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

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Abstract

American workers who receive weekly paychecks tend to earn lower hourly wages and have less liquid wealth than those who earn every two weeks. I explain these stylized facts by showing, through a labor search model incorporating workers' liquid assets with potentially binding constraints, that paycheck frequency serves as a job amenity that comes with a compensating wage differential. Even though they might earn lower wages, workers with less liquidity are willing to accept jobs that pay more frequently because they help smooth consumption between weeks in a month without the need to resort to expensive loans. The distribution of liquidity in equilibrium plays a key role in underpinning the wage distributions conditional on pay frequency.

Keywords: Paycheck frequency, compensating differentials, liquidity constraint

JEL codes: E21, E24, J32, J33

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1 Introduction

Research in labor economics has traditionally focused on the differences in wages across jobs. However, recent work has started taking into account non-wage aspects of the job contract, which might be critical for workers' choices (see Maestas et al. 2023 for example). In this paper I focus on paycheck frequency as an important yet so far overlooked aspect in labor markets. The permanent income hypothesis predicts that the timing of pay should not matter as earners would simply smooth their consumption evenly between periods. However, in the presence of uninsurable idiosyncratic shocks and liquidity constraints, a higher paycheck frequency translates into better consumption smoothing possibilities and thus certainly plays a role in understanding earners' welfare.

Some important questions thus arise naturally: is there any economic mechanism linking pay frequency to cross-sectional characteristics such as wages or liquid wealth? Does pay frequency have any real effects on behaviors and outcomes on the labor market? The underlying channel might have significant implications for earnings inequality, as nearly 90% of private employees in the U.S. receive their paychecks more often than once every month (Burgess 2014), among whom biweekly and weekly are the two most common pay frequencies. Figure 1 visualizes this stylized fact with data from the Consumer Expenditure Survey (CEX) between 2006 and 2019.

The main contribution of this paper is to uncover a novel, quantitatively important dimension, namely pay frequency, that serves as an amenity when workers consider a job offer. Specifically, I find that, for workers with limited liquidity, the consumption smoothing benefit of weekly paychecks is highly valued. Given the same amount of labor earnings each month, more frequent paychecks help constrained households smooth their consumption more easily without resorting to expensive credits. Consequently, they prefer a weekly-paying job over a biweekly job, even though the former might pay a lower wage than the latter. This result explains the empirical relations observed in the data.

My study is motivated by surprising empirical observations. Using survey data I first document a stylized fact among American workers: weekly earners tend to have lower

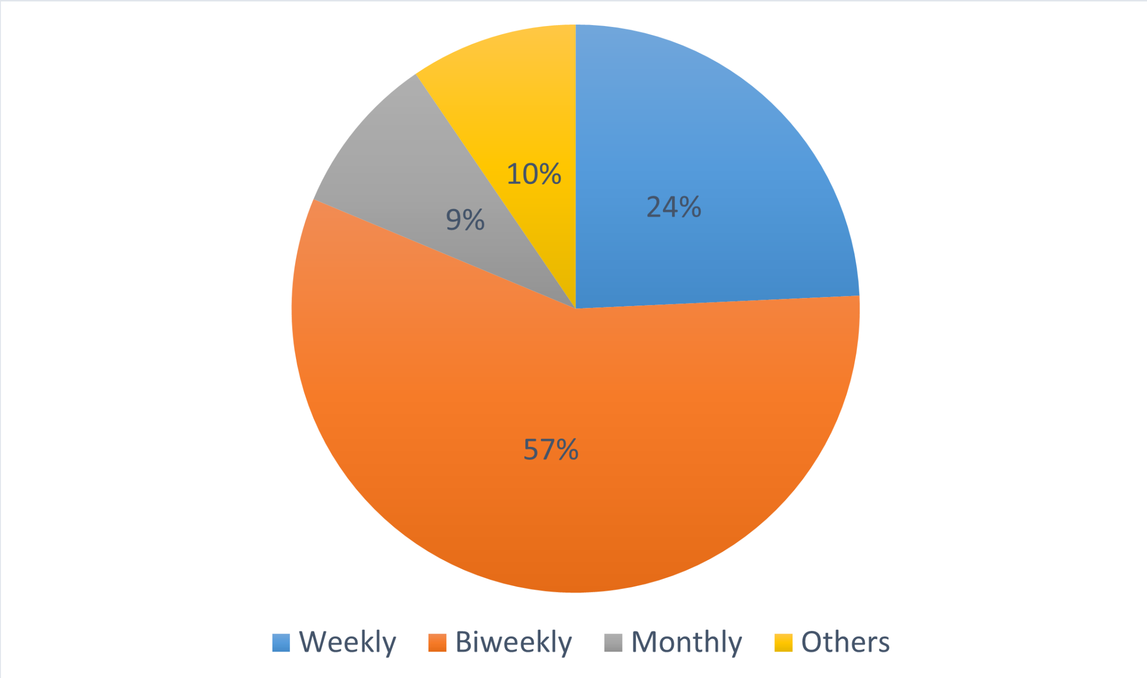

Figure 1: Shares of paycheck frequencies in the U.S.
Source: Pooled CEX Interview Data 2006-2019.

hourly wages and live in households with less net liquid wealth than biweekly earners, even after taking into account their demographic characteristics, education, and occupation. Specifically, weekly earners tend to receive a 6% lower hourly wage and have 60% less liquidity than biweekly earners on average. To investigate the channel behind this joint distribution of paycheck frequencies, earnings, and liquidity I build a standard direct labor search model with frictions and idiosyncratic employment shocks, incorporating three important extensions. First, jobs in my model are characterized by *both* wage and pay frequency and are of endogenous supply. Second, instead of behaving hand-to-mouth, i.e. consuming every period's wage completely, workers in my model are risk averse with heterogeneity in net liquid assets and potentially binding borrowing constraints. Third, to highlight the effect of paycheck frequencies, I model intra-month consumption with a time structure of multiple sub-periods inside a period.

