“We offer weekly pay”: Paycheck frequency and the need for liquidity of American workers*

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Abstract

Using the U.S. micro data, I document a novel fact that American workers who receive weekly paychecks tend to earn lower hourly wages and have less liquid wealth than those who earn every two weeks. To explain these stylized facts, I build a labor search model incorporating workers' liquidity constraints and featuring paycheck frequency as a job amenity that comes with a compensating wage differential. Workers with less liquidity are willing to accept jobs that pay more frequently even though they earn lower wages on average because they can better smooth consumption between weeks in a month without the need to resort to expensive loans. The interaction between the equilibrium distribution of liquidity and search frictions plays a key role in underpinning wage inequality across pay frequencies.

Keywords: Paycheck frequency, compensating differentials, liquidity constraint

JEL codes: E21, E24, J32, J33

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1 Introduction

The majority of American workers receive their paychecks either every week or every other week. In a world with frictionless financial markets, how often workers get paid would not play a role in their inter-temporal consumption smoothing decisions (Hall 1978), nor should there be any substantial differences between weekly and biweekly earners. If market imperfections such as borrowing limit exist, however, what makes some people choose weekly over biweekly paying jobs? How does paycheck frequency affect workers' labor market choices? What are the implications for wage inequality and aggregate welfare?

In this paper I propose that paycheck frequency is an important yet so far overlooked non-pecuniary aspect of jobs. In the presence of expensive borrowing costs and liquidity constraints, given a sum of future earnings, earners with low liquid wealth would prefer to receive smaller yet more frequent installments. A higher paycheck frequency translates into better consumption smoothing possibilities and thus acts as a non-pecuniary job feature. Workers are willing to trade off a better-, biweekly-paying job against one that pays lower wages but every week, giving rise to compensating wage differentials (Rosen 1986).

Using the Consumer Expenditure Survey (CEX) data, I first document that nearly a quarter of surveyed workers receive weekly paychecks, while more than half receive biweekly paychecks. Another stylized fact is that weekly earners tend to have lower hourly wages and live in households with less liquidity than biweekly earners. Even after I take into account differences in demographic characteristics, education, and occupation, weekly earners tend to receive a 6% lower hourly wage and have between 44% and 75% less liquidity than biweekly earners on average.

To investigate the channel behind this joint distribution of paycheck frequencies, earnings, and liquidity, I build a directed labor search model with idiosyncratic employment shocks, incorporating three important extensions. First, jobs in my model are characterized by *both* wage and pay frequency. Second, workers in my model are risk averse with heterogeneity in net liquid assets and a potentially binding borrowing constraint. Third, to highlight the effect of paycheck frequencies, the model has a time structure that calls for intra-period consumption smoothing.

In my model workers start a period by drawing stochastic employment shocks and then have to make consumption-saving decisions for each sub-period within that period. One can think of each period as a month and each sub-period as a week. If employed, they receive income in different patterns depending on their paycheck frequency. Consumption precedes the receipt of paychecks in each sub-period. If unemployed, they can direct their search for a job to a particular sub-market indexed by a wage-frequency bundle. On the other side of the market, firms enter those sub-markets competitively by posting vacancies. There are administrative and processing costs ("admin costs") associated with each paycheck, which, besides the equilibrium sorting of workers, also contribute to the average wage gap between the two pay frequencies.

In equilibrium, unemployed workers with limited liquidity optimally search for a lower wage in exchange for both a higher matching chance with a vacancy, as well as more frequent paychecks in order to smooth inter-temporal consumption. While the first channel is well known in the literature, the second channel is novel. A higher paycheck frequency becomes a valued job amenity for constrained workers on the labor market, consequently requiring a compensating wage differential. This effect deteriorates for workers with higher levels of liquidity, as they can smooth consumption easily and therefore are indifferent to paycheck frequency. The calibrated model performs well in matching key empirical moments, including liquid assets and the share of weekly earners. Importantly, I can also fully capture the untargeted wage gap between the two frequencies after controlling for other observable characteristics.

Next I conduct decomposition exercises of the inter-frequency wage gap, which comes from two sources: the admin costs and the liquidity-based sorting channel that I describe above. When shutting down the latter, I find that the wage gap between the two paycheck frequencies almost disappear. Around 98% of the wage gap can be explained by the equilibrium distribution of liquidity. The remaining gap is explained by the admin costs. This result highlights the quantitative role of my novel channel and how inequality in liquidity can in turn translate into inequality in wage through consumption smoothing and paycheck frequency.

I then implement two counterfactual exercises to illustrate the quantitative magnitude of my proposed channel. Since the main driver behind my results is the liquidity constraint (potentially) faced by job seekers, I alternatively adjust it by (1) relaxing/ tightening the ad hoc borrowing limit and (2) increasing/ decreasing unemployment benefit. I find that loosening the liquidity constraint makes more people hold negative liquid wealth and sort into weekly-paying jobs, consequently decreasing the inter-frequency wage gap, while tightening the constraint has the opposite effects. All exercises generate quantitatively significant responses in labor earnings and net liquid wealth, underscoring the role of liquidity constraint in determining the wage gap between the two frequencies in equilibrium.

Finally, I evaluate the effects on welfare and labor market outcomes of extending the unemployment benefits duration by 13 weeks, or 50% of the baseline duration. Thanks to the policy, unemployed workers face less pressure from benefits expiration and therefore can afford to wait and search for higher paying jobs. Despite a slight increase in unemployment rate, welfare as measured by lifetime consumption equivalence improves for all workers, conditional on world states, in the new steady state. Aggregate welfare also increases by 0.25% compared to the baseline.

1.1 Related Literature

This paper relates to several strands of literature on consumption and labor markets. First, the effect of *income* frequency on consumption smoothing is increasingly documented. Numerous studies document an over-reaction in consumption of program recipients following the benefits' arrival dates (Stephens Jr 2003, Shapiro 2005, Mastrobuoni & Weinberg 2009, Zhang 2017), which is explained by a lack of self-control. Moreover, exploiting different variations in the pay schedules of Social Security benefits, Stephens Jr (2003), Berniell (2018), and Matikka et al. (2019) all find that more frequent paychecks result in smoother within-month expenditures, especially for households with lower incomes. Aguila et al. (2017) also show significant consumption smoothing effects of pay frequency for Mexican program recipients when comparing monthly and bimonthly schedules. My work is different from these papers as I focus on wage-earning workers, i.e. those who constantly face labor market shocks instead of benefits recipients with generally stable streams of earnings.

The effect of *paycheck* frequency on consumption pattern has also been explored in the literature through the lens of behavioral bias. Notably, Parsons & Van Wesep (2013) provide a theoretical framework for the optimal timing of paychecks and find that firm-devised contracts which align the arrival of pay with the timing of workers' consumption needs will have welfare-improving effects. Baugh & Correia (2022) extend this model by incorporating credit card borrowings and illiquid savings. Using an online account aggregator's micro data, they find that those with higher paycheck frequency generally borrow less with credit cards yet experience more episodes of financial distress. On a separate note, De La Rosa & Tully (2022) find a positive relation between spending and paycheck frequency, which they explain by the concept of subjective wealth: more frequently paid workers are more certain about their ready-to-use liquidity over a period, thus perceiving themselves to have more wealth and spending more. My paper builds on a different premise, demonstrating that even in the absence of present bias, liquidity constraint can explain the relevance of paycheck frequency for consumption smoothing.

I also associate this paper with the growing literature strand which studies job amenities besides wage. The existence of non-pecuniary features such as working conditions and job security is well documented and their importance to workers is shown to be significant (Bonhomme & Jolivet 2009, Mas & Pallais 2017, Sorkin 2018). Moreover, Hall & Mueller (2018) estimate the dispersion of these amenities to be larger than that of offered wages. Non-wage values are also incorporated into equilibrium labor search models to explain wage differentials (Luo & Mongey 2019, Taber & Vejlin 2020, Lamadon et al. 2022, Jarosch 2023). Using experimental data and a stated-preference approach, Maestas et al. (2023) quantify the willingness to pay for different aspects of working conditions, stressing how the variations in preferences for amenities across workers can affect wage inequality. However, none of these studies investigates the role of paycheck frequency as a job amenity, for which gap this paper aims to fill.

Finally, I also position my work among the literature on how wealth affect individuals' labor market outcomes, which predominantly employs a variety of labor search frameworks. Krusell et al. (2010) incorporate incomplete markets with heterogeneous agents and aggregate shocks into the frictional labor market, giving way for self-insurance motives of workers. Lise (2013) further underlines the role of idiosyncratic employment risks by adding on-the-job search. As workers constantly move up and down the wage ladder, they optimally adjust their precautionary savings, which helps explain the distributions of earnings and liquid wealth. Herkenhoff (2019) points out that more availability of consumer credits to unemployed workers also influences job-searching behavior of workers and the aftermath of recessions. Focusing on student debts, Luo & Mongey (2019) find that college graduates who are more heavily indebted choose to take jobs that pay higher wages, albeit with lower amenities. Eeckhout & Sepahsalari (2024) show that job seekers with little wealth might forgo high-paying jobs in exchange a higher matching probability, giving rise to a sorting mechanism. Griffy (2021) studies how wealth affects the life-cycle accumulation of human capital, while Chaumont & Shi (2022) focus on how the two channels of self-insurance, savings and job searching, interact and the implication for optimal unemployment insurance. Compared to these studies, my paper uses a similar theoretical framework, but differs in the subject of study: how artificial arrangements like pay frequency generate sizable wage inequality through the channel of liquid wealth.

Structure: The remaining part of the paper is organized as follows. In the next section, I discuss the data that I use for the main analysis and demonstrate some descriptive characteristics of the sample. In section 3, I use a stylized theoretical model to demonstrate the main economic channel and characterize the equilibrium analytically. In section 4, I extend the model in multiple dimensions and calibrate it to match data. Section 5 discusses the results and explores the main mechanism through counterfactual exercises. Section 6 presents the policy experiment. Finally, section 7 concludes.

2 Empirics

2.1 Data

I use the Interview data of the CEX from 2006 to 2019 as there were few substantial changes in state-level payday requirements of the U.S. states during this period. The Survey is conducted quarterly and each household is interviewed at most 4 consecutive times before being rotated out and replaced by a new household. Besides standard demographic information, what matters for this study is data on the frequency of the last paycheck that the interviewees received.[1] To the best of my knowledge, the CEX is the only public micro dataset with useful information about this aspect.[2] In addition, number of working weeks, usual hours at work per week, and salary before taxes and deductions during the last 12 months are collected in the first and fourth interviews. Questions on financial standings, which cover liquid assets and credit card debts at the time of the interview and one year before that, are asked only in the fourth interview.

I apply multiple filters to select my sample, with the detailed procedure available in the Appendix A.1. Apart from dropping observations with incomplete or implausible information, I limit the sample to prime-aged household heads who are the primary earner in their family. In the 12 months before the last interview round they must be employed on a regular basis, i.e. at least 40 weeks *and* 30 hours per week. Paycheck frequency and wage information is collected from heads, while net liquidity is from their respective household level. In the end, my sample has 6,031 household heads, among whom there are 1,668 weekly earners and 4,363 biweekly earners in their corresponding fourth interview. For further analysis, I use only the fourth interview

[1] I treat semi-monthly paychecks as biweekly for simplicity. There are typically two months in each calendar year in which biweekly-paid workers receive their paychecks thrice, while semi-monthly jobs always pay twice per month.

[2] The CEX asks interviewees about their last paycheck and the time interval that it covers. In comparison, for example, the Current Population Survey (CPS) asks people about "the easiest way" to report their earnings (hourly, weekly, biweekly, annually, and so on). Meanwhile, the Survey of Income and Program Participation (SIPP) asks more explicitly about the type of their pay rate, but most respondents quote their wage in terms of either hourly or annual pay. Both are not useful for my analysis.

instead of exploiting the panel structure of the dataset because information about liquidity is only available in this round. I report the demographic characteristics of the final sample across the two pay frequencies in Table A1.

