

The Fiscal Policy Mix: UI Extensions Shape Fiscal Multipliers

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Abstract

Government consumption stimulus is typically deployed alongside other fiscal measures that may affect the fiscal multiplier. This paper investigates the interaction of the fiscal multiplier with a prime component of such policy mix: unemployment insurance (UI) extensions. We document empirically that longer pre-existing UI duration significantly reduces government spending multipliers, using state-level military spending shocks and variation in UI duration across U.S. states. To interpret the evidence, we build a small-open-economy model with search-and-matching frictions and heterogeneous households. The model separates two mechanisms: (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. Quantitatively, the calibrated model indicates that the second channel dominates.

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

JEL Classification: E62, E24, E21, J6

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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 constitute a prime example of such fiscal policy mix: the duration of UI benefits is systematically extended as unemployment rates increase during recessions, precisely those times where government spending seeks 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 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 unemployment insurance (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 identification 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 of why extended UI duration can reduce the size of 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.

More in detail, our empirical evidence uses a quarterly-frequency panel dataset at the

state level in the US. 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 government spending from Department of Defense contracts data. Following Nakamura and Steinsson (2014), we employ a Bartik-type identification strategy that exploits the cross-state heterogeneous sensitivities to national military spending.

We supplement these identified government spending shocks with a measure of UI extensions across states and over time. Namely, the institutional design of UI extensions in the US provide us with rich variation in UI duration, useful to investigate how this 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. This regular level is set independently of the business cycle. In addition, UI policies such as the Extended Benefits Program or 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 that there is ample heterogeneity in UI duration across US states and over time.

The main empirical finding is as follows: when fiscal shocks hit a state with pre-existing UI extensions, the size of the fiscal multiplier falls significantly. We obtain this result by computing relative state-level unemployment and earnings government spending multipliers conditioning on the *pre-existing* UI extensions by means of 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 lead to a lower fiscal multiplier. We take two further steps to verify that this indeed holds in the data.

First, we augment our baseline specification to consider a series of “horse races” between UI duration and alternative competing state-level variables. A first one accounts for state-level economic slackness, addressing the possibility that fiscal multipliers might vary with the business cycle (Auerbach and Gorodnichenko, 2012; Bernardini *et al.*, 2020). A second one considers the fraction of unemployed workers receiving UI benefits, helping us to control for the fact that the degree of insurability against unemployment could affect the size of the fiscal multiplier (Albertini *et al.*, 2021). A third one accounts for state-level political orientation, as 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 drive the size of the fiscal multiplier and UI duration. For example, it could be that a state has temporarily higher unemployment and hence an extended UI because it has more rigid wages than the average. Such region-specific characteristics would also affect the size of the fiscal multiplier. We first note that even if this is the case, this feature would drive up the size of the multiplier, which is exactly the opposite of what we find. However, we still address this concern by relying on UI extensions due to measurement errors in tracking real-time unemployment constructed by [Chodorow-Reich *et al.* \(2018\)](#) as an instrument for actual UI duration. This extension of our baseline unties differences in UI duration across states to potential differences in unobserved characteristics.

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

We next present a model of a small open economy that belongs to a monetary union, which mimics our empirical setting, to interpret our empirical findings ([Galí and Monacelli, 2005](#)). We introduce search-and-matching frictions in the framework together with household heterogeneity in the İmrohoroglu-Bewley-Hugget-Aiyagary tradition. The rich heterogeneity allows for a realistic quantitative assessment of the effects of both government spending ([Galí *et al.*, 2007](#); [Auclert *et al.*, 2018](#)) and of 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 UI when the local unemployment rate is above some pre-defined threshold, mimicking the actual policy rule.

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 quantitatively and qualitatively our empirical findings, 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: the government spending expansions reduces the unemployment rate, shorting the duration of unemployment spells and

hence the need to precautionary save, further stimulating consumption.

Regarding the fiscal policy mix, the model provides two competing and related explanations of why extended UI duration could reduce the size of fiscal multiplier. First, there is a *level effect*. Namely, when UI duration is longer, the idiosyncratic risk associated to unemployment spells is dampened. As a result, the precautionary saving channel of government spending is less relevant, reducing the size of the multiplier. A second explanation is a *endogenous UI duration effect*. More precisely, 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. Such a reduction in the duration of UI extensions, in the model, delivers a increase in precautionary savings and a restriction of households consumption, dampening the expansionary effects of government spending. Importantly, such endogenous response is only present when UI duration has been previously extended. The reason for this is that when UI is at its regular duration level, the UI duration cannot be further reduced even if the unemployment rate further falls. In other words, the institutional design of UI extensions delivers a differential response of UI duration to the unemployment fall that follows a government spending shock across pre-existing levels of UI duration, the state variable of our empirical setting.

We build a series of counterfactuals in the model to understand which of the previous competing explanations drive our finding of a smaller fiscal multiplier when UI has been previously extended. We find that the level effect has rather smaller 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 using our 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 differentiate out the monetary policy response to fiscal measures. Our findings indicate that while the monetary policy response tends to mitigate the consequences of UI extensions on the size of the fiscal multiplier, the channels that we present in this paper still operate and are relevant at the aggregate level.

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

First, our paper also belongs to the literature recognizing that the size of the government spending multiplier is not a single invariable statistic but that it is rather shaped by

economic characteristics. Among these, attention has been paid to how multipliers are different in expansions from recession (Auerbach and Gorodnichenko, 2012; Ramey and Zubairy, 2018; Bernardini *et al.*, 2020), the exchange rate response (Born *et al.*, 2021), the demographic characteristic of the population (Basso and Rachedi, 2021), the sign of the shocks (Barnichon *et al.*, Forthcoming), or 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 size 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 this detracts less 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 rather focusing of the fiscal policy mix on spending side that is actively enacted 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 exploring 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 the previous frameworks to incorporate search-and-matching frictions in the labor market in an open-economy framework, which allows us to study the interactions 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 provides our main empirical results. Section 4 outlines the model, which we calibrate to the US economy in section 5. Section 6 provides the model results. A final section concludes.

¹For 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).

2 UI background and Data

To understand and estimate the effects of unemployment insurance (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 duration of UI benefits of 26 weeks. This regular duration of UI benefits is set irrespective of the regional unemployment rate. During downturns, however, US states can extend the duration of UI benefits when unemployment is above some predetermined threshold. Namely, the Extended Benefits program (EB) allows US states to provide an additional duration of UI benefits of up to 20 weeks, depending on their unemployment rate. In addition to this, the Emergency Unemployment Compensation program activated during the Great Recession allowed states to extend UI duration by 53 weeks in addition to previous extensions. Similarly, the Temporary Extended Unemployment Compensation program enacted in 2002 allowed for additional extensions as unemployment increased after the dot com bubble crash.

The various UI programs have led to substantial variability in the duration of UI benefits, both over time and among 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 crisis in the early 2000' and the financial crisis most states did not offer additional UI extensions. However, the average UI extension duration markedly increased from 2008 onwards and between 2002 and 2004. It is important to note that this increase was not uniform across states, as evident from the disparities between the maximum and minimum actual duration of UI benefits.