Workers in my model start a period by drawing stochastic employment shocks and then, depending on their state, have to make consumption-saving decisions for each sub-period (week) within that period (month). If employed, they receive income in different patterns depending on their paycheck frequency. A weekly earner receives a fourth of monthly income every week, while a biweekly earner receives one half of monthly income in the second week and the other half in the last week of the month. 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 also fixed administrative and processing costs ("admin costs") associated with each paycheck, which are fully passed on by firms to workers.

In equilibrium, unemployed workers with limited liquidity optimally search for a lower wage in exchange for both a higher matching chance with a vacancy and a more frequent paycheck in order to smooth inter-temporal consumption. While the first trade-off 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 distribution of liquidity among workers plays a key role in determining the empirical wage gap between the two frequencies.

Calibrating the model to match important features of the CEX data, I can capture key empirical moments in wage, assets, and weekly earners' share among employed workers. My model, albeit parsimonious, can fully capture the wage gap between the two frequencies after controlling for other observable characteristics. I then implement two simple counterfactual exercises to illustrate policy-relevant implications of my findings. Since the main driver behind the economic channel in my model is liquidity constraints faced by workers, I alternatively ameliorate them by relaxing the borrowing constraint and increasing unemployment benefit. I find that both exercises generate quantitatively significant responses in labor earnings and net liquid wealth, underscoring the role of liquidity constraint in determining the distribution of wages over the two frequencies in equilibrium.

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 present 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. However, different from my work, both papers assume no income uncertainty in their models, which is an integral part of the labor market. Using an online account aggregator's micro data, Baugh & Correia (2022) also test their theoretical predictions and 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.

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 this paper aims to fill in the gap.

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 (2023) 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 generates sizable wage dispersion 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 explain the theoretical model and characterize the equilibrium analytically. In section 4, I extend the model for quantitative analysis and discuss calibration results. Section 5 provides counterfactual exercises. Finally, section 6 concludes.

2 Data and Empirics

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. To the best of my knowledge, the CEX is the only public micro dataset with useful information about this aspect.[1] 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.

[1]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 term of either hourly or annual pay. Both are not useful for my analysis.

2.1 Sample Data

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.[2] 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. 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 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

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

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 drop observations with labor earning per hour below a half of the federal minimum wage of $7.25 or above $100 (adjusted to 2001 U.S. dollars).

In the end, my sample has 4,037 household heads, among whom there are 1,040 weekly earners and 2,997 biweekly earners in their corresponding fourth interview. For further analysis, I use only the fourth interview instead of exploiting the panel structure of the dataset because information about liquidity is only available in this round.

2.2 Descriptive Analysis

Table 1 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 appears in education, 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.

Next I examine hourly wage and net household liquidity for the two pay frequencies in my restricted sample, conditional on workers being classified as employed by the fourth interview. All monetary values are measure in 2001 U.S. dollars, adjusted by

Characteristics	*Restricted Sample* Weekly *(N=1,040)*	*Restricted Sample* Biweekly *(N=2,997)*	*Full Sample* Weekly *(N=12,363)*	*Full Sample* Biweekly *(N=27,171)*
Average age	43.82	43.01	39.47	40.90
Male share (%)	78.08	59.73	59.83	46.93
White share (%)	88.27	85.32	85.61	82.75
College Degree (%)	26.73	58.69	22.74	48.79
Married (%)	59.04	56.76	52.98	58.03
Manual occupations (%)	72.88	39.17	76.41	46.80
Family Size	2.90	2.68	3.19	2.95

Table 1: Demographic and Economic Characteristics: weekly vs biweekly
Note: Pooled CEX Interview Data 2006-2019 (Round 4). Full sample $N = 39,534$, restricted sample $N = 4,037$. Blue-collar workers include machine or transportation operators, laborers, construction and mechanics workers.

annual CPI. 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. 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.

I describe in Table 2 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 25%-lower end, but higher positive net liquidity along the rest of the spectrum. If we look closer at liquid wealth and liquid borrowing separately, most of the discrepancies in net liquid assets can be attributed to biweekly earners having relatively higher liquid wealth than weekly ones, while the differences in loans among those who borrow are not very large.[3] I confirm this impression by carrying

[3]In my sample 67% of weekly earners and 70% of biweekly earners report having some liquid

out mean-comparison tests between the two frequency groups for liquid wealth and liquid borrowing (see Table 7 in the Appendix).

However, keep in mind that the differences in liquid borrowing might also reflect the variations in credit limits among workers, which is endogenous to their earnings. 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 two rows of Table 2. 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 zero net liquidity, the biweekly counterpart still has a buffer stock worth around 15 hours of labor.

	Frequency	**p-10**	**p-25**	**p-50**	**p-75**	**p-90**
Hourly wage	Weekly	8.18	10.84	14.94	20.43	27.93
	Biweekly	9.32	12.92	18.71	26.80	35.47
Net liquidity (in level)	Weekly	-8,388	-2,432	0	1,514	10,607
	Biweekly	-10,054	-2,184	236	6,305	32,892
Liquid wealth (+)	Weekly	0	147	814	3,194	12,978
	Biweekly	8	424	1,902	8,674	35,842
Liquid borrowing (-)	Weekly	0	0	864	4,446	10,731
	Biweekly	0	0	1,176	5,144	13,459
Net liquidity (in hourly wage)	Weekly	-496.8	-158.3	0	92.0	591.4
	Biweekly	-507.8	-123.5	15.5	308.0	1,374.6
Net liquidity (in last paycheck)	Weekly	-10.9	-3.3	0	2.1	11.9
	Biweekly	-5.9	-1.4	0.2	3.5	15.9

Table 2: 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. In the last four rows, I express net liquidity as a fraction of hourly wage and of the last paycheck, respectively. $N_{Weekly} = 1,040$, $N_{Biweekly} = 2,997$.

borrowing at the time of the fourth interview.

2.3 Regressions

The next step in my analysis is to control for several potential confounding factors that might be relevant for the differences that we observe in wages and net liquidity between weekly and biweekly earners, as implied by the descriptive statistics. The following regressions do not suggest causality, given that no credible exogenous variations are available in the data, but rather make workers with different paycheck frequencies as comparable as possible. First, I regress log hourly wage of workers employed at the time of the fourth interview on their pay frequency dummy, controlling for a set of demographic and socioeconomic variables. Specifically, controls include age and age squared, educational attainment, gender, race, occupation, marital status, urban residence dummy as well as year fixed effects.[4] I cluster standard errors at the household level, which is the sampling unit in the CEX Survey.

