Paycheck frequencies, wages, and the need for liquidity of workers in the U.S.*

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Job Market Paper

Abstract

American workers who receive weekly paychecks tend to earn lower hourly wages and have less liquid wealth than those who are paid every two weeks. I explain these stylized facts by showing, through a labor search model incorporating workers' liquid assets, that frequency serves as a compensating differential on the labor market. Workers with less liquidity are willing to accept jobs that pay more frequently in exchange for lower wages, because the frequent payments help them smooth their consumption within 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. Calibrating the model to U.S. data, I find that administrative costs for processing each paycheck is around 2.6% of the median workers' weekly wage, explaining approximately 8% of the wage gap between weekly and biweekly earners.

Keywords: Paycheck frequency, labor search, liquid assets

JEL codes: E21, E24, J32, J33

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1 Introduction

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[1], as shown in Figure 1 with data from the Consumer Expenditure Survey (CEX) between 2010 and 2018. Theoretically speaking, if the market for state-contingent claims is complete, the permanent income hypothesis implies that pay frequencies 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 and thus certainly plays a role in understanding workers' welfare. A question thus arises naturally: is there any economic mechanism linking pay frequency with cross-sectional characteristics such as wages or liquid wealth that entices workers to opt for some particular pay patterns? This question is important as the underlying, so far overlooked channel might have significant implications for both welfare and inequality analyses.

In this paper I first document a stylized fact among American workers: weekly earners tend to have lower hourly wages and live in households with less net liquid wealth than biweekly earners, even after taking into account their demographics, education, and occupation. To investigate the channel behind this joint distribution of paycheck frequencies, earnings, and liquidity I build on a McCall-class labor search model with three important extensions. First, while traditional models generally determine the

[1] I do not differentiate between biweekly and semi-monthly jobs 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. Looking at these two frequencies separately does not change the distribution substantially.

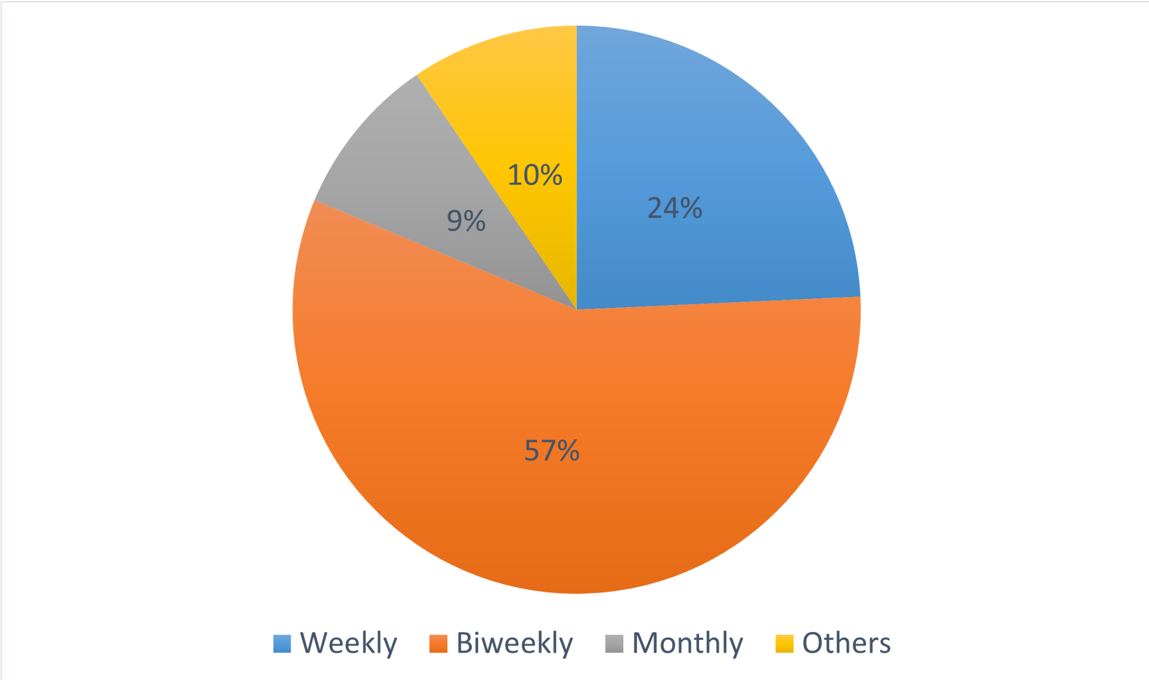

Figure 1: Shares of paycheck frequencies
Pooled CEX Interview Data 2010-2018

value of a job solely by the dimension of wage for simplicity, jobs in my model are characterized by *both* wage and pay frequency. 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. Third, to highlight the effect of paycheck frequencies, I incorporate intra-month consumption with realistic borrowing constraints and uninsurable idiosyncratic employment risks. Workers start a period either employed or unemployed by drawing stochastic shocks and then, depending on their state, have to make consumption-saving decisions for each sub-period within that period. If unemployed, they have a chance of receiving a job offer in the form of a wage-frequency bundle. Otherwise, they can receive income in different patterns depending on their paycheck frequency. There are also administrative and processing costs (from here on "admin costs") associated with each payroll, which are fully passed on by firms to workers, thus making more frequent paychecks costlier.

The main contribution of this paper is to uncover a novel, quantitatively important dimension, namely pay frequency, that serves as a compensating differential when workers consider a job offer. Specifically, I find that, for workers with limited liquidity, the consumption smoothing benefit of weekly paychecks outweighs the additional admin costs. Given the same amount of labor earnings each month, more frequent paychecks help households smooth their consumption more easily without resorting to expensive credits. Conditional on liquid wealth, constrained unemployed workers have a lower reservation wage policy for a weekly job than for a biweekly job. Consequently, they are more likely to accept a weekly-paying job in the form of having a lower reservation policy for that job than for a biweekly job with a similar wage offer. This result explains the empirical relations observed in the data.