2.2 Wage and Liquidity Gaps by Pay Frequency

Next I examine hourly wage and net household liquidity for the two pay frequencies in my restricted sample. All monetary values are measure in 2001 U.S. dollars, adjusted by annual CPI. I compute hourly wages of workers from their last paycheck amount, their pay frequency, and the usual hours that they work per week. I define net liquid assets as total liquid wealth such as checking and savings accounts, money market accounts, certificates of deposits, stocks, bonds, and directly-held mutual funds, net of credit card debts as total liquid borrowing.[3] As the CEX does not ask people about their cash holdings, I follow Kaplan & Violante (2014) and assume cash to be 5% of the sum of other liquid assets. Similar to the literature (e.g. Lise 2013, Griffy 2021), I use net liquid assets as the proxy for how constrained workers are.

I describe in Table 1 the *unconditional* distribution of hourly wage and liquid wealth for weekly and biweekly earners. For each characteristic, I consider the corresponding values at 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles. Regarding hourly wage, biweekly workers earn more than their weekly counterparts at every considered point along the spectrum. Moreover, the higher we move up the distribution, the larger the difference in wage between the two frequencies becomes, pointing to a much more skewed distribution of biweekly pattern compared to that of weekly one. For households' net liquid assets, biweekly earners tend to have lower negative net liquid wealth than weekly earners within the bottom 10%, but higher positive net liquidity along the rest of the spectrum. If we look separately at the two components of net liquidity, liquid wealth and liquid borrowing, most of the discrepancies in net liquid assets can be attributed to biweekly earners having relatively higher liquid wealth than weekly ones. The median household in my sample does not have liquid debt, and among those who borrow, weekly earners tend to have higher outstanding credit card debts.[4]

[3] Henceforth I use *net liquidity* and *net liquid assets/wealth* interchangably.

[4] In my sample 46% of weekly earners and 51% of biweekly earners report having some liquid

However, keep in mind that the differences in liquid borrowing might also reflect the variations in credit limits among workers, which is not observed in the data. To better capture how relatively liquidity-constrained households are, I normalize net liquidity by hourly wage and the amount that heads earn in the last paycheck, respectively, as shown in the last four rows of Table 1. In general, weekly earners are more constrained than biweekly earners over the whole distribution, even after taking labor earnings into account. While the median weekly-paid worker is basically hand-to-mouth with near-zero net liquidity, the biweekly counterpart still has a buffer stock worth around 30 hours of labor.

	Frequency	**p-10**	**p-25**	**p-50**	**p-75**	**p-90**
Hourly wage	Weekly	7.67	10.23	14.30	19.52	26.52
	Biweekly	8.96	12.43	18.43	26.58	35.83
Net liquidity (in level)	Weekly	-5,816	-694	4	1,393	8,690
	Biweekly	-6,815	-629	483	5,253	31,303
Liquid wealth (+)	Weekly	0	8	599	2,278	10,130
	Biweekly	0	303	1,620	7,244	33,762
Liquid borrowing (-)	Weekly	0	0	0	2,187	7,682
	Biweekly	0	0	0	57	2,975
Net liquidity (in hourly wage)	Weekly	-367.1	-47.4	0.4	84.8	477.3
	Biweekly	-371.3	-35.2	31.7	260.8	1,316.3
Net liquidity (in last paycheck)	Weekly	-8.3	-1.1	0.0	1.9	10.3
	Biweekly	-4.2	-0.4	0.4	2.9	15.0

Table 1: Hourly wages and liquid assets/borrowing distribution (2001 US$)
Note: Pooled CEX Interview Data 2010-2018 (Round 4). p-x denotes the x-th percentile value of the variables listed in the leftmost column. Net liquidity = Liquid wealth − Liquid borrowing. Liquid wealth includes checking and savings accounts, money market accounts, certificates of deposits, stocks, bonds, and directly-held mutual funds. Liquid borrowing indicates the amount of outstanding credit card debts, therefore positive. $N_{Weekly} = 1,668$, $N_{Biweekly} = 4,363$.

The next step in my analysis is to control for many potential confounding factors when comparing wages and net liquidity between the two types of workers. Some candidates might be, for example, educational attainment and occupations. The regressions, shown in Appendix A.1, do not aim at causality implications given that

borrowing at the time of the fourth interview.

no credible exogenous variations are available in the data, but rather make workers with different paycheck frequencies as comparable as possible. The overall results still suggest statistically significant premiums in both wage and net liquidity in favor of biweekly earners. On average, they earn 6% more per hour and have between 44% and 75% more net liquidity than weekly earners.

To summarize, the weekly frequency typically demonstrates a strong correlational link with lower wages and less liquid wealth. In order to explain these stylized facts, I devise a theoretical model in the next section. My main thesis is that more frequent paychecks are a more attractive option to those with low levels of liquid assets, which in turn incentivizes constrained workers to search for weekly-paying jobs even at lower offer wages. I intentionally keep the model simple to help with tractability and intuition development. Nevertheless, it illustrates the economic channel central to the paper and builds the theoretical foundation for quantitative analysis later.

3 Stylized Model

3.1 Setup

3.1.1 Environment

Time and Population: Time is discrete and runs forever, with each period further divided into two sub-periods. There is no aggregate uncertainty in the model. Two types of agents populate the economy: indefinitely lived workers and firms. The former are of unit measure and can be either employed or unemployed, differing ex ante in their liquid asset endowment a. The latter are of infinite number but enter labor markets endogenously, so their measure in equilibrium is in accordance with the free entry condition.[5]

Agents: Workers are risk averse and make consumption decision every sub-period

[5] I assume that firms are owned by absentee investors.

to maximize their lifetime utility

$$\bar{U} = \mathbb{E}_0 \Sigma_{t=0}^{\infty} \beta^{2t} [u(c_{1t}) + \beta u(c_{2t})].$$

$\bar{U}$ is the expected sum of the stream of instantaneous utility $u(c)$, discounted at a weekly factor $\beta \in (0,1)$, with $\{c_{jt}\}_{j=1}^{2}$ being the sub-periodic consumption within period t. The instantaneous utility function $u(.)$ has standard characteristics: $u'(.) > 0$, $u''(.) < 0$, and $u(.)$ satisfying Inada conditions. Workers can save or borrow using liquid assets a which are subject to the borrowing constraint $\underline{a}$. When employed, they supply an inelastic unit of labor.

Firms are identical and risk neutral, each providing one job upon market entry. Filled jobs generate a constant level of output x every period. The flow profit from an operating firm paying its worker wage w is linear $(x - w)$. Firms discount the future at period-rate $\beta_F \in (0,1)$, which I assume to potentially differ from the equivalent monthly discount rate of workers. On firms' timeline, there are no sub-periods, i.e. β_F is the monthly discount factor. [6]

Paycheck Frequencies: The earnings inflows of workers depend on the employment status and, if employed, the paycheck frequency. Specifically, there are two paycheck frequencies. If paid *weekly*, workers receive a half of the periodic wage every sub-period; if paid *biweekly*, thy receive nothing in the first sub-period and the whole sum in the second. Meanwhile, unemployed workers simply receive unemployment benefit $b > 0$ every sub-period.

Labor Markets: Uncertainty in the economy comes entirely from the labor market. Each period employed workers face an exogenous risk δ $(0 < \delta < 1)$ of being separated from the current job at the beginning of each period. They then can start searching for a new job immediately. If the search is successful, they would be employed in the new job in the same period. Otherwise, they would become unemployed until the next period starts, when they can search again. On the firms

[6] We can think of this setup as a scenario in which firms give a sum to a paycheck dispensing intermediary at every month beginning. The intermediary then deducts a fee, or the admin cost which I explain later, from that amount before transmitting the rest to the employed worker at predetermined frequency throughout that month.

side, each unmatched firm opens a vacancy at a per-period continuation cost κ, for which they commit to a wage w paid at frequency s.

Every paycheck is costly for firms to process, which I model with a function of monthly *admin cost* $\phi(s)$, with $\phi(\text{weekly}) > \phi(\text{biweekly})$. These costs are internalized by firms when they post wages. For simplicity, I assume that the admin costs depend only on pay frequency now. Later, when quantifying the model in Section 4, I will allow them to depend also on wage. That specification takes into account costs that potentially varies with wages, e.g. employer's share of social contributions per payroll. Overall, admin costs capture the wedge between labor costs to firms and wages to workers.

Matching: Job search is competitive as each period unemployed workers decide to participate in the submarket (w, s) characterized by wage level w and frequency s. If matched with a firm, the vacancy is filled and they immediately enter the working arrangement. I assume that within each submarket the matching function is $M(u, v)$, where u is the number of searching workers and v the number of vacancies, and has constant returns to scale. Let $\theta = v/u$ be the submarket tightness, then the job finding rate is $\frac{M(u,v)}{u} = p(\theta)$ and the contact rate is $\frac{M(u,v)}{v} = q(\theta)$. As tightness θ rises, the former increases while the latter decreases. The job finding rate and the contact rate within a submarket are related by the standard equation $p(\theta) = \theta q(\theta)$. There are no endogenous separations or on-the-job search.[7]

Timing: A period starts with the realization of the separation shocks. Next, newly separated workers, together with remaining unemployed workers from the previous period, direct their search to open vacancies. The matching process occurs, after which a fraction of job seekers become employed and start their new jobs immediately, while the others are unemployed for this period. Afterwards, all workers start consuming. At the end of each sub-period, workers receive their respective earnings or unemployment insurance (UI) benefits.

[7]I abstain from modeling on-the-job search for two reasons. Theoretically, I do not need it for demonstrating the mechanism in this paper. Quantitatively, my main focus is the inter-frequency gaps in wage and liquidity, not the overall liquid wealth distribution or wage dispersion, which on-the-job search normally can explain well.

3.1.2 Workers' Problem

Unemployed workers decide which submarkets (w, s) to search in where frequency s can be either weekly W or biweekly B. The corresponding tightness of the submarket is denoted as $\theta(w, s)$. We can write the value function of searching $S(a)$ at the beginning of each period with assets level a as:

$$S(a) = \max_{\theta(w,s)} p(\theta(w, s))E(a, w, s) + [1 - p(\theta(w, s))]U(a) \tag{1}$$

If workers fail to match with a vacancy, they are unemployed for the rest of the period and have the value:

$$U(a) = \max_{c_{1t},c_{2t}} u(c_{1t}) + \beta u(c_{2t}) + \beta^2 S(a_{2t}) \tag{2}$$

s.t.

$$\begin{aligned} c_{1t} + a_{1t} &= a + b \\ c_{2t} + a_{2t} &= a_{1t} + b \\ a_{1t}, a_{2t} &\geq \underline{a} \end{aligned}$$

where $\{a_{1t}, a_{2t}\}$ denote the net assets level at the end of sub-period 1 and 2 respectively. Otherwise, if workers successfully match with a job, they will enter production immediately. The period-beginning value function $E(a, w, s)$ of an employed worker with job arrangement (w, s) and asset level a is:

$$E(a, w, s) = \max_{c_{1t},c_{2t}} u(c_{1t}) + \beta u(c_{2t}) + \beta^2 \Bigg[\delta S(a_{2t}) + (1 - \delta)E(a_{2t}, w, s)\Bigg] \tag{3}$$

s.t.

$$\begin{aligned} c_{1t} + a_{1t} &= a + y_{1t}(w, s) \\ c_{2t} + a_{2t} &= a_{1t} + y_{2t}(w, s) \\ a_{1t}, a_{2t} &\geq \underline{a}. \end{aligned}$$

The income streams for a weekly frequency are $y_{1t}(w, s = W) = y_{2t}(w, s = W) = \frac{w}{2}$ and, for a biweekly one, are $y_{1t}(w, s = B) = 0$ and $y_{2t}(w, s = B) = w$. At the beginning of the next period, if hit by the separation shock, workers lose their current jobs and can start searching immediately for a new job.

3.1.3 Firms' Problem

Firms' side will be parsimonious as they are not the focus of this paper. I assume that firms cannot observe the liquidity of individual workers and therefore cannot price discriminate when offering contracts.[8] Every period unmatched firms decide on the optimal submarket (w, s) to post a vacancy. The value of opening a vacancy is:

$$V = -\kappa + \beta_F \max_{w,s} \Big[q(\theta(w,s))J(w,s) + (1 - q(\theta(w,s)))V \Big]. \tag{4}$$

The value of a successful match is adjusted by the probability of matching, therefore equalizing the expected value of entering any submarket to firms. If matched with an unemployed worker, firms commit to the wage and pay frequency of the posted position until the match is exogenously destroyed. $J(w, s)$ is the match value after the firm fills its vacancy and starts production in the same period, paying the employed worker wage w at frequency s:

$$J(w,s) = x - w - \phi(s) + \beta_F \Big[\delta V + (1-\delta)J(w,s) \Big]. \tag{5}$$

3.2 Equilibrium Characterization

I demonstrate below agents' solutions to maximization problems and how they altogether characterize the equilibrium. This interaction gives rise to the key mechanism linking paycheck frequency, wages, and liquidity in this paper.

