the intertemporal elasticity of substitution, and c_t is a composite consumption index consisting of Home and Foreign goods:

$$c := \left[(1-\alpha)^{1/\eta} c_H^{\frac{\eta-1}{\eta}} + \alpha^{1/\eta} c_F^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}, \tag{6}$$

where $\eta > 0$ is the elasticity of substitution between Home and Foreign goods and $\alpha \in [0, 1]$ measures the degree of home bias. c_H and c_F are CES aggregators over intermediate-good varieties j with elasticity ε: $c_k := \left(\int_0^1 c_{jk}^{\frac{\varepsilon-1}{\varepsilon}} dj\right)^{\frac{\varepsilon}{\varepsilon-1}}$ for $k \in \{H, F\}$.

Households optimally allocate consumption expenditures between Home and Foreign goods according to:

$$c_{Ht}(s) = (1-\alpha)\left(\frac{P_{Ht}}{P_t}\right)^{-\eta} c_t(s); \quad c_{Ft}(s) = \alpha \left(\frac{P_{Ft}}{P_t}\right)^{-\eta} c_t(s), \tag{7}$$

where $P_{H,t} := \left(\int_0^1 P_{jH,t}^{1-\varepsilon} dj\right)^{\frac{1}{1-\varepsilon}}$ is the price index of Home goods and $P_{F,t} := \left(\int_0^1 P_{jF,t}^{1-\varepsilon} dj\right)^{\frac{1}{1-\varepsilon}}$ is the price index of Foreign goods in units of domestic currency. The consumer price

[6] Specifically, $\log h_{i,t} = \rho_h \log h_{i,t-1} + \varepsilon_{i,t}^h$, where $\varepsilon_{i,t}^h$ is normally distributed with mean zero and variance σ_h^2.

index P_t is given by:

$$P := \left[(1-\alpha)P_H^{1-\eta} + \alpha P_F^{1-\eta}\right]^{\frac{1}{1-\eta}}. \tag{8}$$

As in McKay and Reis (2021), we assume that firm dividends d_t are rebated lump-sum to households in proportion to their idiosyncratic productivity h_t. In addition to dividends, household income depends on the joint idiosyncratic state over employment and eligibility status (n, e). An employed household ($n = 1$) earns the real wage w_t, regardless of its eligibility status e. An unemployed and eligible household ($(n, e) = (0, 1)$) receives unemployment benefits b_t from the government. An unemployed household that has exhausted its unemployment benefits ($(n, e) = (0, 0)$) receives transfers $\tilde{b}_t \leq b_t$, capturing safety-net programs such as food stamps. All sources of income are subject to the tax rate τ_t.

The ex post real return on households' mutual-fund asset holdings a_{t-1} is denoted by r_t^a. Appendix B.3 provides a detailed description of the mutual fund problem, following Auclert *et al.* (2021). There, we show that the mutual fund implies that the expected return on household assets equals the ex ante real interest rate, $r_{t+1} = \frac{1+i_t}{1+\pi_{t+1}}$, where i_t is the nominal interest rate and π_{t+1} is consumer price inflation. Because the mutual fund trades both domestic and foreign bonds, it also delivers the familiar UIP condition, but is otherwise inconsequential. Appendix B.2 provides Foreign households' demand for Home goods.

4.3 Firms

The supply side of the economy has two layers of production. Producers of labor goods produce a homogeneous good using labor hired in a frictional labor market. A unit mass of differentiated-goods producers, indexed by j, purchases labor goods and transforms them into differentiated varieties, setting prices subject to Rotemberg-style adjustment costs (Rotemberg, 1982).

Producers of differentiated goods. Differentiated-goods producers operate under monopolistic competition. They set prices subject to quadratic adjustment costs (Rotemberg, 1982) and purchase labor goods at marginal cost MC_t to produce differentiated varieties. The solution to their maximization problem, described in more detail in Appendix B.4, yields the conventional nonlinear Phillips curve:

$$\log(1+\pi_{H,t}) = \kappa_p \left(\frac{MC_t}{P_{H,t}} - \frac{\varepsilon - 1}{\varepsilon} \right) + \mathbb{E}_t \frac{1}{1+r^a} \log(1+\pi_{H,t+1}) \frac{Y_{t+1}}{Y_t}, \tag{9}$$

where $1 + \pi_{H,t} := {}^{P_{H,t}}/_{P_{H,t-1}}$ denotes gross domestic inflation and Y_t is aggregate output.

Producers of labor goods. Producers of labor goods consist of single-worker firms that use a linear technology to produce homogeneous labor goods. Let J_t^L denote the value of a filled job, given by

$$J_t^L = Z \frac{MC_t}{P_t} - w_t + \mathbb{E}_t \frac{1}{1+r^a} (1-\delta) J_{t+1}^L, \tag{10}$$

where MC_t is the price of labor goods and Z denotes steady-state aggregate productivity.

Hiring a worker involves posting vacancies at cost κ_v per vacancy. In equilibrium, and under free entry, firms post vacancies until the expected gains from posting an additional vacancy are driven to zero:

$$\kappa_v = q_t J_t^L. \tag{11}$$

The presence of matching frictions implies that multiple wages are bilaterally efficient (Hall, 2005). We resolve this indeterminacy by assuming the following rule for the real wage w_t:

$$\log\left({}^{w_t}/_{w}\right) = \phi^w \log\left({}^{w_t^{\text{Nash}}}/_{w^{\text{Nash}}}\right), \tag{12}$$

where variables without time subscripts denote steady-state values. The parameter $\phi^w \in [0,1]$ measures the degree of real wage flexibility.

We denote by w_t^{Nash} the Nash-bargained wage. Wage bargaining in our model takes place between the firm and a worker union that negotiates on behalf of workers. The Nash-bargained wage solves

$$w_t^{\text{Nash}} = \arg\max_w \left(J_t^L\right)^{\varepsilon^w} \left(\Delta_t^{N,U}\right)^{1-\varepsilon^w}, \tag{13}$$

where $\Delta_t^{N,U}$ is the surplus from moving from unemployment to employment. We assume that the worker union maximizes the surplus of the average worker, so that $\Delta_t^{N,U}$ aggregates surpluses across idiosyncratic states. We relegate the details of the bargaining problem to Appendix B.5. Our wage-setting assumptions imply that UI benefits and duration can affect real wages through their impact on workers' outside option, as in Chodorow-Reich *et al.* (2018) and Mitman and Rabinovich (2024). At the same time, bargaining over the average worker, rather than at the individual level, keeps the framework computationally tractable.