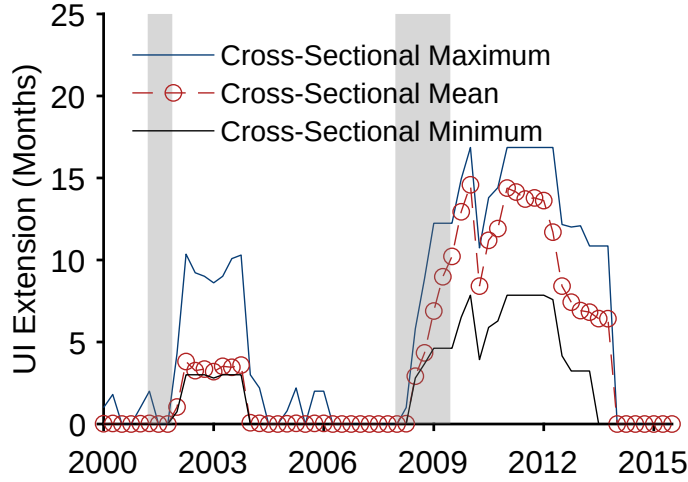


Figure 1: Duration of UI extensions

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

2.2 Data

To implement our identification strategy, we construct a panel dataset for US states at quarterly frequency running from 2000 to 2015. We obtain the measure of actual UI duration and the time series of the state-level unemployment rate from [Chodorow-Reich *et al.* \(2018\)](#). From the same source, we also obtain a state-level time series of the fraction of unemployed workers that receive UI payments. In addition, we obtain from the Regional Economic Accounts of the Bureau of Economic Analysis state-level earnings, defined as pre-tax wages and salaries, which we take as a proxy of state-level economic activity. We complete these state-level variables with the political dataset of [Carlino *et al.* \(2023\)](#), which contains for each state the vote distribution in Gubernatorial Elections.

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

More specifically, our measure of government spending at the state level is constructed using the Department of Defense (DOD) contracts available on [USASpending.gov](#).² This

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

data source provides comprehensive details on contracts signed since 2000. It also supplies detailed information on the name and location (zip code) of the primary contractor, the total contracted amount (obligated funds), and the contract duration. In most instances, the primary zip code where the contracted work was carried out is also available. The detailed geographic and timing structure of this dataset makes it well-suited for our analysis.

The information on the duration of each contract allows us to construct a proxy for spending outflows associated with each contract over time by equally allocating the obligated amount throughout the contract’s duration (Auerbach *et al.*, 2024). Then we aggregate spending across contracts in a location at each point in time, leaving us with a state-level panel dataset of military government spending at quarterly frequency.

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 large obligations of similar magnitude. Following Auerbach *et al.*, 2020, 2024, when consecutive obligations and de-obligations with magnitudes within 0.5% of each other, we consider both contracts 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 an 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 hold robustly in alternative specifications that address potential threats to identification.

3.1 Fiscal Multipliers and UI Duration

Throughout our analysis, we make use of 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 a direct estimation of impulse response functions without imposing dynamic restrictions. Furthermore, local projections can be easily extended to study state-dependent responses, rendering them well-suited for our analysis.

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

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

where $T_{i,t-1}^*$ is the additional duration of UI benefits, expressed in months, in state i of the US at time $t - 1$. $\alpha_{i,h}$ denotes state-fixed effects that allow us to control for state-specific characteristics that are constant over time. $\delta_{t,h}$ are time-fixed effects that control for shocks and policy changes (such as the monetary stance) that hit the US as a whole at a particular point in time. $Z_{i,t-1}$ is a set of control variables, discussed in more detail below.

The regression model (1) allows us to compute the endogenous 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 $Y_{i,t+h}$ with previously *extended UI* 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: either the cumulative change in the state unemployment rate, $\sum_{j=0}^h \frac{(U_{i,t+j} - U_{i,t-1})}{U_{i,t-1}}$, or 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 that we consider is the change in state government 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 cross-state heterogeneous sensitivities to national military spending (see, for example, Nakamura and Steinsson 2014 or Auerbach *et al.* 2020). Namely, we instrument the cumulative changes of $X_{i,t+j}$ using the cumulative changes of total national government military spending interacted with a state dummy.³ The “first-stage” interpretation of this instrumental-variables strategy is that we regress changes in state-level government spending on changes in aggregate military spending, controlling for fixed effects and other covariates. This first stage isolates the systematic state-level sensitivity to

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

national military spending from endogenous changes in state-level government spending that may arise from political or regional business-cycle factors.

Our set of controls, Z_{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 change of unemployment, earnings and, government military spending. In addition, we include the lags of two additional controls that aim to account for time-varying state characteristics that could be simultaneously correlated with fiscal multipliers and pre-existing UI duration. On the one hand, [Carlino et al. \(2023\)](#) shows that partisanship of state governors affects the efficacy of fiscal policy, while we observe that more progressive states tend to have longer UI durations. Therefore, we also include as a control the lags of a dummy for political leadership, which takes value one if the share of republican votes in the last Gubernatorial Elections was larger than fifty percent. Moreover, we also include among our set of controls the fraction of unemployed workers who receive UI benefits, helping us to control for the fact that the degree of insurability against unemployment could affect the size of the fiscal multiplier, as illustrated in [Albertini et al. \(2021\)](#). Namely, 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 We show the estimated cumulative unemployment and earnings multipliers in the first and second columns of Table 1, respectively. [Driscoll and Kraay \(1998\)](#) standard errors are reported in parentheses, which correct for potential residual correlations across US regions 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. We report in Appendix A the cumulative responses for different horizons.

Independently of the outcome variable that we look at, we find that fiscal multipliers are systematically smaller when UI duration has been previously extended. More precisely, the estimated coefficient of β of the first column shows that an increase in government military spending reduces the unemployment rate when UI is at its regular level, with the associated multiplier being roughly -5.53 . Extended UI dampens this estimated positive impact on unemployment, as indicated by the coefficient β^{UI} : it reduces the unemployment multiplier by 0.79 , in about 14%. Similarly, the second column of Table 1 shows that the earnings multiplier is 1.47 during normal times (β), while it is reduced by approximately -0.29 when UI duration has been extended (β^{UI}). All these effects are

	Dependent Variable	
	Unemployment	Earnings
β	-5.53*** (1.71)	1.47** (0.60)
β^{UI}	0.73** (0.32)	-0.29*** (0.05)
F-statistic	10527.75	10527.75
Observations	2300	2300

Note: Cumulative 8-quarter ahead ($h = 8$) responses unemployment and earnings during normal times (β) and the additional effects when UI is extended (β^{UI}). 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 1: Fiscal Multipliers and UI Extensions

statistically different from zero at the, at least, 5% level.

3.2 Addressing Threats to Identification

The causal interpretation running from extended UI duration to a fall in the fiscal multipliers implicitly assumes that no other state-level characteristic correlated with UI duration leads to a lower fiscal multiplier. We next enrich the specification (1) in several dimensions to verify that this indeed holds in the data.

Horse races First, we consider a series of “horse races” between the UI duration $T_{i,t-1}^*$ and alternative competing state-level variables, $R_{i,t-1}$. More specifically, we augment equation (1) as follows:

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

Above, β_h^R captures the additional effect of the competing variable $R_{i,t-1}$, while β_h^{UI} measures the additional effect of extended UI while controlling for the state variable $R_{i,t-1}$. We consider three of such competing explanatory variables, discussed next.

The first competing variable that we consider is a measure of state-level slackness which mimics the definition of a recession, measured as a dummy variable that takes value one if state-level unemployment has been increasing for at least two consecutive quarters.