The baseline results, which are shown in the first column of Panel A in Table 3, confirm 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").[5] The results are reported in the next two column of Panel A in Table 3. On average biweekly earners have higher hourly wages than weekly earners in both sub-samples, but the wage premium is only statistically significant for borrowers. This result suggests a robust correlation between the wage gap and credit card debts.

[4] Unfortunately, I cannot 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.

[5] Out of 1,239 non-borrowers in my sample, the majority are households reporting not having any credit card with 1,188 counts.

Panel A: Log hourly wage

	(1) Baseline (N=4,037)	(2) Borrowers (N=2,798)	(3) Non-borrowers (N=1,239)
Biweekly dummy	0.060***	0.071***	0.036
	(0.017)	(0.020)	(0.031)
R^2	0.342	0.272	0.451

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

Panel B: Log current liquidity (N=4,037)

Biweekly dummy	0.901***	0.621***
	(0.295)	(0.214)
Log liquidity 1 year before		0.705***
		(0.013)
R^2	0.2371	0.6064

Table 3: Regressions on paycheck frequency

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. Controls in Panel A are age, age squared, gender, education, occupation, race, marital status, urban residence dummy, and year fixed effects. Controls in Panel B include those and family size, number of children, credit cards ownership dummy, last year wage.

I repeat the exercises with net liquidity at the fourth interview ("current liquidity") as the dependent variable.[6] Besides earlier independent variables, I also control for family size, number of children, and the wage 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 3 shows that the average gap in net liquidity between biweekly and weekly earners stand at more than 90% 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.[7] This variable indirectly takes into account any unobserved heterogeneity

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

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

related to workers' savings decisions. The gap in liquidity between the two paycheck frequencies is still statistically significant, albeit with a smaller magnitude of 62%. Meanwhile R-squared increases by three times, implying that much of variations in current liquidity can be explained by those in its one-year lag.

Overall, 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 conjecture 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. The model also offers me the framework for further quantitative analysis when I bring theory to the data.

3 Stylized Model

In this section I provide a parsimonious model of a labor market with job heterogeneity in wages and pay frequencies. I intentionally keep it 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.

3.1 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.[8]

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

Agents: Workers are risk averse and make consumption decision every period 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 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.[9]

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*, the worker receives a half of her periodic wage every sub-period; if paid *biweekly*, she receives 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 an employed worker faces an exogenous risk δ $(0 < \delta < 1)$ of being separated from the current job at the beginning of each period. She then can start searching for a new job immediately. If the search is successful, she would be employed in the new job in the same period. Otherwise, she would become unemployed until the next period starts, when she can search again. On the firms side, each unmatched

[9]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.

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 linear *admin cost* function $\phi(s)$. Firms have to pay a constant ϕ every month for a biweekly-paying position and a double of that amount, i.e. 2ϕ, for a weekly one. These costs are internalized by firms when they post wages.

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 quits or on-the-job search.

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:

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

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.[10] Every period unmatched firms decide on the optimal submarket (w, s) to post a vacancy. The value of opening a vacancy is:

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

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

It is straightforward to see that firms stick to a submarket until the vacancy is filled. 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 Analysis

Firms' solution: 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:

$$V = 0$$

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. $\frac{\partial \theta(w_s^*)}{\partial w} < 0$.[11] 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 opening submarket that pays wage w_W^* at weekly frequency, there exists an equivalent biweekly-paying submarket in the sense that firms are indifferent between them, which is characterized by wage w_B^* that 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 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.

Workers' solution: I proceed in two steps. First, I derive workers' optimal consumption decisions, taking their employment status and income as given. Then, 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 first order conditions are:

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

where inequality holds if the corresponding borrowing constraint binds. In addition,

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

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 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 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 high wage-to-liquidity ratio, who have to wait until the second sub-period to collect their earnings.

Equilibrium Characterization: To solve for 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 is common in the existing literature: 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, liquidity constrained workers will also direct their search to weekly-paying jobs with lower wages. To see why, consider a unemployed worker facing potentially binding constraints who can direct her search to jobs with different paycheck frequencies. For this worker, conditional on the same level of wage, the potential gain from employment $E(a, w_s, s)$ in the weekly-paying job is always higher than that in the biweekly-paying job, as she still has to wait until the second week for her first paycheck in the latter case. To keep the balance in equation 12, she demands a relatively higher wage for biweekly frequency. Figure 7 in the Appendix illustrates this trade-off. For a constrained worker, at lower levels of wage, an additional dollar given to wage is valued considerably less in a biweekly-paying job compared to a weekly-paying job. 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.

Finally, plugging the expression of $p(\theta_s(w_s))$ into equation 12 we can simplify it to

$$\left(\frac{\partial \theta(w_s)}{\partial w} + \frac{\theta(w_s)}{x - \phi(s) - w_s} \right) [E(a, w_s, s) - U(a)] + \theta(w_s) E_w(a, w_s, s) = 0 \tag{13}$$

which governs the optimal search strategy of unemployed workers with net liquidity a.[12] The solution $w_s^*(a)$ to condition 13 exists for every open submarket due to continuity of the objective function 1. There also exists a region $\mathcal{A}$ of liquidity a in which workers can optimally search for jobs of either frequencies. Let $w_s^*(a)$ be the search policy that satisfies condition 13 for $s = \{W, B\}$, the following equation holds

[12]In specific, $\frac{\partial p(w_s)}{\partial w} = \frac{\hat{\kappa}}{x - \phi(s) - w_s} \frac{\partial \theta(w_s)}{\partial w} + \frac{\hat{\kappa} \theta(w_s)}{(x - \phi(s) - w_s)^2}$.

for every $a \in \mathcal{A}$

$$p(\theta(w_W^*))[E(a, w_W^*, s = W) - U(a)] = p(\theta(w_B^*))[E(a, w_B^*, s = B) - U(a)]. \quad (14)$$

Workers are indifferent between these two wage policies as long as both submarkets are open, because searching in any of them yields the same expected value. More excess value of employment relative to unemployment in one submarket compared to that in the other is offset by a lower matching rate.