4.4 Government

The government consists of a monetary authority and a fiscal authority. Consistent with our empirical setting, we assume that the monetary authority sets the domestic nominal interest rate to credibly maintain a fixed nominal exchange rate, $\mathcal{E}_t = \mathcal{E}$.

The fiscal authority is subject to the following budget constraint:

$$\frac{P_{H,t}}{P_t} G_t + (1+r_t) B_{H,t-1} + b_t U_t^e + \tilde{b}_t U_t^{ne} = B_{H,t} + \tau_t \left(w_t N_t + b_t U_t^e + \tilde{b}_t U_t^{ne} + d_t \right) + \mathrm{TR}_t. \tag{14}$$

Here, G_t denotes government consumption of domestic goods. We assume that it follows an AR(1) process in log deviations from steady state with persistence ρ_G:

$$\log(G_t / \bar{G}) = \rho_G \log(G_{t-1} / \bar{G}) + \varepsilon_t^G \tag{15}$$

In addition to spending on domestic goods, the government operates a UI system. The UI system is characterized by the benefit level paid to eligible households, b_t, and by the probabilities of losing and regaining eligibility, $\{pe_t, pr\}$. For the benefit level, we assume a constant replacement rate b applied to the prevailing real wage:[7]

$$b_t = b w_t. \tag{16}$$

We assume that the local government keeps government debt constant at its steady-state value, $B_{H,t} = B_H$. It therefore finances its expenditures by adjusting the income tax rate τ_t and through transfers from the federal government, TR_t. For the latter, we assume that transfers increase to cover UI payments above their steady-state level. This assumption is consistent with the financing of the UI system in our sample period, during which UI extensions were financed through the federal budget in the Great Recession

[7]This functional form captures, in a parsimonious way, the fact that UI benefits in the US are typically indexed to past earnings.

(Isaacs, 2019). Formally, TR_t obeys the following rule:

$$\mathrm{TR}_t = \left(b_t U_t^e + \tilde{b}_t U_t^{ne}\right) - \left(bU^e + \tilde{b}U^{ne}\right). \tag{17}$$

A central feature of the US UI system is that benefit duration responds on labor market conditions. As highlighted in the empirical section, regions can extend the duration of UI benefits during periods of high unemployment. At the same time, when unemployment is low, benefit duration is not reduced but instead remains at its baseline level. We capture these features parsimoniously by assuming that the average duration of UI benefits in the model, $T_t^* = pe_t^{-1}$, is set as follows:

$$T_t^* = \begin{cases} T^* & \text{if} \quad U_t \leq \tilde{U}, \\ T^* \left(\frac{U_t}{\tilde{U}}\right)^{\phi_U} & \text{otherwise.} \end{cases} \tag{18}$$

Here, $T^* = pe^{-1}$ denotes the steady-state average duration of UI benefits. Benefit duration is endogenous to the business cycle: the government increases T_t^* whenever the unemployment rate exceeds the threshold $\tilde{U} \in (U, 1)$. The UI duration rule, $T^* = T^* \left(\frac{U_t}{\tilde{U}}\right)^{\phi_U}$ when unemployment is high, captures the main features of UI extensions in the US to a first-order approximation. This is a modeling assumption that preserves computational tractability and follows similar choices made in the literature (see, for example, Gorn and Trigari 2024 or Christiano *et al.* 2016).

In addition to the UI system, the government provides safety-net transfers $\tilde{b}_t$ to unemployed households that are not eligible for unemployment benefits:

$$\tilde{b}_t = \tilde{b} w_t, \quad \tilde{b} \leq b. \tag{19}$$

That is, we assume that safety-net transfers are also characterized by a constant replacement rate $\tilde{b}$. Appendix B.6 provides a formal definition of equilibrium.

5 Calibration

We calibrate the model to a representative region of the US. One period corresponds to one quarter. Calibrated parameter values are summarized in Table 3.

Households. We set the coefficient of relative risk aversion, σ, to the standard value of 2. We jointly calibrate the discount factors $\{\beta_1, \beta_2\}$ to match an annual debt-to-GDP ratio of 0.45, the average ratio of federal debt held by the public to GDP in the data, and a quarterly aggregate marginal propensity to consume of 0.20 (Parker *et al.*, 2013). The elasticity of substitution across intermediate goods, ε, is set to 7. Next, following Nakamura and Steinsson (2014), we set the import share α to 0.3 and the trade elasticity η to 2. Parameter values for the idiosyncratic productivity process follow the estimates in Bayer *et al.* (2019).

Firms. We set the vacancy-posting cost κ_v to 4.5% of the quarterly real wage, in line with Silva and Toledo (2009). We calibrate the firm's bargaining power in (13) to match a vacancy-filling rate of 0.71, as in Den Haan *et al.* (2000). The degree of wage rigidity, ϕ^w, is chosen to match an impact elasticity of the real wage with respect to output of 0.45 in response to government spending shocks (Hagedorn and Manovskii, 2008). The Phillips-curve slope κ_p is set to imply an average price duration of five quarters in the equivalent Calvo setting. We normalize steady-state productivity Z so that steady-state aggregate consumption equals one.

Labor Market. The separation rate δ is set to 0.10, a standard value in the literature; see, for example, Shimer (2005). The elasticity of matches with respect to vacancies, γ, is set to 0.5, within the range estimated in Petrongolo and Pissarides (2001). Matching efficiency χ is calibrated to target a steady-state employment rate of 0.94.