Firms' wage-posting strategy: The free entry condition implies that firms will keep filling up every submarket until the value of opening a new vacancy equates the entry cost:

$$V = 0$$

[8]Chaumont & Shi (2022) prove in a similar setting that, even without observing workers' current level of liquidity, firms can still make inference about it through their history of employment.

Substituting this into the value function 4 of searching firms and re-arranging terms gives:

$$J(w^*, s^*) = \frac{\kappa}{\beta_F q(\theta(w_s^*))} \tag{6}$$

where $w_s^* = (w^*, s^*)$ is the optimal posting strategy. Note that equation 6 holds only for open submarkets, which are those with $\beta_F J(w^*, s^*) \geq \kappa$, i.e. the discounted value of match exceeds the posting costs. Otherwise, no firms enter those submarkets and their tightness is zero. Meanwhile, using the free entry condition, we can also rewrite equation 5 as follows:

$$J(w, s) = \frac{(x - w) - \phi(s)}{1 - \beta_F(1 - \delta)}. \tag{7}$$

Combining 6 and 7 we get the equation relating wage to tightness of the optimal submarket choice:

$$w_s^* = x - \phi(s^*) - \frac{\hat{\kappa}}{q(\theta_s^*)} \tag{8}$$

where $\hat{\kappa} = \frac{[1-\beta_F(1-\delta)]\kappa}{\beta_F} > 0$ and $\theta_s^* = \theta(w_s^*)$. Job filling rates increase when firms raise their offered wages. Because $q'(\theta) < 0$ by construction, this result also implies that tightness θ is decreasing in wage, i.e. $\frac{\partial \theta(w_s^*)}{\partial w} < 0$.[9] When deciding which submarket to post vacancies, firms balance between gains from paying a lower wage and a lower market tightness, i.e. a higher filling rate. Eventually firms are indifferent to entering any submarkets in equilibrium as they all give the same expected value for posting a vacancy. A direct result of this characterization is that firms do not need knowledge of workers' distribution over states to solve for optimal posting strategies. All they need to know instead is the tightness of each submarket.

Another implication is that for every two opening submarkets, one of which pays wage w_W^* at weekly frequency and the other pays wage w_B^* at biweekly frequency, the wage gap satisfies:

$$w_B^* - w_W^* = [\phi(W) - \phi(B)] + \hat{\kappa}\left[\frac{1}{q(\theta_W^*)} - \frac{1}{q(\theta_B^*)}\right]. \tag{9}$$

The wage gap between the two pay frequencies depends on two factors: the difference

[9] To see this, we invert equation 8 to $\theta(w_s^*) = q^{-1}\left(\frac{\hat{\kappa}}{x - \phi(s^*) - w_s^*}\right)$.

in their associated admin costs and that in the job filling rates. The first term is straightforward, as firms internalize the admin costs and fully pass them to workers. The second term measures firms' trade-off between relatively higher filling rate and higher wages. For example, when the vacancy is more likely to be filled in the biweekly submarket than in the weekly one, i.e. $q(\theta_B^*) > q(\theta_W^*)$, the biweekly wage posted by firms will be unambiguously higher than the weekly wage. As we see later, the job filling rates depend on unemployed workers' search policy, which in turn ultimately depends on the distribution of liquidity.

Workers' consumption policy: I proceed in two steps. First, I derive workers' optimal consumption decisions, taking their employment status and income as given. Then, using the resulting value functions of employment in specific submarkets, I solve for the optimal searching strategy of unemployed workers. Recall that equation 3 expresses the value of being employed in job (w, s), the corresponding first order conditions are:

$$\begin{aligned} u'(c_1^s) &\geq \beta u'(c_2^s) \\ u'(c_2^s) &\geq \beta \Big[\delta S_a(a_2^s) + (1-\delta) E_a(a_2^s, w, s) \Big] \end{aligned} \tag{10}$$

where inequality holds if the corresponding borrowing constraint binds.[10] In addition, we also get the following envelope conditions:

$$\begin{aligned} E_a(a, w, s) &= u'(c_1^s) \\ E_w(a, w, s = W) &= \frac{u'(c_1^W) + \beta u'(c_2^W)}{2} + \beta^2 (1-\delta) E_w(a_2^W, w, s = W) \\ E_w(a, w, s = B) &= \beta u'(c_2^B) + \beta^2 (1-\delta) E_w(a_2^B, w, s = B) \end{aligned} \tag{11}$$

If workers are unconstrained, it is clear from 10 and 11 that $E_a(a, w, s) < E_w(a, w, s)$. In that case, an additional dollar to wage brings more marginal utility to workers than one to their liquidity because it also raises the future value of staying in employment. For workers facing the constraint in the first sub-period, however, the comparison is more ambiguous. The more they value contemporary intra-period

[10] For unemployed workers, the FOC in the first sub-period is the same, while the one in the second sub-period becomes $u'(c_2^U) \geq \beta S_a(a_2^U)$.

consumption smoothing, the better off they are by trading an additional dollar to wage and forfeiting expected future earnings for one to the present liquidity, i.e. $E_a(a, w, s) > E_w(a, w, s)$. This is especially the case for constrained biweekly earners with relatively low liquidity-to-wage ratio, who have to wait until the second sub-period to receive their earnings.

Workers' searching policy: To solve for the equilibrium, I rewrite the maximization problem of job seekers, taking into account firms' optimal strategy of wage posting. Given frequency s, the tightness of each submarket can be exactly pinned down by its corresponding wage level. Workers now solve equation 1 with respect to the new constraint:

$$p(\theta(w_s, s)) = p(w_s) = \frac{\hat{\kappa}\theta(w_s)}{x - \phi(s) - w_s}$$

which follows from condition 8 and $p(\theta) = \theta q(\theta)$. For each frequency s, I can then derive the first order condition for searching:

$$\frac{\partial p(w_s)}{\partial w}[E(a, w_s, s) - U(a)] + p(w_s)E_w(a, w_s, s) = 0 \tag{12}$$

The first term is the waiting cost of searching in submarkets with higher wages than w_s and forfeiting the gain from employment, scaled by the reduction in matching chance. The second term is the benefit of a better paying job conditional on successfully matching. While deciding which submarket to search in, workers need to balance this trade-off between a higher wage and a smaller chance of matching.

There are two economic channels driving searching decisions here. The first one, the *precautionary searching* is common in the existing literature: *within* each pay frequency, for searchers with low liquid wealth, it is punitive to stay unemployed too long because they face the risk of depleting their wealth. The closer they are to the borrowing constraint, the larger the gain from immediate employment, $E(a, w_s, s) - U(a)$, becomes for them to relinquish. As a result, they search for lower paying jobs that are easier to get, i.e. in submarkets with higher matching rates $p(w_s)$ out of precautionary motives.

The second, novel channel in my model is that, *between* pay frequencies, liquidity constrained workers will also direct their search to weekly-paying jobs with lower wages, which I call the *compensating differential* channel. To see why, consider a job seeker facing the potentially binding constraint when considering which sub-market to search in.[11] For this worker, conditional on wage, the potential gain from employment $E(a, w_s, s)$ in the weekly-paying job is higher than that in the biweekly-paying job because in the latter case she still has to wait until the second week for her next paycheck, unable to smooth intra-period consumption. To keep the balance in equation 12, she demands a relatively higher wage for a biweekly frequency, which however has a lower matching rate $p(w)$. As a result, the expected value of employment of the weekly-paying job is higher, and she optimally directs her search there. A more frequent paycheck therefore is a job amenity on the labor market that is desired by constrained workers and comes with a compensating wage differential in equilibrium.

3.3 Block Recursive Equilibrium

The stationary equilibrium in this model is a *Block Recursive Equilibrium* à la Shi (2009) and Menzio & Shi (2011). Specifically, it contains a set of value functions $S(a)$, $E(a, w, s)$, and $U(a)$ for workers, value function $J(w, s)$ for matched firms, consumption policy functions $\{c_1^U(a), c_2^U(a)\}$ and $\{c_1^E(a, w, s), c_2^E(a, w, s)\}$ of workers, searching policy $\bar{w}_s(a) = \{w_W(a), w_B(a)\}$ of job seekers, wage posting strategy w_s^* of unmatched firms, and market tightness function $\theta(w, s)$ such that

- policies $\{c_j^U(a), c_j^E(a, w, s)\}_{j=1,2}$ solve workers' consumption problems $U(a)$ and $E(a, w, s)$, while $\bar{w}_s(a)$ solves their searching problem $S(a)$
- wage offer policy w_s^* solves unmatched firms' vacancy posting problem,
- tightness $\theta(w, s)$ implied by free entry condition in all submarkets $(w, s) \in \Theta$,
- the aggregate state transition is consistent with policy functions.

Notice that the first two conditions of the equilibrium definition hold without agents' knowledge of the distribution of workers across states, hence block recursivity. All

[11] Her search policies $\{w_W, w_B\}$, if both existing, have to each satisfy condition 12.

necessary information for individual decision rules is captured by the market tightness, which agents can fully observe.

4 Quantitative Model

4.1 Extended Features

I extend the stylized model in several aspects to match key data moments better. First, each period now has four sub-periods instead of two. A period corresponds to a month, while a sub-period to a week. Workers now make consumption decisions every week and face labor market shocks every month's beginning. Weekly earners receive their paychecks four times per month, each time $\frac{w}{4}$, while biweekly earners receive $\frac{w}{2}$ twice per month in the *second* and *fourth* week. On the firms side, production and vacancies posting decisions now occur at the beginning of every month.

Second, admin costs now depend on both paycheck frequency and the level of wage, which I parametrize as

$$\phi(w,s) = \phi_1(s) + \phi_2 w = \begin{cases} 4\phi_1 + \phi_2 w \text{ if } s = \text{weekly} \\ 2\phi_1 + \phi_2 w \text{ if } s = \text{biweekly.} \end{cases} \quad (13)$$

This assumption implies that a higher offered wage also costs a proportional ϕ_2 more for firms, besides a per-paycheck component ϕ_1. Two jobs with the same monthly wage, one paying weekly and the other biweekly, thus have a $2\phi_1$ difference in admin costs to firms. Moreover, workers take this into account when forming their searching policy. From their perspective, a higher targeted wage is now harder to match with because it entails more admin costs for firms, preventing them from entering the respective submarket given fixed vacancy cost κ.[12]

Third, the liquid assets now entail exogenous monthly interest rates $(1 + R(a))$, with that for borrowing higher than that for saving, i.e. $R(a^-) > R(a^+)$. Moreover,

[12] Workers now solve for optimal searching policy that satisfied equation 1 and the constraint $p(\theta(w_s, s)) = \frac{\hat{\kappa}}{x - \phi(w,s) - w_s}$.

I also assume that interest only compounds at the last week of every month, i.e. the fourth sub-period of every period. For net borrowers, this mechanism mimics the grace period of credit cards. As long as borrowers pay off their balance by month end, they do not need to bear any interest costs for intra-month borrowings.

Finally, I assume that unemployed workers, conditional on having earned income from unemployment benefit in the previous month, face an idiosyncratic shock π of their benefits expiring at the beginning of the next month, before the search phase.[13] In that case, they receive nothing but a small subsistence non-labor income y_{min} every week until they find a new job. The equations characterizing workers' value functions are in the Appendix A.2. Those for firms stay the same.

4.2 Calibration

I calibrate the model to the data under a set of standard parameter choices and simplifying assumptions. The model period is one month and sub-period is one week. I first externally calibrate a set of parameters using benchmark targets from other quantitative studies and then calibrate the rest inside the model.