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 submarket $(w, s) \in \Theta$,
- 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 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, while biweekly earners do so twice per month on the *second* and *fourth* week. On the firms side, production and vacancies posting decisions now occur at the beginning of every month. Paying a work every week costs firms 4ϕ per month to process, while biweekly paycheck costs 2ϕ. Second, 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, 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. The equations characterizing workers' value functions are in the Appendix.

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 externally calibrate a set of parameters using the benchmarks in other quantitative studies and 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 .

Labor market dynamics: 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 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 13 for job searchers and solve for the solution numerically.

I set the matching elasticity η to 0.6, which lies between the values of 0.41 estimated by Eeckhout & Sepahsalari (2023) and 0.65 by Chaumont & Shi (2022).

Wages and unemployment benefits: I normalize the support of monthly wages to be between 0.05 and 2. Note that because I focus on a subset of the working population in the U.S., the equilibrium wage distribution in my model, which is fully endogenous to firms' decision, might never reach these bounds. Firms' monthly output x is chosen to be 2.5. This implicitly puts a limit on maximum admin costs per paycheck, which is calibrated internally later.[13] Hornstein et al. (2011) estimate the mean-min ratio of the wage distribution in the U.S. to be between 1.7 and 2. Using the larger of these two numbers and the estimate that average replacement rate of unemployment insurance is 40% (Shimer 2005) , I can set the benefit flow to be $b = \frac{0.05\times 2\times 0.4}{4} = 0.01$ per week.

Assets: Net liquid assets are defined as in Section 2. I trim the bottom and top 0.5% tails of the net liquidity distribution to drop outliers. Regarding interest rates, given zero nominal return on liquid assets and a consistent inflation rate of 2% during the sampled period, the real return rate is −2%, and I set $R(a^{+}) = -0.17\%$ as the corresponding monthly rate. Liquid borrowings are assumed to be non-collateral credit card debts. The Federal Reserve's Consumer Credit Release (Fed G.19)[14] reports that the average interest rate on revolving consumers' debts is 14% per annum, so I set the monthly rate $R(a^{-}) = 0.95\%$ after adjusting for inflation. Last, I set the borrowing limit $\underline{a} = -2$, or one month worth of the maximum wage.

Other parameters: I jointly calibrate five remaining parameters $\{\beta, \beta_F, \chi, \kappa, \phi\}$ by targeting five empirical moments from the sample: the average ratio of net liquidity to

[13]Specifically, the admin costs should not exceed $\frac{2.5-2}{4} = 0.125$ for the flow value of a weekly-paying job with maximum offered wage to firm to remain non-negative.

[14]See https://www.federalreserve.gov/releases/g19/current/.

monthly wage for all employed workers, ratios of the $75th$-percentile, $25th$-percentile, and mean of weekly earners' wage to those of biweekly ones, as well as the *fraction* of weekly earners among employed workers. The choice of these moments invites a discussion. First, discount rate β governs inter-temporal consumption smoothing and thus directly corresponds to the level of net liquidity normalized by income. Next, the admin costs ϕ imposes a meaningful difference between the two paycheck frequencies from firms' perspective, regulating the share of weekly earners in equilibrium. Finally, the three parameters (β_F, χ, κ) jointly determine the matching rates in my model, thus affecting the differences between frequencies across the wage distributions.

	Externally Calibrated	
Parameter	**Value**	**Source**
Risk aversion σ	2	standard
Separation rate δ	0.026	10% quarterly rate (Chaumont & Shi 2022)
Credit limit $\underline{a}$	-2	one max monthly wage
Saving rate $R(a^+)$	0.17%	annual bond rate 2%
Borrowing rate $R(a^-)$	0.95%	average annual card debts rate 14%
Unemployment benefit b	0.01	40% replacement rate (Shimer 2005)
Matching elasticity η	0.6	from literature, see text
	Internally Calibrated	
Parameter	**Value**	**Target**
Workers' weekly discount factor β	0.993	Mean net liquidity/monthly wage
Firms' monthly discount factor β_F	0.985	P75 w_W/P75 w_B
Matching efficiency χ	0.463	Mean w_W/Mean w_B
Vacancy posting flow cost κ	0.869	P25 w_W/P25 w_B
Admin cost per paycheck ϕ	0.004	Share of weekly earners

Table 4: Model parameters
Px denotes the x-th percentile value. w_W is hourly wage of weekly earners. w_B is hourly wage of biweekly earners.

Estimation: 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 asset distribution.[15] I minimize the distance between model-implied moments and empirical

[15] I assume that everyone starts with zero wealth in the first period.

moments to calibrate those parameters. For the stationary equilibrium, I keep only the last 12 months and take averages of moments across periods and simulations. All data moments come from the corresponding residuals of regressions on wage and liquidity after controlling for observable characteristics.[16] Table 4 summarizes the calibrated parameters and their sources and targets.

Overall the externally calibrated parameters fall within reasonable ranges. Discount factors β of workers and β_F of firms are close to the standard estimation in the literature, with firms being almost as patient as workers. The flow cost of vacancy is 0.87, or 34% of firms' flow output when matched, which is larger than the estimated ratio of 21% in Eeckhout & Sepahsalari (2023). Admint cost per paycheck stands at 0.004, translating into a monthly difference in costs of 0.008 between weekly and biweekly patterns. This amount is significant, only slightly less than the weekly unemployment benefit b.

4.3 Model fit

Targeted moments: The upper part of Table 5 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 features of the data. The targeted moments are close to their empirical counterparts. The ratio between net liquidity and hourly wage is overstated by the model, but not by a large margin. The gap between two frequencies at the respective 75th percentiles is slightly larger in the data than in the model. This result is unsurprising, given that my model is relatively parsimonious. Nevertheless, the average wage gap between the two frequencies in the data, after controlling for potential confounders, can be almost fully explained by my model.