Government. We set the nominal interest rate to match an annualized real rate of 4%. The tax rate is set to target a government-consumption-to-GDP ratio of 0.14. The UI replacement rate b is set to 0.83 to match the income drop upon unemployment estimated in Ganong and Noel (2019). Similarly, we set the replacement rate for safety-net transfers, $\tilde{b}$, to match the income drop upon UI exhaustion in Ganong and Noel (2019). We set the baseline probability of losing UI eligibility, pe, to imply a baseline expected UI duration of two quarters, which corresponds to the most common UI duration across US regions. Following Mitman and Rabinovich (2024), we set the probability of regaining UI eligibility while employed to 0.5, implying that it takes two quarters on average for an employed household to regain eligibility. We set the responsiveness of UI duration to the unemployment rate, ϕ_U, to mimic the average increase in UI duration during the Great

Parameter	Description	Value	Target / Source
Households			
$1/\sigma$	IES	0.50	Standard value
β_1	Discount factor high	0.98	$B_H/4Y = 0.45$
β_2	Discount factor low	0.93	MPC = 0.20
ρ_h	Persistence h	0.98	Bayer *et al.* (2019)
σ_h	Std. innovations to h	0.06	Bayer *et al.* (2019)
ε	Elast. subs. intermediate goods	7	Standard value
η	Elast. subs. H and F goods	2	Nakamura and Steinsson (2014)
α	Share imported goods	0.30	Nakamura and Steinsson (2014)
Firms			
κ_v	Vacancy posting cost	0.05	4.5% of quarterly wage
ε^W	Bargaining power firm	0.18	$q = 0.71$
ϕ^w	Wage rigidity	0.35	Hagedorn and Manovskii (2008)
Z	St-st. productivity	1.23	$C = 1$
κ_p	Slope NKPC	0.05	Mean price duration of 5 q.
Labor market			
δ	Separation rate	0.10	Standard value
χ	Matching efficiency	0.66	$N = 0.94$
γ	Curvature matching function	0.50	Petrongolo and Pissarides (2001)
Government			
τ	Steady-state tax rate	0.20	$G/Y = 0.14$
$1+i$	Steady-state nominal rate	1.01	Real rate 4% p.a.
b	Replacement rate UI	0.83	Income drop unemployment
$\tilde{b}$	Replacement rate safety-net	0.54	Income drop UI exhaustion
pe	Prob. loosing eligibility	0.50	Avg. duration UI of 2 q.
pr	Prop. regaining eligibility	0.50	2 q. to regain eligibility
$\tilde{U}$	UI extension threshold	0.06	Normalization
ϕ^U	UI duration rule	3.88	Average UI extension

Table 3: Calibrated parameters.

Notes: Variables without time subscripts denote steady-state values. The main text provides further details.

Recession in our dataset. Specifically, UI duration rises by about 3.3 quarters on average, while the unemployment rate rises to 7.7%, which implies $\phi_U = 3.88$. Finally, we set the unemployment threshold for UI extensions, $\tilde{U}$, equal to the steady-state unemployment rate of 6.0%.

Moment	Model	Data	Data Source
1. Marginal Propensities to Consume (MPC)			
Quarterly Agg. MPC (targeted)	0.20	0.20	Parker and Broda (2013)
Annual MPC Employed	0.49	0.47	Kekre (2022)
Annual MPC Unemployed	0.64	0.72	Kekre (2022)
2. Consumption and Unemployment			
Cons. drop during unemp. w/ UI benefits	6pp	8pp	Ganong and Noel (2019)
Cons. drop during unemp. w/o UI benefits	19pp	24pp	Ganong and Noel (2019)
Employed's cons. response to job loss risk	-0.62%	-0.70%	Graves (2023)

Table 4: Untargeted Moments: Data vs. Model

Notes: Comparison between steady-state untargeted moments in the model versus the data. See the text for details.

Steady-State Untargeted Moments: Data vs. Model. Our model incorporates several channels through which changes in UI benefit duration can affect aggregate outcomes. On the demand side, these include households' precautionary-saving responses to changes in UI duration (Graves, 2020; Gorn and Trigari, 2024), as well as the fact that unemployed households tend to have higher-than-average marginal propensities to consume (MPCs). As a result, increasing transfers to these households can raise aggregate demand (Kekre, 2022). Table 4 reports key steady-state moments that discipline these demand channels in the model and compares them with the data.

The first set of moments concerns the average MPC and its heterogeneity between employed and unemployed households. As noted above, we target an average quarterly MPC of 0.20, in line with Parker *et al.* (2013). The next two rows report annual MPCs for employed and unemployed households of 0.49 and 0.64, respectively.[8] These values are close to the empirical estimates in Kekre (2022), which uses the 2010 Survey of Household Income and Wealth administered in Italy to estimate annual MPCs by employment status.[9]

The second set of moments concerns consumption dynamics over unemployment

[8]We compute MPCs in the model by simulating the partial-equilibrium consumption response of a panel of households to a \$500 transfer (in model-equivalent units), as in Kaplan and Violante (2014) and Kekre (2022).

[9]US-based evidence on MPC heterogeneity by employment status is limited. The use of this Italian evidence is common in the literature; see, for example, Jappelli and Pistaferri (2014).

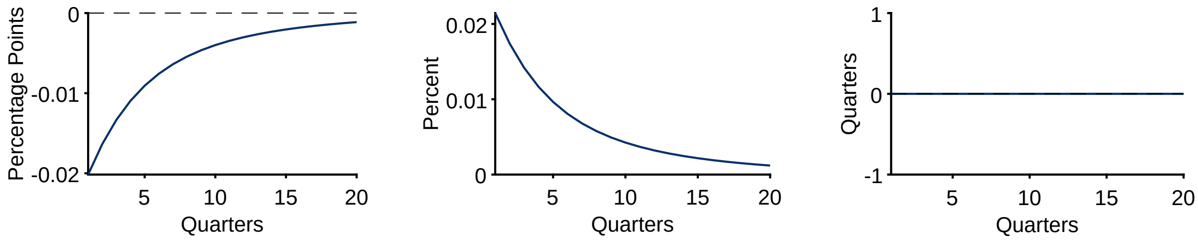
spells and households' precautionary-saving responses. Comparing these statistics to the data is important to ensure that the model does not overstate the consumption consequences of unemployment. The first row reports the average consumption drop upon unemployment while receiving UI benefits. The next row reports the average consumption drop after UI exhaustion. Although we do not target these moments, the model matches closely the empirical estimates in Ganong and Noel (2019).[10] The final row reports the partial-equilibrium consumption response of employed households to an increase in job loss risk, which provides a summary measure of the strength of precautionary saving. Specifically, following Graves (2020), we consider a 20% increase in the job separation rate over the course of a year and compute the impact response of employed households' consumption. The model implies a consumption response that is slightly below the empirical estimate in Graves (2020), which is based on the Survey of Consumer Expectations administered by the New York Fed.

In sum, these moments indicate that the model captures household behavior observed in the data remarkably well, despite its relative parsimony. The model's successful micro-level predictions provide a solid starting point for evaluating how UI extensions shape fiscal multipliers in general equilibrium, to which we turn next.