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. I can also pin down the admin costs to be around 20 U.S. dollars in 2015 denomination, which is a bit higher than the median hourly wage of \$19 in my sample. Suppose a standard full-time 40-hour working week, that amount translates to a considerable cost of 2.6% of median labor earnings. Put in contrast to a difference of \$6 in the data between average hourly wages of the two frequencies, the admin costs alone can account for 8.3% of this gap. Overall, while my model leaves open the possibility of important equilibrium behaviors on the firms side, i.e. firms might strategically offer lower wages for weekly-paying jobs if they can target constrained workers, it is still successful in capturing a quantitatively important channel on the workers side.

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 along two margins. First, I increase unemployment benefit amount by 20% to evaluate the effects on average wages as well as on net liquidity of workers in equilibrium. Second, as borrowing constraints in my model are dependent on contemporary earnings of workers, I relax these limits so that they can borrow more out of their earnings. I find that the former exercise generates quantitatively more significant responses in labor earnings and net liquid wealth than the latter, with an average increase of $2 in hourly wages for a $64 hike in weekly unemployment benefits.

1.1 Related Literature

The positive effect of a higher *income* frequency on consumption smoothing, which is the main element in my model, is unambiguously and increasingly documented. Berniell (2018) investigates both micro- and macroeconomic effects of pay cycles in the U.S. At the household level, the author uses "as-good-as-random" data on American retiree couples who receive Social Security payments either once or twice a month depending on the time they retired and their birthdays. She finds that households with more frequent paychecks have significantly smoother within-month expenditure patterns, and this effect is stronger for income-poorer people. In a similar vein, Matikka et al. (2019) use data of Finnish pensioners who receive their social security income from two separate sources: an employer-based one typically at month beginning and a national one, whose arrival dates depend on the initial letter of recipients' last name. This rule effectively generates randomization in the pattern that people receive their pensions. The authors also find a smoother consumption profile for those receiving national pensions later in the month, i.e. having the two payment dates every month instead of one. Another work is by Aguila et al. (2017), in which the authors exploit the difference in disbursement rates of two pension programs in the Mexican State of Yucatan. They find that monthly-program recipients enjoy more consumption smoothing, have more available food and more health-care use than those subject to the bimonthly-program. Some other studies focus exclusively on food consumtion of welfare programs' beneficiaries and find an extreme reaction in food intake on benefit receipt dates (Shapiro 2005, Mastrobuoni & Weinberg 2009). They often attributes the non-smooth consumption pattern to a lack of self-control and call for a higher frequency of program benefit payouts as an easy fix. My work is different from these papers, as I focus on wage-earning workers, i.e. those who constantly face labor market shocks and thus income uncertainty, instead of benefits recipients, who tend to have generally stable streams of earnings.

My project is also related to the growing literature strand which studies *paycheck* frequencies. 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. These contracts are however prone to ex post suboptimal re-negotiations, so paycheck regulations are necessary. Baugh & Correia (2022) extend this model by incorporating credit card borrowings and illiquid savings. Using online account aggregator micro data, they provide insightful empirical evidence on the correlation between paycheck frequencies and the utilization of debts: those paid more frequently borrow less with credit cards yet experience more episodes of financial distress. Nevertheless, both of these two papers explain the relevance of pay frequencies for workers' welfare through the lens of present bias. As shown in my model, even in the absence of hyperbolic discounting, income uncertainty and a potentially binding borrowing constraint still jointly generate the need for liquidity under standard assumptions, making workers value the consumption-smoothing benefit of higher pay frequencies.

Finally, my work is also closely related to the literature on how assets holdings affect individuals' labor market outcomes. Lise (2013) underlines the role of idiosyncratic employment risks in capturing and explaining the distribution of precautionary savings across workers. As workers constantly move up and down the wage ladder, they optimally build and deplete their savings in anticipation of future employment shocks. In the other direction, as Herkenhoff (2019) points out, more availability of consumer credits, which help smooth consumption, also influences job-searching behavior of workers. The author links the expansionary credit access of unemployed workers to the effects of employment dynamics on the extent and the persistence of business cycles, as unemployment spells are prolonged and reservation wages are increased. In a different study 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. More recently, Eeckhout & Sepahsalari (2021) document what they call the precautionary job search motive among workers looking for jobs: those with lower levels of assets, due to their limited ability to smooth consumption once unemployed, forgo high-paying posts in exchange for ones with lower wages but a higher probability to match. My paper is however the first, according to my knowledge, to study the effect of liquidity on pay frequencies and wages simultaneously.

Structure: The remaining part of the paper is organized as follows. In section 2, 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 discuss calibration results and provide interpretation about the quantification of the underlying economic channel. Finally, section 5 concludes.

2 Data

I pool the Interview data of the CEX across years from 2010 to 2018 as there were few substantial changes in state-level payday requirements as well as in labor market conditions 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 demographics information, what matters the most for this study is that the interview asks about the frequency of the last paycheck that the interviewees received. Employment status, job characteristics, and salary before taxes and deductions during the last 12 months are collected in the first and fourth interviews. Data on financial standings is asked only in the fourth interview, which covers liquid assets and credit card debts at the time of the interview and one year before.

Sample data: Since the aim is to uncover the association among pay frequency, wage, and liquid wealth, I limit my sample to the last interview rounds of each surveyed household, as all relevant information is collected in this round. In other words, I do not utilize the panel feature of the CEX data. I follow Zhang (2017) in sample restriction. First, I only keep households with complete and valid data on relevant variables such as employment status, wages if employed, liquid assets and debts. Topcoded[2] and bracket values 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.