Non-targeted moments: To further validate the performance of my model against the data, I also examine moments of the net liquidity gap across different percentiles, which I do not target for calibration. The model moments are close to those in the

[16]Except for paycheck frequency, controls are similar to those in the reduced-form regressions in Section 2. The regression for net liquidity also omits hourly wage as a regressor. Residuals are then obtained separately for each frequency group.

Targeted Moments	Model	Data
Median liquidity/wage	1.280	1.006
P75 w_W/P75 w_B	0.96	0.92
Mean w_W/Mean w_B	0.95	0.96
P25 w_W/P25 w_B	0.94	0.95
% weekly earners	27.2%	25.8%
Non-targeted moments	**Model**	**Data**
P75 a_W/P75 a_B	0.93	0.95
P50 a_W/P50 a_B	0.92	0.89
P25 a_W/P25 a_B	0.90	1.03

Table 5: Moments - Model versus Data
Px denotes the x-th percentile value. w_W (a_W) is hourly wage (net liquidity) of weekly earners. w_B (a_B) is hourly wage (net liquidity) of biweekly earners.

data. Net liquidity of weekly earners are higher than that of biweekly earners in the data, while it is the reverse case in the model. This discrepancy can be explained by the fact that I assume an ad hoc, exogenous borrowing constraint $\underline{a}$ for everyone in my model, while in reality the constraint might vary across workers, depending on their earnings. Nevertheless, my model is still doing well in matching important dimensions in the data. This result allows me to proceed with my quantitative analysis in the next section.

5 Quantitative Results

5.1 Policy Functions

Saving decisions: Figure 2 illustrates the average consumption policy in the model at different levels of net liquidity at the start of the month. I contrast the policies of unemployed workers against those of weekly and biweekly earners. For each frequency type, I examine the consumption profiles at three level of wage: low, medium, and high. 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 cash-on-hand among the former group. Second, among constrained workers, there is a visible gap in consumption between the two frequencies, which is due to biweekly earners' inability to smooth consumption in this region. This gap widens at higher levels of wage, as the wealth-to-wage ratio increases, indicating a higher need for liquidity.

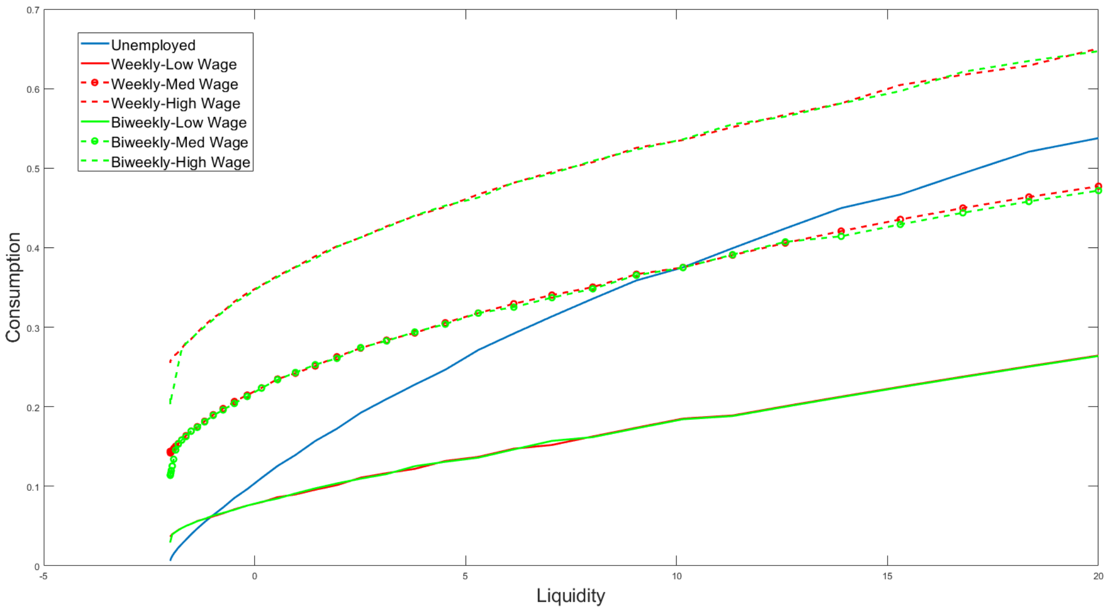

Figure 2: Consumption Policy - by wage

Liquidity denotes the level of net liquidity a at period's beginning. Consumption denotes consumption policy averaged across 4 sub-periods given a. The blue curve corresponds to unemployed workers. The red (green) curve corresponds to weekly (biweekly) earners. Three levels of wage: low wage (solid), medium wage (dash with dots), high wage (dash).

Figure 3 plots the difference in liquidity between the end and the start of the period for the same groups of workers as in Figure 2. 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 unequivocally tap into their wealth, as the corresponding blue curve lies entirely below the zero line. Meanwhile, employed workers close to the constraint, except at low wage, 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.