6 The Effects of UI Extensions on Fiscal Multipliers

In this section, we assess the importance of accounting for the fiscal policy mix by quantifying the effects of UI extensions on fiscal multipliers through the lens of the model. First, we describe the shocks we consider to approximate our empirical setting. Second, we show that the model matches reasonably well the dampening effect of UI extensions on state-level fiscal multipliers documented in Section 3. Finally, we use the model to investigate the mechanisms underlying this dampening result. To account for the nonlinear UI duration rule in (18), we compute nonlinear perfect-foresight responses of the economy to aggregate shocks. Specifically, we use a shooting algorithm and update our guess using the version of Newton's method developed in McKay *et al.* (2016).

[10] Both consumption drops are measured relative to pre-unemployment consumption, as in Ganong and Noel (2019). As in the data, averages are taken over the first two quarters in which households receive UI benefits and over the subsequent two quarters in which households remain unemployed but are no longer eligible for UI.



(a) Unemployment **(b)** Output **(c)** UI duration

Figure 2: Impulse responses to a government spending shock

Notes: Impulse responses to a government spending shock in the model starting from the steady state.

6.1 Responses to Government Spending Shocks

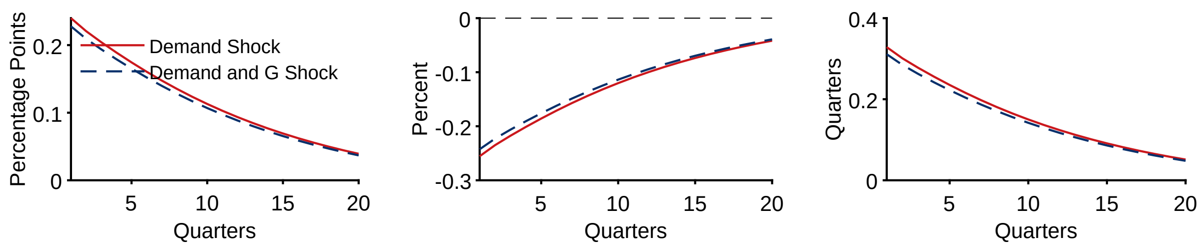
We next describe the experiments that approximate our empirical setup. These experiments provide the basis for computing the fiscal multipliers discussed in the next section.

First, we consider a government spending shock ε_t^G (recall equation 15) starting from the model's steady state. This experiment allows us to compute the fiscal multiplier in normal times, when UI duration is at its regular level. Figure 2 reports impulse responses to the government spending shock.[11] In the model, the fiscal expansion raises output (panel b) through the standard demand channels (Woodford, 2011), and also through reduced precautionary saving. Higher government spending stimulates hiring, increasing job-finding rates and lowering the unemployment rate (panel a). As a result, the expected duration of unemployment spells declines, reducing the idiosyncratic risk associated with unemployment. Households' precautionary-saving motive is therefore attenuated, supporting consumption and amplifying the stimulus. Importantly, in this experiment UI duration is at its regular level. Because this regular level acts as a floor, the decline in unemployment does not trigger a reduction in UI duration; see panel c.

Second, we consider two additional experiments. In the first, we generate a demand-driven recession by increasing households' discount factor. In the second, we consider the same recession but add a government spending shock. The difference in responses between these two experiments allows us to compute the fiscal multiplier when UI is extended, mimicking our empirical setting.

Figure 3 plots responses to the demand shock (solid red lines) and to the same demand

[11] We set the persistence of government spending to $\rho_G = 0.93$, estimated by regressing our aggregate government spending series on its lag. This persistence matches the estimate in Nakamura and Steinsson (2014).



(a) Unemployment **(b)** Output **(c)** UI duration

Figure 3: Impulse responses in a demand-driven recession

Notes: Red solid lines: impulse responses to a discount-factor shock. Blue dashed lines: impulse responses to the same discount-factor shock together with a government spending shock.

shock combined with a government spending shock (dashed blue lines). The demand shock raises unemployment and lowers output (panels a and b). During such a recession, UI duration increases endogenously in response to higher unemployment, according to the policy rule in (18).[12] The fiscal expansion mitigates both the decline in output and the rise in unemployment (compare the solid and dashed lines in panels a and b). Importantly, because the fiscal stimulus lowers unemployment, UI duration rises by less; see the difference between the solid and dashed lines in panel c. Thus, when government spending increases during a period of pre-existing extended UI, it induces a relative decline in UI duration.

6.2 Fiscal Multipliers

We use the previous set of experiments to compute the model counterparts of the empirical fiscal multipliers and the additional effects of UI duration reported in Table 1. It is worth noting that in all experiments we consider, the government spending impulse is identical. Consequently, the denominator used to compute fiscal multipliers is common across scenarios, and all differences in model-based multipliers reflect differences in the impact of the spending increase on unemployment or earnings, as captured by the numerator.

First, we compute fiscal multipliers in normal times, when UI duration is at its regular level, using the government spending shock starting from the steady state in Figure 2. We interpret this experiment as the model analogue of our empirical estimates without

[12]We choose the size of the discount-factor shock so that UI duration rises by about one month on impact, in line with our empirical setting, and we assume a government spending shock of the same size in percentage terms.

	Unemployment		Earnings	
	Model	Data	Model	Data
Multiplier Normal Times	-6.47	-5.53	0.59	1.47
Additional Effect UI Extensions	0.91	0.73	-0.23	-0.29

Note: Comparison of employment and earning multipliers between model and data. Data values refer to the baseline empirical estimates presented in Table 1. See the main text for further details on the model-based simulations.

Table 5: Model vs. Data

extended UI (the coefficient β in (1)), since pre-existing UI extensions in the model—as in the data—are zero.

Second, we compute the fiscal multiplier when the government spending shock occurs in a state with extended UI, using the recession experiments in Figure 3. Third, we take the difference between these two multipliers. This difference provides the model-based analogue of the additional effect of UI extensions on the fiscal multiplier (the coefficient β^{UI} in (1)).