This horse race accounts for the fact that the amount of slackness in the economy and UI extensions are naturally correlated. This correlation could bias our results to the extent that fiscal multipliers depend on the phase in the business cycle. Namely, our finding that longer UI duration reduces state-level fiscal multipliers could be explained if the economy is less sensitive to demand shocks when the level of local slackness is higher. Note, however, if anything, previous literature has found exactly the opposite. That is, previous research has documented that government spending multipliers are typically larger during recessions ([Auerbach and Gorodnichenko, 2012](#); [Bernardini *et al.*, 2020](#)).

The second competing variable that we consider is the deviation of the fraction of unemployed workers receiving UI from its average. Even though we previously included the fraction of UI recipients in our set of controls, considering it as a competing "horse" allows us to formally account for the fact that the pool of UI recipients could affect the size of the fiscal multiplier. For example, as illustrated in [Albertini *et al.* \(2021\)](#), a change in the fraction of UI recipients could imply a different consumption gap between employed and unemployed, affecting the fiscal multiplier.

The third competing explanatory variable that we account for is the political orientation of the state, as measured by our political leadership dummy – already included in the set of controls in our baseline – that takes value one if the share of republican votes in the last Gubernatorial Elections was larger than a half. Including this as a competing variable in (2) allows to account for the fact the political party of the state might affect the effects of fiscal policy ([Carlino *et al.*, 2023](#)) and that more progressive states tend to have

longer UI duration.

Accounting for Unobserved Covariates Second, in addition to the competing explanatory variables explained above, we consider an additional instrument for the pre-existing UI duration $T_{i,t-1}^*$ to address a more general potential concern that some underlying unobserved covariate could be jointly driving UI extensions and the size of the fiscal multiplier when UI is extended.

For example, it could be that two states have different additional UI durations at a given point in time not because they have faced a different history of shocks but rather because they have faced the same shock which has been amplified in the state with a UI extension. Common sources of shock amplification are, for example, differences in wage rigidity (Hall, 2005) or financial constraints (Bernanke *et al.*, 1999). Another source could be potential heterogeneity in the characteristics of unemployed workers across states (Birinci and See, 2023). For example, states where the pool of unemployed workers has relatively less wealth and hence a larger marginal propensity to consume may lead to an amplification of demand shocks. We first note that this is likely to be biasing our estimates of the effects of UI duration on the fiscal multiplier towards zero. Namely, suppose that a state has temporarily higher unemployment, and hence longer UI duration, because local wages are more rigid. By the same logic, we would expect that fiscal shocks are amplified in that state, leading to larger fiscal multipliers when UI is extended.

Nevertheless, we address the previous concern by using the measurement-error approach of Chodorow-Reich *et al.* (2018). These authors identify variations in the duration of UI benefits that are driven by unemployment measurement errors. Namely, Chodorow-Reich *et al.* (2018) relies on revisions of the unemployment rate to decompose the variation in the duration of UI benefits T_t^* into two parts. The first part comes from differences in economic conditions. The second part arises from measurement error in the real-time data used to determine UI benefits extensions and is, therefore, orthogonal to economic conditions or region-specific characteristics. Following the notation of these authors, we label the part of UI extensions due to pure measurement error as $\hat{T}_{i,t-1}$.

We rely on the part of UI extensions driven by measurement error, $\hat{T}_{i,t-1}$, to untie differences in UI duration from potential differences in unobserved characteristics. Namely, instead of instrumenting the interaction term $T_{i,t-1}^* \cdot X_{i,t+j}$ with the interaction of total national government military spending with state dummies and pre-existing actual UI duration, $T_{i,t-1}^*$, we instrument it with $\hat{T}_{i,t-1}$ correspondingly interacted with national

	Baseline	Horse Races			
		Slackness	Slackness and $\hat{T}$ Instrument	UI Receip. and $\hat{T}$ Instrument	Political and $\hat{T}$ Instrument
Earnings (β^{UI})	-0.29*** (0.05)	-0.36*** (0.08)	-0.44*** (0.13)	-0.31** (0.15)	-0.30*** (0.11)
Unemployment (β^{UI})	0.73** (0.32)	0.88*** (0.30)	0.74*** (0.25)	0.54** (0.26)	0.76** (0.30)

Note: Cumulative 8-quarter ahead ($h = 8$) additional effects when UI is extended (β^{UI}) to the responses of unemployment and earnings. 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. The first column reproduces our baseline results (see Table 1). The second to last column consider alternative competing explanatory variables (see equation (2)). The third to last column, in addition, incorporate UI extensions due to measurement error (Chodorow-Reich *et al.*, 2018) as an instrument for actual UI duration.

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

spending and state dummies.⁴

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

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

In the third column, we also consider state-level slackness as a competing explanatory variable and, in addition, we employ UI duration due to measurement error ($\hat{T}_{i,t-1}$) as an instrument for actual UI duration extensions ($T_{i,t-1}^*$). The results reveal that including this instrument does not meaningfully alter our baseline results, leading us to conclude that

⁴Formally, if $\hat{T}_{i,t-1}$ and the national-level military spending measure interacted with the state dummies labeled $DoD_{i,t}$, are (jointly) exogenous. That is $\mathbb{E}[\varepsilon_{i,t} | \hat{T}_{i,t-1}, DoD_{i,t}] = 0$. Then by the law of iterated expectations, we obtain $\text{Cov}(\hat{T}_{i,t-1} DoD_{i,t}, \varepsilon_{i,t}) = 0$. Therefore, the product $\hat{T}_{i,t-1} DoD_{i,t}$ is a valid instrument for the interaction term of interest.

there is a limited role for the argument that there might be some underlying unobserved factor driving our empirical findings on the stabilization consequences of UI extensions. More precisely, the earnings and unemployment multipliers are still dampened significantly.

The fourth and fifth columns keep $\hat{T}_{i,t-1}$ as an instrument for actual UI duration and state-level slackness as a competing variable, but consider either the share of UI recipients or the political leadership dummy as additional competing variables. The estimated effects arising from these extended specifications show that pre-existing extended UI leads to a dampening of the unemployment and earnings multipliers, in line with our baseline results.

Overall, Table 2 reveals that the empirical findings presented in section 3.1 hold robustly across the different extensions considered, both qualitatively and quantitatively. Namely, the empirical evidence in these sections robustly shows that fiscal multipliers tend to be lower when UI duration is extended.

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

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 lenses of a quantitative model, which mimics the empirical setting. Namely, we first show that the model can match well the empirical relationship between fiscal multipliers and UI duration. We next use the model to tease out the transmission channels at work, which allow us to disentangle among different explanations for our empirical findings.

Towards 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). Our 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. Since the Home region has a negligible size with respect to the whole economy, economy-wide variables are exogenous from the viewpoint of Home. In line with our empirical setting, we will assume that the

monetary authority at Home adopts a fixed exchange rate with respect to Foreign. This allows us to interpret Home as a region of the US economy. Financial markets are incomplete both domestically and internationally, and households at Home can only save into a domestic and a foreign bond through assets issued by a representative mutual fund. Regarding notation, we use the subscripts H and F for 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 $t - 1$, there is a mass N_{t-1} of employed households, and a mass $U_{t-1} = 1 - N_{t-1}$ of unemployed households. At the start of period t , an exogenous fraction δ of employed households separates from firms and instantaneously joins the pool of unemployed households. Therefore, unemployment at the beginning of the period is given by $1 - (1 - \delta)N_{t-1}$. Firms must open vacancies V_t to be matched with a currently unemployed worker. New matches M_t are formed according to the function:

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

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

We define labor-market tightness as the ratio of vacancies over unemployment $\theta := V_t / (1 - (1 - \delta)N_{t-1})$. 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:

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

UI eligibility. Households can be either eligible or non-eligible to receive unemployment benefits. We assume that the transition between eligibility states is stochastic (Chodorow-Reich *et al.*, 2018; Mitman and Rabinovich, 2024). The probability of losing eligibility is endogenously set by the government and described in more detail below. Therefore, policy influences the idiosyncratic risk faced by households as the UI system provides them with direct insurance against income drops during unemployment spells.

