Consumption Commitments and Unemployment Insurance*

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Abstract

Households allocate more than 40% of their budget to goods and services that are difficult to adjust, such as rents, mortgages, insurance, or mobile plan contracts. Each quarter only about 11% of households adjust the consumption of such items, which are called "commitments". Commitments imply monthly payments that are hard to avoid and make employment and income fluctuations more costly. In this paper, we study the role of unemployment insurance when households consume two goods, an adjustable good and a commitment good. We build a search model with heterogeneous agents and incomplete markets, where individuals face unemployment shocks and exert effort to find a job while unemployed. The government runs an unemployment insurance (UI) program. The model is calibrated to the US economy and matches, among other targets, the elasticity of unemployment duration with respect to the UI generosity. We first show that reducing the UI generosity significantly affects search effort and unemployment durations in the benchmark economy. In contrast, the effects are smaller in an economy without commitments. Commitments also induce households to build larger precautionary savings. We then calculate the welfare benefits of unemployment insurance. In the benchmark economy with commitments, eliminating the UI implies a welfare cost of around 4.5% (measured by a consumption compensating variation). The cost is higher for poorer households. In an economy without commitments, the welfare cost of eliminating UI is only 3.4%. The optimal UI replacement rate is 65% in the benchmark economy, higher than the current US policy (50%).

JEL Codes: E2, H2, I38.

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1 Introduction

Households allocate a significant part of their budget to goods or services that are costly to adjust, the so-called "consumption commitments". These commitments include mortgage or rental payments, insurance payments, or mobile phone plans. They imply predetermined, regular (typically monthly) payments that can't be easily avoided and limit households' ability to adjust consumption. Theoretical analysis by Chetty and Szeidl (2007) shows that commitments increase the welfare cost of adverse income shocks since the consumption adjustment is almost entirely made through adjustable goods, such as food, entertainment, transport, etc.

Unemployment spells are one of the most important negative income shocks that households experience throughout their working life. Around 1.6% of individuals transition from employment to unemployment each month, and the average duration of unemployed individuals is around 6.5 months (Current Population Survey, 2015-2018).

Unemployment insurance is the main government program that supports unemployed individuals. A worker, who has been employed at least for a year, can receive UI benefits for up to 6 months if she becomes unemployed. Yet, for 35% of households, unemployment can last for more than 6 months. Ganong and Noel (2019) find that households' expenditures drop by more than 12% once the entitlement period ends. In 2017, around 2.6% of households received unemployment insurance at some point during the year (CPS). The numbers were much higher during the great recession (7.7% in 2009) and COVID-19 crisis (12.4% in 2020).

The benefits of the UI program depend critically on how much it helps households smooth their consumption (Gruber 1997). These benefits have to be weighted against the negative labor supply incentives it creates (Baily 1978, Chetty 2008). There is an extensive literature in macroeconomics that studies the impact of UI programs on labor markets and tries to evaluate its costs and benefits. The existing analysis, however, abstracts from consumption commitments. This is surprising since households devote a significant fraction of their budget to commitments. In this paper, we fill this void in the literature. We ask: How do commitments affect the search behavior of unemployed individuals? How does it affect their savings?

How valuable are the UI programs in an economy with commitments?

To answer these questions, we first present evidence on the importance of commitments. Using the Consumer Expenditure Survey (CEX) and the Survey of Income and Program Participation (SIPP), we show that a small fraction of households adjust shelter (2.5%), insurance (30%) or phone payments (35%) every quarter. The expenditure on these services amounts to 40.6% of household expenditures. In contrast, 70-80% of households adjust food, transport or entertainment expenses each quarter. We also show that consumption expenditures on commitments barely change during unemployment, while consumption of food, transport and entertainment fall by 15 to 30%. Thus, the consumption adjustments during unemployment are mainly made through the "adjustable goods" margin, making unemployment spells more painful. As a result, individuals with commitments have higher incentives to leave unemployment. Indeed, in the data, individuals who are renters or have mortgage payments are more likely to leave unemployment than homeowners, even after controlling for observable characteristics.

Next, we build an infinite horizon, search model with heterogeneous agents and incomplete markets with two goods, an adjustable good and a commitment good. Individuals are heterogeneous in their labor productivity, which consists of a persistent component and a fixed component. The fixed types capture college and non-college individuals in the data. Individuals face exogenous unemployment shocks and decide how much effort to exert to find a new job when they are unemployed. The government taxes income and runs an unemployment insurance program. The model period is a month, and unemployed individuals can receive unemployment benefits for a maximum of 6 months, with a replacement rate of 50% up to a cap. Furthermore, the probability of finding a job decreases with unemployment duration so that the model can generate a distribution of durations in unemployment consistent with the data. The model captures the key trade-off for the UI design. On the one hand, the UI provides transfers to individuals when the marginal value of such transfers is very high. On the other hand, transfers reduce search effort and have to be financed by increasing distortionary taxes.

We calibrate the model's parameters to the US data for the 2015-2019 period. The model reproduces the share of commitments in household budgets and the fraction of households who adjust their consumption of commitments. It also captures the distribution of unemployment durations and moments of the wealth distribution. Furthermore, the model can generate an elasticity of unemployment duration with respect to unemployment insurance benefit duration that is consistent with available micro evidence.

We then use the calibrated model to study the importance of commitments. We first show that commitments increase precautionary savings significantly. If we set the cost of adjustments for commitments in the benchmark economy to zero, i.e., make both goods fully adjustable, median savings decline by 20%.

Next, eliminate UI by reducing the replacement rate from its benchmark value of 50% to zero (no unemployment insurance case). We do this both in the benchmark economy and an alternative economy without commitment goods. The model without commitments matches precisely the same moments as the benchmark economy, except those regarding commitments. When unemployment insurance is eliminated, the unemployment duration reduces by 23% in the benchmark, while the fall is only 14% in the economy without commitments. Similarly, the effort exerted to find a job increases faster in an economy with commitments, as households have much larger incentives to move out of unemployment.

Finally, we quantify the welfare benefits of unemployment insurance, focusing again on the benchmark versus no-commitments economy. The welfare benefits of unemployment insurance in the benchmark are significant: eliminating unemployment insurance implies a median welfare loss of 4.5%, measured in consumption variations. The loss, however, is much lower in an economy without commitments, 3.4%. The loss for non-college individuals is more significant, 5% in the benchmark and 3.9% in the no-commitments economy. The optimal UI replacement rate is 65% in the benchmark economy, higher than the current US policy (50%).

1.1 Related Literature

This paper is related to three strands of the literature. First, it is related to the literature on consumption commitments. Chetty (2003) and Chetty and Szeidl (2007) show how commitments amplify the welfare costs of adverse income shocks since households have to concentrate reductions in consumption on the adjustable goods' margin (like food). Chetty and Szeidl (2016) explore the differences between models with consumption commitments and habit formation. While both models behave similarly for small and moderate shocks, in commitment models, agents can sharply reduce commitments in the face of extreme events, which is consistent with empirical evidence. Other papers have studied the implications of commitments for different economic outcomes, e.g., wage rigidities (Postlewaite, Samuelson, and Silverman 2008), housing consumption (Shore and Sinai 2010), and marriage behavior (Santos and Weiss 2016). We bring insights from this literature into a quantitative macro model of unemployment insurance.

Second, the paper is related to the empirical studies on the welfare value of unemployment insurance. Traditional approaches, carried by Baily (1978) or Gruber (1997) among others, are based on measuring consumption changes after job loss and then scaling by the risk aversion coefficient to estimate the welfare value of UI. This literature finds significant but moderate consumption drops after unemployment events and a low value of unemployment insurance for standard levels of risk aversion. These findings have been revisited by recent studies. Landais and Spinnewijn (2021) use differences in the marginal propensity to consume of employed and unemployed and find significant welfare gains from unemployment insurance.[1] Giupponi, Landais, and Lapeyre (2021) suggest that unemployment insurance offers more insurance value than other programs like short-time-work (widely used in Europe during the COVID-19 recession), but that both programs are good complements during recessions.

Finally, there is an extensive literature that studies unemployment insurance within quantitative macroeconomic models. Following Bewley (1986), Huggett (1993), Aiyagari (1994) tradition in macroeconomics, these papers emphasize the importance of heterogeneity and insurance, features that imply a high optimal replacement rate for UI programs. Yet, the adverse effects of UI on search behavior, as emphasized by Chetty (2008), and on job creation, as stressed by Krusell, Mukoyoma, and Sahin (2010), can imply low, even zero, replacement rates. Among recent contributions, Setty and Yedid-Levi (2021) find that the optimal replacement rate should be 27%, and that UI can be very valuable for individuals at the bottom of

[1] Hendren (2017) finds that existing willingness to pay measures underestimate the value of UI due to individuals' knowledge of future job loss.

the wealth distribution. Choi and Valladares-Esteban (2020) find that the optimal replacement rate should be close to zero for married couples since household labor supply can provide enough insurance. Similarly, Haan and Prowse (2020) emphasize the importance of other welfare programs and find a minimal role for unemployment insurance.[2] We complement this literature by exploring the importance of unemployment insurance under the presence of commitments.