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 3 states that only allow weekly as legal paycheck frequency: Connecticut, New Hampshire, and Rhode Island. Next, I drop households with more than one earner in order to clearly identify the accurate frequency. If a household has two working members, for example, both earning biweekly but one on the first and third week of the month while the other on the second and fourth week, that household as a whole should be more correctly classified as a weekly-earning unit. I also exclude households with pension-earning members for the same reason. Furthermore, I filter out households with non-positive family income and/or non-positive food expenditure. At individual level, non-working people not actively searching for jobs as well as those outside the prime age range (from 25 to 65 years old) are also dropped. Finally, I drop from my sample observations with labor earning per hour below a half of the federal minimum wage of $7.25 (adjusted to 2015 dollars).

[2] CEX topcodes, among other items, salary and liquid assets/borrowings.

Assigning a worker as either weekly or biweekly earner can be problematic due to the sparseness of labor status data in the CEX. Even though she might be employed at both the first and the fourth rounds, it is possible that she starts the survey with a job different from the one she has in the final interview, and the econometrician has no reliable way to identify that transition. Therefore, in the analysis below and in my later calibration, I only consider and assign paycheck frequency to employed workers if they work at least 50 weeks in the past 12 months, i.e. those who are very likely to stay in the same job. In the end, my sample has 3,038 households from the last interview round, among whom there are 113 unemployed heads, 823 weekly paid heads, and 2,102 biweekly paid heads.

Descriptive Analysis: Table 1 compares weekly and biweekly earners in my sample before versus after selection by certain demographic characteristics, namely average age, gender, race, and education attainment. In general the demographics of my restricted sample is comparable to that of the full sample for both frequency groups, implying that the multiple restrictions do not impair the representativeness of my final sample. When we compare the two pay-frequency groups, there are little differences in the average ages or white shares among workers. Meanwhile, weekly-paying jobs tend to have a higher share of male workers, likely due to the high concentration of these jobs in male-dominated industries such as mining and construction (Burgess 2014). 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 turn to the distribution of hourly wage and net household liquidity for the two

Characteristics	*Restricted Sample*		*Full Sample*	
	Weekly	**Biweekly**	**Weekly**	**Biweekly**
Average age	43.74	43.83	42.37	43.24
Male share (%)	71.32	54.00	61.57	48.77
White share (%)	83.60	78.69	86.05	81.43
College Degree (%)	27.22	52.24	24.91	49.52

Table 1: Demographic and Economic Characteristics: weekly vs biweekly
Note: Pooled CEX Interview Data 2010-2018 (Round 4). Only employed workers.
Full sample $N = 30,027$, restricted sample $N = 2,925$.

pay frequencies in my restricted sample, conditional on workers being employed at the time of interview. All monetary values are measure in 2015 U.S. dollars, adjusted by annual CPI. Hourly wage is calculated from salary in the past 12 months divided by working hours[3] during the same period. I define net liquid assets as total liquid wealth such as checking and savings accounts, money market accounts, and certificates of deposits, net credit card debts as total liquid borrowing (Lise 2013). 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 distribution of hourly wage and liquid wealth for weekly and biweekly earners. For each variable, I consider the corresponding values at 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles. Regarding hourly wage, we can clearly see that biweekly workers earn more than their weekly counterparts at every considered point. 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 observations of households' net liquid assets, the respective frequency is that of the principal earner in the household.

[3]This information is derived from the number of weeks (including leaves and holidays) that the person works during that time span and the usual number of hours worked per week.

While the 25%-lower ends are similar, with biweekly even more likely to have negative net liquid wealth than weekly earners, the former have much more positive liquidity along the higher part 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, as up to one half of workers in each sample do not borrow, while the differences in loans among those who do are not very large[4]. However, keep in mind that this difference in liquid borrowing might also reflect differences in eligibility for credit cards.

	Frequency	**p-10**	**p-25**	**p-50**	**p-75**	**p-90**
Hourly wage	Weekly	8.57	11.46	16.26	23.44	32.31
	Biweekly	10.21	14.10	21.23	32.32	45.32
Net liquidity	Weekly	-3,500	0	2	1,076	6,143
	Biweekly	-4,698	0	348	3,413	15,685
Liquid wealth	Weekly	0	0	341	1,780	6,825
	Biweekly	0	106	1,127	5,091	16,477
Liquid borrowing	Weekly	0	0	0	628	5,155
	Biweekly	0	0	0	1,783	7,114

Table 2: Hourly wages and liquid assets/borrowing distribution (2015 US$)
Note: Pooled CEX Interview Data 2010-2018 (Round 4). p-x denotes the x-th percentile. Restricted sample, $N_{Weekly} = 823$, $N_{Biweekly} = 2,102$.

One might be skeptical that the differences in hourly wages between weekly and biweekly earners can be explained by an unobservable factor that is unrelated to the liquidity channel that I propose. An obvious candidate of such concerns is education: people with higher educational attainment might be more likely to qualify for jobs that pay higher wages and also happen to offer biweekly paychecks more often. We also see from Table 1 that a significantly higher share of biweekly earners are college graduates.

[4] I confirm this impression by carrying out mean-comparison tests between the two frequency groups for liquid wealth and liquid borrowing (see Table 7 in the Appendix).

In order to address this possibility, I regress log hourly wage of workers employed at the time of the fourth interview on their pay frequency, controlling for education, age and age squared, gender, as well as time and occupation fixed effects[5]. The results, which can be found in Table 9 of the Appendix, show that, even when conditioned on educational attainment or on occupations, biweekly earners still receive a statistically and economically significant wage premium between 8 and 12 percentage points on average compared to weekly earners. Therefore, the differences in jobs' requirements and roles alone cannot explain the gap in hourly earnings between the two frequencies.