Table 5 reports the model-based estimates of fiscal multipliers and the additional effects of UI duration, computed as described above, alongside their empirical counterparts. As in the data, model-based multipliers are computed at horizon $h = 8$. The first row reports the fiscal multiplier in normal times, when UI has not been extended. For unemployment, the model implies a multiplier of -6.47, only slightly larger in magnitude than the empirical estimate of -5.53. We also compute the earnings multiplier, where earnings are defined in the model as aggregate pre-tax labor earnings of employed workers. In this case, the model delivers a multiplier of 0.59, somewhat smaller than the earnings multiplier estimated in the empirical section.[13]

The second row of Table 5 shows that the model is broadly consistent with the effects of UI extensions on fiscal multipliers implied by our empirical analysis. In particular, the model-implied additional effect of UI extensions on the unemployment multiplier is 0.91, corresponding to a reduction in the multiplier of about 14%. This is close to the empirical estimate of 0.73, which corresponds to a reduction of about 13%. For earnings,

[13]One reason the model generates a smaller earnings multiplier than the data is that it abstracts from the intensive margin of hours worked. Incorporating hours could increase the model-based multiplier; see, for example, Albertini *et al.* (2021).

the model-implied additional effect is -0.23, compared with -0.29 in the data.

6.3 Quantifying the Transmission Channels

In the model, the fiscal policy mix matters for two main reasons: UI extensions can alter the effectiveness of fiscal stimulus through two distinct, but related, channels.

The first channel is a *level effect*. Extended UI duration reduces the risk associated with unemployment by providing households with an income buffer for longer. As a result, the additional insurance provided by UI extensions attenuates the precautionary-saving channel of government spending described above, and may therefore reduce the size of the fiscal multiplier. We refer to this mechanism as the level effect because it depends only on the level of UI duration in place.

The second channel is an *endogenous UI duration effect*. This mechanism reflects the fact that UI extensions, both in the model and in the data, are determined to a large extent by the unemployment rate (recall the policy rule in (18)). When government spending reduces unemployment, UI duration may also decline. This induced reduction in UI duration affects households' decisions and, in turn, the effectiveness of the fiscal stimulus, thereby shaping the fiscal multiplier. Importantly, UI duration can fall only when UI has been previously extended, since benefit duration cannot decline below its regular level even if unemployment falls below its steady-state value. Consequently, the endogenous-duration channel is operative only when UI is initially extended. This is precisely what we find in our experiments: the government spending shock does not affect UI duration when the economy starts from the steady state (Figure 2), whereas it reduces the increase in UI duration when UI is initially extended (Figure 3).

We next use the model to disentangle the level and endogenous-duration effects and to provide additional detail on the transmission mechanisms at work.

Level Effect We quantify the contribution of the level effect using the following counterfactual. We repeat the simulations in Figure 3, but impose that UI duration does not respond to the fiscal shock during the demand-driven recession. Specifically, we compute equilibrium responses to the government spending shock when UI is initially extended, while exogenously fixing UI duration to follow the same path as under the demand shock alone (i.e., absent the fiscal shock). This counterfactual shuts down the endogenous-duration channel. As a result, the only difference relative to the normal-times multiplier (Figure 2) is that the increase in government spending occurs when UI duration is higher.

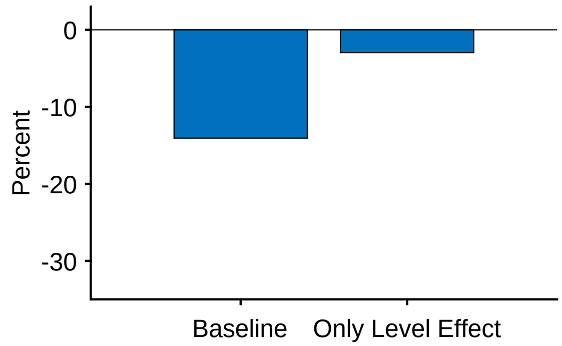


Figure 4: Level vs. Endogenous UI Duration Effects.

Notes: Additional effect of UI extensions on the size of the government spending multiplier associated to unemployment in the baseline model and in a counterfactual where only the level effect is present.

Figure 4 reports the results. The first bar reproduces our baseline estimate of the additional effect of UI extensions on the unemployment multiplier: UI extensions reduce the fiscal multiplier by about 14% (Table 5).

The second bar in Figure 4 shows that if only the level effect were present, the model-implied difference would be about 3%. In other words, through the lens of the model, the fiscal policy mix considered here, UI extensions and government spending, matters primarily because of the endogenous response of UI duration.

Endogenous UI Duration Effect Figure 4 shows that UI extensions affect fiscal multipliers primarily through the endogenous response of UI duration to the fiscal shock. In the model, this endogenous change in UI duration transmits through three mechanisms: (i) it affects wages and hence hiring, (ii) it redistributes income toward high-MPC unemployed households, and (iii) it affects households' precautionary-saving incentives. We quantify the contribution of each mechanism using counterfactual experiments.

Wages. First, longer UI duration improves workers' outside option, putting upward pressure on wages and thereby restraining hiring. We measure the strength of this channel by repeating the experiments in Section 6.1 under the assumption that real wages do not respond to the change in UI duration induced by the fiscal shock. Specifically, we compute wage responses as if UI duration followed the path implied by the demand shock alone (i.e., absent the fiscal shock). That is, we shut down the response of wages to changes in UI duration induced by the fiscal shock, while allowing wages to respond

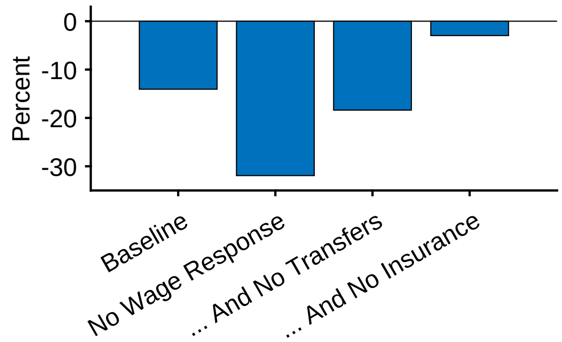


Figure 5: Decomposing the Endogenous UI Duration Effect.

Notes: Additional effect of UI extensions on the size of the government spending multiplier associated to unemployment in the baseline model and in different counterfactuals that illustrate the channels at work of the endogenous UI duration effect, see the main text for details on the counterfactuals.

endogenously to all other developments in the economy.[14] The second column in Figure 5 shows that the dampening effect of UI extensions on fiscal multipliers would more than double if wages did not respond. Intuitively, when wages are allowed to adjust, the fiscal-shock-induced decline in UI duration moderates wage pressure, stimulates hiring, and therefore reduces unemployment.