The rest of the paper is organized as follows. Section 2 presents evidence on commitments. Section 3 describes the model economy. Section 4 presents the calibration. Section 5 presents the results. Finally, section 6 concludes.

2 Facts

2.1 Commitments

In this section, we document how often households adjust their consumption expenditures for different goods. The main data source is the Consumer Expenditure Survey (CEX hereafter). The CEX is conducted by the U.S. Bureau of the Census, and provides detailed information on how much households spend on products and services, together with other socio-economic variables, such as demographic characteristics, income, assets and employment.

The CEX consists of two surveys: the Interview Survey and the Diary Survey. The analysis in this section uses the Interview Survey. The Interview Survey is a rotating panel in which households are asked to report their expenditures for different items for the previous 3 months. Around 7,100 consumer units are interviewed for a maximum of four consecutive calendar quarters, and around 25% of the sample in every quarter are new families interviewed for the first time. The Interview Survey contains data on purchases of goods and services like food, transport, rent,

[2] Within this literature, other papers focus on how UI should vary over the business cycle, e.g., Mitman and Rabinovich (2015), Jung and Kuester (2015), and Landais, Michaillat, and Saez (2018), or UI as an automatic stabilizer within models with nominal rigidities, e.g., Kekre (2021), McKay and Reis (2021), Nakajima (2012) and Hagedorn, Karahan, Mitman, and Manovskii (2013) study the role of UI extensions during the Great Recession.

insurance, cars, etc. which amount to around 95% of all household expenditures.[3]

Table 1 shows the fraction of households adjusting expenditures from one quarter to the next for different goods and services and the share of each item in total household expenditures for non-durable goods.[4] For any consumption item i, the fraction of households adjusting that consumption of that good in quarter t is computed as the share of households whose expenditure changes by more than 10% from quarter $t-1$ to quarter t.[5] This is done for all items in the first column of Table 1, except for shelter.

While the CEX contains rich data on consumption and surveys households for a maximum of 4 quarters, it does not follow households that change their residence. This poses a limitation to analyze the dynamics of payments related to shelter, i.e. rents, mortgages, housing insurance, etc. Expenditure changes in these items are likely to be due to households moving to a new house and getting a new mortgage, housing insurance, or paying a different rent. As a result, to overcome this limitation, we use the Survey of Income and Program Participation (SIPP hereafter) from 2014-2018. The SIPP is a continuous series of panels in which households are interviewed every quarter, for up to four years, about income, taxes, transfer government programs, assets and demographic characteristics. The SIPP includes a binary variable for each month that indicates whether the household has moved to a new house, which can be used to compute the fraction of households that move.

For shelter in Table 1, we use SIPP and compute adjustments as the fraction of households that move to a new address from quarter $t-1$ to quarter t. Our approach follows Chetty and Szeidl (2007), who compute the fraction of households adjusting shelter expenditures based on households who move to a new address in the Panel Study of Income Dynamics (PSID).

The second column in Table 1 reports the expenditure share of each item in households' total expenditure. We take the second quarter of 2016 and aggregate

[3] The Diary Survey is conducted for a period of two consecutive 1-week periods where the household must complete a diary of expenditures, and it is meant to capture very high frequency expenditures.

[4] The analysis abstracts from durable goods, since their expenditure is infrequent and consumption does not require a periodic payment. Shelter (or housing services) are included since almost 80% of households pay either a mortgage or a rent, i.e. they make a periodic payment.

[5] In Appendix A, we have explore other thresholds for the definition of adjustment, in particular, we present Table 1 for thresholds of 1% and 5%. While the fraction adjusting for every item increases, we find a clearly difference in adjustment rates for commitments and the other goods.

expenditures of each item for all households and divide them by total expenditures.[6]

The critical message from Table 1 is that a significant fraction of households adjusts their expenditures on goods like food, tranposrt, entertainment, or utilities each quarter. About 70% of households adjust their food consumption, while the share that adjusts transport or entertainment is above 80%.

On the other hand, a much smaller fraction of households adjust shelter (payments on mortgages, rents, and housing insurance), phone services, or insurance contracts (life, vehicle, or health). The fraction that adjusts these items is well below 50%; around 30% for most items, and only 2.5% for shelter, which reflect their nature as commitment goods.

In total, adding the expenditure shares of commitments, the consumption of commitments amount for around 40% of household expenditures other than durables. This figure is close to the one found by Chetty and Szeidl (2007), who estimate that around a half of household expenditures are commitments. The average of households adjusting commitments weighted by their expenditure share is 11.8%.

In Appendix B, we reproduce Table 1 conditional on the socioeconomic characteristics of household heads. We focus on education groups (college vs. non-college), marital status (married vs. single), and whether children are present at home. The expenditure shares and fraction of households that are adjusting are pretty similar for these the groups. The singles tend to spend a larger fraction of their expenditures on commitments, 42.4%, than married couples, 39.6%, and are more likely to move, but differences are rather small.

2.2 Unemployment and Commitments

Next, we study whether households are less likely to adjust commitments and other goods during an unemployment spell. This is critical to understand how much households can smooth consumption during an unemployment spell and, as a result, how much they value unemployment insurance.

While the CEX has very rich information on consumption categories, information on labor market outcomes is much more limited. Information on employment

[6] The choice of a specific quarter is done to reduce sample attrition bias, since some households appear for less than 4 quarters. We have checked computing those figures for several different quarters and years and expenditure shares remain essentially the same.

Table 1: Fraction of Households Adjusting between two Quarters

	% Adjust	Expenditure Share
Food	70.8%	19.9%
Utilities	65.1%	5.1%
Transport	83.5%	21.3%
Entertainment	80.9%	6.1%
Shelter	2.5%	27.0%
Phone	35.2%	3.1%
Life insurance	29.0%	0.9%
Vehicle insurance	31.2%	3.4%
Health insurance	28.1%	6.2%

Note: All the figures are obtained from CEX (2015-2019), except for fraction adjusting shelter which is computed as the fraction of movers using the SIPP. See the text for more details.

status is gathered in the first and fourth interviews of the CEX, and only provides the number of weeks worked during the previous 12 months. However, no specific question about the employment status of the head of the household, i.e. a categorical variable on whether the head is employed, unemployed or out of the labor force, at the time of both interviews is asked.[7] This poses important limitations. First, given that questions on employment are asked in the first and the last interviews, which are three quarters apart, the analysis can only be done on an annual basis (not quarterly, as in Table 1). However, around 70% of unemployed individuals have unemployment durations that are less than 6 months, and they can receive unemployment insurance benefits for at most 6 months. As a result, an analysis on annual frequency will not capture how unemployment affects household expenditures. Second, the lack of a specific question about employment status makes it impossible to determine whether the household head is unemployed at the last interview. We only know the fraction of weeks they did not work during the previous year. Therefore, Table 1 cannot be replicated for unemployment events, and a different strategy should be used to study the consumption adjustments during unemployment.

To overcome these limitations, we follow Chodorow-Reich and Karabarbounis (2016), and use the number of weeks worked in the previous 12 months (asked in the last interview of each household) as a measure of unemployment exposure. Then, we study how households' annual expenditure on different consumption items is related to their exposure to unemployment during the year. In particular, we can

[7] See Gruber (1998) and Aguiar and Bils (2015) for further discussion.

run the following regression:

$$\log C_{kit} = \gamma_k^0 + \beta_k X_{it} + \gamma_k^u D_{it}^u + \gamma_k^n D_{it}^n + \epsilon_{kit}, \tag{1}$$

where C_{kit} corresponds to consumption of good k by individual i in year t, X_{it} denotes a vector of socioeconomic characteristics, D_{it}^u and D_{it}^n are the fraction of time individual i spends as unemployed and out of the labor force in year t, respectively. Parameter γ_k^u (γ_k^n) measures the log point difference of consumption of good k between a household whose head is unemployed (out-of-the labor force) with respect to that of the same good of households whose head is employed.