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 low levels of liquid assets make more frequent paychecks a more attractive option, which in turn incentivizes constrained households, who value liquidity particularly, to accept 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 Model

3.1 Setup

A continuum of measure one is populated by agents who live indefinitely and differ ex ante in liquid asset endowment a and employment status (employed and unemployed).

[5]Unfortunately, I cannot observe the industries that workers in my sample work in. Instead, I observe the "occupations," which are their specific roles at work, e.g. managers, clerical support, operators, laborers.

Time is discrete and runs forever, with each period further divided into four sub-periods. It is helpful to think of each full period as one month and each sub-period as approximately one week hereafter. I consider a partial equilibrium in which prices and shocks are all exogenous. Specifically I abstract from modeling firms' decisions and endogenizing the wage offer distribution, which I discuss in greater detail later, as those factors bring no relevant value at the cost of more complications to my current theoretical setting.

The inflows of resource depend on the employment status and, if employed, the paycheck frequency of the current job. Specifically, unemployed workers receive benefit $b > 0$ every week[6]. There are two paycheck frequencies for employed agents: either the worker receives a fourth of her monthly wage every sub-period (weekly-paid) or a half of the whole sum in the second and fourth sub-period (biweekly-paid). In addition, a fixed amount ϕ of admin costs incurs every time a paycheck is processed. These costs represent an umbrella concept encompassing a plethora of costs and fees associated with paying a paycheck, such as accounting fee, processing fee, and so on. I assume that the employers fully pass on admin costs to their employees. Therefore, given the same nominal monthly wage w, a weekly frequency means that the worker effectively receives $\left(\frac{w}{4} - \phi\right)$ every sub-period while a biweekly frequency means the worker receives nothing in the first and third sub-periods and $\left(\frac{w}{2} - \phi\right)$ in the second and fourth sub-periods. Figure 2 illustrates the general timeline.

Uncertainty in the economy comes entirely from the labor market. An employed worker faces a separation risk $\delta > 0$ at the beginning of each period and, if hit by

[6] In reality unemployment benefits in the U.S. are currently paid on a biweekly basis in only 9 states and weekly in all other states (Zhang 2021)

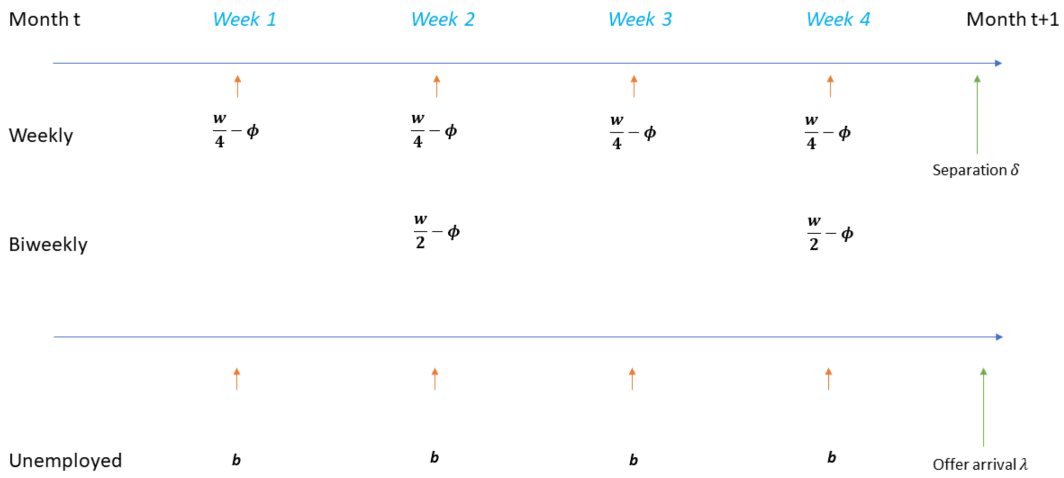

Figure 2: Timeline of events

the spell, would become unemployed at least until the next period. Equivalently, an unemployed worker has at every period's beginning a chance $\lambda > 0$ of randomly being offered a job bundle (w, s) of monthly wage w and paycheck frequency s. The joint distribution of job-bundle offerings follows $(w, s) \mapsto F(w, s) : W \times S$ where W is the set of positive wages and $S = \{\text{weekly}, \text{biweekly}\}$ that of the two frequencies. If the value of the offered job bundle is less than the value of unemployment, the worker rejects the offer and stays unemployed for that period. Within each period, there is no further uncertainty that workers, either employed or unemployed, face. Still, intra-month consumption smoothing matters because there are two weeks each month during which biweekly earners do not have inflows of earnings. If they are at the same time liquidity constrained, they would suffer significant disruptions in disposable resources and, consequently, consumption.

Because the level of liquid assets is the main driver of frequency distribution, I explicitly model assets as realistic as possible. Within each sub-period, all workers consume and either save in a riskless bond that pays rate $R(a^+)$ or borrow without collateral, i.e. using revolving credit cards, at rate $R(a^-)$. I assume that borrowing is relatively expensive, i.e. $R(a^-) > R(a^+)$. Moreover, interests compound only at the beginning of the last sub-period in each month. For instance, carrying a negative amount of asset from the first week to the third week in the month incurs no interest payment, but carrying it over to the last week does. This feature mirrors credit cards' grace period, typically ranging from 21 to 28 days after receiving the bill, during which the card holder pays no interest to the card issuer for the use of her credit line. The workers also do not need to settle their loans in full amount on the due date. However, if they begin a period with less net holdings than their credit limit, they are not eligible for any credit extension and thus cannot borrow more. Specifically, I model the borrowing limit as a multiplier γ of monthly net income, so given the period's starting assets level a, the constraints are $\underline{a}^U = \min\{a, -4b\gamma\}$ for an unemployed worker and $\underline{a}^W = \min\{a, -(w - \tilde{\phi})\gamma\}$ for an employed worker earning a monthly wage w with $\tilde{\phi}$ being the total admin costs paid in a month, i.e. 4ϕ for a weekly and 2ϕ for a biweekly earner. This condition ensures that, even if in debt, workers do not have to immediately deleverage when their employment status changes between periods (Luo & Mongey 2019).