More precisely, consider a household that is unemployed and eligible to receive unemployment benefits at the end of the period $t - 1$. Next period t , conditional on remaining unemployed, the household remains eligible with time-varying probability $(1 - pe_t)$.

With complementary probability, pe_t , the household loses eligibility for the remainder of the unemployment spell. Therefore, the expected duration of UI benefits is given by pe_t^{-1} . The stochastic expiration of unemployment benefits captures, in a parsimonious way, the limited duration of unemployment benefits present in the UI system of the US. Once the non-eligible unemployed household finds a job, it regains eligibility probability with constant probability pr for the rest of the employment spell. This assumption captures the fact that it takes several months for a recently hired worker to regain UI eligibility. We denote by $\{N_t^e, N_t^{ne}\}$ the mass of employed households that are respectively eligible and non-eligible at the end of the period. We define $\{U_t^e, U_t^{ne}\}$ analogously for unemployed households. The laws of motion for each of 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 the idiosyncratic states of a household 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 falls into unemployment, it can be either eligible or non-eligible to receive unemployment benefits, $e \in \{1, 0\}$. Next to these, households differ in their idiosyncratic labor income productivity h , which follows an exogenous $AR(1)$ process in logs.⁵ Additionally, we allow for permanent differences in households' discount factors $\beta \in \{\beta_1, \beta_2\}$, a modeling strategy commonly used in the literature to match the high degree of wealth inequality and the large marginal propensities to consume present in the data (Carroll *et al.*, 2017). Finally, a marks households' savings in assets issued by a representative mutual fund.

A household characterized by its idiosyncratic state vector s at time t , chooses consumption c_t and next-period savings a_t to solve:

$$\begin{aligned} V_t(s) &= \max_{c_{Ht}, c_{Ft}, a_t} \frac{c(c_{Ht}, c_{Ft})^{1-\sigma}}{1-\sigma} + \beta \mathbb{E}_t V_{t+1}(s') \\ \text{s.t. } \quad &\frac{P_{Ht}}{P_t} c_{Ht} + \frac{P_{Ft}}{P_t} c_{Ft} + a_t = (1 - \tau_t) h_t \left(d_t + \mathbb{I}_{n=1} w_t + \mathbb{I}_{(n=0, e=1)} b_t + \mathbb{I}_{(n=0, e=0)} \tilde{b}_t \right) \\ &\quad + (1 + r_t^a) a_{t-1}, \quad a_t \geq 0, \end{aligned} \tag{5}$$

where $\sigma > 0$ marks the inverse of the intertemporal elasticity of substitution and c is a

⁵Namely, $\log h_{i,t} = \rho_h \log h_{i,t-1} + \varepsilon_{i,t}^h$, where ε^h is normally distributed with mean zero and variance σ_h^2 .

composite consumption index consisting of consumption of Home and Foreign goods:

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

where $\eta > 0$ marks 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 themselves 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 divide their consumption expenditures between Home and Foreign goods according to:

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

where $P_{Ht} := \left(\int_0^1 P_{jHt}^{1-\varepsilon} dj \right)^{\frac{1}{1-\varepsilon}}$ marks the price index of domestic goods and $P_{Ft} := \left(\int_0^1 P_{jFt}^{1-\varepsilon} dj \right)^{\frac{1}{1-\varepsilon}}$ is the price of foreign goods in units of the domestic currency. P_t is the consumer price index, given by:

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

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

The ex-post real return on households' holdings of mutual fund's assets a_{t-1} is given by r_t^a . We provide a detailed description of the mutual fund problem in [Appendix B.3](#), which follows the modeling strategy of [Auclert et al. \(2021\)](#). There, we show that the mutual fund problem equates the expected return on household assets to the ex-ante real interest rate $r_{t+1} = \frac{1+i_t}{1+\pi_{t+1}}$, where i is nominal interest rate and π_t is consumer price inflation. Additionally, since the mutual fund trades domestic and foreign bonds it yields the familiar UIP condition, but is otherwise inconsequential. In [Appendix B.2](#) we also

provide 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 homogeneous goods using labor hired in a frictional labor market as a production input. A unit mass of producers of differentiated goods indexed by j differentiates labor goods and set prices subject to adjustment costs à la [Rotemberg \(1982\)](#).

Producers of differentiated goods. Differentiated goods producers operate under monopolistic competition. They set prices subject to quadratic adjustment costs ([Rotemberg, 1982](#)) and buy labor goods at price MC_t to transform them into differentiated goods. The solution to the maximization problem, described in more detail in [Appendix B.4](#), yields the conventional non-linear Phillips Curve:

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

where $1 + \pi_{Ht} := P_{Ht}/P_{Ht-1}$ denotes gross domestic inflation and Y_t is aggregate output.

Producers of labor goods. Producers of labor goods are composed of a single worker and use a linear technology to produce homogeneous labor goods. We denote by J_t^L the value of a firm with a worker, given by:

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

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

Hiring a worker involves posting vacancies at cost κ_v per vacancy. In equilibrium and with free entry, firms post vacancies until the expected gains from not doing so are zero:

$$\kappa_v = q_t J_t^L. \quad (11)$$

The presence of matching frictions in the labor market means that multiple wages are bilaterally efficient ([Hall, 2005](#)). We resolve this indeterminacy by assuming the following rule for the real wage w_t :

$$\log(w_t/w) = \phi^w \log(w_t^{\text{Nash}}/w^{\text{Nash}}), \quad (12)$$

where variables without a time subscript mark steady-state values. $\phi^w \in [0, 1]$ measures the degree of real wage flexibility.

We denote by w_t^{Nash} the Nash-bargained wage. Wage bargaining in our model is carried out between the firm and a worker union that negotiates the wage on behalf of workers. Namely, the Nash-bargained wage is given by:

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

where $\Delta_t^{N,U}$ is the surplus of moving from unemployment to employment. We assume that the worker union maximizes the surplus of the average worker, such that $\Delta_t^{N,U}$ represents the surplus aggregating over different idiosyncratic states. We relegate the details of the bargain problem to Appendix B.5. The wage-setting assumptions that we entertain mean that UI benefits and duration can affect real wages through their impact on workers' outside option, as in for example Chodorow-Reich *et al.* (2018) or Mitman and Rabinovich (2024). At the same time, our assumption that bargaining takes place at the average rather than at the individual level keeps our framework computationally tractable.

4.4 Government

The government is comprised 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 fix the nominal exchange rate $\mathcal{E}_t = \mathcal{E}$.

The fiscal authority is subject to the following budget constraint:

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

Above, G_t marks government consumption of domestic goods. We assume that it follows a $AR(1)$ process in log-deviations from steady state with persistence ρ_G .