Since, as pointed out above, the CEX does not ask questions about job search, we set $D_{it}^n = 1$ if the household head reports not having worked at all in the previous year. For the rest of households, D_{it}^u is defined as the fraction of weeks the household head has not worked, that is, $D_{it}^u = 1 - (\text{weeks worked})_{it}/52$. We use cross-sectional variation to identify the change in consumption as a consequence of unemployment. For that purpose, we need an extensive vector of controls, X_{it}, so that differences in ex-ante permanent income are absorbed. The control variables include region and year fixed effects, housing tenure categorical variable, liquid savings, a polynomial of order 2 in the age of the household head, a polynomial of order 2 in household size, an indicator for marital status, an indicator variable for education of the head interacted with year dummies, number of cars and race of the household head.[8]

The results are presented in column 1 of Table 2. Estimates for γ^u imply a statistically significant decline for food, entertainment and transportation expenditures of between 15 and 30% for a worker that is unemployed for a year.[9] In contrast, if we focus on commitments, like shelter or insurance contracts, the decrease in consumption is not statistically significant for most of the cases. Only vehicle insurance exhibits a significant decline. This suggests that consumption of commitment goods are also much less adjusted during unemployment than other goods or services like food or entertainment.

[8] Housing tenure indicates whether the head of the household owns the house where she lives with a mortgage, without a mortgage or whether she is a renter. Education includes less than college and college. Finally, race is a categorical variable indicating whether the head is White, Asian, Latin American, Native American or African American.

[9] Part of this decline might reflect households switching to cheaper products, as emphasized by Aguiar and Hurst (2005).

Table 2: Unemployment and Commitments

Consumption item	Estimates for γ^u	Ganong and Noel (2019)	Kolsrud et al. (2018)
Food	-0.141*** (0.040)	-15.8%	-0.083* (0.044)
Transport	-0.272*** (0.094)	-10.6%	-0.348*** (0.080)
Entertainment	-0.254*** (0.092)	-13.4%	-0.189*** (0.072)
Shelter	-0.052 (0.056)	—	0.043 (0.031)
Health insurance	-0.184 (0.119)	-2.8%	—
Vehicle insurance	-0.110* (0.07)		—
Life insurance	0.000 (0.188)		—

Note: The first column displays the estimates for γ^u from regression 1. Second column includes the decrease in consumption during unemployment calculated by Ganong and Noel (2019), their study include only aggregate payments for insurance and not by item as done in the first column. The third column shows the estimates of decrease in consumption during an unemployment spell from Kolsrud et al. (2018), shelter in this case only include rental payments.

These results are consistent with available evidence on how households adjust their consumption during unemployment. Ganong and Noel (2019), using data on consumer checking and credit card accounts in the US, construct a database with monthly spending categories and unemployment insurance recipients. They find that insurance payments decrease by a small amount during unemployment (only by 2.8%), while other goods or services like groceries, transportation or entertainment fall by a much more important magnitude (between 10-15%). There is also evidence on consumption adjustments in other countries. Kolsrud, Landais, Nilsson, and Spinnewijn (2018), using data from a household consumption survey in Sweden, find that, during an unemployment spell, goods like food, transportation and recreation fall significantly, between 10 and 30%, while rental payments are not reduced.[10] These results, which are in line with the ones obtained using CEX data for the

[10] These authors run the regression: $\log c_{it} = \eta_1 \mathbb{I}\left[0 < t <= 20\ wks\right] + \eta_2 \mathbb{I}\left[t > 20\ wks\right] + X_i'\gamma + \epsilon_{it}$ where $\mathbb{I}\left[0 < t <= 20\ wks\right]$ denotes whether the individual has been employed for less than 20 weeks, $\mathbb{I}\left[t > 20\ wks\right]$ for more than 20 weeks and X_i a vector of controls including year and month dummies. η_1 (η_2) denotes the effect on consumption of being unemployed for less than (more than) 20 weeks relative to an individual that will become unemployed in the following 6 months. Coefficients for η_2 are presented in table 2.

United States, are presented in columns 2 and 3 of Table 2.[11]

In summary, households devote a significant fraction of their expenditures, around 40%, on goods or services that are difficult to adjust. These goods and services, which are mainly shelter payments (rents and mortgages) and insurance payments, are also infrequently adjusted by households when the head experiences an unemployment spell. While goods or services that are frequently adjusted cover food, transportation or entertainment, which are also the ones whose adjustment is larger during an unemployment event.

2.3 Commitments and Unemployment Duration

Next, we study how fast individuals leave unemployment depending on whether they have commitments or not. SIPP provides detailed monthly information on unemployment and homeownership status, in particular, it specifies whether the head is an owner without a mortgage, an owner with a mortgage or a renter. In this section, we focus on shelter payments for commitments since SIPP does not provide data on insurance or phone consumption. In particular, we define an individual to have commitments if she owns a house but faces mortgage payments or if she is a renter. Otherwise she does not have commitments.

We use a Cox proportional hazards model in order to study the impact of commitments on unemployment durations controlling for several observable characteristics.[12] In particular, we run the following regression:

$$\log h_{it} = \alpha_t + \beta_1 \text{Commit}_i + \beta_2 X_{it} \tag{2}$$

where h_{it} denotes the hazard rate, α_t denotes the logarithm of the baseline hazard function, Commit_i is a binary variable that takes value 1 if she has commitments just before becoming unemployed, and 0 otherwise. X_{it} is a vector of covariates that includes education, age, year, state, marital status, race, unemployment insurance reception and liquid assets before unemployment. β_1 is the coefficient of interest

[11] Harmenberg and Öberg (2021) focus on adjustment on durables vs non-durables and show that, during unemployment, households mainly adjust non-durables.

[12] Appendix C shows the Kaplan-Meier survival functions for individuals with commitments and without them, without controlling for observed characteristics.

Table 3: Cox Regression Model

	Regression coefficient	exp(coefficient)
Commit	0.233** (0.073)	1.26
Education COL	0.191** (0.067)	1.21

Note: The first row shows the coefficients for β_1 (column 1) and $\exp(\beta_1)$ (column 2).

and denotes the hazard ratio or relative hazard of leaving unemployment of individuals with commitments with respect to individuals without them. $\beta_1 > 0$ means that individuals with commitments have a higher hazard rate of exiting unemployment, thus they leave unemployment faster. $\beta_1 < 0$ means that individuals without commitments leave unemployment faster.

Table 3 presents the results of regression 2. The first line presents the coefficient β_1 and its exponential. As an example of the results for control variables, we also show the coefficient for education in row 2. According to the exponential of β_1 (1.26), the hazard rate of exiting unemployment for individuals with commitments exceeds by 26% that of those without commitments.[13]

In summary, individuals with mortgage payments or renters are more likely to leave unemployment than homeowners without mortgages.

3 Model

We study a search model with heterogenous agents and incomplete markets with two consumption goods: an adjustable good (c_t) and a "commitment" good (s_t) that is costly to adjust. The economy is populated by a unit mass of infinitely-lived individuals, who face a constant probability of death, π, every period. Individuals can save in a risk-free asset, a_t, with (exogenously given) return, r, and they are not allowed to borrow, $a_t \geq 0$.

Individuals are heterogeneous in their fixed type, θ, which captures permanent pre-labor market differences in education or skills. Each period they also face an

[13] We can also see that individuals with college education leave unemployment faster than those without it.

idiosyncratic productivity shock, denoted by ξ. Each period, there is a chance that the individual is hit by an exogenous unemployment shock and becomes unemployed. Once unemployed, individuals need to exert search effort to find a new job. There is a government that taxes households and provides unemployment insurance (UI henceforth) to unemployed individuals who are eligible.

Preferences Individuals choose consumption of each good, savings, and search effort to maximize their lifetime utility. They discount future consumption by $\beta_\theta = \widehat{\beta}_\theta \pi$, where $\widehat{\beta}_\theta$ denotes the standard discount factor which may depend on the fixed type of the individual.

The per-period utility function from consumption at time t is given by

$$u(c_t, s_t, s_{t-1}) = \frac{\mathbb{C}_t^{1-\sigma}}{1-\sigma} - \kappa_f \mathbb{I}\left\{s_t \neq s_{t-1}\right\}, \tag{3}$$

where $\mathbb{C}_t$ denotes a consumption aggregator and σ the coefficient of risk aversion. Whenever consumers change consumption of their commitment goods, i.e. whenever $s_t \neq s_{t-1}$, the household incurs a fixed cost of adjustment, denoted by κ_f. The function $\mathbb{I}\left\{x\right\}$ is an indicator that is equal to one whenever the statement x is true. The consumption aggregator, $\mathbb{C}_t$, is defined as

$$\mathbb{C}_t = \left[\alpha c_t^\eta + (1-\alpha) s_t^\eta\right]^{\frac{1}{\eta}}, \tag{4}$$

where η determines the elasticity of substitution between adjustable goods and commitments. In particular, the elasticity of substitution between adjustable goods and commitments is given by $\epsilon = 1/(1-\eta)$. If $\eta = 0$, the CES function collapses to Cobb-Douglas with unit elasticity. If $\eta < 0$ the goods are complements while if $\eta > 0$ they are substitutes. α is the weight of adjustable goods in the utility function.