Workers maximize their lifetime utility

$$\bar{U} = \mathbb{E}_0 \Sigma_{t=0}^{\infty} \beta^{4t} [u(c_{1t}) + \beta u(c_{2t}) + \beta^2 u(c_{3t}) + \beta^3 u(c_{4t})] \tag{1}$$

which is the expected sum of the stream of instantaneous utility $u(c)$, discounted at a factor $\beta \in (0,1)$, with $\{c_{jt}\}_{j=1}^4$ the sub-periodic consumption for each week within period t. The instantaneous utility function $u(.)$ has standard characteristics: $u'(.) > 0$, $u''(.) < 0$, and $u(.)$ satisfying Inada conditions. We can write the unemployed worker's value function $U(a)$ when a period starts with assets level a recursively as:

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

s.t.

$$\begin{aligned} c_{1t} + a_{1t} &= a + b \\ c_{2t} + a_{2t} &= a_{1t} + b \\ c_{3t} + a_{3t} &= a_{2t} + b \\ a_{1t}, a_{2t}, a_{3t}, a' &\geq \underline{a}^U \end{aligned}$$

where $U^1(a_{3t})$ is the continuing value at the beginning of the fourth sub-period. Specifically, we write

$$\begin{aligned} U^1(a_{3t}) = \max_{c_{4t}, a'} u(c_{4t}) + \beta \Big[\lambda \int_{W \times S} & max\{U(a'), E(a', w, s)\} dF(w, s) \\ & + (1-\lambda) U(a') \Big] \end{aligned}$$

s.t.

$$\begin{aligned} c_{4t} + a' &= (1 + R(a_{3t})) a_{3t} + b \\ a' &\geq \underline{a}^U. \end{aligned}$$

Here $\{a_{jt}\}_{j=1}^4$ the net assets level at the end of each week, $a_{4t} = a'$ the assets carried over across periods, and $E(a', w, s)$ the value of being employed in the next period.

Similarly, the period-beginning value function $E(a, w, s)$ of an employed worker with job bundle (w, s) and initial asset level a is:

$$E(a, w, s) = \max_{\{c_{jt}, a_{jt}\}_{j=1,2,3}} u(c_{1t}) + \beta u(c_{2t}) + \beta^2 u(c_{3t}) + \beta^3 E^1(a_{3t}, w, s) \tag{3}$$

s.t.

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

where

$$E^1(a_{3t}, w, s) = \max_{c_{4t}, a'} u(c_{4t}) + \beta \left[\delta U(a') + (1 - \delta) E(a', w, s) \right]$$

s.t.

$$\begin{aligned}
&c_{4t} + a' = (1 + R(a_{3t}))a_{3t} + y_{4t}(w, s) \\
&a' \geq \underline{a}^W.
\end{aligned}$$

The income streams for a weekly frequency are $\{y_{jt}(w, s)\}_{j=1}^4 = \frac{w}{4} - \phi$ and, for a biweekly one, are $y_{1t}(w, s) = y_{3t}(w, s) = 0$ and $y_{2t}(w, s) = y_{4t}(w, s) = \frac{w}{2} - \phi$.

3.2 Equilibrium Analysis

We can characterize the decision rules for both employed and unemployed workers. For simplicity I denote

$$\Psi(a, w, s) = \max\{U(a), E(a', w, s)\}.$$

The first-order conditions for unemployed workers reads:

$$\begin{cases} u'(c_{1t}) \geq \beta u'(c_{2t}) \\ u'(c_{2t}) \geq \beta u'(c_{3t}) \\ u'(c_{3t}) \geq \beta U_a^1(a_{3t}) \end{cases} \tag{4}$$

$$u'(c_{4t}) \geq \beta \left[\lambda \int_{W \times S} \Psi_a(a', w, s) dF(w, s) + (1 - \lambda) U_a(a') \right]. \tag{5}$$

On the other hand, the first-order conditions for employed workers reads:

$$\begin{cases} u'(c_{1t}) \geq \beta u'(c_{2t}) \\ u'(c_{2t}) \geq \beta u'(c_{3t}) \\ u'(c_{3t}) \geq \beta E_a^1(a_{3t}, w, s) \end{cases} \tag{6}$$

$$u'(c_{4t}) \geq \beta[\delta U_a(a') + (1 - \delta) E_a(a', w, s)]. \tag{7}$$

In all these conditions, inequality is strict if the respective borrowing constraint binds. Finally, the set of four envelope conditions for unemployed and employed workers, in both sub-periods, are respectively:

$$U_a(a) = u'(c_{1t})$$

$$U_a^1(a_{3t}) = (1 + R(a_{3t}))u'(c_{4t})$$

$$E_a(a, w, s) = u'(c_{1t})$$

$$E_a^1(a_{3t}, w, s) = (1 + R(a_{3t}))u'(c_{4t})$$

Substituting FOCs into these envelope conditions, we get the Euler equations that, together with equations 4 and 6, jointly define the equilibrium:

$$U_a^1(a_{3t}) \geq \beta[1 + R(a_{3t})]\left[\lambda \int_{W\times S} \Psi_a(a', w, s)dF(w, s) + (1-\lambda)U_a(a')\right]$$

$$E_a^1(a_{3t}, w, s) \geq \beta[1 + R(a_{3t})][\delta U_a(a') + (1-\lambda)E_a(a', w, s)]$$

These two equations also play a central role in solving the model numerically. After fixing an exogenous grid of assets at third-week end a_3 and guessing arbitrary value functions $U(.)$ and $E(.)$ over another grid of initial assets a, I can use the equations to compute the optimal policy $c_4^*(a_3)$. Simultaneously, I use grid search method to find for every possible pair (a, a_3) the optimal path $\{c_i^*(a, a_3)\}_{i=1,2,3}$ that leads from starting assets a to a_3 while still satisfying the budget constraint at every sub-period. I then use those policies to update the value functions and iterate them until convergence.