Preference: I set the utility function to be of CRRA form, $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$ where σ is the relative risk aversion. I set $\sigma = 2$ in conformity with standard macroeconomics literature. I assume that workers and firms might potentially have different time discount rates, i.e. the monthly equivalence of β might differ from β_F. Apart from imposing one less restriction on parameters, this assumption is reasonable in light of workers' exogenous risk of dropping out of the labor force permanently due to premature death or disability, for example. The monthly discount factor β_F of firms is set to 0.9968 to match the annual interest rate of 4%.

Labor market: I set the monthly separation rate $\delta = 0.026$ to match the monthly job-to-unemployment transition reported by the Current Population Survey (CPS) as in Chaumont & Shi (2022). Next, I follow Menzio & Shi (2011) and assume a standard CES matching function $p(\theta) = \chi\theta(1 + \theta^{\eta})^{\frac{-1}{\eta}}$ where η is the matching elasticity and

[13]This excludes those who just become unemployed in the same period, i.e. unemployed workers receive benefits for at least one period before facing the expiring risk.

χ is the matching efficiency. This functional form also gives us $q(\theta) = p(\theta)/\theta = \chi(1+\theta^{\eta})^{\frac{-1}{\eta}}$. Using this new denotation, I can simplify the optimal condition 12 for job searchers and solve for the solution numerically.

I set the matching elasticity η to the standard value 0.5 which targets the sensitivity of the matching rate to market tightness (Petrongolo & Pissarides 2001). I normalize the monthly output of a match x to 1, so that other monetary values in the model are expressed in terms of output unit. The UI benefit expiry rate $\pi = 0.182$ is calibrated from the average duration of eligible benefits in the U.S., which is 26 weeks. To prevent periodic consumption c from ever falling to 0 at the borrowing constraint, I assume a very small flow of subsistence income $y_{min} = 0.01$ every week for unemployed workers whose UI benefits have expired.

Assets: For interest rates, I set $R(a^{+}) = 0.15\%$ to match the annual return rate on savings of 2%. Liquid borrowings are assumed to be non-collateral credit card debts. Using data from the Federal Reserve's Consumer Credit Report (Fed G.19)[14], I calculate that the average interest rate charged by commercial bank on all credit card debts is 12.92% per annum, so I set the monthly borrowing rate $R(a^{-}) = 0.94\%$.[15]

Internal calibration: I jointly calibrate the seven remaining parameters $\{\beta$, χ, κ, ϕ_1, ϕ_2, $\underline{a}$, $b\}$ by matching eight empirical moments with their model-implied counterparts: the average ratios of net liquidity to monthly wage for weekly and biweekly earners, the fraction of weekly earners among employed workers, the share of workers with negative net liquidity, the unemployment rate, the job-finding rate of unemployed workers, and the inter-frequency differences of wages evaluated at the $75th$ and $25th$ percentiles. [16]

The choice of calibration targets invites a discussion. While all remaining parameters jointly determine endogenous outcomes in the model, as in standard moment-

[14]See https://www.federalreserve.gov/releases/g19/HIST/cc_hist_tc_levels.html.

[15]Combining the borrowing rate with the assumed flow of subsistence income y_{min}, I can calculate the lower bound for to-be-calibrated borrowing constraint $\underline{a}$ at around -4.25. If liquidity ever falls below this level, unemployed workers with no UI will not be able to maintain both positive consumption and no-default condition.

[16]Since I want to know how much of the empirical wage gap between the two pay frequencies can be explained by my model, I do not target it.

matching calibration procedures, some are more informative about a particular feature of the data than others. First, discount rate β and unemployment benefit b altogether govern inter-temporal consumption smoothing of workers and thus directly corresponds to the level of savings, conditional on pay frequency. Note that I look at liquidity normalized by wage instead of liquidity itself because saving decisions are endogenous to earnings. All else equal, a higher discount rate unambiguously leads to a higher saving rate out of income, while a higher benefit level has the opposite effect by reducing precautionary savings. Moreover, the intra-month consumption-saving problems faced by a weekly earner and by an unemployed worker, with or without UI, are almost identical except for the level of income received every week. Therefore, the average liquidity-to-income ratio of weekly earners can help pin down benefit level b.

Next, the admin costs' per-paycheck component ϕ_1 imposes a meaningful difference between the two paycheck frequencies from firms' perspective, regulating the relative supply of job types and subsequently the share of weekly earners in equilibrium, which is around 27.7% in the data. Together with the wage-dependent component ϕ_2, it helps pin down the differences in wages at the $75th$ and $25th$ percentiles between the two frequencies. The borrowing constraint $\underline{a}$ is disciplined by the fraction of 16% of workers with negative net liquidity in the data. The prime-age unemployment rate of 6.5% over the 2006-2019 period, retrieved from FRED, Federal Reserve Bank of St. Louis, can be targeted by the vacancy cost κ. The matching efficiency χ regulates the average monthly unemployment-to-employment transition rate of 22.4% over the same period, as estimated and maintained by Fujita & Ramey (2009) using the Current Population Survey.

Given an initial guess of the remaining parameters, I first solve for corresponding policy functions and then use them to simulate the economy 10 times, each with 20,000 workers over 600 months, starting from the same initial joint distribution. I assume that everyone starts being unemployed with zero wealth in the first period.[17] To compute model moments in the stationary equilibrium, I keep only the last 12 months and take averages of moments across periods and simulations. I minimize

[17] There is no substantial difference in results if I instead assume a (uniformly) random distribution of workers across states at the first period. The economy always converges to a stationary equilibrium after enough periods.

Externally Calibrated		
Parameter	**Value**	**Source**
Risk aversion σ	2	Standard
Match flow output x	1	Normalized
Separation rate δ	0.026	10% quarterly job loss rate
Saving rate $R(a^{+})$	0.15%	Annual risk-free rate 2%
Borrowing rate $R(a^{-})$	0.94%	Average annual card debts rate 12.9%
Firms' monthly d.f. β_F	0.9968	Annual interest rate 4%
Matching elasticity η	0.5	Petrongolo & Pissarides (2001)
UI expiry rate π	0.182	UI potential duration 26 weeks
Internally Calibrated		
Parameter	**Value**	**Targets**
Workers' weekly d.f. β	0.9970	Mean liquidity-wage ratio - Weekly
UI benefit per week b	0.0531	Mean liquidity-wage ratio - Biweekly
Credit limit $\underline{a}$	-3.0055	% with negative liquidity
Vacancy posting flow cost κ	0.4067	Unemployment rate
Matching efficiency χ	0.6880	Monthly job-finding rate
Admin cost base component ϕ_1	0.0004	% weekly earners
Admin cost wage component ϕ_2	0.0022	P75 w_B - P75 w_W, P25 w_B - P25 w_W

Table 2: Model parameters

Note: Px denotes the x-th percentile value. w_W (w_B) is the log hourly wage of weekly (biweekly) earners, which is residualized in the data. The share of weekly earners and the liquidity-wage ratios are computed directly from the sample. All other targeted moments are extracted from different sources. See text for details.

the sum of squared distance between the resulting simulated moments and their empirical counterparts to calibrate the remaining parameters, using the inverse squares of empirical moments as the weighting matrix. Table 2 summarizes the calibrated parameters and their sources and targets.

4.3 Model Behaviors

Targeted moments: The upper panel of Table 3 compares the moments generated from the model with those observed from the data, which are also the calibration targets. In general my model does a good job in capturing the key targeted features of the data. The exceptions are the $75th$ to $25th$ percentiles ratios of wages, which are both understated in the model compared to those in the data. The model-generated wage premiums of biweekly earners are positive, as in the data, at both considered percentile pairs. However, the relative wage gap is decreasing in size along the distribution, while it is the reverse in the data.

Targeted Moments	**Model**	**Data**
Mean liquidity/monthly wage - Weekly	0.511	0.515
Mean liquidity/monthly wage - Biweekly	1.735	1.363
% weekly earners	28.7%	27.7%
% workers with negative liquidity	11.5%	16%
Unemployment rate	6.7%	6.5%
U-E transition rate (monthly)	27.4%	22.4%
P75 w_B - P75 w_W	0.032	0.074
P25 w_B - P25 w_W	0.052	0.051
Non-targeted moments	**Model**	**Data**
Mean w_W - Mean w_B	0.047	0.047
P90-P50 ratio w_W	1.022	1.715
P90-P50 ratio w_B	1.007	1.638

Table 3: Moments - Model versus Data

Note: Px denotes the x-th percentile value. For data moments, w_W (w_B) is the log hourly wage of weekly (biweekly) earners, which is residualized in the data. Unemployment rate target comes from FRED data. Job finding rate target comes from Fujita & Ramey (2009). See text for details.

Non-targeted moments: To further validate the performance of my model against the data, I compare other moments which I do not target in my calibration in the lower panel of Table 3. Most importantly, my model can explain almost entirely the average wage gap between weekly and biweekly earners in the data.[18] This result is achieved without heterogeneity in preferences and labor productivity, therefore highlighting the quantitative importance of the underlying economic channel in my model.

The $90th$-to-$50th$ wage ratios, which capture the level of dispersion among the upper half of wage distribution, are understated for both pay frequencies in the model. Since wage dispersion is notoriously difficult to capture with standard search and

[18] The empirical wage gap is computed using residuals from the regressions of log hourly wage on observable controls *except* for pay frequency. See Appendix A.1 for details.

matching models (Hornstein et al. 2011), this result is unsurprising since my model is relatively parsimonious and does not account for on-the-job search. However, since the focus of this paper is the *inter*-frequency wage gap, it is not problematic that the model understates *intra*-frequency wage dispersion. Still, I can capture the salient pattern that the ratio is higher among weekly earners than biweekly earners, i.e. the above-median wage distribution is less dispersed for the latter group.

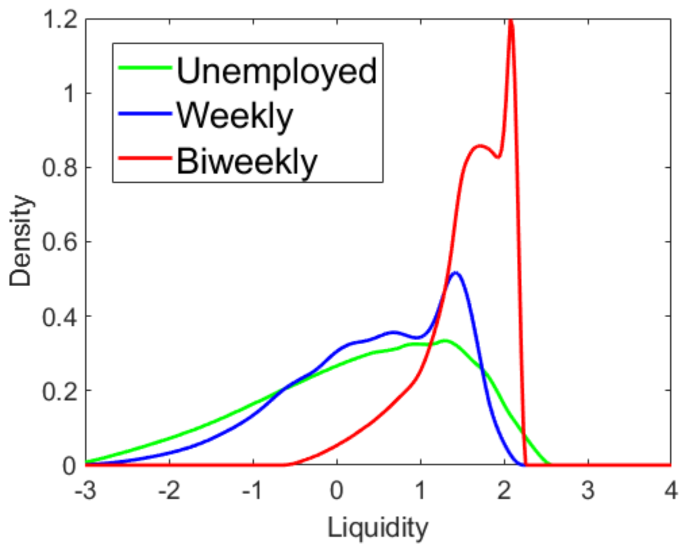


Figure 1: Distribution of Liquidity in Equilibrium

Note: The blue line corresponds to the density function of unemployed workers' net liquidity. The red (yellow) line corresponds to the density function of weekly (biweekly) earners' net liquidity.

Stationary Liquidity Distribution: Figure 1 illustrates the net liquidity distributions of unemployed workers, weekly-, and biweekly earners in equilibrium. There are two distinctive characteristics. First, biweekly earners tend to hold significantly more liquidity than the other two groups, staying far away from the borrowing limit. They want to avoid hitting the constraint and thus deviating from optimal consumption in weeks that they do not earn paychecks. Second, the net liquid wealth distributions of unemployed workers and weekly earners are close to each other. As argued before, their intra-month maximization problems are almost identical except for the level of income each week. Weekly earners save more than unemployed workers both due to higher earnings and out of the precautionary motive. The associating intra-month consumption and saving policy functions are shown in Appendix A.3.