Unemployed individuals exert effort, $\nu \in [0, 1]$, to find a job. The level of effort affects the probability of finding a job. However, effort has a utility cost. In particular, we assume a quadratic utility cost,

$$\psi(\nu) = \psi \nu^2, \tag{5}$$

where ψ controls the level of disutility.

Finally, when a household dies, a new household is born with zero assets and an initial level of commitments, s_0.

3.1 Labor Market

Employed individuals Labor income (w) for an employed individual is given by

$$\log w = \theta + \xi, \tag{6}$$

where θ is the fixed component of productivity, and ξ is a persistent productivity shock. The permanent component takes two values $\theta \in \{\theta_l, \theta_h\}$. The fraction of each type is f_l and f_h, respectively. The persistent component follows a standard AR(1) process while the individual is employed, and it is given by

$$\log \xi' = \rho_\xi \log \xi + \epsilon_\xi, \quad \epsilon_\xi \sim \mathcal{N}(0, \sigma_\xi^2), \tag{7}$$

where ρ_ξ is the autocorrelation coefficient of the persistent producitivity process and ϵ_ξ an i.i.d. shock normally distributed with zero mean and variance σ_ξ^2. For any variable x, x' indicates its next period value.

Each period, an employed individual is separated from her job with probability δ_θ, which depends on her skill type.

Unemployed individuals Unemployed individuals exert search effort, ν, which affects the job finding probability,

$$\mathcal{P}(\nu, n_u) = \nu\Phi(n_u), \tag{8}$$

where the function Φ controls for the duration dependence of the probability of finding a job per unit of search effort and, following Kekre (2021), it is given by

$$\Phi(n_u) = \begin{cases} 1 - \lambda_0 + \lambda_0 \exp(n_u\lambda_1) & \text{if } n_u < 8, \\ 1 - \lambda_0 + \lambda_0 \exp(7\lambda_1) & \text{if } n_u \geq 8, \end{cases} \tag{9}$$

where n_u corresponds to the number of periods the individual has been unemployed, λ_0 controls the level of the function, while λ_1 determines the rate of the decline in the probability of finding a job with unemployment duration. This function captures duration dependence of unemployment consistent with empirical evidence that hazard rates of finding a job are higher for newly unemployed than for long-term ones, see Kroft, Lange, Notowodigdo, and Katz (2016). We assume a flat profile of the function after 8 months unemployed.[14] During unemployment, the idiosyncratic productivity shock of an individual, ξ, remains constant.

3.2 Government

Unemployment Insurance The government runs an unemployment insurance program that provides benefits to unemployed individuals. Following the UI rules for eligibility in the US, unemployed individuals qualify to receive benefits if they have worked during the last $\overline{N_E}$ periods prior to unemployment. Furthermore, they are entitled for benefits for a maximum of $\overline{N_{UI}}$ periods. Benefits depend on labor income before unemployment and are given by

$$B(w_{-1}) = \min\left\{\Theta_0 w_{-1}, \Theta_1\right\}, \tag{10}$$

where w_{-1} denotes earnings in the period before becoming unemployed, and Θ_0 is the replacement rate, the ratio of benefits to earnings before unemployment. UI benefits are subject to a cap, Θ_1, which makes the replacement rate progressive, i.e., it is lower for individuals who surpass the cap.

Taxes The government collects income taxes through a progressive tax schedule, and uses these revenues to fund the unemployment insurance system and exogenous government expenditure, G. We consider a parametric function for the average tax rate that depends on income widely used in the public finance literature (Benabou 2002, Heathcote, Storesletten, and Violante 2017). In particular, the average tax rate of a household with income y is

$$t(y) = 1 - \gamma y^{-\tau} \in [0,1], \tag{11}$$

where γ controls for the level of taxes, and τ drives the degree of progressivity of the tax system. Household's tax liability is then given by $T(y) = y \cdot t(y)$.

[14] This is done both for computational purposes, and for the fact that the profile of empirical hazard rates after 8 months looks much flatter than for shorter durations, see Kroft et al. (2016).

3.3 Individual Decisions

Employed individuals The state of an employed individual consists of her productivity (θ and ξ), the number of periods she has been employed (n_E), the amount of commitments consumed in the previous period (s_{-1}) and assets (a). The employment history, n_E, is necessary to determine eligibility for UI benefits in case of suffering an unemployment shock. The problem of an employed agent is given by

$$
\begin{aligned}
V_E(\theta, \xi, n_E, a, s_{-1}) = \max_{c,s,a'} & \left[u(c, s, s_{-1}) + \beta_\theta \left\{ (1-\delta_\theta) \mathbb{E}_{\xi'} \left\{ V_E(\theta, \xi', n_E + 1, a', s) \right\} + \right. \right. \\
& \left. \left. \delta_\theta V_U(\theta, \xi, 1, \mathcal{E}', a', s) \right\} \right],
\end{aligned}
$$

subject to

$$
\begin{aligned}
c + s + a' &= y + a - T(y), \\
y &= w(\theta, \xi) + ra, \\
\mathcal{E}' &= \mathbb{I}(n_E \geq \overline{N_E}),
\end{aligned}
$$

and

$$
c > 0, \quad s > 0, \quad a' \geq 0.
$$

The indicator $\mathcal{E} \in \{0, 1\}$ denotes the eligibility status for unemployment insurance benefits.

Employed individuals decide how much to consume of adjustable goods, commitments, and save. As noted before, adjusting commitments is costly, therefore not all agents will decide to adjust them each period. They receive labor income and asset income and pay taxes according to the progressive tax schedule, $T(y)$. Employed individuals become separated from their jobs with probability δ_θ, the second line in the value function. If the individual remains employed, then she will experience a productivity shock to the persistent component next period, ξ', and n_E will go up by one period. On the other hand, if the individual becomes unemployed, she will start next period with $n_u = 1$, which indicates the number of periods an individual has been unemployed. She will be eligible for unemployment insurance benefits if she has worked for $n_E \geq \overline{N_E}$ periods, indicated by $\mathcal{E}'$.

Unemployed individuals The state space of unemployed individuals comprises her skills, persistent component of productivity before unemployment (denoted by ξ_{-1}), number of periods unemployed (n_u), eligibility for UI benefits ($\mathcal{E}$), assets and commitments from previous period. An unemployed individual is eligible for UI benefits if she has worked more than $\overline{N_E}$ (consecutive) months before becoming unemployed and if she has not stayed unemployed for more than $\overline{N_{UI}}$. The problem for unemployed is given by

$$
\begin{aligned}
V_U(\theta, \xi_{-1}, n_u, \mathcal{E}, a, s_{-1}) = \max_{c,s,a',\nu} & \left[u(c, s, s_{-1}) - \psi(\nu) + \right. \\
& \beta_\theta \left\{ \mathcal{P}(\nu, n_u) V_E(\theta, \xi_{-1}, 1, a', s) + \right. \\
& \left. \left. (1 - \mathcal{P}(\nu, n_u)) V_U(\theta, \xi_{-1}, n_u + 1, \mathcal{E}', a', s) \right\} \right],
\end{aligned}
$$

subject to

$$
\begin{aligned}
& c + s + a' = y + a - T(y), \\
& y = \mathcal{E} B(\exp(\theta + \xi_{-1})) + ra, \\
& \mathcal{E}' = \begin{cases} \mathcal{E}, & \text{if } \; n_U < \overline{N_{UI}}, \\ 0, & \text{otherwise.} \end{cases}
\end{aligned}
$$

and

$$
c \geq 0, \quad s \geq 0, \quad a' \geq 0,
$$

Like employed individuals, unemployed individuals decide how much to consume of both goods and how much to save. They also decide how much effort to exert in order to find a job. With probability $\mathcal{P}$, which depends on effort (ν) and the number of periods unemployed (n_u), the individual finds a job. Then, she starts employment with persistent productivity $\xi' = \xi_{-1}$ and $n_E = 1$. If the individual does not find a job, then she will continue to be unemployed, and will be eligible for unemployment insurance in the next period ($\mathcal{E}' = 1$) if she is eligible this period ($\mathcal{E} = 1$), and has been receiving unemployment benefits for less than $\overline{N_{UI}}$ periods. Otherwise she is not eligible for benefits and her income will only come from her assets.