Discussion: Unemployed workers typically face a trade-off when being offered a job. On one hand, more frequent paychecks means better consumption smoothing and less pressure for expensive borrowings between sub-periods. On the other hand, a high frequency entails more admin costs and thus effectively reduces the total amount that workers actually earn. For those with little wealth and being borrowing-constrained, the need of liquidity to smooth consumption is more acute, outweighing the additional admin costs of more frequent paychecks. Consequently, these workers are willing to accept a job that pays more often even though the wage can be lower. For those with higher liquid holdings and/or more room to borrow, the prevailing option is less frequent paychecks so that they can avoid paying extra admin costs.

We can formalize the discussion above. Let first denote a weekly paycheck as s_w and a biweekly one as s_b. For any arbitrary w, we consider two employed workers earning the same wage w but at different paycheck frequencies in two extreme scenarios of period-beginning assets a. If a is very close to the liquidity constraint $\underline{a}^B(w)$[7], obviously the value of the weekly earner is higher than that of the biweekly one

$$E(a, w, s_w) > E(a, w, s_b)$$

due to very little consumption that the latter can afford in the first week. On the other end of the spectrum, assume a is very high (tending to infinity), and the workers always have enough liquidity to cover their consumption without ever having to turn to borrowing[8]. In that case, the only difference in the amount of resource between the two workers is the extra admin costs of 2ϕ every month. What we effectively have then is

$$E(a, w, s_b) = E(a, w + 2\phi, s_w) > E(a, w, s_w)$$

where the inequality comes from the value of employment monotonically increasing in wage. Now apply the fact that the value of employment is continuous, concave, and also strictly increasing in liquid assets, it is clear that for every wage level w, there must exist an unique value of assets $\hat{a}(w)$ such that $E(\hat{a}(w), w, s_w) = E(\hat{a}(w), w, s_b)$. If a is below this level, the value of being paid weekly is greater; otherwise, that of biweekly pay is greater.

Let $w^*(a, s)$ be the reservation wage of an unemployed agent with asset level a for a

[7] In fact, the biweekly earner always has more room to borrow than the weekly one in this case.

[8] Further assume near-zero returns on positive net holding of liquid assets.

job paying at frequency $s = \{s_w, s_b\}$. This means that

$$E(a, w^*(a, s_w), s_w) = U(a) = E(a, w^*(a, s_b), s_b) \tag{8}$$

i.e. at any particular level of assets, the values of being employed at the corresponding reservation wages are always equal among different frequencies. Keep in mind that the admin costs have been internalized within $E(.)$ through the budget constraints and thus do not show up here.

For any assets level a within our state space, there always exist the two corresponding reservation wages $w^*(a, s_w)$ and $w^*(a, s_b)$ which jointly satisfy equation 8. Now, for $w^*(a, s_w)$, given what I prove earlier, there also exists an unique assets level $\hat{a}(w^*(a, s_w))$ which satisfies:

$$E(\hat{a}(w^*(a, s_w)), w^*(a, s_w), s_w) = E(\hat{a}(w^*(a, s_w)), w^*(a, s_w), s_b)$$

Examining the relation between a and $\hat{a}(w^*(a, s_w))$ reveals important insights about wage reservation policies. For example, if $a < \hat{a}(w^*(a, s_w))$, we have

$$E(a, w^*(a, s_w), s_w) > E(a, w^*(a, s_w), s_b) \tag{9}$$

Combining 8 and 9 implies that

$$E(a, w^*(a, s_b), s_b) = E(a, w^*(a, s_w), s_w) > E(a, w^*(a, s_w), s_b).$$

As $E(.)$ is strictly increasing in wage w, we conclude that for any $a < \hat{a}(w^*(a, s_w))$,

$$w^*(a, s_b) > w^*(a, s_w),$$

i.e. people willing to accept low-paying job as long as they are paid more frequently. The opposite is true for the case where $a > \hat{a}(w^*(a, s_w))$ due to symmetry. In summary, conditional on liquid assets a, workers have higher reservation wage policy for a frequency if the value of having a job with such frequency is lower than that with the other frequency.

Another prediction of my model is that conditional on wage and starting liquidity, workers with different paycheck frequencies will have different saving policies, as denoted by the policy functions $a^*(a, w, s)$. This is a new feature compared to traditional consumption-saving models which ignore the patterns of income flows. The prediction can be easily cross-validated by regressing workers' net liquidity on their starting wealth one year before[9], their wage over the year, and the pay frequency. Table 8 in the Appendix confirms that given everything else the same, biweekly earners on average save around \$1,000 more per year than weekly earners. In other words, frequency clearly play a significant role in the optimal saving decisions of workers.