5 Results

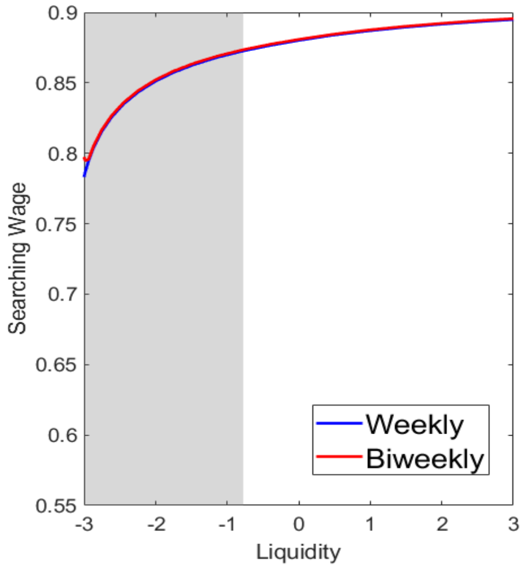
5.1 Job Search policy

I plot the searching policies of unemployed workers with different levels of liquidity, conditional on whether they still receive unemployment benefits, in Figure 2. For each level of net liquidity, I plot the submarkets that corresponding unemployed workers search in, each indexed by the targeted wage, paycheck frequency (blue curve for weekly, red curve for biweekly).

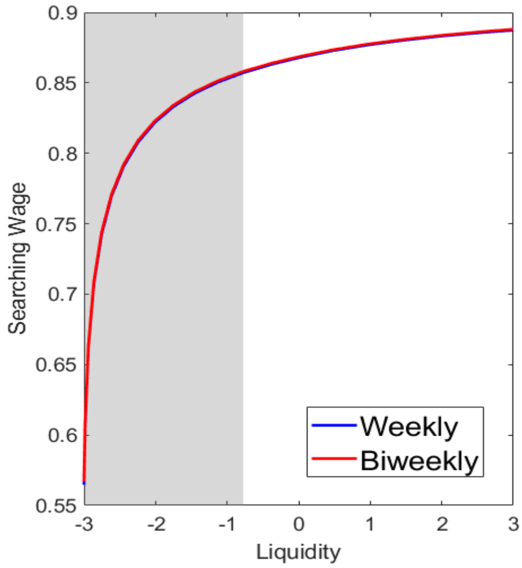
First, comparing the left and right panels, we can see that job seekers' policies vary greatly by whether their UI benefits have expired. Targeted wages are always higher for those still having access to UI than for those who do not, thanks to a higher value of outside option while searching. The differences between two panels are largest near the borrowing constraint, illustrating the value of UI benefits in providing workers with needed liquidity. When UI expires, they are willing to search for jobs with lower wages and higher matching probabilities. The difference decreases at higher levels of net liquidity as they can then use their buffer stock to smooth consumption.

Second, within each panel, two patterns emerge and correspond to the two channels driving job search decisions discussed in Section 3. Targeted wages are significantly lower near the constraint for both pay frequencies and gradually rise with liquidity level, indicating the relevance of the precautionary searching channel. Moreover, conditional on liquidity, searching wages are also higher for biweekly-paying jobs than for weekly ones, with the inter-frequency gap visibly larger near the constraint in the case of benefits-receiving job seekers (see the left panel). This result comes from the compensating differential channel.

The shaded area in each panel denotes the region of liquidity in which job seekers always choose a weekly-paying job over a biweekly one. Conditional on liquidity, a point on the blue curve in this area brings workers more value from employment than



(a) With UI benefits



(b) Without UI benefits

Figure 2: Searching policies of unemployed workers

Note: The left panel shows the target searching wage of unemployed workers with UI benefits. The right panel shows the target searching wage of unemployed workers without UI benefits. Liquidity denotes the level of net liquidity a at period's beginning. The shaded (bright) area denotes the region of liquidity with which workers choose jobs with a weekly (biweekly) paycheck frequency. The blue (red) lines correspond to the target wage of a weekly (biweekly) paying jobs.

a point on the red curve. In the bright area it is the opposite case, and the two areas are divided by a threshold in net liquidity (around -1). Below this level, the expected benefits of a higher wage in a biweekly job cannot compensate for low consumption due to the liquidity constraint in the first week of the month. Above this level, where workers can comfortably borrow more to finance their consumption, the value of more frequent liquidity of weekly paychecks is outweighed by a lower level of monthly wage. Therefore, job seekers overwhelmingly prefer biweekly-paying jobs in this region.

Overall job search policies align with my model's theoretical predictions, demonstrating clearly both the precautionary searching channel and the compensating differential channel. Paycheck frequency serves as a job amenity on the labor market for low-liquidity workers, who value more frequent flows of earnings and therefore self-select into weekly- but lower-paying jobs.

5.2 Decomposing Wage Gap

Since the focus of this paper is the inter-frequency wage gap, I attempt to analyze how much of it can be explained through the channels in my model. As shown in Equation 9, there are two main components of the average wage gap.[19] First, admin costs, which firms fully pass on to workers when posting jobs, can affect the average wage gap in two contrasting directions. On one hand, conditional on wage, weekly frequency is costlier to process due to more per-paycheck costs. This component can be quantified directly from the calibration result of $\phi_1 = 0.0004$, which explains $\frac{0.0004\times 2}{0.0469} = 1.71\%$ of the average wage gap. On the other hand, weekly-paying jobs have lower wages than biweekly ones on average, thus entailing less wage-based costs. Second, the job-sorting mechanism, arising from the equilibrium distribution of liquidity combined with the compensating differential channel, makes workers with potentially binding liquidity constraints self-select into lower-wage, weekly-paying jobs. This channel is represented by the difference in the average (inversed) job filling rates between two frequencies in Equation 9.

	Contribution to Wage Gap	**% Contribution**
Baseline	0.0469	100%
Admin costs - Per paycheck ϕ_1	0.0008	1.71%
Admin costs - Wage-based ϕ_2	-0.0004	-0.97%
Liquidity-based Sorting	0.0459	97.93%

Table 4: Inter-Frequency Wage Gap Decomposition
Wage gap is calculated as the difference between the average monthly wages of biweekly and weekly earners in the model. Two decomposing exercises are respectively shown in the two last rows: (1) turn off the wage-based component of admin costs and (2) force job seekers to target paycheck frequency randomly at 50-50 chance. See text for details.

I quantify the importance of each remaining component in explaining the average wage gap through two decomposing exercises. First, I switch off the discrepancy in admin costs by setting the wage-dependent part ϕ_2 to 0. As shown by the third row in Table 4, the result is negative because biweekly earners have higher wages on average than weekly earners. However, the absolute magnitude is small, indicating

[19]The average wage gap is: $\mathbb{E}(w_B) - \mathbb{E}(w_W) = [\mathbb{E}(\phi_W) - \mathbb{E}(\phi_B)] + \hat{\kappa}\left[\frac{1}{\mathbb{E}(q(\theta_W))} - \frac{1}{\mathbb{E}(q(\theta_B))}\right]$.

little contribution of the wage-based admin costs to the overall wage gap. This is unsurprising provided that the calibrated ϕ_2 is already small. I conclude that, albeit allowing for a flexible functional form of the cost schedule, the contribution of admin costs to the wage gap is driven mainly by the per-paycheck costs. In terms of absolute value, they stand at 0.0004 per paycheck in the model, or around 0.16% the average match output per week. For a position producing $3,000 per week, for example, this translates into a $5 admin costs per paycheck.

In the second exercise, I switch off the job-sorting channel by imposing job seekers' choices between the two paycheck frequencies as a randomization with a 50-50 chance rather than as a policy function of liquidity derived from the optimization problem.[20] This assumption ensures that the intra-month consumption policies are left untouched, and that a job seeker at every level of liquidity has an equal chance of becoming either a weekly or a biweekly earner. Therefore, any discrepancy in average wage between the two paycheck frequencies comes entirely from the admin costs after successful matching. The result is shown in the last row in Table 4, suggesting that 97.93% of the wage gap can be explained by the sorting mechanism. Overall, this highlights the overwhelming importance of the liquidity distribution in determining the wage gap between the two frequencies.

5.3 Equilibrium Effects of the Liquidity Constraint

The main driver of wage inequality between the two paycheck frequencies is the liquidity constraint. To quantitatively study the underlying mechanism, I alternatively conduct four counterfactual exercises which aim at either relaxing or strengthening the liquidity constraint. First, I increase and decrease the absolute value of the ad hoc borrowing constraint $\underline{a}$ by 20%. Next, I increase and decrease the amount of weekly unemployment benefit b by 50%. All other parameters are fixed at the calibration benchmark, and I examine each new stationary equilibrium following an exercise.

The results for these exercises are reported respectively in Table 5. In each column,

[20] Of course, the share of weekly earners in this case is close to 50%, but this should not matter for the wage gap.

representing a corresponding exercise, I look at the deviations, expressed in percents, from the baseline results in key aggregate measures: the liquidity-to-wage ratios and gap, the wage gap, the share of weekly earners, and the share of workers with negative liquid assets. A positive (negative) deviation stands for a relative increase (decrease) in the respective measure compared to the benchmark calibration. The resulting distributions of liquidity and wage from the four exercises are plotted in Figure 3, where solid lines represent the baseline scenario. For each exercise, the reported effects are a combination of the direct effect (from policy changes) and the equilibrium effect (from changes in distribution).

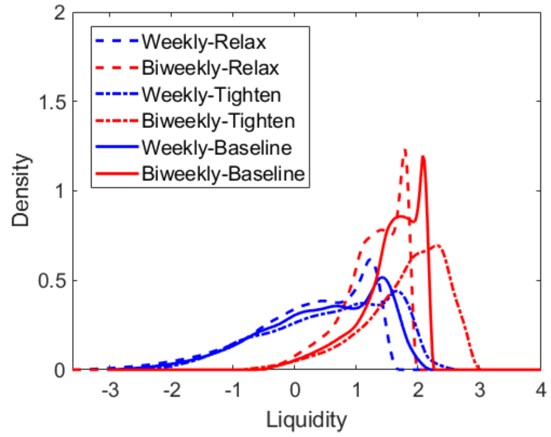
	Borrowing constraint		**Unemployment benefit**	
	(1)	*(2)*	*(3)*	*(4)*
	+ 20%	*- 20%*	*+ 50%*	*- 50%*
Liquidity-wage weekly $\frac{a_W}{w_W}$	-50.2%	37.0%	-43.4%	43.7%
Liquidity-wage biweekly $\frac{a_B}{w_B}$	-17.7%	17.6%	-12.7%	23.8%
Liquidity gap $\frac{a_B}{w_B} - \frac{a_W}{w_W}$	-4.1%	9.5%	0.17%	15.6%
Wage gap $w_B - w_W$	-18.7%	41.8%	-0.05%	8.3%
% weekly earners	38.8%	-49.2%	6.6%	-19.9%
% Liquidity < 0	49.7%	-40.1%	12.1%	-19.2%

Table 5: Changes in Key Moments - Counterfactuals vs. Baseline
Numbers denote deviations in percents from the baseline results. w_W (w_B) is the average monthly wage of weekly (biweekly) earners in the model. a_W/w_W (a_B/w_B) is the ratio of net liquidity to monthly wage of weekly (biweekly) earners in the model. For borrowing constraint, the first column denotes a relaxation and the second column denotes a constriction. See text for details about each exercise.

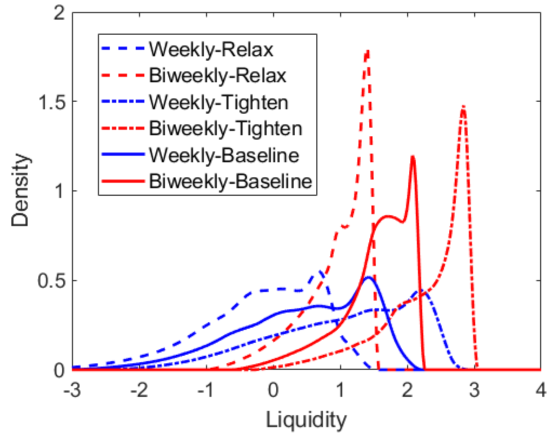
Noticeably from Table 5, relaxing the liquidity constraint, either by enabling more borrowing (column 1) or giving more unemployment benefit (column 3), significantly decreases the wage gap and increases the share of weekly earners in the economy compared to the baseline. As the need for liquidity eases in both cases, workers have less incentives to save, and the distributions of net liquidity for both types of earners shift to the left, as shown by the dashed lines in Figures 3a and 3b. The implications are twofold. On one hand, more people hold negative net liquidity, and they are also more likely to choose weekly over biweekly paychecks due to the compensating differential channel. On the other hand, since job seekers can smooth intra-month consumption better, they can afford waiting for matching with a higher-paying but harder-to-get job thanks to the precautionary searching channel, which pushes wages up (see dashed lines in Figures 3c and 3d). However, since biweekly earners already have high wages in the baseline, the rightward shifts in their wages in both relaxation scenarios are less pronounced than those of weekly earners, which explains the drop in the wage gap. Moreover, the combining effect makes the liquidity-to-wage ratios decrease for both worker groups, with an overall larger drop among workers who choose the weekly frequency.