3.4 Government's Budget

Let $x^E = (n_E, a, s_{-1})$ be the state vector for employed individuals over assets, last period's commitments, and number of months employed. Define $x^U = (n_u, a, s_{-1})$ accordingly. We denote the probability distribution of employed individuals as $\Psi^E(\theta, \xi, x^E)$, and the one for unemployed individuals as $\Psi^U(\theta, \xi, \mathcal{E}, x^U)$. Then, the marginal distribution over productivity types for employed individuals corresponds to $\widehat{\Psi}^E(\theta, \xi) = \int \Psi^E(\theta, \xi, x^E) dx^E$ and for unemployed individuals is $\widehat{\Psi}^U(\theta, \xi, \mathcal{E}) = \int \Psi^U(\theta, \xi, \mathcal{E}, x^U) dx^U$. Finally, define by $\widehat{T}(\theta, \xi, x^E)$ and $\widehat{T}(\theta, \xi, \mathcal{E}, x^U)$ taxes paid by employed and unemployed individuals and $\widehat{B}(\theta, \xi, \mathcal{E})$ unemployment benefits. Then the budget constraint for the government is given by

$$\begin{aligned}
&\int \mathcal{E}\widehat{B}(\theta, \xi, x^U)\ \widehat{\Psi}^U(\theta, \xi, \mathcal{E})\ d\theta\ d\xi\ d\mathcal{E} + G = \\
&\int \widehat{T}(\theta, \xi, x^E)\ \widehat{\Psi}^E(\theta, \xi)\ d\theta\ d\xi + \int \widehat{T}(\theta, \xi, \mathcal{E}, x^U)\ \widehat{\Psi}^U(\theta, \xi, \mathcal{E})\ d\theta\ d\xi\ d\mathcal{E}
\end{aligned} \tag{12}$$

The first line of equation 12 denotes government expenditure. Government expenditures comprise unemployment benefits for those unemployed who are eligible for benefits (that is, $\mathcal{E} = 1$) and other government spending, G. The second line includes government revenues from taxation of employed and unemployed households.

4 Calibration

We calibrate the model economy in two stages. In the first stage, some parameters are directly estimated from the data, taken from the literature, or chosen to reflect the existing US policies. Then, we calibrate internally the remaining parameters so that the model replicates some key features of the US economy regarding unemployment durations and commitments expenditures. Model period is set to 1 month.

4.1 Parameters set a priori

Unemployment Insurance We set $\overline{N_E} = 12$, so individuals can qualify for UI benefits if they have worked one year before unemployment, and $\overline{N_{UI}} = 6$ so they qualify up to a maximum of 6 months.[15] I also set the replacement rate and the cap to $\Theta_0 = 0.50$ and $\Theta_1 = 0.67$ following Graves (2021).

Labor Market We assume that the two values for the fixed effect, low and high, correspond to non-college and college education in the data. The fraction of each group is computed from CPS (2014-2018) for people aged 25-54 as $f_h = 0.367$ and $f_l = 0.633$. The values for the permanent component of productivity are calibrated using the model, see Section 4.2 for more details.

For the parameters of the persistent shock process, ρ_ξ and σ_ξ^2, I convert to monthly frequency the annualized values for persistence and variance of the persistent shock from Krueger, Mitman, and Perri (2016). Thus, $\rho_\xi = 0.997$ and $\sigma_\xi^2 = 0.03$.

Finally, the probability that employed individuals get separated from their job is set to $\delta_{\theta_l} = 0.018$ and $\delta_{\theta_h} = 0.012$ which corresponds to the employment-unemployment transitions in CPS for the 2014-2018 period.

Taxes We take the values for γ and τ, which govern the level of taxes and the progressivity of taxation, from Guner, López-Daneri, and Ventura (2016) so that $\gamma = 0.911$ and $\tau = 0.053$. This estimates imply an average tax rate of 8.9% and a marginal tax rate of 13.7% for household with income equal to the mean, which was around \$97,000 in the US in 2016 (FRED). For higher incomes, both average and marginal tax rates increase due to the progressivity of the system.

Other parameters The probability of death is set to $\pi = 1/360$ such that agents remain alive, on average, for 30 years. We set the curvature in the utility function to $\sigma = 1.5$, a standard value in the literature (see, e.g., Blundell, Dias, Meghir, and Shaw (2016)). We set the interest rate to $r = 0.0024$ so that the annual interest

[15] Although rules for unemployment insurance varies by states, most of them set these eligibility requirements and maximum period of benefits as of January 1, 2020 (see U.S. Department of Labor 2020, pages 3-2 and 3-27).

Table 4: Parameters set a priori

Parameter		Description	Source
π	1/360	Probability of death	Average of 30 years
σ	1.5	Coefficient risk aversion	Standard
$\overline{N_E}$	12	Employment requirement for benefits	Department of Labor
$\overline{N_{UI}}$	6	Employment requirement for benefits	Department of Labor
Θ_0	0.50	Replacement rate	Graves (2021)
Θ_1	0.67	Cap on UI	Graves (2021)
f_l	0.633	Fraction non-college	CPS (2014-2018)
f_h	0.367	Fraction college	CPS (2014-2018)
ρ_ξ	0.997	Persistence shock	Krueger et al (2016)
σ_ξ	0.03	Variance persistent shock	Krueger et al (2016)
δ_{θ_l}	0.018	Probability job loss, non-college	CPS (2014-2018)
δ_{θ_h}	0.012	Probability job loss, college	CPS (2014-2018)
r	0.0024	Interest rate	Annual rate 3%
γ	0.911	Tax function level	Guner et al. (2016)
τ	0.053	Tax function curvature	Guner et al. (2016)

rate is 3%.[16] We set $s_0 = 0.02$ so individuals are born with commitments equal to 2% of average earnings.[17] Parameters set a priori are presented in table 4.

4.2 Calibrated parameters

We are left with 10 parameters to calibrate internally: values for the fixed effects (θ_h and θ_l), parameters for patience ($\hat{\beta}_{\theta_h}$ and $\hat{\beta}_{\theta_l}$), the share of commitments in the utility function (α), the utility cost of adjusting commitments (κ_f), parameters that determine the probability of finding a job (λ_0 and λ_1), the level of disutility from exerting effort (ψ), and the parameter that determines the elasticity of substitution between adjustable goods and commitments (η). We calibrate them using the Simulated Method of Moments. In particular, let $\mathcal{C}$ be the vector of parameters, $\mathcal{M}(\mathcal{C})$ the vector of moments that the model generates with those parameters, and $\overline{\mathcal{M}}$ the

[16] The real lending interest rate between 2000 and 2015 was 2.91%, the World Development Indicators, the World Bank, https://data.worldbank.org/indicator/FR.INR.RINR?locations=US.

[17] Setting s_0 to a small number is necessary for computational reasons.

vector of targets from the data. Then, the parameter vector, $\mathcal{C}^*$, is determined by

$$\mathcal{C}^* = \arg\min_{\mathcal{C}} (\mathcal{M}(\mathcal{C}) - \overline{\mathcal{M}})'(\mathcal{M}(\mathcal{C}) - \overline{\mathcal{M}}). \tag{13}$$

Moments

We consider four sets of moments. The first set of moments includes the ratio of average earnings of college educated to non-college educated, which is equal to 2.18 (CPS, 2014-2018), and normalization of average earnings in the economy to 1. The second set includes targets on consumption commitments. As we reported in section 2, commitments constitute 40.6% of total household expenditures. Furthermore, 11% of households adjust commitments in each quarter. Since we collapse all the commitments in just one good in the model, we take the average of adjustment of commitments weighted by their expenditure share in commitments.[18]

The third set of moments is related to unemployment duration: average duration of unemployed, the fraction of unemployed with a duration between 4 and 6 months, and the fraction of unemployed staying longer than 6 months (CPS, 2014-2018). We also target the elasticity of unemployment duration, D, with respect to unemployment insurance benefit duration, i.e. $\frac{dD}{dN_{UI}}\frac{\overline{N_{UI}}}{D}$. In their review of the literature, Schmieder and von Wachter (2016) report a median elasticity of 0.37. The last set of moments is related to the wealth distribution. We target the ratio of median assets to mean earnings from the Survey of Consumer Finances, which equals to 1. Finally, we target the share of wealth held by top 40% (SCF, 2013).

Identification

The parameters for the fixed effect of labor productivity, θ_h and θ_l, are key to match the ratio of average earnings of college educated to non-college educated and the normalization of average earnings to 1.

The parameters regarding commitments, α and κ_f, are important to match the fraction of commitment expenditures in total expenditure and the fraction of households adjusting commitments on a quarterly basis. A higher κ_f makes it harder for individuals to change commitments and, thus, implies a lower fraction of indi-

[18] Given that the target is on a quarterly, adjustment in the model is computed comparing commitments at period t and period $t-3$, so both are comparable.

viduals who decide to adjust. The level of the disutility from effort, ψ, helps to match the average unemployment duration. However, the average unemployment duration does not ensure that the distribution of durations that the model generates will be consistent with the data. For that purpose, parameters for the job finding probability function, λ_0 and λ_1, are used. Specifically, we target the fractions of medium-term unemployed (between 4 and 6 months), and long-term (more than six months unemployed) respectively.