Transfers to High-MPC Households. Second, longer UI duration implies greater transfers toward high-MPC unemployed households, which tends to raise aggregate demand (recall Table 4). Building on the economy with wages held fixed with respect to the UI-induced change, we quantify this channel as follows. We consider a counterfactual in which households expect UI duration to adjust in response to the fiscal shock during the demand-driven recession, but the associated change in transfers does not occur.[15] The third column of Figure 5 shows that this transfer channel substantially mitigates the dampening effect of UI extensions. In particular, the additional effect on the fiscal multipliers falls from about -30% in the economy with only fixed wages to about -20% once we additionally shut down the transfer channel.

Insurance. Third, longer UI duration reduces the consumption risk associated with unemployment spells, lowering precautionary saving and raising aggregate demand. To

[14] For example, if the fiscal shock increases labor market tightness, this effect is still reflected in wages.

[15] Technically, this amounts to computing consumption policy functions from the household problem under the assumption that the UI duration entering the Euler equations follows the baseline path, while computing the distribution across eligibility states as if UI duration did not respond to the fiscal shock.

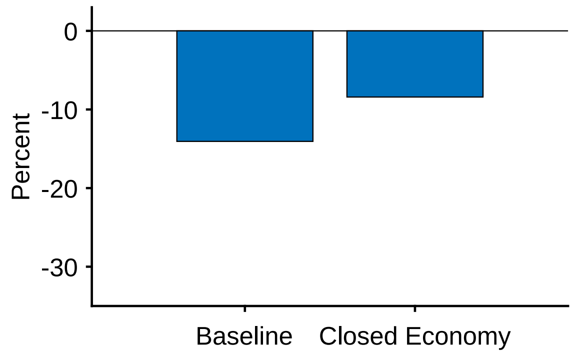


Figure 6: Baseline vs. Closed Economy

Notes: The figure reports the additional effect of UI extensions on the unemployment government-spending multiplier in the baseline model and in the closed-economy version of the model.

assess this channel, we consider a final counterfactual in which, in addition to holding wages fixed and shutting down the transfer channel as described above, households do not expect UI duration to change in response to the fiscal shock during the demand-driven recession. This counterfactual shuts down the insurance channel. It is therefore equivalent to imposing that UI duration does not respond to the fiscal expansion and instead follows the same path as in the recession without the fiscal shock. The final column of Figure 5 shows that, once this channel is shut down, the additional effect of extended UI becomes substantially smaller.

Closed Economy. The results so far concern the interaction between government spending shocks and UI extensions in a setting meant to capture state-level variation. This case is relevant for policymaking given the local dimension of UI policy: it speaks to the potential asymmetric transmission of aggregate fiscal expansions when UI policies vary across states. However, because the increase in UI duration documented in Section 2.1 was widespread across states, it is natural to ask what the union-wide effects of UI extensions on fiscal multipliers are.

We assess the union-wide consequences of the fiscal policy mix by considering a closed-economy version of the model. The second bar in Figure 6 shows that the dampening effect of UI extensions on the government spending multiplier remains nonzero, but becomes smaller—about -8%. The reason is that, in a closed economy, the central bank raises the nominal interest rate in response to inflationary pressures generated by the fiscal expansion and the associated change in UI duration. This monetary tightening dampens aggregate demand and therefore attenuates the effect of UI extensions on the effectiveness of fiscal stimulus.

7 Conclusion

We show that the fiscal policy mix—comprising unemployment insurance (UI) extensions and government spending—is an important determinant of the fiscal multiplier. We provide empirical evidence that UI extensions reduce the size of state-level fiscal multipliers. To interpret this finding, we develop a small open-economy model with heterogeneous households and equilibrium unemployment that closely matches the data. The model attributes the dampening effect primarily to an endogenous UI-duration mechanism: higher government spending reduces unemployment, which shortens the duration of UI benefits. This endogenous adjustment affects households through redistribution and precautionary-saving channels, ultimately lowering the fiscal multiplier.

Our analysis is positive rather than normative, but the findings suggest that accounting for the fiscal policy mix may have important implications for the design of optimal fiscal policy over the business cycle. Moreover, while we focus on UI extensions, the mechanisms highlighted in this paper may also apply to other fiscal instruments that are relevant during recessions, when government spending aims to be most effective, such as automatic stabilizers (McKay and Reis, 2021).

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Online Appendix to "The Macroeconomic Effects of Unemployment Insurance Extensions: A Policy Rule-Based Identification Approach"

Rubén Domínguez-Díaz   *Donghai Zhang*

A Empirical appendix

The results presented in section 3.1 of the main text show that pre-existing UI duration reduced unemployment and earnings fiscal multipliers.

As a summary statistic of the overall effects, we focused on the cumulative responses at horizon $h = 8$ in the main text, following Nakamura and Steinsson (2014). Table A.1 complements that evidence by showing the estimated coefficients for different horizons, from $h = 5$ to $h = 8$. The left panel shows the baseline effects (β_h), while the right panel shows the additional effects when UI is extended (β_h^{UI}). The table confirms that pre-existing extended UI leads to a statistically significant dampening of earnings and unemployment multipliers. These effects become stronger as the horizon increases, with the largest effects observed at $h = 8$, consistent with the evidence discussed in the main text.

	Earnings	Unemployment		Earnings	Unemployment
β_5	1.43***	-4.63***	β_5^{UI}	-0.25***	0.60*
	(0.52)	(1.65)		(0.06)	(0.34)
β_6	1.46**	-4.97***	β_6^{UI}	-0.28***	0.62*
	(0.58)	(1.72)		(0.07)	(0.35)
β_7	1.46**	-5.27***	β_7^{UI}	-0.28***	0.66**
	(0.60)	(1.75)		(0.06)	(0.33)
β_8	1.47**	-5.53***	β_8^{UI}	-0.29***	0.73**
	(0.60)	(1.71)		(0.05)	(0.32)

Note: Cumulative responses at horizons $h = 5, \ldots, 8$. Driscoll and Kraay (1998) standard errors are in parentheses. All regressions include state and time-fixed effects and are estimated by two-stage least squares. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table A.1: Extended UI vs. Normal Times