Columns 2 and 4 show the scenarios where the liquidity constraint is tightened by a stricter borrowing limit and less UI benefits, respectively. As expected, the effects along key measures move in the opposite directions compared to the two previous relaxation exercises. Workers generally hold more liquid assets than in the benchmark out of precautionary motives, as shown by the dotted-dashed lines in Figures 3a and 3b, thus reducing the share of workers with negative liquidity as well as the share of weekly earners. The more restricted availability of liquidity also makes unemployed workers less picky in their application strategy, with jobs seekers targeting lower wages overall (see the dotted-dashed lines in Figures 3c and 3d). Putting together, the two exercises increase the liquidity-to-wage ratios of both weekly and biweekly earners and widens the wage gap between these two groups due to intensifying precautionary searching and compensating differential channels.

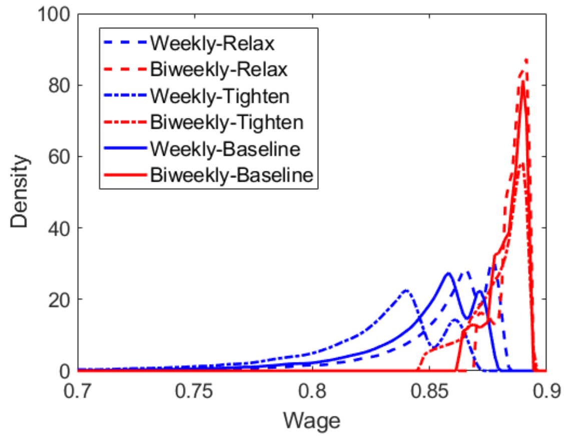
Another noteworthy pattern from Table 5 is that albeit similarities in the directions of changes, the two classes of counterfactual exercises still produce considerable discrepancies in magnitude along most dimensions. Specifically, adjusting the borrowing limit affects the liquidity-wage ratio among weekly earners significantly more compared to adjusting the UI benefits. Little changes are observed for biweekly earners. Moreover, the wage gap, the share of weekly earners, and the share of workers with net liquid wealth also respond more substantially in the former case. Since changes in the liquidity-wage ratio of biweekly earners across the two classes of exercises are close, the differences in other outcomes are attributable to the mechanisms through which they affects the equilibrium liquidity distributions rather than to the absolute value of changes in exercises (20% versus 50%). Adjusting the borrowing limit matters disproportionately for the lower end of the distribution, who hold neg-



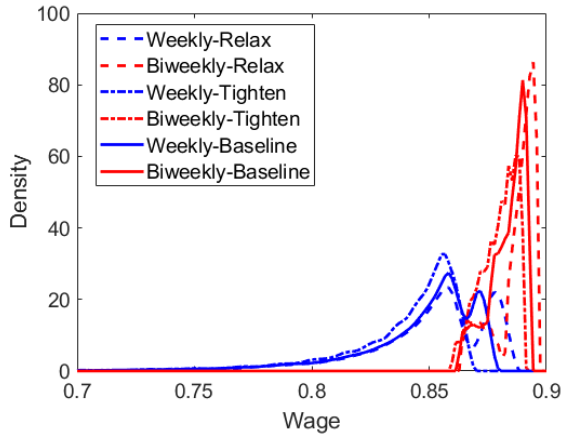
(a) Adjusting borrowing limit - Liquidity



(b) Adjusting UI benefits - Liquidity



(c) Adjusting borrowing limit - Wage



(d) Adjusting UI benefits - Wage

Figure 3: Distribution of Liquidity and Wage - Counterfactuals
Note: The blue (red) line corresponds to that of weekly (biweekly) earners. The solid lines show the baseline results. The dashed lines show when liquidity constraint is relaxed (higher borrowing limit or higher UI benefits). The dotted-dashed lines show when liquidity constraint is tightened (lower borrowing limit or lower UI benefits).

ative net liquid wealth and also search for weekly paychecks. On the other hand, adjusting unemployment benefits affects all job seekers' search behaviors and also employed workers' precautionary savings. Therefore, the resulting share of weekly earners and the wage gap also respond less vigorously to changes in UI benefits.

6 Policy Experiment

As illustrated before, the liquidity constraint of job seekers has considerable quantitative implications for equilibrium outcomes. One way of alleviating the constraint is through prolonging the potential duration in which they are eligible for UI.[21] In this section I used the calibrated model to examine the effects of implementing an extension of the potential UI duration by 13 weeks, or 50% of the baseline duration. First, I amend the model by introduce a linear tax τ on employed workers' earnings to finance the UI program.[22] Denote μ_{UI} the measure of unemployed workers receiving UI benefits and w_i the labor earnings of employed workers i in a month. Tax rate τ needs to satisfy the balance budget condition:

$$4b \times \mu_{UI} = \tau \times \int_i w_i di \tag{14}$$

i.e. total payout amount of benefits is equal to total tax revenue. Iterating on the tax rate using this equation while keeping changes in calibration targets to the minimum yields $\tau_{Baseline} = 1.13\%$. Next, I implement the policy by decreasing the parametric expiration rate π to 0.1143 to match the new expected UI duration of 39 weeks. The extension of course needs to be balanced by a higher tax rate, which I compute to be $\tau_{Experiment} = 1.30\%$.

I measure changes in welfare caused by the policy experiment compared to the baseline by the percentage change in consumption equivalence, i.e. by how much consumption in every future period should increase so that workers are indifferent in

[21]This practice is normally implemented during episodes of economic downturns such as the Great Recession or the COVID-19 pandemic. Here I examine the scenario where UI duration is raised permanently.

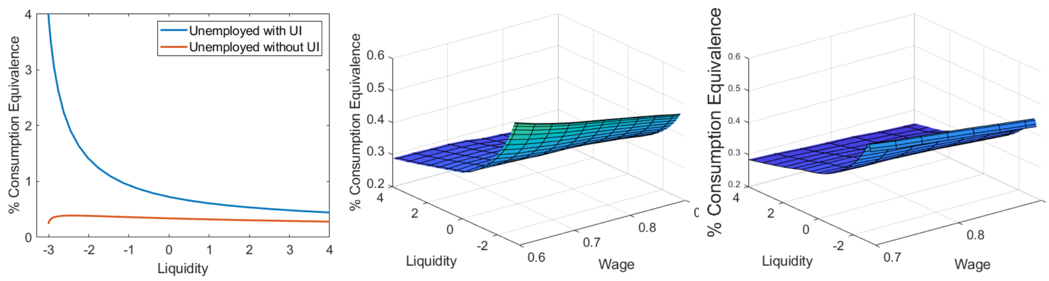
[22]This means that a worker with monthly wage w now receives $(1 - \tau)w$.

terms of expected lifetime utility between the two economies. For each worker i let the state vector Ω_i consist of employment status, job's wage and paycheck frequency if employed, UI expiration status if unemployed, and starting liquidity level a_i. Denote $\bar{U}(\Omega_i) = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_t [u(c_t(\Omega_i))]$ the expected lifetime utility in the baseline and $\hat{U}_i(\Omega_i) = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_t [u(\hat{c}_t(\Omega_i))]$ that in the experiment, where $c_t(.)$ and $\hat{c}_t(.)$ are respective consumption functions. The consumption-equivalent measure ψ_i for worker i satisfies

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t [u((1+\psi_i)c_t(\Omega_i))] = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t [u(\hat{c}_t(\Omega_i))]. \tag{15}$$

A higher ψ_i indicates that workers in the baseline economy have to be compensated more, in terms of consumption, to attain the same level of lifetime utility as those comparable in the experiment. Similarly, the utilitarianism aggregate measure Ψ for *aggregate* welfare comparison is

$$\int_i \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t [u((1+\Psi)c_t(\Omega_i))]di = \int_i \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t [u(\hat{c}_t(\Omega_i))]di. \tag{16}$$



(a) Unemployed workers (b) Weekly earners (c) Biweekly earners

Figure 4: Consumption equivalence ψ_i across workers
Note: The three panels show the consumption equivalence measure ψ from the experiment, computed as percentage of lifetime consumption in the baseline model. The Left Panel shows the result for unemployed workers (with and without UI benefits), the Middle Panel for weekly earners, and the Right Panel that for biweekly earners. In the Left Panel, the blue (red) line shows those with (without) UI benefits. Liquidity denotes the level of net liquidity a at beginning of period $t = 0$. Wage in the Middle and Right Panels denotes the monthly wage that workers currently earn. See text for detail.

In Figure 4 I plot the measure ψ_i among workers for different realizations of the state vector Ω_i in the steady state. The results indicate that, fixing the stationary distribution, the duration extension policy causes significant across-the-board welfare improvements for all workers compared to the baseline, which amount to between 0.3% and more than 4% of lifetime consumption. Note that for employed workers, the policy works through heightening their expected value in the case of a separation shock in the future. There is nevertheless considerable heterogeneity in effect magnitudes depending on the state of workers.

Among unemployed workers (the Left Panel), the policy improves welfare by a larger degree for benefit-receiving workers (the blue line) with less liquidity, with nearly 4% improvement near the borrowing constraint down to around 0.5% at higher levels of net liquidity in equilibrium. The only exception to this pattern is workers whose UI benefits have already expired (the red line) *and* close to borrowing constrained. These workers have to direct their search to low-paying jobs which provide relatively low value that an extended UI duration in the future cannot fully compensate for.

Among employed workers (the Middle and Right Panels), the duration extension enhances welfare in similar fashion for both weekly and biweekly earners. The magnitude of improvement is larger the closer workers are to the borrowing constraint (up to 0.5%), with much less gradients along the wage dimension. Understandably, these are people having the greater problem smoothing their consumption in a spell of unemployment, and the extended potential duration provides them with more much-needed liquidity in such a scenario.

Moments	**Change in Percents**
Unemployment Rate	1.70%
% UI Receivers	15.38%
% Weekly Earners	22.90%
Wage Gap $w_B - w_W$	-13.90%
Job Finding Rate	-1.47%
Reemployment Wage	0.12%

Table 6: Changes in Labor Market Outcomes - UI Duration Extension Experiment
Numbers denote deviations in percents from the baseline results. w_W (w_B) is the average monthly wage of weekly (biweekly) earners in the model. See text for details.

Table 6 shows changes in aggregate labor market outcomes caused by the experiment. Unsurprisingly, the extended potential duration slightly increases the unemployment rate and the share of unemployed workers receiving benefits. Moreover, because this experiment also relaxes the liquidity constraint of workers, we observe the same patterns as in the exercises in Section 5, namely an increase in the share of weekly earners and a decrease in the inter-frequency wage gap. Thanks to less liquidity pressure, job seekers are also more picky and target generally higher wages. The closer they are to the liquidity constraint, the larger the hike in targeted wages, as shown in Appendix A.4. In aggregate the job finding rate drops by 1.5%, while mean reemployment wage only rises slightly by 0.12%.

These results align with previous studies on the marginal effect of potential UI duration on job searching behaviors. Exploiting a sharp discontinuity in UI rules for Austrian workers, Card et al. (2007) find a significant drop in job finding rates, but not in reemployment wage, for those eligible for a longer potential duration. Similarly, Johnston & Mas (2018) find a higher exit rate from unemployment but no difference in reemployment earnings following an unexpected cut in UI duration in the state of Missouri. On the contrary, using German data, Schmieder et al. (2016) find a small but statistically significant reduction in reemployment wages because of UI extension, which they attribute to lower wage offers following longer nonemployment period. Since the wage distribution in my model does not depend on the length of the unemployment spell, it naturally does not reflect this mechanism. UI duration extensions can only affect reemployment wages in my model through the job search channel, which has a small positive effect.