Stationary Equilibrium Definition: Given labor market uncertainties δ and λ and job-bundles offer distribution $F(w, s)$, a stationary equilibrium is a set of value functions $E(a, w, s)$ and $U(a)$, optimal decision rules $\{c_j^U(a)\}_{j=1,2,3,4}$ of unemployed workers and $\{c_j^E(a, w, s)\}_{j=1,2,3,4}$ of employed workers, reservation wage policy $w^*(a, s)$, and a distribution Γ^a across labor market states, frequencies if employed, wages, and

[9] The interviewees are asked in the fourth round about this information.

net liquid wealth such that

- $U(a)$ and $E(a, w, s)$ are the respective solutions to the Bellman equations 2 and 3,
- $\{c_j^U(a)\}_{j=1,2,3,4}$ and $\{c_j^E(a, w, s)\}_{j=1,2,3,4}$ are the associated consumption policy functions which together solve the utility maximization problem 1,
- $w^*(a, s)$ satisfies the accepting rules 8 for $s = \{s_w, s_b\}$,
- given the state space and the policy functions, denote $\mathbf{P}^a$ the mapping from the current distribution across workers to that of the next model period, then $\Gamma^a = \mathbf{P}^a \circ \Gamma^a$.

4 Calibration and Results

4.1 Calibration

I calibrate the model to the CEX 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 as many parameters as possible using the benchmark in other quantitative studies and calibrate the rest inside the model.

Preference: I set the utility function to be of CRRA form, $u(c) = \frac{c^{1-\theta}}{1-\theta}$ where θ is the relative risk aversion. I set $\theta = 2$ in conformity with standard literature (Guvenen & Smith 2014).

Labor market dynamics: I calibrate the job offer arrival rate λ within the model. I set the monthly separation rate $\delta = 0.035$ to match the quarterly job-to-unemployment rate of 10% reported by the Job Openings and Labor Turnover Survey (JOLTS) as in Herkenhoff (2019).

Wages and unemployment benefits: I further trim the top 0.5% of the empirical wage distribution in my sample. I then assume that the distributions of wage and frequency within job offer bundles are independent from each other. Conditional on receiving a job offer with hourly wage $w \sim G(w)$, a unemployed worker can stochastically draw a weekly frequency with the probability p and a biweekly one with probability $1 - p$. I parameterize the wage offering $G(w)$ as log normal with parameters (μ,σ) and assume that employed workers in my model all work 40 hours per week in order to impute their weekly earnings. For simplicity, instead of modeling unemployment compensation as a fraction of the last wage before separation and having to keep track of this amount as an additional state variable, I assume b to be equal to the average weekly benefit amount in the U.S. during the period 2010-2017, which is about \$320 according to the Department of Labor[10].

Assets: Net liquid assets are defined as in Section 2. Each household in the CEX reports their financial data in the first and the fourth interview, but for my purpose I use only observations from the last round after trimming the bottom and top 1% tails to designate net liquid assets. The reason is that only at this round is households' wealth data directly linked to one of the three distinctive status of interest: unemployed, weekly-paid, and biweekly-paid workers. Regarding interest rates, given

[10]Source here.

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)[11] 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. Lastly, for the borrowing limit, the median credit limit of working-age Americans from the Survey of Consumer Finances is 74% quaterly labor earnings (Kaplan & Violante 2014), which I translate into $\gamma = 2.22$ times the monthly earnings.

Table 3 summarizes the externally calibrated parameters and their sources.

Parameter	**Value**	**Source**
Risk aversion θ	2	Guvenen & Smith (2014)
Separation rate δ	0.035	10% quarterly rate (JOLTS, Herkenhoff 2019)
Credit limit γ	2.22	Kaplan & Violante (2014)
Saving rate $R(a^+)$	-0.17%	net return -2% p.a.
Borrowing rate $R(a^-)$	0.95%	net card debts rate 12% p.a. (Fed G.19)
Unemployment benefit b	\$320	Average weekly benefit amount 2010-2017

Table 3: Externally calibrated parameters

Estimation: Given an initial guess of the remaining parameters $\{\beta, \phi, \lambda, \mu, \sigma, p\}$, I start by solving for policy functions and then use the results to iteratively calculate the invariant distribution over assets. I jointly calibrate those parameters by matching stationary moments in the data. There are two calibration versions: one just-identified with six targeted moments and one over-identified with eight moments. The first version targets the following moments: the respective average net liquid as-

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

sets level of the unemployed, weekly-, and biweekly earners, the fraction of weekly earners among employed workers, and the respective means of hourly wage of weekly and biweekly earners. The second version targets these six plus the standard deviations of hourly wage of weekly and biweekly earners. All data moments are the arithmetic means of the corresponding measures in the fourth interview averaging across sampled years .

The choice of these moments also invites a discussion. First, the parameters (μ, σ) of the wage distribution $G(w)$ directly correspond to the earnings distributions of weekly and biweekly earners, conditional on the reservation wage policy. The constant probability p of drawing a weekly frequency offer plays a part in pinning down the weekly-to-biweekly-earners ratio. The other part, given such a stationary wage-frequency offer distribution, is jointly dictated by the admin costs ϕ. An increase in admin costs would translate monotonically to a drop in shares of weekly versus biweekly earners. Finally, the discount factor β, measuring how impatient workers are between consumption in this week versus the next, is traditionally captured by descriptive moments of the assets distribution. However, the expectation of how quickly unemployed workers can find a new job, which corresponds to the offer arrival rate λ, also differentiates their average liquidity level from that of the employed.

4.2 Results

Calibrated parameters: The calibration results can be found in Table 4. Overall there are no significant differences between the two calibration versions except for admin cost ϕ. The just-identified model implies that each paycheck costs workers a quite substantial amount of \$63, while that in the over-identified version is \$20. For the median weekly earner in the data who make around \$19 per hour, those figures respectively correspond to 8.3% and 2.6% of her weekly gross earnings paid on admin costs, given the assumption that she works on average 40 hours a week. Out of the \$6 gap in average wages between the two frequencies observed in the data, admin costs thus amount to more than 8%. The difference between the two versions can be explained if we take into account the fact that my model emulates only the partial equilibrium where the wage offer distribution is exogenously given. Admin cost ϕ, being a key parameter in the model, also captures this non-modeled component of the data. By targeting only mean hourly wages in the just-identified version, I leave room for ϕ to grow more freely in calibration.