B Model appendix

B.1 UI eligibility

The law of motion for each eligibility state is given by:

$$N_t^e = (1-\delta+\delta f_t)N_{t-1}^e + pr(1-\delta+\delta f_t)N_{t-1}^{ne} + f_t\left(U_{t-1}^e + prU_{t-1}^{ne}\right) \tag{20}$$

$$N_t^{ne} = (1-pr)(1-\delta+\delta f_t)N_{t-1}^{ne} + (1-pr)f_t U_{t-1}^{ne} \tag{21}$$

$$U_t^e = (1-f_t)(1-pe_t)\left(U_{t-1}^e + \delta N_{t-1}^e\right) \tag{22}$$

$$U_t^{ne} = (1-f_t)\left(U_{t-1}^{ne} + \delta N_{t-1}^{ne}\right) + (1-f_t)pe_t\left(U_{t-1}^e + \delta N_{t-1}^e\right) \tag{23}$$

B.2 Foreign Households

We assume that demand from Foreign households for a variety j of domestically-produced goods is given by:

$$C_{jHt}^* = \left(\frac{P_{jHt}^*}{P_{Ht}^*}\right)^{-\varepsilon} C_{Ht}^*, \tag{24}$$

where P_{Ht}^* is the price of home goods denominated in unit of Foreign currency and C_{Ht}^* marks aggregate foreign demand for Home goods. The latter is assumed to be given by:

$$C_{Ht}^* = \alpha\left(\frac{P_{Ht}^*}{P_t^*}\right)^{-\eta} C_t^*, \tag{25}$$

where P_t^* is the economy-wide price index and C_t^* denotes aggregate Foreign consumption.

We assume that the law of one price holds at all times, meaning that $P_{Ht} = \mathcal{E}_t P_{Ht}^*$ and $P_{Ft} = \mathcal{E}_t P_{Ft}^*$. Here, $\mathcal{E}_t$ marks the nominal exchange rate defined as units of domestic currency per unit of foreign currency. That is, an increase in $\mathcal{E}_t$ marks a depreciation of the domestic currency. We define the real exchange rate Q_t as:

$$Q_t := \frac{\mathcal{E}_t P_t^*}{P_t}, \tag{26}$$

and the terms of trade S_t as the price of imports P_{Ft} over the price of exports P_{Ht}:

$$S_t := \frac{P_{Ft}}{P_{Ht}}. \tag{27}$$

B.3 Mutual Fund

A representative risk-neutral fund issues one-period real bonds A_t to households to finance purchases of risk-free domestic government bonds B_{Ht} and foreign bonds B_{Ft}:[16]

$$A_t = B_{Ht} + Q_t B_{Ft} \tag{28}$$

The ex-post return r_t^a is given by the beginning-of-period flow constraint of the mutual fund:

$$(1 + r_t^a)A_{t-1} = (1 + r_t)B_{H,t-1} + (1 + r_t^*)Q_t B_{F.t-1}. \tag{29}$$

Here r_t marks the ex-post real return on domestic government bonds B_{Ht}. This is linked to the nominal interest rate set by the monetary authority i_t through the standard Fisher equation:

$$1 + r_t := \frac{1 + i_{t-1}}{1 + \pi_t}, \tag{30}$$

where $1 + \pi_t := {}^{P_t}/_{P_{t-1}}$ marks the gross consumer price inflation. Analogously, $1 + r_t^*$ denotes the real gross return on foreign bonds, denoted in units of the foreign currency. Similarly, r_t^* is linked to the nominal interest rate i_t^* on foreign bonds through $r_t^* = \frac{1+i_t^*}{1+\pi_t^*}$, where $1 + \pi_t^* := {}^{P_t^*}/_{P_{t-1}^*}$.

The first-order conditions of the mutual fund's problem deliver the non-arbitrage condition between domestic and foreign bonds, the real uncovered-interest-parity condition:

$$\mathbb{E}_t \frac{1 + i_t}{1 + \pi_{t+1}} = \mathbb{E}_t \frac{1 + i_t^*}{1 + \pi_{t+1}^*} \frac{Q_{t+1}}{Q_t}, \tag{31}$$

and the non-arbitrage condition between the return received on government bonds and the return paid on liabilities:

$$\mathbb{E}_t 1 + r_{t+1}^a = \mathbb{E}_t 1 + r_{t+1} \tag{32}$$

B.4 Producers of differentiated goods.

Differentiated goods producers operate under monopolistic competition and set prices subject to quadratic adjustment costs (Rotemberg, 1982). A firm j purchases X_{jt} homo-

[16]We follow Auclert *et al.* (2021) in modeling the mutual fund. The mutual fund assumption is a common modeling strategy in the literature that features multiple assets and heterogeneous agents; see, for example, Gornemann *et al.* (2021) and Kaplan *et al.* (2018).

geneous goods from labor good producers at price MC_t and transforms them into differentiated goods using a linear technology $Y_{jt} = X_{jt}$. A typical producer of differentiated goods j solves:

$$\max_{\{P_{jHt+k}\}_{k=0}^{\infty}} \mathbb{E}_t \sum_{k=0}^{\infty} (1+r^a)^{-k} \left[\left(P_{jHt+k} - MC_{t+k}\right) Y_{jt+k}^D - \frac{\kappa_p}{2\varepsilon} \log\left(\frac{P_{jHt+k}}{P_{jHt+k-1}}\right)^2 P_{Ht+k} Y_{t+k}^D \right],$$

$$\text{subject to} \quad Y_{jt}^D = \left(\frac{P_{jHt}}{P_{Ht}}\right)^{-\varepsilon} \left(C_{Ht} + C_{Ht}^* + G_t\right). \tag{33}$$

Above, Y_{jt}^D marks aggregate demand for variety j and $Y_t^D = C_{Ht} + C_{Ht}^* + G_t$ denotes aggregate demand for domestically-produced goods. Here, G_t is government consumption of Home goods and C_{Ht}^* is Foreign's demand of Home goods. The first-order condition of the above problem yields the New Keynesian Phillips Curve in the main text (9).