Finally I turn to the aggregate welfare effect Ψ of the extension policy. This effect is the combination of the policy's direct effect and that from changing the stationary distribution. I find that compared to the baseline, the new steady state in the experiment slightly increases aggregate welfare by around 0.25%. This result is smaller in magnitude than those for individual workers conditional on states. I decompose it into the two aforementioned components by computing the social welfare function in Equation 16 with the counterfactual policy functions while keeping the *baseline* stationary distribution. With this approach, I can measure the aggregate welfare improvement of the policy *on impact* to be 0.32%. However, as the precautionary saving motive of workers becomes not as strong as before, they tend to hold less liquidity overall, which puts them in lower-value states and offsets parts of earlier welfare gains as the economy transitions to the new steady state. This result once again highlights the importance of the liquidity distribution in shaping workers' behaviors and welfare in my model.

7 Conclusion

In this paper I document a stylized fact using U.S. data that compared to biweekly earners, weekly earners both receive significantly less hourly wage and have lower net liquid assets on average. Using a directed labor search model with idiosyncratic unemployment risks and heterogeneity in liquidity, I show that weekly paychecks are more desired by workers facing liquidity constraints because they help smooth intra-month consumption better. The more constrained workers are, the more they prefer weekly-paying over biweekly-paying jobs even at lower wages. Paycheck frequency therefore serves as a job amenity on the labor market that is accompanied with a compensating wage differential.

Calibrating my model to the data, I can validate the quantitative importance of this novel economic channel and show that around 98% of the inter-frequency wage gap is attributable to the liquidity distribution through the compensating differential channel. A series of exploratory counterfactual exercises show that the liquidity constraint matters quantitatively for model outcomes. Extending the UI benefits potential duration can be welfare-improving with modest effects on job finding rate and reemployment wage. Incorporation of on-the-job search and workers' idiosyncratic productivity shocks might help capturing remaining within-frequency wage dispersion in the data, which is left for future work.

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A Appendix

A.1 Empirical Analysis

A.1.1 Sample

Sample Selection: I follow Zhang (2017) in sample restriction. First, I only keep households with complete and valid data on relevant variables for my analysis. Those with top-coded salary or liquid assets/borrowings are also eliminated. Next, I drop self-employed people and those working without payment or with meals as payment. I also drop people employed in armed forces, farming, forestry or fishing.

Most states in the U.S. regulate the "payday requirement," or the minimum frequency at which employees receive their paychecks within a month.[23] Due to the variation in state-level payday laws, I restrict my sample to states in which workers can freely choose between weekly and biweekly frequency. That means that I exclude the three states that only allow weekly as legal paycheck frequency: Connecticut, New Hampshire, and Rhode Island. Since paycheck frequency is specific to each worker, I only consider that of the primary earner, or the 'head', if a household has more than one working adult. This member is the one who is employed for 40 weeks or more in the past 12 months, works at least 30 hours per week on average, *and* earns more than half of the family's total income. The average share of heads' labor earnings out of total family income in the sample is around 85% for each type of paycheck frequency. Furthermore, I filter households with non-positive family income, non-positive food expenditure, or family income less than food expenditure. At individual level, non-working people not in active search for jobs as well as those outside the prime age range (between 25 and 60) are also dropped.

Calculating the relevant labor compensation for workers is complicated due to the scarcity of employment status data in the CEX. I can infer that workers are exposed to at least one period of unemployment if the number of working weeks in the year before is less than 52. Otherwise, while they might be fully employed at every week

[23]See details at https://www.dol.gov/agencies/whd/state/payday.

between the first and the fourth interview rounds, it is possible that they starts and ends the survey with two different jobs. For this reason, I compute hourly wages at the fourth interview from the last gross paycheck that workers receive, the frequency of that paycheck, and the usual number of working hours per week. If the data on last gross paycheck is not available, I impute wages from annual salary divided by the product of the usual working hours per week and the number of weeks worked in the past 12 months. While this approach ignores instantaneous changes in the intensive margin of labor supply, it provides a more accurate measure of the relevant labor earnings that I aim to capture. After this step, I truncate observations with labor earning per hour below a half of the federal minimum wage of $7.25 and censor those above $100 (adjusted to 2001 U.S. dollars). Regarding net liquidity at the last interview, I also censor those below the 1% and above the 95% percentiles.

A.1.2 Demographic Characteristics

Table A1 compares weekly and biweekly earners in my sample along certain demographic characteristics, namely average age, gender, race, education attainment, marital status, family size, and share of manual workers, i.e. those not employed as either managers, professionals, teachers, or clerical workers. In general the demographic features of my restricted sample are very similar to those of the full sample for both frequency groups. When we compare the two pay-frequency groups, there are little differences in the average age, race, marital status, and family size among workers. Meanwhile, weekly-paying jobs tend to have a higher share of male workers, and this gender gap intensifies in the restricted sample due to the consideration of only household heads. Weekly payments are also much more popular than biweekly ones among manual occupations, likely due to the high concentration of these jobs in industries with shorter pay periods such as manufacturing and construction (Burgess 2014). On a related note, the most significant difference emerges along the education dimension, in which approximately half of biweekly earners have at least a college degree while the share is only a bit more than a quarter for weekly earners.

Characteristics	*Restricted Sample* Weekly *(N=1,668)*	Biweekly *(N=4,363)*	*Full Sample* Weekly *(N=12,363)*	Biweekly *(N=27,171)*
Average age	43.62	43.18	39.47	40.90
Male share (%)	77.76	60.35	59.83	46.93
White share (%)	87.95	84.21	85.61	82.75
College Degree (%)	25.06	56.41	22.74	48.79
Married (%)	57.73	56.59	52.98	58.03
Manual occupations (%)	75.18	40.32	76.41	46.80
Family Size	2.87	2.69	3.19	2.95

Table A1: Demographic and Economic Characteristics: weekly vs biweekly
Note: Pooled CEX Interview Data 2006-2019 (Round 4). Full sample $N = 39,534$, restricted sample $N = 6,031$. Blue-collar workers include machine or transportation operators, laborers, construction and mechanics workers.

A.1.3 Regressions

I control for several potential confounding factors that might be relevant for the differences that I observe in wages and net liquidity between weekly and biweekly earners, as implied by the descriptive statistics. First, I run the following regression

$$\log(w_{it}) = \alpha_w + \beta_w D_{it}^{Biweekly} + \Gamma_w X_{it} + \epsilon_{it}^w \tag{A1}$$

where $\log(w_{it})$ is the log hourly wage of worker i who is employed at the fourth interview round in year t. The independent variable of interest, the dummy $D_{it}^{Biweekly}$, equals to 1 if the worker receives biweekly paycheck and 0 otherwise. The control vector X_{it} includes age and age squared, educational attainment, gender, race, occupation, marital status, urban residence dummy as well as year fixed effects.[24] I cluster standard errors ϵ_{it}^w at the household level, which is the sampling unit in the CEX Survey.

The baseline estimate of β_w, which is shown in the first column of Panel A in Table

[24]I do not observe the industries that workers work in. Instead, I observe the occupations, which are their specific roles at work, e.g. managers, clerical support, operators, laborers. That is however not a concern because paycheck frequency tend to be common across occupations instead of industries. An accountant in a construction firm, for example, is still more likely to get paid biweekly instead of weekly.

A2, confirms that biweekly earners receive a statistically and economically significant wage premium of 6% on average compared to weekly earners. Standard workers' observable characteristics therefore cannot fully explain the wage gap between the two frequencies. I am also interested in the heterogeneity of this wage gap along the liquidity dimension. Therefore, I run the regression again separately for two groups of households: those with positive balances on credit cards at the time of the last interview ("borrowers") and those not ("non-borrowers").[25] The results are reported in the next two column of Panel A in Table A2. As we can see, the hourly wage gap is attributable to that among households with non-zero liquid borrowings. Although both statistically significant, the magnitude of the gap among borrowers is twice that among non-borrowers. This result suggests a robust correlation between the wage gap and credit card debts.

However, for evaluating the performance of my quantitative model, I do not use estimates of β_w for the empirical wage gap. The reason is that I cannot ascertain that some parts of the errors ϵ^w are not correlated with both wages and pay frequency. This possibility increases the risk that unobserved characteristics and equilibrium effects that might bias the estimates. To effectively isolate all elements related to pay frequency from wages, I instead run the Equation A1 again *without* the dummy $D^{Biweekly}$, then calculate the gap in the residuals conditional on pay frequency.

I repeat the exercises with log net liquidity $\log(a_{it})$ at the fourth interview ("current liquidity") of worker i in time t as the dependent variable.[26]

$$\log(a_{it}) = \alpha_a + \beta_a D_{it}^{Biweekly} + \Gamma_a \tilde{X}_{it} + \epsilon_{it}^a$$

Besides earlier controls as in the wage regression equation, I also include in $\tilde{X}_{it}$ family size, number of children, wage and other incomes earned throughout the year. Moreover, I also include a dummy for whether the household owns at least one credit card. The first column of Panel B in Table A2 shows that the average gap β_a in net

[25]Out of 3,058 non-borrowers in my sample, there are 1,089 households reporting not having any credit card.

[26]I follow Lise (2013) in monotonically transforming net liquid wealth a using the formula $\log(a+\sqrt{1+a^2})$, which accounts also for non-positive values.

Panel A: Log hourly wage

	(1) Baseline (N=6,031)	(2) Borrowers (N=2,973)	(3) Non-borrowers (N=3,058)
Biweekly dummy	0.060***	0.084***	0.043**
	(0.014)	(0.020)	(0.019)
R^2	0.363	0.272	0.433

Borrowers have positive credit card balance at time of the last interview.

Panel B: Log current liquidity (N=6,031)

Biweekly dummy	0.748***	0.444***
	(0.238)	(0.148)
Log liquidity 1 year before		0.800***
		(0.010)
R^2	0.1148	0.6523

Table A2: Regression results

This table reports coefficient estimates for the dummy of a biweekly paycheck. Standard errors clustered at household level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Only workers employed at the last interview, working more than 40 weeks and more than 30 hours each week past year are included. See text for the full list of controls.

liquidity between biweekly and weekly earners stand at 75% and is significant. One might still be skeptical about endogeneity caused by unobserved heterogeneity among households. For example, if some workers are inherently more impatient than others, they might prefer a shorter pay period and at the same time hold less liquid assets. To address this possibility I re-run the previous regression and additionally control for the level of liquidity *one year* before that interview round, as in the second column of Panel B.[27] This variable indirectly takes into account any unobserved heterogeneity related to workers' savings decisions. The gap in liquidity between the two paycheck frequencies is still statistically significant, albeit with a smaller magnitude. Meanwhile R-squared increases by six times, implying that much of variations in current liquidity can be explained by those in its one-year lag.

[27]In specific, the Survey asks people only in the fourth interview about their liquid wealth and borrowings at that moment and one year before.

A.2 Quantitative Model's Equations

The following equations characterize the equilibrium in the quantitative model where each period (month) has four sub-periods (weeks). Note that firms' value functions remain the same, except with a monthly period now. The compounded interest rate $R(a)$ depends on the sign of a. The value of search to unemployed workers now depends not only on their level of liquidity a but also on whether they still have access to unemployment benefit b, i.e. $S(a,b)$ if yes and $S(a,0)$ if not. Note that every week, regardless of their employment status and unemployment benefit eligibility, workers receive a subsistence non-labor income y_{min} to keep consumption from falling to zero.