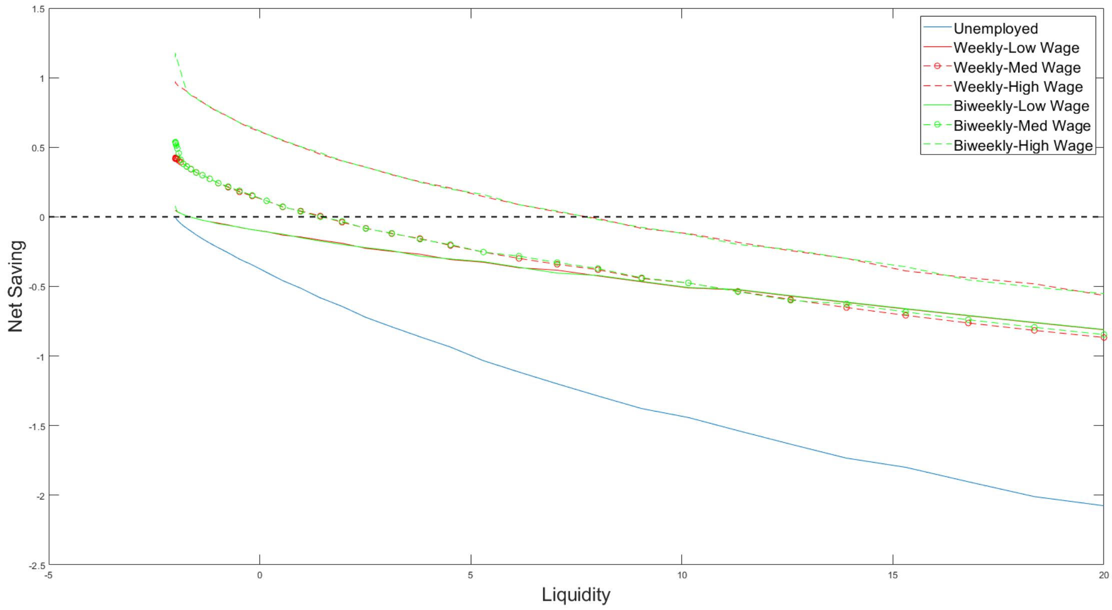

Figure 3: Net Saving Policy - by wage
Liquidity denotes the level of net liquidity a at period's beginning. Net saving denotes the difference between a and period's end net liquidity ($\Delta a = a' - a$). Black horizontal line indicates no change in liquidity. The blue curve corresponds to unemployed workers. The red (green) curve corresponds to weekly (biweekly) earners. Three levels of wage: low wage (solid), medium wage (dash with dots), high wage (dash).

Job search decisions: Next, I observe the searching behaviors of workers with different levels of liquidity. In Figure 4 I plot the sub-markets that unemployed workers with particular net liquidity search in, each indexed by wage on the vertical axis and paycheck frequency (blue curve for weekly, red curve for biweekly). Going along the liquidity dimension from left to right we can notice three distinct regions. First, workers near the constraint only search for weekly-paying jobs, since no biweekly ones pay high enough to compensate for the lack of consumption smoothing that they face. The next region is where both curves exist. At any level of liquidity in this region, workers are indifferent between the two jobs with different pay frequencies. However, biweekly offers have slightly higher wages than those of weekly ones, denoting a higher matching rate for the latter conditional on wages (see Figure 5). Last, for workers with considerable liquidity, the consumption smoothing advantage of more frequent paychecks vanishes, as they can always tap on their wealth. Since wages searched by those are relatively high, firms are reluctant to offer weekly-paying jobs that come with more admin costs eating up their profits. As a result, workers only search for biweekly-paying jobs in this region. Overall frequency serves as a job amenity on the labor market for liquidity constrained workers, enticing them into weekly- yet lower-paying jobs. This channel is quantitatively important, explaining the wage gap between the two frequencies observed in the data.

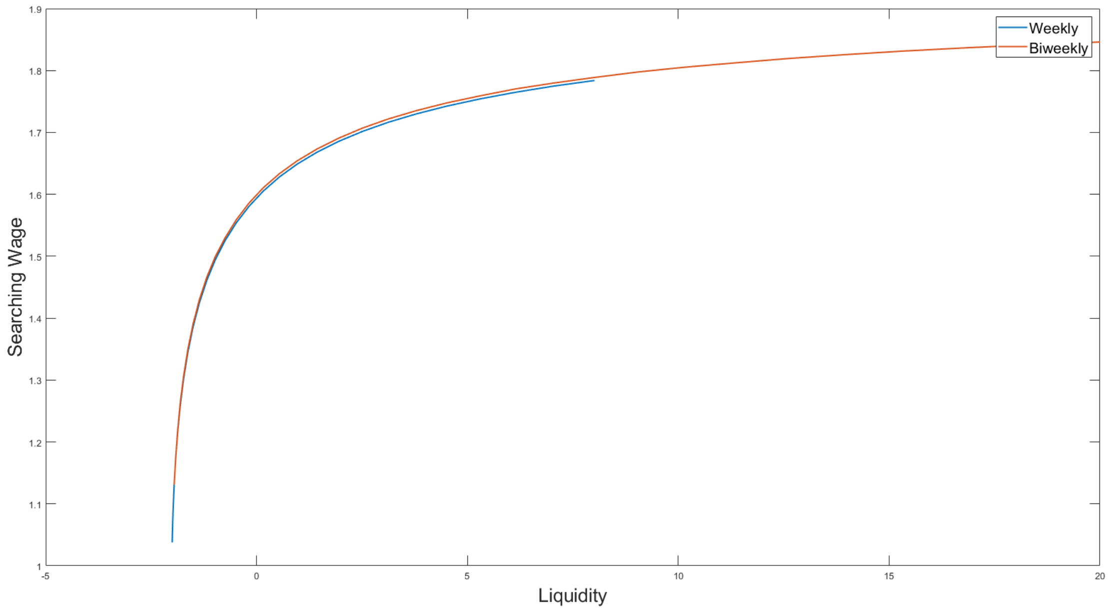

Figure 4: Job Search Policy
Liquidity denotes the level of net liquidity a at period's beginning. The blue (red) curve corresponds to the search wage of weekly (biweekly) paying jobs.

5.2 Effects of Liquidity Constraints (Preliminary)

To study the role of liquidity constraints in equilibrium, I alternatively conduct two counterfactual exercises that both aim at relaxing these constraints. First, I double the capacity of workers to borrowing to twice maximum monthly wage, i.e. $\underline{a} = -4$.

Second, I double the amount of weekly unemployment benefit, i.e. $b = 0.02$.[17] All other parameters are fixed at the calibration benchmark. The relating moments are shown in Table 6.

	Baseline	**More borrowing**	**More benefit**
Targeted Moments			
Median liquidity/wage	1.280	1.251	1.411
P75 w_W/P75 w_B	0.96	0.95	0.95
Mean w_W/Mean w_B	0.95	0.93	0.92
P25 w_W/P25 w_B	0.94	0.91	0.91
% weekly earners	27.2%	15.6%	17.5%
Non-targeted moments			
P75 a_W/P75 a_B	0.93	0.89	0.86
P50 a_W/P50 a_B	0.92	0.88	0.84
P25 a_W/P25 a_B	0.90	0.86	0.81

Table 6: Moments - Counterfactuals

Px denotes the x-th percentile value. w_W (a_W) is hourly wage (net liquidity) of weekly earners. w_B (a_B) is hourly wage (net liquidity) of biweekly earners. The first exercise doubles borrowing constraint. The second exercise doubles unemployment benefit. See text for details.