Next to expenditures on the consumption of domestic goods, the government runs a UI system. This is defined by both the unemployment benefits provided to eligible households b_t , and the probabilities of losing and regaining eligibility $\{pe_t, pr\}$. As regards the level of unemployment benefits, we assume that it is defined by a constant replacement

rate b over the prevailing real wage:⁶

$$b_t = bw_t. \quad (15)$$

We assume that the local government keeps government debt constant at its steady-state value, $B_{H,t} = B_H$. Therefore, it finances its expenditures by adjusting the income tax rate τ_t and through transfers that it receives from the federal government TR_t . As regards the latter, we assume that transfers increase to cover expenditures in UI payments above their steady-state level. This assumption is consistent with the financing of the UI system in our sample period, where UI extensions were financed through the federal budget during the Great Recession (Isaacs, 2019). Formally, TR_t obeys the following rule:

$$TR_t = (b_t U_t^e + \tilde{b}_t U_t^{ne}) - (b U^e + \tilde{b} U^{ne}). \quad (16)$$

A central feature of the UI system in the United States is that the duration of UI benefits is highly non-linear. Namely, as highlighted in the empirical section, US regions can extend the duration of UI benefits during times of high unemployment. At the same time, during times of low unemployment, the duration of UI benefits is not reduced but rather kept at its baseline level. We capture these features in a parsimonious way by assuming that the average duration of UI benefits in our model, $T_t^* = pe_t^{-1}$, is set as follows:

$$T_t^* = \begin{cases} T^* & \text{if } U_t \leq \tilde{U}, \\ T^* \left(\frac{U_t}{\tilde{U}} \right)^{\phi_U} & \text{else.} \end{cases} \quad (17)$$

Above, $T^* = pe^{-1}$ marks the steady-state average duration of UI benefits. The average duration of UI benefits is endogenous to the business cycle. Namely, the government increases the average duration of UI benefits whenever the unemployment rate is above some pre-defined threshold $\tilde{U} \in (U, 1)$.

Next to the UI system, the government provides safety-net transfers $\tilde{b}_t$ to the unemployed households that are not entitled to receive unemployment benefits:

$$\tilde{b}_t = \tilde{b}w_t, \quad \tilde{b} \leq b. \quad (18)$$

That is, we also assume that safety-net transfers are characterized by a constant re-

⁶The functional form that we entertain for unemployment benefits captures, in a parsimonious form, that unemployment benefits in the US are typically indexed to past earning.

placement rate $\tilde{b}$. Appendix B.6 provides a formal definition of the equilibrium.

5 Calibration

We calibrate the model to a representative region of the US. One period in the model is one quarter. The calibrated parameters are summarized in Table 3.

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

Firms. The vacancy-posting cost κ_v is set equal to 4.5% of the quarterly real wage, in line with Silva and Toledo (2009). We set the bargaining power of the firm in the Nash-bargained wage (13) to target a vacancy-filling rate of 0.71, as in Den Haan *et al.* (2000). The degree of wage rigidity, ϕ^w , targets an impact elasticity of the real wage to output of 0.45 in response to government spending shocks (Hagedorn and Manovskii, 2008). The calibrated slope of the Phillips Curve κ_p implies an average price duration of 5 quarters in a Calvo setting. The steady-state value of productivity Z is set such that steady-state aggregate consumption is equal to one.

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

Government. We set the nominal rate to hit an annualized real rate of 4%. The tax rate is set to target a ratio of government consumption to GDP of 0.14. The replacement rate of UI b is equal to 0.83 to target the income drop upon unemployment estimated in Ganong and Noel (2019). Similarly, we set the replacement rate of the safety-net transfers

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. losing 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 indicate steady-state values. The main text provides further details.

$\tilde{b}$ to target the income drop upon UI exhaustion estimated in [Ganong and Noel \(2019\)](#). We set the baseline probability of losing UI eligibility, pe , to target an average baseline duration of UI benefits of two quarters, the most common duration of UI benefits in most US regions. Following [Mitman and Rabinovich \(2024\)](#) we set the probability of regaining UI while employed equal to 0.5. This implies that, on average, it takes two quarters for an employed household to regain UI eligibility. We set the response of UI duration T_t^* to

changes in the unemployment rate, ϕ^U , such that it mimics the average increases of UI extensions in response to the average increase in the unemployment rate observed during the Great Recession in our dataset. Given that in our dataset UI duration increases on average by roughly 3.3 quarters and the unemployment rate increased to 7.7%, this leads to $\phi^U = 3.88$. Finally, we find that the unemployment threshold for the extension of UI benefits equals the steady-state unemployment rate, 6.0%.

Steady-state Untargeted Moments: Data vs. Model. Our model incorporates several channels through which changes in UI benefits duration can have an aggregate impact. On the demand side, these are the households' precautionary savings responses to changes in UI duration (Graves, 2020; Gorn and Trigari, 2024) as well as the fact that unemployed households tend to have larger than average marginal propensities to consume (MPC), meaning that increasing the transfers allocated to these households may increase aggregate demand (Kekre, 2022). Table 4 reports several key steady-state moments that shape these aggregate demand channels in the model and compares them with the data.

The first set of moments looks at the average MPC and its heterogeneity between employed and unemployed households. As explained above we target an average quarterly MPC of 0.20, in line with the estimates of Parker *et al.* (2013). The next two rows report the annual MPC of employed and unemployed households, which are 0.49 and 0.64 respectively.⁷ These values are remarkably close to the empirical estimates reported in Kekre (2022), which draws from the 2010 Survey of Household Income and Wealth administered in Italy to compute these the annual MPCs by employment status.⁸

The second set of moments looks at the consumption responses through unemployment spells and the precautionary savings response of households. Comparing these statistics to the data is relevant to make sure that the model does not overstate the consumption consequences of going through unemployment spells. The first row here reports the average consumption drop upon unemployment while receiving UI benefits. The next row shows the average consumption drop after UI exhaustion. Despite that we do not target these moments, the model replicates quite well the empirical estimates of

⁷We compute the MPCs in the model by simulating the partial equilibrium consumption response in a panel of households to a \$500 transfer (in model-equivalent units), as in Kaplan and Violante (2014) and Kekre (2022).

⁸Unfortunately, US-based evidence on MPC heterogeneity by employment group is scant. The use of this Italian data is common in the literature, see for example Jappelli and Pistaferri (2014).

Moment	Model	Data	Data Source
<i>1. Marginal Propensities to Consume (MPC)</i>			
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)
<i>2. Consumption and Unemployment</i>			
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.

[Ganong and Noel \(2019\)](#).⁹ The final row measures the partial equilibrium consumption response of employed households to an increase in job loss risk. This serves as a good measure of how reasonable the precautionary savings motive of households is. More specifically, we follow [Graves \(2020\)](#) and consider an average increase in the job separation rate of 20% over the course of a year and then we compute the average consumption drop of employed households on impact. The model delivers a consumption response that is just slightly below the empirical value estimated in [Graves \(2020\)](#) using data from the Survey of Consumer Expectations administered by the New York Fed.

In sum, the moments discussed above show that the model captures remarkably well the behavior of households observed in the data, despite its relative parsimony. The successful micro predictions of the model provide a solid starting point to evaluate 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 examine the relevance of accounting for the fiscal policy mix by computing the effects of UI extensions on multipliers through the lenses of the model. First,

⁹Both consumption drops are measured relative to pre-unemployment consumption levels, as in the empirical estimates of [Ganong and Noel \(2019\)](#). As in the data, the averages are taken over the first two quarters in which households receive UI benefits and over the next two subsequent quarters over which households remain unemployed but lose UI eligibility.