The elasticity between adjustable goods and commitments, η, determines how easily a household can substitute for different types of goods. Suppose the utility function was close to linear, with a high elasticity. In that case, a household could achieve a given utility level by freely substituting goods subject to adjustments with others. In such a world, commitments would not make income and employment shocks more challenging to cope with. On the other extreme, if the utility function was Leontief, any adjustment in adjustable goods had to be matched with adjustment of commitment goods, making consumption smoothing much more difficult. As a result, the elasticity of substitution between two types of consumption goods impacts how much households are willing to put effort to move out of unemployment and, therefore, determines the elasticity of unemployment duration with respect to unemployment benefits.

Finally, to determine the parameters for patience, we turn to the wealth distribution. Since more than 60% of individuals in the model are non-college, β_{θ_l} helps to match median assets. On the other hand, β_{θ_h} allows us to match the share of top 40% of the wealth distribution.

The parameters are presented in Table 5. A cost of $\kappa_f = 0.12$ implies that individuals that want to adjust consumption of commitments must pay a utility cost equivalent to 6% of utility derived from average consumption in the economy. Values for λ_0 and λ_1 imply a decreasing profile of job finding probabilities. In particular, the probability of finding a job, for a unit of effort, in the first month of unemployment is around 80%, decreasing this probability quickly towards 27% after 6 months. $\eta = -1.0$ implies an elasticity of substitution between commitments and adjustables of $\epsilon = 0.5$, that is, in the monthly model, both goods are poor substitutes. Finally, patience parameters imply that college individuals are more patient in the model

Table 5: Parameters and targets

Parameter		Value	Moment
Labor Productivity			
θ_l	Permanent shock non-college	-0.36	Normalized average earnings to 1
θ_h	Permanent shock college	0.42	Ratio average earnings COL/NCOL
Preferences			
α	Share of adjustables in utility	0.70	Commit. expenditure/Total expenditure
κ_f	Cost of adjusting commit.	0.12	Fraction adjusting commitments
ψ	Level disut. effort	27.5	Mean duration unemployment
$\widehat{\beta}_{\theta_l}$	Patience non-college	0.9870	Median assets
$\widehat{\beta}_{\theta_h}$	Patience college	0.9945	Share wealth top 40%
η	Elasticity adjust-commit	-1.0	Elasticity U duration-UI benefit duration
Job finding function			
λ_0	Level job finding function	0.95	Fraction duration unemp. 4-6 months
λ_1	Slope job finding function	-0.25	Fraction duration unemp. >6 months

Note: Calibrated parameters and the corresponding moments they target.

than non-college ones, so college educated are able to accumulate more assets, which is a standard result.

4.3 Benchmark Economy

Table 6 collects the moments included in the calibration and their data counterparts. The model captures well the ratio of average earnings of college educated with respect to non-college educated. The model also reproduces well moments related to consumption commitments. The share of commitments in total expenditure generated by the model is 40.9%, very close to its data counterpart. A total of 11.4% of individuals in the model adjust commitments from quarter to quarter, in line with the fraction computed from the data.

The model also does a good job in matching the average duration in unemployment. Individuals, in the model, stay in unemployment for an average of around 6 months and a half, very close to that in the data. The model also generates a distribution of durations close to the one of the data. Around 46% of unemployed individuals in the model have durations of 4 months or higher and around a third

Table 6: Model fit, Targeted Moments

Moment	**Model**	**Data**
Ratio average earnings COL/NCOL	2.16	2.18
Normalized earnings	1.0	1.0
Commitments' expenditure/Total expenditure	40.9%	40.6%
Fraction adjusting commitments (quarterly)	11.4%	11.8%
Mean duration unemployment (months)	6.69	6.57
Fraction unemployed with duration 4-6 months	13.2%	11.9%
Fraction unemployed with duration >6 months	33.3%	35.0%
Elasticity U duration-UI benefit duration	0.36	0.37
Median assets/Mean earnings	0.7	1.0
Share wealth top 40%	80.1%	93.3%

Note: Targeted moments generated by the model and their data counterpart.

stay unemployed for a period longer than 6 months, which is the maximum benefit period to receive unemployment insurance benefits.

A key moment in our model is the elasticity of unemployment duration to unemployment insurance benefit durations. This elasticity measures the response of individuals to a change in the maximum number of months in which she can receive unemployment benefits. Thus, having a reasonable response of durations to unemployment insurance policy parameters is key for the reliability of counterfactual experiments. The model generates an elasticity of unemployment duration with respect to unemployment insurance benefit duration of 0.36, which is very close to the median elasticity found in the literature.

Another important dimension of the model is the wealth distribution. The model generates a fraction of median assets to average earnings equal to 0.7 compared to a ratio of 1 in the data. The share of wealth held by the top 40% of the distribution generated by the model is 80.1% compared to 93% in the data.

4.3.1 Non-targeted moments

In this section, we briefly discuss how the model perform with respect to some non-targeted moments, reported in Table 7. The unemployment rate in the benchmark economy is 4.9%, while its data counterpart, for individuals with age 25-55, is 5.0%

Table 7: Non-targeted moments

	Model	Data
Unemployment rate	4.9%	5.0%
Unemployment rate, non-college	5.7%	6.0%
Unemployment rate, college	3.2%	2.7%
Duration, non-college	6.8	6.9
Duration, college	6.5	6.1

(CPS, 2014-2018). The model also generates reasonable unemployment rates for each education group, 3.2% for college (compared to 2.7% in the data), and 5.7% for non-college (compared to 6.0% in the data).

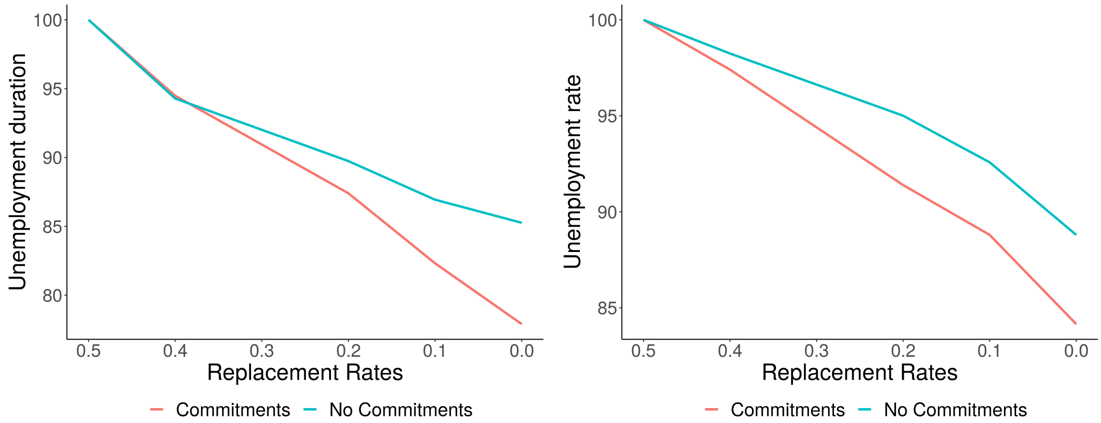
Similarly, average unemployment durations by education group are also close to the durations in the data. In particular, average duration of non-college educated is 6.8 months (6.9 months in CPS 2014-2018). For college educated individuals, the average duration generated by the model, 6.5 months, is slightly larger than the one in the data, which is 6.1 months. Therefore, the model generates realistic unemployment rates and durations by education types, even though they are not target, which allows us to study the value of unemployment insurance in an economy with commitments for different education groups.

4.3.2 Precautionary Savings

Since commitments amplify welfare costs from negative income and employment shocks, it is expected that agents in an economy with commitments would like to increase asset holdings in order to moderate these costs. For that purpose, we can compare the benchmark economy with an economy with two goods but in which there is no adjustment cost in any of the goods.

We find that, while median assets in the benchmark economy with commitments are 0.71, this figure is reduced to 0.57. The precautionary savings are substantially higher in an economy with commitments.