It is noticeable that relaxing liquidity constraint, either by enabling more borrowing or giving more unemployment benefit, significantly reduces the share of weekly earners in the economy compared to the baseline. As the need for liquidity lessens, workers can smooth intra-month consumption more easilty, and the share of weekly earners drop from more than 27% in the basline to between 15 and 18% in my exercises. Meanwhile, liquidity and wage distributions are both different from those in the baseline. The gaps in wage and liquidity are wider between the two frequencies, indicated by universally lower ratios at different percentiles along the spectrum.

The relative changes in wage ratios are similar in both exercises, with a larger drop towards the lower end of the distribution (from 0.94 to 0.91 at the 25th percentile). Weekly workers become clearly wage-poorer when constraints are relaxed, as only those with low liquidity and relatively less attractive outside options search for weekly-paying jobs at wage discount now. On the other hand, there are larger drops in liq-

[17]Since I do not include the government in my model, I assume that the more generous benefits are financed by a lump sum tax on firms' absentee owners that does not distort entry decisions.

uidity ratios when allowing more benefit compared to when allowing more borrowing. The difference between the two outcomes can be explained by the fact that workers in the second exercise, thanks to more generous benefits, rely less on their liquidity stock to smooth consumption, thus having less precautionary saving incentives. Overall these results are in line with the main predictions of my model.

6 Conclusion

In this paper I explore the empirical association between paycheck frequency, wages, and liquidity among American workers and find that, compared to biweekly earners, weekly earners both receive less hourly wage and have lower net liquid assets on average. Using a competitive labor search model with idiosyncratic unemployment risks and heterogeneity in liquidity, I show that, given the same amount of monthly labor earnings, 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 are willing to accept weekly-paying jobs even at lower wages. Frequency therefore serves as a job amenity on the labor market that is accompanied with a compensating wage differential. Calibrating my model to the CEX data, I can validate the quantitative importance of this novel economic channel and capture key empirical moments in wage and liquidity distributions observed. Two exploratory counterfactual exercises that relax the liquidity constraints show significant responses of both wage and liquidity gaps in equilibrium.

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A Appendix

A.1 Graphics

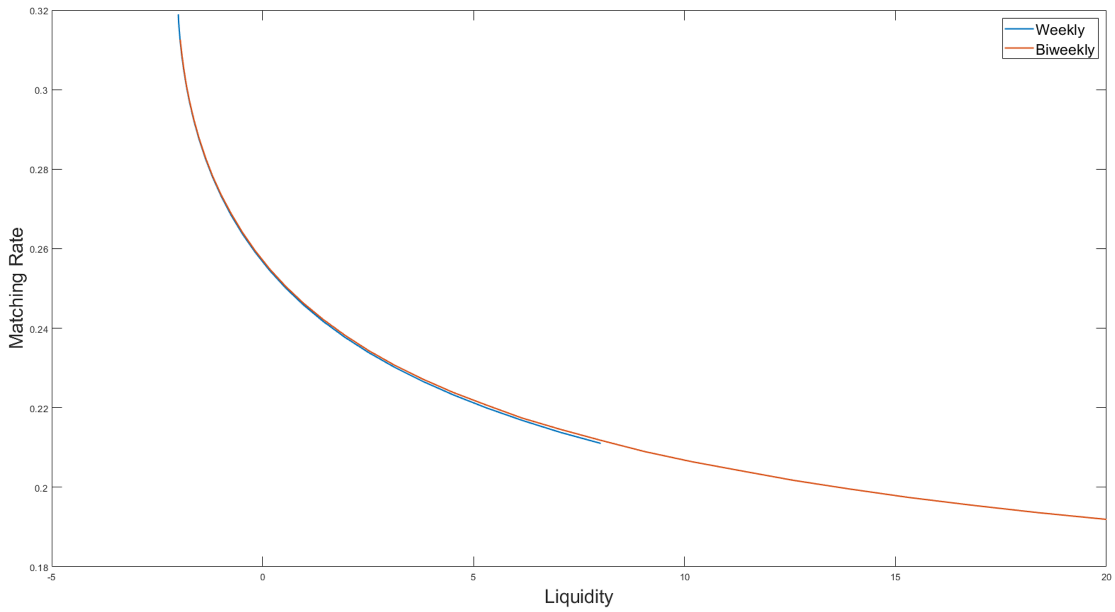

Figure 5: Matching probabilities of optimal searching policies
Liquidity denotes the level of net liquidity a at period's beginning. The blue (red) curve corresponds to the search wage of weekly (biweekly) paying jobs.