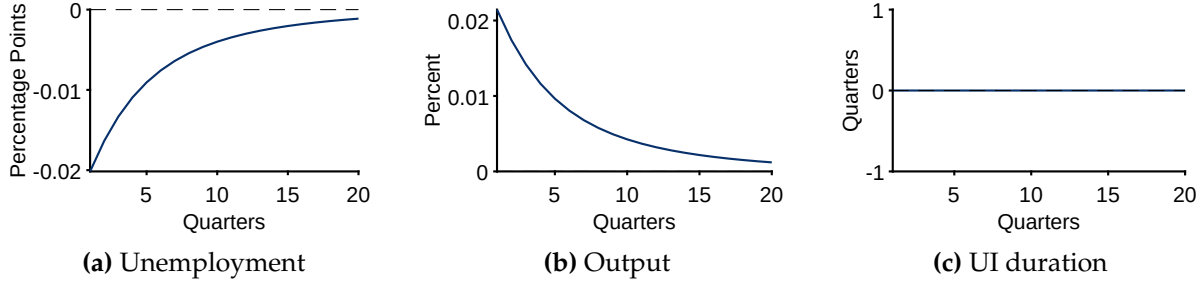


Figure 2: Impulse responses to a government spending shock

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

we describe the series of shocks that we consider to approximate our empirical setting. Second, we show that the model matches reasonably well the dampening effects of UI extensions on state-level fiscal multipliers, as documented in section 3. Finally, we use the model to investigate the channels behind this dampening result. As to account for the non-linear UI duration rule described by (17) we compute the non-linear perfect-foresight responses of the economy to aggregate shocks. In particular, we use a shooting algorithm. When updating our guess, we employ the version of Newton’s method developed in McKay *et al.* (2016).

6.1 Responses to Government Spending Shocks

We present next the series of experiments that approximate our empirical set-up. These serve as a basis to compute the fiscal multipliers discussed in the next section.

First, we consider a government spending shock starting from the steady state of the model. This will allow us to compute the fiscal multiplier during normal times, when UI duration is at its regular level. Figure 2 shows the impulse response functions to the government spending shock in this first experiment.¹⁰ In the model, the stimulus of fiscal spending raises output (panel b) via traditional demand channels (Woodford, 2011), but also through reduced precautionary savings. The increase in government spending stimulates hiring, increasing job finding rates and reducing the unemployment rate (see panel a). As a result, the expected length of unemployment spells falls, reducing the idiosyncratic risk associated to unemployment. Consequently, the precautionary savings

¹⁰We set the persistence of government spending ρ_G to 0.93, which we obtain by regressing our aggregate measure of government spending on its lag. The estimated persistence is identical to the one estimated in Nakamura and Steinsson (2014).

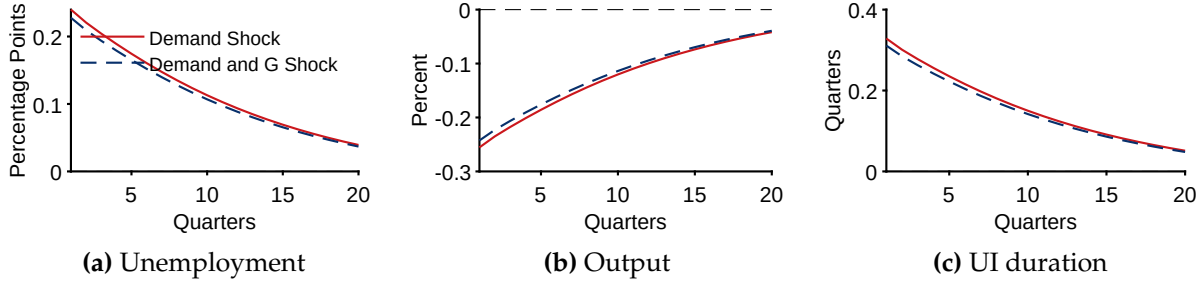


Figure 3: Impulse responses in a demand-driven recession

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.

motive of households is tempered, helping to sustain consumption and contributing to the stimulus. Importantly, note that in this experiment UI duration is at its regular level. Since this regular level sets a floor for UI duration, the drop in the unemployment rate does not come with a drop in UI extensions, observe panel (c).

Second, we consider two additional experiments. In the first one, we generate a demand-driven recession via an increase in households' discount factor. In the second one, we consider the same recession but accompanied by a government spending shock. The difference in responses between these two experiments serves us to compute the fiscal multiplier with extended UI, mimicking our empirical setting.

Figure 3 shows with solid red lines the responses to the demand shock and with dashed blue lines the responses when this demand shock comes accompanied by the government spending shock. The demand shock generates an increase in the unemployment rate and a fall in output (panels (a) and b). During such a recession, UI duration increases endogenously in response to a rising unemployment rate, according the UI duration policy rule (17).¹¹ The increase in government spending during the recession helps to mitigate the fall in output and the increase in the unemployment rate, compare solid and dashed lines in panels (a) and (b). Importantly, in this case, the lower unemployment rate that comes with the fiscal stimulus implies that UI duration increases by less, observe the difference between solid and dashed lines in panel (c). That is, the government spending shock leads to a relative fall in UI duration when this occurs at a time with pre-existing extended UI.

¹¹We pick the size of the discount factor shock such that UI duration increases, in line with our empirical setting, by about a month on impact and assume a shock of the same size for the government spending shock 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

6.2 Fiscal Multipliers

We rely on the previous set of experiments to compute the model counterpart of the empirical fiscal multipliers and additional effects of UI duration presented in Table 1.

First, we compute fiscal multipliers during normal times, when UI duration is at its regular level, by considering the government spending shock that occurs starting at the steady state in Figure 2. We see this as approximating our empirical estimates without extended UI (the coefficient β in our regression (1)) as pre-existing UI extensions in the model – as in the data – are equal to zero. Second, we compute the fiscal multiplier when the government spending shock occurs at a time when UI duration is extended, during the demand-driven recession, based on the responses shown in Figure 3. Third, we take the difference between these two multipliers. This difference gives us the model-based estimate of the additional effect of UI extensions on the size of the fiscal multiplier (the coefficient β^{UI} in our regression (1)).

Table 5 shows the model-based estimates of the fiscal multipliers and additional effects of UI duration, computed as described previously, alongside their empirical counterparts. As in the data, model-based multipliers are computed for horizon $h = 8$. The first row shows the size of the fiscal multiplier during normal times, when UI has not been extended. In the case of unemployment, we obtain a model-based multiplier of -6.47 , just slightly larger than the -5.53 obtained from the data. We also compute the fiscal multiplier for earnings, defined in the model as aggregate pre-tax labor earnings of employed workers. In this case, the model delivers a fiscal multiplier of 0.59 , somewhat

smaller than the earnings multiplier uncovered in our empirical section.¹²

The second row of Table 5 shows that the results implied by the model are consistent with the effects of UI extensions on fiscal multipliers that we infer from our empirical analysis. Namely, the model-implied additional effect of UI extensions on the fiscal multiplier for unemployment is 0.91, representing a fall in the fiscal multiplier of about -14% , close to the 0.73 – representing a fall of about -13% – that we found in the data. For the case of earnings, the fall in the earning multipliers is -0.23 , while in the data we found -0.29 .

6.3 Quantifying the Transmission Channels

In the model, the fiscal policy mix may matters for two main reasons, which make UI extensions influence the effectiveness of fiscal stimulus.