B.5 Wage bargaining

As described in Section 4.3 of the main text the prevailing real wage follows a rule that depends on the Nash-bargained wage. This, in turn, is the outcome of the wage bargaining between a firm and a union that bargains on behalf of workers. More specifically, the Nash-bargained wage is given by:

$$w_t^{\text{Nash}} = argmax_w \left(J_t^L\right)^{\varepsilon^w} \left(\Delta_t^{N,U}\right)^{1-\varepsilon^w}, \tag{34}$$

where J_t^L is the value of the firm with a worker and $\Delta_t^{N,U}$ represents the average surplus of moving from unemployment to employment for the union. This, in turn, is given by the weighted average of the surplus of moving from unemployment to employment for eligible workers, $\Delta_{t,e=1}^{N,U}$, and non-eligible workers, $\Delta_{t,e=0}^{N,U}$:

$$\Delta_t^{N,U} = (n_t^e + u_t^e)\Delta_{t,e=1}^{N,U} + (n_t^{ne} + u_t^{ne})\Delta_{t,e=0}^{N,U} \tag{35}$$

The surplus of moving from unemployment to employment for eligible workers, $\Delta_{t,e=1}^{N,U}$, is given by:

$$\Delta_{t,e=1}^{N,U} = U(C_{t,e=1}^N) - U(C_{t,e=1}^U) + \beta\mathbb{E}_t(1-\delta)(1-f_{t+1})(\Delta_{t+1,e=1}^{N,U} + pe_{t+1}\Delta_{t+1,n=0}^{E,NE}). \tag{36}$$

This has three main components. First, moving one eligible unemployed worker into employment is valued by the union by the contemporaneous utility gain in the increase in consumption, where this is represented by the gain in the utility of moving from consuming the average consumption of eligible unemployed workers, $C^U_{t,e=1}$, to the average consumption of eligible employed workers, $C^N_{t,e=1}$. The second part in (36) represents the expected discounted future gains from moving to employment. The second term, $(1-\delta)(1-f_{t+1})\Delta^{N,U}_{t+1,e=1}$, represents the future surplus of employment conditional for an eligible worker on keeping the job next period – which happens with probability $(1-\delta)(1-f_{t+1})$. The third term, $pe_{t+1}\Delta^{E,NE}_{t+1,n=0}$, is the average loss for an unemployed worker of losing UI eligibility. Namely, this represents the fact that a current eligible worker remains eligible if she finds a job, while she could lose eligibility with probability pe_{t+1} next period if she did not have a job. Moving to employment today avoids such loss going forward.

Similarly, the average surplus of moving from unemployment to employment for non-eligible workers is given by:

$$\Delta^{N,U}_{t,e=0} = U(C^N_{t,e=0}) - U(C^U_{t,e=0}) + \beta\mathbb{E}_t(1-\delta)(1-f_{t+1})(\Delta^{N,U}_{t+1,e=0} + pr\Delta^{E,NE}_{t+1,n=1}). \tag{37}$$

The intuition for equation (37) is similar to the one described previously. It is worth noting that, in this case, the gain from moving into employment also incorporates the possibility of regaining eligibility through the employment spell, which happens with probability pr. This is captured by the third term in (37), given by $pr\Delta^{NE,E}_{t+1,n=1}$, where $\Delta^{NE,E}_{t+1,n=1}$ is the gain of moving from non-eligibility to eligibility which only can happen at the employment state.

The average surplus of eligibility for unemployed workers is given by:

$$\begin{aligned}\Delta^{E,NE}_{t,n=0} =& U(C^U_{t,e=1}) - U(C^U_{t,e=0}) \\ &+ \beta\mathbb{E}_t\left[(1-f_{t+1})(1-\mathrm{pe}_{t+1})\Delta^{E,NE}_{t+1,n=0} + f_{t+1}(1-\mathrm{pr})\Delta^{E,NE}_{t+1,n=1}\right],\end{aligned} \tag{38}$$

where the first term represents that eligible unemployed workers consume more on average than non-eligible unemployed workers. The second term marks the future value of keeping eligibility while being unemployed, which happens with probability $(1-f_{t+1})(1-\mathrm{pe}_{t+1})$. The final term represents the fact that an eligible unemployed worker who finds a job with probability f_{t+1} next period will enjoy a higher value than a non-eligible unemployed worker who also finds a job but does not regain eligibility, which happens with probability $(1 - pr)$.

Finally, the average surplus of eligibility for an employed worker is given by:

$$\begin{aligned}\Delta^{E,NE}_{t,n=1} &= U(C^N_{t,e=1}) - U(C^N_{t,e=0}) \\ &+ \beta\mathbb{E}_t\left[(1-\delta(1-f_{t+1}))\,(1-\text{pr})\Delta^{E,NE}_{t+1,n=1} + \delta(1-f_{t+1})(1-\text{pe}_{t+1})\Delta^{E,NE}_{t+1,n=0}\right]. \quad (39)\end{aligned}$$

The second term above is the value that an eligible employed worker keeps her job, with probability $(1 - \delta(1 - f_{t+1}))$, relative to the value of a non-eligible employed worker that also keeps her job but does not regain eligibility, which happens with probability $1 - pr$. The final term represents the fact that when a non-eligible worker moves into unemployment – with probability $\delta(1 - f_{t+1})$ – she will not be entitled to receive UI benefits, while an eligible employed worker that becomes unemployed will receive benefits with probability $(1 - \text{pe}_{t+1})$.

B.6 Equilibrium

A *competitive equilibrium* is a set of households' policy functions $\{c_{Ht}(s), c_{Ft}(s), c_t(s), a_t(s)\}$, aggregates $\{C_t, C_{Ht}, C_{Ft}, Y_t, Y_t, N_t\}$, prices $\{P_{Ht}, P_{Ft}, P_t, d_t, \mathcal{E}, Q_t, r^a_t, i_t, w_t, mc_t\}$, and distributions $\{\mu_t\}$ such that given aggregate shocks households optimize, firms optimize, the government budget constraint holds, the market for labor services clears $Y_t = Z_t N_t$, the labor market clears $N_t = \int_S n d\mu_t$, and the market for domestic goods clears:

$$Y_t = C_{H,t} + C^*_{H,t} + G_t. \quad (40)$$

Since we are primarily interested in the joint interaction between government spending and the generosity of unemployment insurance in the domestic economy, we abstract from shocks happening abroad. Given that Home is atomistic with respect to the whole economy, economy-wide variables are constant and equal to their steady-state values. Namely, $P^*_t = P^*$, $C^*_t = C^*$, $i^*_t = i^*$. Furthermore, we focus on a symmetric steady state where all domestic savings are invested in domestic government bonds $A = B_H$.