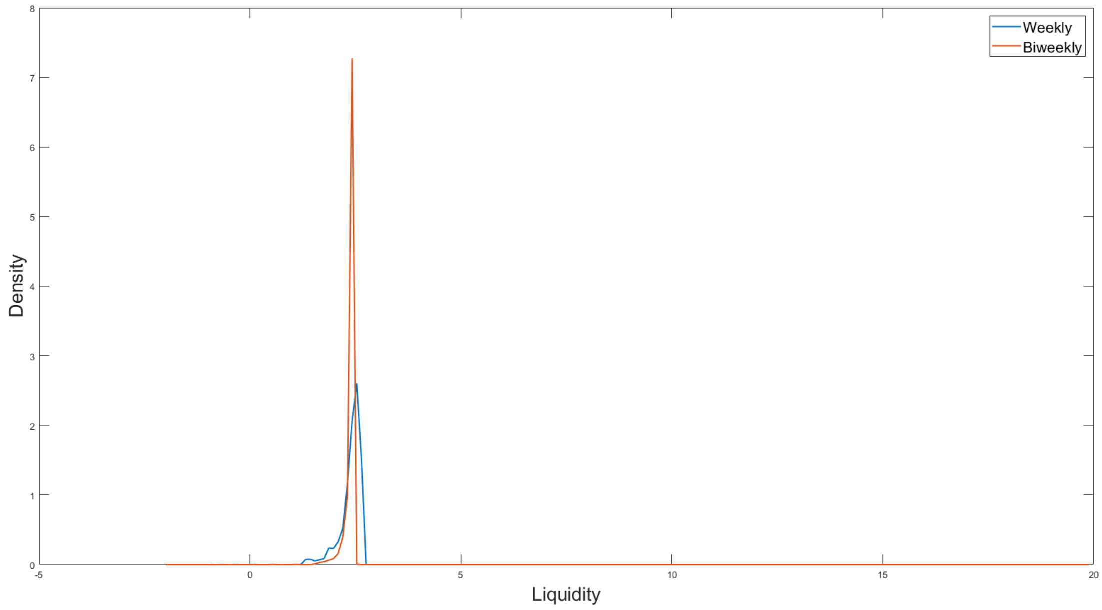

Figure 6: Distribution of Liquidity in Equilibrium - Model
The blue (red) line corresponds to the density function of weekly (biweekly) earners' liquidity.

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.

Value of unemployment with net liquidity a:

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

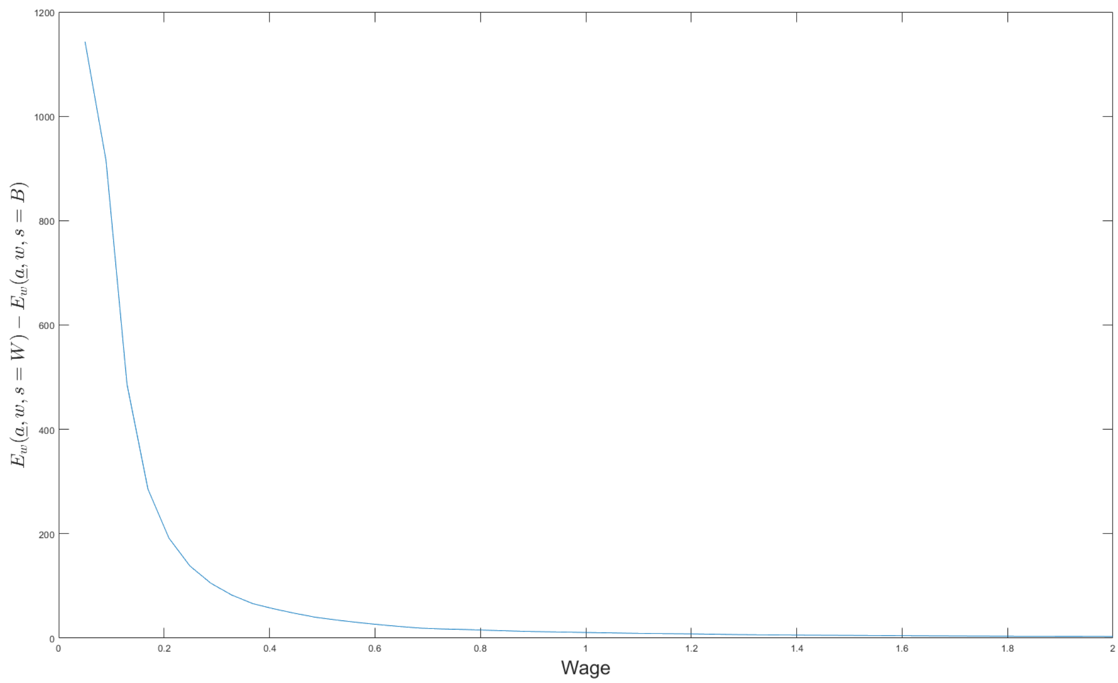

Figure 7: Gap in Marginal Value of Employment with respect to wage between two frequencies
Marginal value observed at the borrowing constraint $\underline{a}$. $E_w(\underline{a}, w, s = W)$ is the marginal value of the weekly-paying job. $E_w(\underline{a}, w, s = B)$ is the marginal value of the weekly-paying job.

s.t.

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

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

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

s.t.

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

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

A.3 Mean comparison tests

	Mean difference	Standard error	t-test statistics	N
Liquid wealth	-8,470.4***	1,401.0	-6.05	4,037
Liquid borrowing - All	-1,142.7**	324.2	-3.52	4,037
Liquid borrowing - Only borrowers	-1,385.7**	450.0	-3.08	2,798

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Mean comparison tests for liquid wealth and liquid borrowing

A.4 Computational Algorithm

First, I discretize the state space (a, w, s) as a grid $\mathbf{S}$ of size $(na \times nw \times ns)$, in which $na = 40$, $nw = 50$, and $ns = 2$. I solve for the stationary equilibrium numerically on this grid using the following algorithm.

1. Guess the wage searching policy $w_s^0(a)$ of workers
2. Calculate the corresponding labor market tightness $\theta(w_s^0(a))$ from equation 8 as well as the matching rate $p(\theta)$
3. Guess workers' value functions $E_0(a, w, s)$ and $U_0(a)$ across the grid $\mathbf{S}$
4. Use VFI to iterate until value functions $U(a)$ and $E(a, w, s)$ converge, holding

searching policy $w_s^0(a)$ constant. We also get the policy functions for consumption.

5. Given market tightness and value functions, for every node a, calculate the corresponding wage policy $w_s^1(a)$ from equation **??** with a numerical solver.

6. Check convergence between $w_s^1(a)$ and $w_s^0(a)$. Update if not converged and return to step 1.

Notice that step 5 involves the knowledge of $E_w(a, w, s)$, which we can easily get from iterating on the equations 11. Since the optimal searching wage $w_s^*(a)$ can be off the grid, this step involves interpolation over the wage dimension. In case of no solution, we conclude that no firms post vacancies targeting workers at those respective levels of wealth.

To calculate the model moments, I simulate the economy with $N = 20,000$ workers for $T = 600$ months by $S = 10$ times. For each simulation, I only use the last 60 periods for calculating the steady state equilibrium to avoid initial condition dependence. The final moments are averaged over simulations.