The first possible explanation is a *level effect*. Namely, an extended UI duration reduces the risk associated with unemployment, as it provides households with an income buffer for longer. Therefore, the insurance provided by UI extensions mutes the precautionary savings channel of government spending described above and hence it might reduce the size of the fiscal multiplier. We call this the level effect, as it only depends on the duration of UI benefits in place.

The second possible explanation is an *endogenous UI duration effect*. This channel is linked to the fact that UI extensions, both in the model and in the data, are determined to a large extent by the level of the unemployment rate (recall the UI policy rule (17)). This implies that when government spending induces a fall in the unemployment rate, UI duration may drop too. Such a drop in UI extensions impacts agents' choices and hence the overall effectiveness of the fiscal stimulus, shaping the size of the fiscal multiplier. Importantly, this reduction in UI duration only happens when UI has been previously extended, since UI duration cannot fall below its regular level even if the unemployment rate falls below its steady-state value. Therefore, this endogenous UI duration effect upon a government spending expansions is only active when UI has been previously extended. Indeed this is the case in our experiments: the government spending shock does not move UI duration (Figure 2), whereas it reduces the overall increase in UI extensions when these have been previously extended (Figure 3).

¹²A potential reason for the smaller earning multiplier in the model, relative to the data, is that we do not include the intensive margin of hours worked. Such an addition could help to increase the model-based multiplier, see for example [Albertini et al. \(2021\)](#).

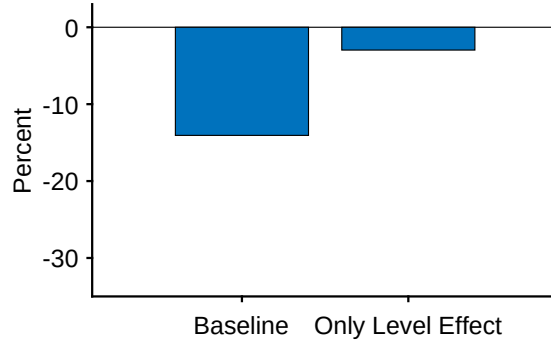


Figure 4: Level vs. Endogenous UI Duration Effects.

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.

We next use the model to disentangle the merits of these level and the endogenous duration effects, and to provide additional details on the transmission mechanisms at work.

Level Effect We quantify the contribution of the aforementioned level effect by building the following counterfactual. We repeat the simulations presented in Figure 3 but assuming that UI duration does not respond to the fiscal shock in the demand-driven recession. That is, we compute the equilibrium responses to the fiscal shock when UI has been extended but exogenously fixing the UI duration to the same path as if there was only a demand shock and no fiscal shock. As a consequence, this counterfactual shuts down the endogenous UI duration response and the only difference between this counterfactual and the fiscal multiplier during normal times (recall Figure 2) is that the increase in government spending occurs at a time where UI duration is longer.

We plot the results in Figure 4. The first bar shows our baseline estimate of the additional effect of UI extensions on the size of the fiscal multiplier associated with unemployment: UI extensions reduce the fiscal multiplier by about 14% (see Table 5).

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

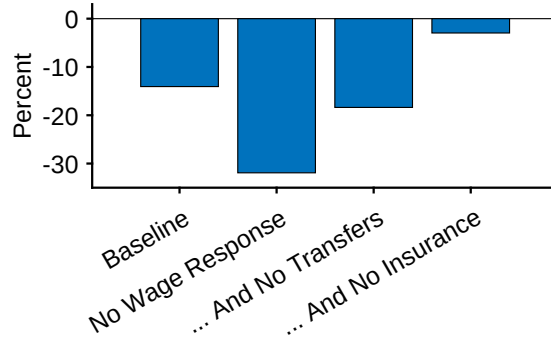


Figure 5: Decomposing the Endogenous UI Duration Effect.

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.

Endogenous UI Duration Effect The previous result presented in Figure 4 shows that fiscal multipliers are affected by UI extensions primarily through the endogenous response of UI duration to the fiscal shock. In our model, this endogenous UI duration change transmits to the economy because it (i) affects wages and hence hiring, (ii) redistributes income to high-MPC unemployed households, and (iii) affects the need to precautionary save. We quantify next each of these three channels of the endogenous UI duration effect by means of counterfactuals.

Wages. First, UI duration improves the outside option of households putting upward pressure on wages and hence restraining hiring. We measure the strength of this channel by repeating our set of experiments outlined in section 6.1 but under the assumption that real wages do not respond to the change in UI induced by the fiscal shock. More precisely, we compute the equilibrium responses of wages as if UI duration was the same as in a situation with the demand shock but without the fiscal shock. 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. This is so because, through this channel, the fall in UI duration that comes with the fiscal shock contains wages, stimulating hiring and therefore reducing unemployment.

Transfers to high MPCs. Second, higher UI duration means that there is a redistribution towards high-MPC unemployed households through transfers, which tend to increase aggregate demand (recall Table 4). Starting from the previous economy with unrespon-

sive wages to the UI duration change, we measure this channel as follows. We consider an alternative counterfactual where households do expect UI duration to change in response to the fiscal shock that occurs during the demand-driven recession but such a change never occurs.¹³ The third column of Figure 5 shows that this transmission channel of UI extensions mitigates significantly the dampening effect of UI duration. Namely, the additional effects on the fiscal multipliers falls from about -30% in the economy with only fixed wages to about -20% in the economy where in addition we shut down transfers.

Insurance. Third, a longer UI duration mitigates the consumption risk of unemployment spells. This leads to a fall in precautionary savings and a corresponding increase in aggregate demand. To show the relevance of this channel we consider a final counterfactual where, in addition to rigid wages and the transfer channel being shut down as explained above, households do not expect UI duration to change in response to the fiscal shock that occurs during the demand-driven recession. Effectively this third counterfactual shuts down the final channel considered and hence it is equivalent to a scenario where UI duration is not allowed to respond to the fiscal expansion, remaining instead at the same level as in the recession without the fiscal shock. The third column of Figure 5 shows that once we shut down this final channel the additional effect of extended UI would significantly smaller.

Closed Economy. Finally, our results so far regard the interaction in the fiscal policy mix in response to state-level government spending shocks and UI extensions. This is a relevant case for policy-making given the local dimension of UI policy, as it speaks to the possible asymmetric transmission of aggregate fiscal expansions insofar UI policies are decided at the state level. However, given that the increase in UI duration documented in Section 2.1 was quite broad across states, it is natural to ask what the union-wide effects of UI extensions on fiscal multipliers are.

We compute the consequences of the fiscal policy mix at the union-wide level by considering a closed-economy version of our model. The second column of Figure 6 shows that in this case the dampening effect of UI extensions on the size of government spending multiplier remains different from zero but it falls meaningfully, to about -8% . The reason

¹³At the more technical level, this amounts to computing the consumption policy function from the household problem under the assumption that the UI duration that enters the Euler equations is the same as in the baseline exercise, but computing the distribution across eligibility states as if UI duration did not respond to the fiscal shock.

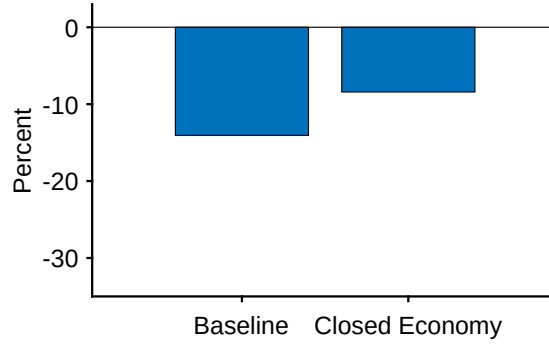


Figure 6: Baseline vs. Closed Economy.