The value of search $S(a,y)$ where $y=\{b,0\}$ indicates the amount of unemployment benefit received per week is:

$$S(a,y)=\max_{\theta(w,s)} p(\theta(w,s))E(a,w,s)+[1-p(\theta(w,s))]U(a,y). \tag{A2}$$

Value of unemployment with net liquidity a and without unemployment benefit:

$$U(a,0)=\max_{\{c_{jt},a_{jt}\}_{j=1,..,4}} u(c_{1t})+\beta u(c_{2t})+\beta^2 u(c_{3t})+\beta^3 u(c_{4t})+\beta^4 S(a_{4t},0) \tag{A3}$$

s.t.

$$\begin{aligned} c_{1t}+a_{1t}&=a+y_{min}\\ c_{2t}+a_{2t}&=a_{1t}+y_{min}\\ c_{3t}+a_{3t}&=a_{2t}+y_{min}\\ c_{4t}+a_{4t}&=(1+R(a_{3t}))a_{3t}+y_{min}\\ a_{1t},a_{2t},a_{3t},a_{4t}&\geq \underline{a} \end{aligned} \tag{A4}$$

Value of unemployment with net liquidity a and weekly unemployment benefit b:

$$U(a,b)=\max_{\{c_{jt},a_{jt}\}_{j=1,..,4}} u(c_{1t})+\beta u(c_{2t})+\beta^2 u(c_{3t})+\beta^3 u(c_{4t})+\beta^4\left[(1-\pi)S(a_{4t},b)+\pi S(a_{4t},0)\right] \tag{A5}$$

s.t.

$$
\begin{aligned}
c_{1t} + a_{1t} &= a + b \\
c_{2t} + a_{2t} &= a_{1t} + b \\
c_{3t} + a_{3t} &= a_{2t} + b \\
c_{4t} + a_{4t} &= (1 + R(a_{3t}))a_{3t} + b \\
a_{1t}, a_{2t}, a_{3t}, a_{4t} &\geq \underline{a}
\end{aligned} \tag{A6}
$$

Value of employment with net liquidity a, wage w and paycheck frequency s:

$$
\begin{aligned}
E(a, w, s) = \max_{\{c_{jt}, a_{jt}\}_{j=1,..,4}} \; & u(c_{1t}) + \beta u(c_{2t}) + \beta^2 u(c_{3t}) + \beta^3 u(c_{4t}) \\
& + \beta^4 \big[\delta S(a_{4t}, b) + (1 - \delta) E(a_{4t}, w, s)\big]
\end{aligned} \tag{A7}
$$

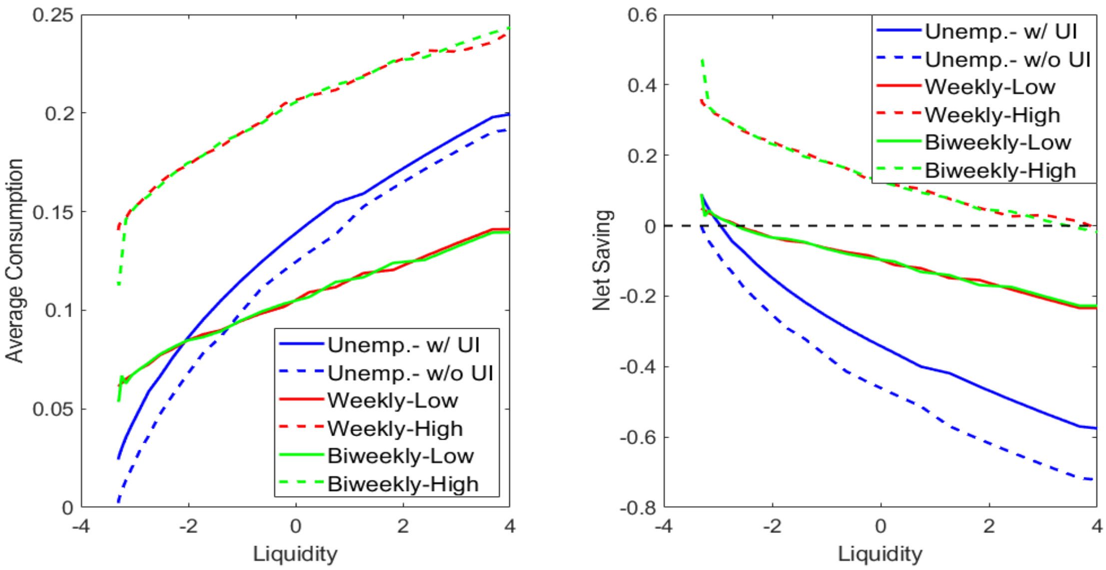
s.t.

$$
\begin{aligned}
c_{1t} + a_{1t} &= a + y_{1t}(w, s) \\
c_{2t} + a_{2t} &= a_{1t} + y_{2t}(w, s) \\
c_{3t} + a_{3t} &= a_{2t} + y_{3t}(w, s) \\
c_{4t} + a_{4t} &= (1 + R(a_{3t}))a_{3t} + y_{4t}(w, s) \\
a_{1t}, a_{2t}, a_{3t}, a_{4t} &\geq \underline{a}
\end{aligned} \tag{A8}
$$

where income $y_{jt}(w, s)$ in week j of the month depends on wage and frequency.

A.3 Consumption-Saving Policy

Figure A1a illustrates the average consumption policy in the model, which is calculated by averaging consumption over weeks, at different levels of net liquidity at the start of the month. I contrast the policies of unemployed workers (blue) against those of weekly (red) and biweekly earners (green). For each frequency type, I examine the consumption profiles at two levels of wage: low (solid) and high (dashed). Two patterns stand out. First, the slope of consumption against net liquidity is steeper for unemployed workers than in the case of employed workers, indicating a higher rate of consumption out of liquidity among the former group. Second, among employed workers near the borrowing constraint, there is a visible gap in consumption between the two frequencies. Weekly earners have a relatively higher level of consumption at all wage levels, which is due to biweekly earners' inability to smooth consumption in this region. This gap also widens at higher levels of wage, as the wealth-to-wage ratio decreases, indicating a higher need for contemporary liquidity.



(a) Consumption Policy (b) Net Saving Policy

Figure A1: Intra-month policy functions

Note: The Left Panel shows the average consumption policy of workers in different states. The Right Panel shows the period-ending net saving policy of workers in different states. Liquidity denotes the level of net liquidity a at period's beginning. Consumption is averaged across 4 sub-periods given a. Net saving denotes the difference between a and period's end net liquidity ($\Delta a = a' - a$). Black horizontal line indicates no change in liquidity. The blue curve corresponds to unemployed workers, solid lines for those with UI benefits and dashed lines for those without UI. The red (green) curve corresponds to weekly (biweekly) earners. Two levels of wage: low wage (solid red and green), high wage (dashed red and green). See text for detail.

Figure A1b plots the difference in net liquidity between the end and the start of the period, which is the net saving policy, for the same groups of workers as in Figure A1a. The horizontal zero line splits the graph into two regions: the upper part means that workers end the period having more liquidity than before, while the lower part indicates the opposite. Unemployed workers without UI benefits unequivocally draw down their wealth to smooth consumption, as the corresponding blue solid curve lies entirely below the zero line. Unemployed workers with UI and low-wage employed workers try to save near the constraint, but start dis-saving after attaining a certain level of liquidity. Meanwhile, high-wage employed workers close to the constraint save their earnings to build up their buffer stock out of precautionary motive. The higher their wages are relatively to liquidity, the more they want to save for consumption smoothing in the adverse event of job separation.

A.4 Policy Experiment Details

I show here more detail about the experiment in which I extend UI duration by 13 weeks, as discussed in Section 6. First, to demonstrate the effect of extended duration on individuals' job searching behavior net of that from the response of the liquidity distribution, I compare the searching policies of UI-receiving workers between the baseline and the experiment in Figure A2.[28] For both types of pay frequency, the searching wages in the experiment (dashed) always lie above those in the baseline (solid), conditional on net liquidity. It is clear that the UI duration extension helps dampen the precautionary searching motive, and every job seeker now targets higher-paying jobs. Moreover, the gap between targeted wages between the baseline and the experiment is larger if job seekers are nearer the borrowing limit, underlining the role of the liquidity constraint in shaping job searching behaviors.

Next, I examine how the distributions of wage and liquidity shift in response to the experiment in Figures A3 and A4, respectively. The solid lines are the baseline, while the dashed lines come from the experiment. We can see that net liquidity slightly shifts to the left in aggregate because the UI duration extension lessens the precautionary saving motive among workers. Meanwhile, the wage distribution significantly shifts to the right, as workers tend to search for higher-paying jobs.

[28]For those with expire UI benefits, the job searching policies are very similar since they are not benefiting from the extension.

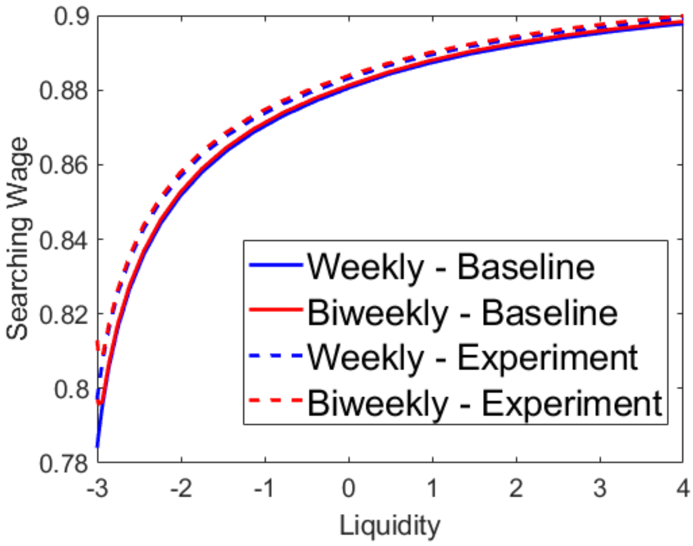


Figure A2: Searching Behaviors - Baseline versus Experiment Experiment
Note: Liquidity denotes the level of net liquidity a at period's beginning. The solid lines correspond to the baseline. The dashed line correspond to the experiment. The blue lines denote weekly-paying jobs, the red lines denote biweekly-paying jobs. See text for detail.

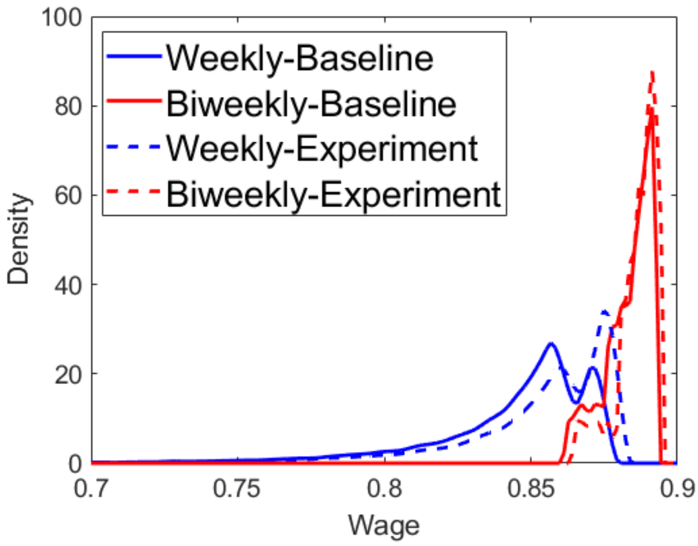


Figure A3: Wage distribution - Baseline versus Experiment Experiment
Note: The solid lines correspond to the baseline. The dashed line correspond to the experiment. The blue lines denote weekly-paying jobs, the red lines denote biweekly-paying jobs. See text for detail.

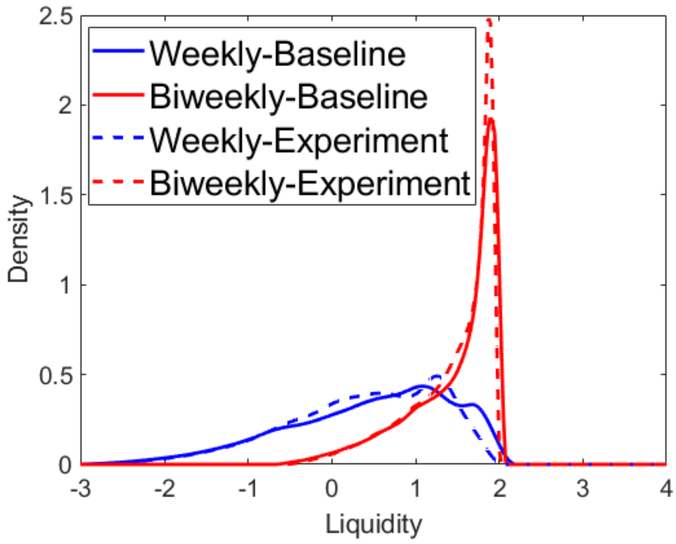


Figure A4: Liquidity distribution - Baseline versus Experiment Experiment
Note: The solid lines correspond to the baseline. The dashed line correspond to the experiment. The blue lines denote weekly-paying jobs, the red lines denote biweekly-paying jobs. See text for detail.