Figure 1: Unemployment and Unemployment Insurance



5 Value of Unemployment Insurance

5.1 Unemployment Insurance and Unemployment Duration

In this section we try to understand how the presence of commitments affects unemployment durations and the unemployment rate in the economy. For that purpose, we compare the response of individuals to different unemployment insurance replacement rates for an economy with and without commitments. The economy without commitments is recalibrated so that unemployment durations and median wealth are the same as the value of those moments in the benchmark economy with commitments.[19]

The left panel of Figure 1 shows how average unemployment duration changes for different replacement rates. Values are normalized such that the benchmark economy corresponds to a value of 100 in both economies and then subsequent values for lower replacement rates are presented as a fraction of the benchmark values. We can see that as replacement rates decrease, the reaction of individuals in an economy with commitments becomes much larger than in an economy with out them. In particular, in the case of no unemployment insurance, average unemployment durations in the economy with commitments decrease by a 23% with respect to the benchmark, while only by 14% in the case of an economy without commitments.

Since average unemployment durations can be driven by extreme durations, the

[19] In particular, we recalibrate r and ψ to obtain the same moments. See Appendix D for details of the calibration of the economy without commitments.

right panel of Figure 1 plots how the unemployment rate varies with replacement rates. We can see that unemployment rates in the economies with and without commitments behave closely for values of replacement rates around 40%. The divergence of unemployment rates becomes becomes much bigger as the replacement rate is reduced consistently with the results obtained from unemployment duration.

In summary, in an economy with commitments, individuals leave unemployment faster than in an economy without commitments. But why does this happen? Figure 2 shows the average effort of unemployed in both economies as a function of replacement rates. Effort is the choice through which the individual controls the speed of finding a job. Furthermore, effort depends on the difference between the expected value of employment and the expected value of unemployment.

In Figure 2, we can see that effort increases faster in the economy with commitments when the replacement rate is reduced. This happens because the gap between the value of employment and unemployment widens much faster in an economy with commitments. In an economy with commitments, individuals do not adjust commitments immediately after experiencing an unemployment shock. Furthermore, they do not adjust their consumption in every period during the unemployment spell. The rigidity not allowing to adjust easily more than 40% of total expenditures makes individuals to concentrate most of the adjustment on adjustable goods. This is more costly in utility terms than adjusting both margins by the same magnitude, as shown by Chetty and Szeidl (2007). Therefore, when replacement rates are high, unemployment insurance allows the individual to moderate the reductions of adjustable goods and, thus, unemployment behavior is close in both economies. However, for low replacement rates, the ability to moderate reductions in consumption is lower and, thus, unemployment events become much more costly in welfare terms in the economy with commitments.

In summary, the cost of unemployment in an economy with commitments is higher than in an economy without commitments, especially for low replacement rates, and, thus, unemployed individuals try to get out of unemployment faster in the former economy.

Figure 2: Unemployment duration and Replacement Rates

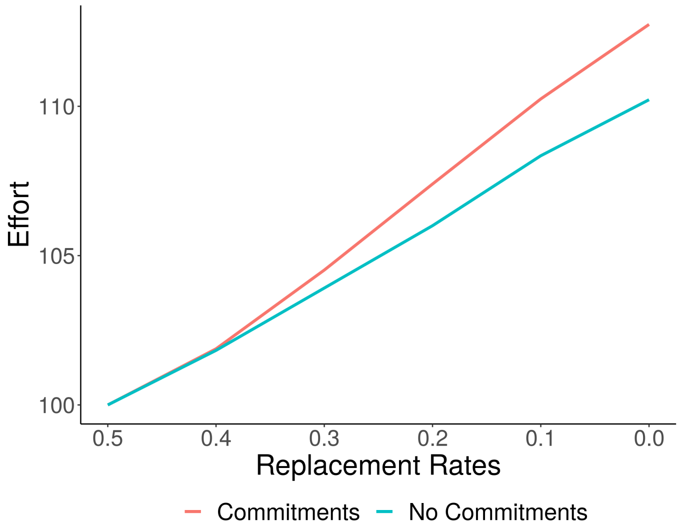


Table 8: Welfare losses from eliminating unemployment insurance

	Commitments	No Commitments
All		
Median CE	4.5%	3.4%
College		
Median CE	4.1%	2.8%
Non-College		
Median CE	5.0%	3.9%

5.2 Welfare Value of Unemployment Insurance

After having studied the job finding response of individuals to unemployment insurance in both economies, we want to quantify how much individuals value unemployment insurance in an economy with commitments with respect an economy without them. For that purpose, we compare the benchmark economy with an economy without unemployment insurance for both cases. For this experiment, we adjust the level of taxes γ so that the government budget remains balanced.

To assess the welfare value of unemployment insurance, we compute welfare gains from UI in terms of consumption terms (extra consumption in each period that should be given to each individual in a counterfactual economy to equalize welfare to the benchmark one).

Table 8 shows the median welfare loss from the elimination of unemployment insurance for an economy with commitments and an economy without commitments. We find that for the median individual in an economy with commitments, the elimination of unemployment insurance implies a welfare loss of 4.5% of consumption compensation. This figure is significantly lower under an economy without commitments, which amounts to 3.4%. Thus, in line with results in the previous section, unemployment insurance is much more valuable in an economy with commitments.

Both groups, college and non-college, value unemployment insurance. Welfare losses from unemployment insurance are very important in an economy with commitments for non-college individuals (5%). There are large welfare losses for college individuals from eliminating unemployment insurance in an economy with commitments (4.1% of consumption) compared to an economy without commitments (only 2.8%). This is due to the big fraction of payments in commitments which makes the self-insurance channel more limited in an economy with commitments than in one without them.

Table 9 shows how different economic variables change when we remove unemployment insurance for both economies (with and without commitments). We can see that unemployment rate decreases more in the economy with commitments, 0.59 percentage points (p.p.), compared to 0.48 p.p. in the economy without commitments.

Removing UI in the economy with commitments generates significant economic costs for households. First, precautionary savings increase importantly (almost double in the economy with commitments) to keep consumption volatility over the life cycle, measured by the coefficient of variation, relatively stable compared to the volatility in the benchmark economy.[20] Although this increase in volatility is moderate, it is higher in the economy with commitments, 2.3% versus 1.0% in the economy without them. Second, effort also increases more in the economy with commitments, by 14%, compared to only 10.7% in the economy without them. Finally, unemployment insurance is important for individuals to keep consumption commitments constant during unemployment. In particular, the fraction of individuals adjusting commitments when they are unemployed increases from 52.8% to 57.8% when unemployment insurance is removed.

[20] The coefficient of variation is defined as the ratio of standard deviation of consumption to average consumption.

Table 9: Unemployment insurance and other economic outcomes

	Commitments		No Commitments	
	UI	No UI	UI	No UI
Unemployment rate	4.88%	4.29%	4.89%	4.41%
CV consumption	100	102.3	100	101.0
Average savings	100	187.4	100	154.3
Effort	100	114.0	100	110.7
% Adjusting, unemployed	52.8%	57.8%	—	—

Note: CV denotes the coefficient of variation, normalized to benchmark value (UI). For CV, average savings and effort, benchmark values are normalized to 100 and values with No UI are expressed as a fraction of benchmark ones.

In summary, the presence of commitments imply significant welfare costs of unemployment spells, in terms of higher precautionary savings, higher exerted effort and the cost of adjusting of commitments.

5.2.1 Optimal Unemployment Insurance

We can extend the welfare analysis to understand what is the value of the replacement rate that maximizes welfare for the median individual in the economy, keeping the cap constant. For that purpose, we repeat the exercise in 5.2 for different replacement rates, adjusting the level of taxes γ so the experiment is revenue neutral, to find the replacement rate that maximizes welfare of the median individual in the economy.

We find that welfare for the median individual, in an economy with commitments, is maximized for a replacement rate of 65% (compared to 50% in the benchmark). With this replacement rate, individual's would have a welfare gain of 0.36%, in consumption terms, with respect to the benchmark. In an economy without commitments, the optimal replacement rate is 55% and the median individual would have a welfare gain of only 0.09%.

In summary, in line with previous results, the optimal unemployment insurance in an economy with commitments is higher than that in an economy without commitments.

6 Conclusions

More than 40% of household expenditures are devoted to the consumption of goods and services whose expenditure is difficult to adjust. These commitments are also much less adjusted than other goods during unemployment events. The presence of commitments magnifies the welfare costs of unemployment since only part of consumers' consumption can be adjusted. As a result, unemployment insurance, which allows individuals to smooth consumption during unemployment spells, becomes a more valuable policy tool.

In this paper, we study the implications of unemployment insurance for employment and welfare under the presence of commitments. To this end, we build a model of heterogeneous agents who face unemployment and income shocks. Individuals consume two types of goods: an adjustable good and a commitment whose consumption is costly to adjust. The government taxes income to finance unemployment benefit payments and exogenous government expenditure. We calibrate this economy to the US 2015-2019 in order to quantify the effects of the unemployment insurance program.