Notes: Additional effect of UI extensions on the size of the government spending multiplier associated to unemployment in the baseline model and in a closed economy.

for this result is that the central bank raises the nominal rate to fight the inflationary pressures generated by the underlying UI change. This, in turn, dampens the expansionary transmission channels operating through aggregate demand, reducing consequences of the change in UI on the effectiveness of the fiscal stimulus, a triple policy mix.

7 Conclusion

We document that the fiscal-policy mix, comprising unemployment insurance (UI) extensions and government spending, is an important determinant of the size of the fiscal multiplier. We first provide empirical evidence that additional UI extensions reduce the size of state-level fiscal multipliers. To explain 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 to an endogenous UI-duration mechanism: higher government spending reduces unemployment, which shortens the duration of UI benefits. This dynamic affects households through redistribution and precautionary-saving channels, ultimately lowering the fiscal multiplier.

Our analysis has focused on positive rather than normative aspects, 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 our analysis has centered 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*** (0.52)	-4.63*** (1.65)	β_5^{UI}	-0.25*** (0.06)	0.60* (0.34)
β_6	1.46** (0.58)	-4.97*** (1.72)	β_6^{UI}	-0.28*** (0.07)	0.62* (0.35)
β_7	1.46** (0.60)	-5.27*** (1.75)	β_7^{UI}	-0.28*** (0.06)	0.66** (0.33)
β_8	1.47** (0.60)	-5.53*** (1.71)	β_8^{UI}	-0.29*** (0.05)	0.73** (0.32)

Note: Cumulative responses at horizons $h = 5, \dots, 8$. 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:

$$N_t^e = (1 - \delta + \delta f_t)N_{t-1}^e + pr(1 - \delta + \delta f_t)N_{t-1}^{ne} + f_t(U_{t-1}^e + prU_{t-1}^{ne}) \quad (19)$$

$$N_t^{ne} = (1 - pr)(1 - \delta + \delta f_t)N_{t-1}^{ne} + (1 - pr)f_tU_{t-1}^{ne} \quad (20)$$

$$U_t^e = (1 - f_t)(1 - pe_t)(U_{t-1}^e + \delta N_{t-1}^e) \quad (21)$$

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

B.2 Foreign Households

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

$$C_{jHt}^* = \left(\frac{P_{jHt}^*}{P_{Ht}^*} \right)^{-\varepsilon} C_{Ht}^*, \quad (23)$$

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:

$$C_{Ht}^* = \alpha \left(\frac{P_{Ht}^*}{P_t^*} \right)^{-\eta} C_t^*, \quad (24)$$

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:

$$Q_t := \frac{\mathcal{E}_t P_t^*}{P_t}, \quad (25)$$

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

$$S_t := \frac{P_{Ft}}{P_{Ht}}. \quad (26)$$

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} .¹⁴

$$A_t = B_{Ht} + Q_t B_{Ft} \quad (27)$$

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

$$(1 + r_t^a)A_{t-1} = (1 + r_t)B_{H,t-1} + (1 + r_t^*)Q_t B_{F,t-1}. \quad (28)$$

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:

$$1 + r_t := \frac{1 + i_{t-1}}{1 + \pi_t}, \quad (29)$$

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:

$$\mathbb{E}_t \frac{1 + i_t}{1 + \pi_{t+1}} = \mathbb{E}_t \frac{1 + i_t^*}{1 + \pi_{t+1}^*} \frac{Q_{t+1}}{Q_t}, \quad (30)$$

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

$$\mathbb{E}_t 1 + r_{t+1}^a = \mathbb{E}_t 1 + r_{t+1} \quad (31)$$

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-

¹⁴We 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:

$$\begin{aligned} \max_{\{P_{jHt+k}\}_{k=0}^{\infty}} \mathbb{E}_t \sum_{k=0}^{\infty} (1+r^a)^{-k} & \left[(P_{jHt+k} - MC_{t+k}) Y_{jt+k}^D - \frac{\kappa_p}{2\varepsilon} \log \left(\frac{P_{jHt+k}}{P_{jHt+k-1}} \right)^2 P_{Ht+k} Y_{t+k}^D \right], \\ \text{subject to } Y_{jt}^D &= \left(\frac{P_{jHt}}{P_{Ht}} \right)^{-\varepsilon} (C_{Ht} + C_{Ht}^* + G_t). \end{aligned} \quad (32)$$

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:

$$w_t^{\text{Nash}} = \operatorname{argmax}_w \left(J_t^L \right)^{\varepsilon^w} \left(\Delta_t^{N,U} \right)^{1-\varepsilon^w}, \quad (33)$$

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, $\Delta_{t,e=0}^{N,U}$:

$$\Delta_t^{N,U} = (n_t^e + u_t^e) \Delta_{t,e=1}^{N,U} + (n_t^{ne} + u_t^{ne}) \Delta_{t,e=0}^{N,U} \quad (34)$$

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

$$\Delta_{t,e=1}^{N,U} = U(C_{t,e=1}^N) - U(C_{t,e=1}^U) + \beta \mathbb{E}_t (1-\delta)(1-f_{t+1}) (\Delta_{t+1,e=1}^{N,U} + p e_{t+1} \Delta_{t+1,n=0}^{E,NE}). \quad (35)$$

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, $C_{t,e=1}^U$, to the average consumption of eligible employed workers, $C_{t,e=1}^N$. The second part in (35) represents the expected discounted future gains from moving to employment. The second term, $(1 - \delta)(1 - f_{t+1})\Delta_{t+1,e=1}^{N,U}$, 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, $pe_{t+1}\Delta_{t+1,n=0}^{E,NE}$, 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:

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

The intuition for equation (36) 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 (36), given by $pr\Delta_{t+1,n=1}^{NE,E}$, where $\Delta_{t+1,n=1}^{NE,E}$ 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:

$$\begin{aligned} \Delta_{t,n=0}^{E,NE} = & U(C_{t,e=1}^U) - U(C_{t,e=0}^U) \\ & + \beta \mathbb{E}_t \left[(1 - f_{t+1})(1 - pe_{t+1})\Delta_{t+1,n=0}^{E,NE} + f_{t+1}(1 - pr)\Delta_{t+1,n=1}^{E,NE} \right], \end{aligned} \quad (37)$$

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 $(1 - f_{t+1})(1 - pe_{t+1})$. 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:

$$\Delta_{t,n=1}^{E,NE} = U(C_{t,e=1}^N) - U(C_{t,e=0}^N) + \beta \mathbb{E}_t \left[(1 - \delta(1 - f_{t+1}))(1 - pr)\Delta_{t+1,n=1}^{E,NE} + \delta(1 - f_{t+1})(1 - pe_{t+1})\Delta_{t+1,n=0}^{E,NE} \right]. \quad (38)$$

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 $(1 - pe_{t+1})$.

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 $\{P_{Ht}, P_{Ft}, P_t, d_t, \mathcal{E}, Q_t, r_t^a, i_t, w_t, mc_t\}$, 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:

$$Y_t = C_{H,t} + C_{H,t}^* + G_t. \quad (39)$$

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 $A = B_H$.