The model economy is used as a quantitative laboratory to study the role of unemployment insurance in an economy with commitments. We first investigate what happens when we make unemployment insurance less generous by reducing its replacement rate. We do this both in the benchmark economy and in an economy where individuals can adjust both goods freely. In an economy with commitments, as the unemployment insurance becomes less generous, unemployed individuals exert more effort to find a new job. As a result, both unemployment durations and the level of unemployment decline sharply. Precautionary savings also increase significantly. These effects are also present in an economy without commitments, but they are much more muted. The average unemployment duration decreases by 23% in the benchmark economy with commitments when unemployment insurance is completely eliminated. The decline is just 14% in the economy without them.

We also find that unemployment insurance is much more valuable in an economy with commitments, especially for low-income, non-college-educated individuals. Eliminating unemployment insurance implies a welfare loss of 4.5% (measures in consumption variation). The loss is only 3.4% in an economy without commitments. In an economy without unemployment insurance, the extra search effort and precautionary savings help individual reduce the duration of unemployment spells and avoid sharp fluctuations in consumption. But these adjustments are costly and much more so in an economy with commitments. Finally, we calculate the optimal, welfare-maximizing replacement rate. In the benchmark economy, the optimal replacement rate is 65%, 15 percentage points higher than the current US value.

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A Adjustments for 5% and 1% thresholds

In this Appendix, we present the fraction of households that adjust their spending on different goods each quarter. We assume that households adjust their consumption in good i if their expenditures have changed for that item for more than 5% from quarter $t-1$ to quarter t (Table A.1). A similar calculation, but with a threshold of 1% instead of 5%, is done to produce Table A.2. In Table 1 in Section 2, the threshold was 10%. The fraction of households adjusting commitments computed as the weighted average of fraction adjusting by the expenditure share of each item is 14.9%, for 5% threshold, and 18.8% for 1% threshold.

Table A.1: Fraction of Households Adjusting between two Quarters, Threshold 5%

	% Adjust	Expenditure Share
Food	88.8%	19.9%
Utilities	82.3%	5.1%
Transport	90.7%	21.3%
Entertainment	91.6%	6.1%
Shelter	2.5%	27.0%
Phone	53.5%	3.1%
Life insurance	36.7%	0.9%
Vehicle insurance	40.1%	3.4%
Health insurance	32.9%	6.2%

Note: Shelter is the same as in Table 1 in Section 2, since it is computed as the fraction of movers in SIPP.

Table A.2: Fraction of Households Adjusting between two Quarters, Threshold 1%

	% Adjust	Expenditure Share
Food	96.2%	19.9%
Utilities	94.1%	5.1%
Transport	97.6%	21.3%
Entertainment	95.3%	6.1%
Shelter	2.5%	27.0%
Phone	60.5%	3.1%
Life insurance	45.3%	0.9%
Vehicle insurance	55.2%	3.4%
Health insurance	45.5%	6.2%

Note: Shelter is not modified as it is computed as the fraction of movers in SIPP

B Adjustments by different demographic groups

In this Appendix, we reproduce Table 1 for different demographic groups: educational attainment of the household heads, college vs. non-college (Table B.3), their marital status, married vs. single (Table B.4), and whether there are children present at home or not (Table B.5). We can see that, while less than college, singles and households without children spend more on commitments and adjust more frequently, although differences are rather small,

Table B.3: Adjustment patterns by education

	Less than College		College	
	% Adjust	Expenditure Share	% Adjust	Expenditure Share
Food	69.0%	20.6%	71.4%	18.7%
Utilities	65.3%	5.7%	65.0%	4.3%
Transport	81.2%	22.2%	84.5%	20.2%
Entertainment	79.4%	5.3%	82.1%	6.8%
Shelter	3.1%	25.7%	2.1%	29.5%
Phone	41.2%	3.4%	33.8%	2.6%
Life insurance	35.3%	0.6%	25.3%	1.0%
Vehicle insurance	37.2%	3.8%	29.9%	2.4%
Health insurance	32.1%	5.9%	27.7%	6.3%

Table B.4: Adjustment patterns by marital status

	Married		Single	
	% Adjust	Expenditure Share	% Adjust	Expenditure Share
Food	68.9%	19.2%	71.0%	20.3%
Utilities	61.4%	4.9%	70.6%	5.3%
Transport	83.7%	22.8%	83.2%	20.1%
Entertainment	81.3%	6.5%	79.4%	5.7%
Shelter	1.7%	25.8%	3.0%	29.8%
Phone	33.6%	3.1%	40.5%	3.1%
Life insurance	32.6%	1.0%	28.7%	0.5%
Vehicle insurance	33.7%	3.1%	30.3%	3.6%
Health insurance	29.8%	6.7%	27.2%	5.4%

Table B.5: Adjustment patterns by children presence at home

	Children		No Children	
	% Adjust	Expenditure Share	% Adjust	Expenditure Share
Food	66.5%	20.7%	69.7%	18.9%
Utilities	69.9%	5.3%	70.2%	4.7%
Transport	81.0%	21.9%	81.5%	20.1%
Entertainment	81.4%	6.4%	79.9%	5.8%
Shelter	1.6%	26.2%	3.0%	27.7%
Phone	36.8%	3.1%	34.4%	3.0%
Life insurance	29.4%	0.9%	28.9%	0.8%
Vehicle insurance	30.4%	3.0%	32.4%	3.5%
Health insurance	27.6%	6.4%	29.7%	6.2%

C Kaplan-Meier survival functions

In this Appendix, we show the Kaplan-Meier survival functions for individuals with and without commitments according to the definition in Section 2.3. The Kaplan-Meier non-parametric estimator of the survival function, $S(t)$, gives the fraction of individuals unemployed by duration. In particular, it is defined as

$$S(t) = \prod_{t_i<t} \frac{n_i - d_i}{n_i},$$

where n_i denotes the number of unemployed individuals just before t_i and d_i the individuals that leave unemployment at t_i. While computing the Kaplan-Meier survival functions, we take into account censored spells (some individuals end their spell in unemployment). Figure C.3, shows the Kaplan-Meier non-parametric survival functions. We can see that individuals with commitments leave unemployment faster than individuals without commitments. After 5 months of unemployment, about 55% of individuals without commitments remain unemployed, while only 45% of those with commitments.

Figure C.3: Unemployment duration by consumption commitments

D Calibration for Economy without Commitments

In this Appendix, we present the parameter values used for the counterfactual economy without commitments. Table D.6 presents the parameters that were calibrated a priori in the economy with commitments. Only the interest rate r has been recalibrated to match median assets in the economy. Table D.7 presents the calibrated parameters in the economy without commitments. In this table, only ψ has been adjusted to match mean unemployment duration.

Table D.6: Parameters a priori in economy with commitments

Parameter		Description	Source
π	1/360	Probability of death	Average of 30 years
σ	1.5	Coefficient risk aversion	Standard
$\overline{N_E}$	12	Employment requirement for benefits	Department of Labor
$\overline{N_{UI}}$	6	Employment requirement for benefits	Department of Labor
Θ_0	0.50	Replacement rate	Graves (2021)
Θ_1	0.67	Cap on UI	Graves (2021)
f_l	0.633	Fraction non-college	CPS (2014-2018)
f_h	0.367	Fraction college	CPS (2014-2018)
ρ_ξ	0.997	Persistence shock	Krueger et al. (2016)
σ_ξ	0.03	Variance persistent shock	Krueger et al. (2016)
δ_{θ_l}	0.018	Probability job loss, non-college	CPS (2014-2018)
δ_{θ_h}	0.012	Probability job loss, college	CPS (2014-2018)
r	0.0035	Interest rate	Median assets like benchmark
γ	0.911	Tax function level	Guner et al. (2016)
τ	0.053	Tax function curvature	Guner et al. (2016)

Table D.7: Calibrated parameters in economy without commitments

Parameter		**Value**	**Moment**
Labor Productivity			
θ_l	Permanent shock non-college	-0.36	Normalized average earnings to 1
θ_h	Permanent shock college	0.42	Ratio average earnings COL/NCOL
Preferences			
α	Share of adjustables in utility	0.700	Commit. expenditure/Total expenditure
κ_f	Cost of adjusting commit.	0.000	No Commitments
ψ	Level disut. effort	27.0	Mean duration unemployment
$\widehat{\beta}(\theta_l)$	Patience non-college	0.987	Median assets
$\widehat{\beta}(\theta_h)$	Patience college	0.9945	Share wealth top 40%
η	Elasticity adjust-commit	-1.0	Elasticity U duration-UI benefit duration
Job finding function			
λ_0	Level job finding function	0.95	Fraction duration unemp. 4-6 months
λ_1	Slope job finding function	-0.25	Fraction duration unemp. >6 months

Note: Calibrated parameters and the corresponding moments they target.