Jointly calibrated:	**Just-identified**	**Over-identified**
Discount factor β	0.9937	0.9921
Admin cost ϕ	\$63	\$20
Offer arrival rate λ	0.342	0.376
Mean log wage offer μ	2.564	2.547
Std log wage offer σ	0.538	0.619
Chance of weekly-paying offer p	0.261	0.229

Table 4: Internally calibrated parameters - Two versions

Other calibrated parameters are all reasonable and within our expectation. The discount factors β are considerably close to 1 in both specifications due to the fact that the workers' inter-temporal horizon is only a week. The means and standard deviations of the log wage offer distribution in both versions are comparable to evidence from the literature. For example, Hall & Mueller (2018) use weekly survey data from unemployed workers in New Jersey between 2009 and 2010[12] to nonparametrically estimate the mean and standard deviation of log hourly wage offers to be 2.75 and 0.52. Their estimated mean is slightly higher than my calibrated μ because unemployed benefits are relatively more generous in New Jersey in comparison with other states (Krueger et al. 2011). Also notice that the chance p of being offer a weekly-paying job is always lower than the weekly share among all employed workers in data. If job seekers always accept job offers, p would be the share we observe in equilibrium. However, since workers with little liquid wealth are more likely to accept a weekly paying job, as we shall see, the actual share must be consequently higher than p.

Model fit: Table 5 compares the moments generated from the two calibrated versions of the model with those observed from the data. For wage-related moments from the model, I have deducted the corresponding admin costs in their calculations to make them comparable to data moments.

Moments	**Just-id.**	**Over-id.**	**Data**
Avg. net liquid wealth - Unemployed	$635	$687	$680
Avg. net liquid wealth - Weekly	$1,982	$1,497	$1,572
Avg. net liquid wealth - Biweekly	$4,574	$4,857	$4,808
Weekly-to-Employed ratio	26.92%	25.85%	26.78%
Mean hourly wage - Weekly	$21.70	$23.62	$18.63
Mean hourly wage - Biweekly	$22.73	$25.21	$24.50
Std. dev. hourly wage - Weekly	*$8.06*	$10.18	$10.18
Std. dev. hourly wage - Biweekly	*$8.10*	$10.37	$13.61

Untargeted moments in italics. $ denotes 2015 US Dollars.

Table 5: Moments - Model versus Data

Overall, both calibration specifications do a good job in matching liquidity-related mo-

[12]The survey is conducted by Krueger et al. (2011), who explicitly asked unemployed job seekers about, among other things, how many job offers they received in the week before and the corresponding wages of each offer.

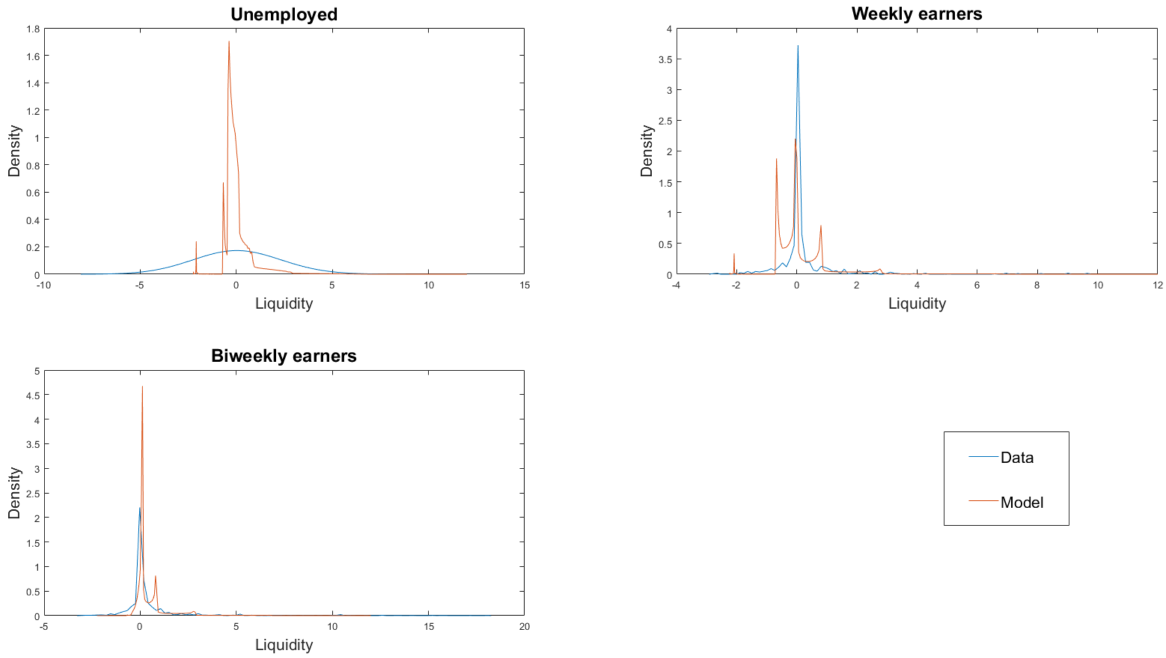

Figure 3: Density distributions of assets - Data vs. Model

ments and the share of weekly frequency. While the over-identified version matches averages of net liquidity slightly better, the just-identified one gives a weekly-to-employed ratio closer to the data moment. For illustrative purpose, Figure 3 compares the density distribution of net liquid assets from the data and that from the over-identified model among the three group of workers. Assets distributions are generally matched well around the means, but are overstated by the model in the cases of unemployed workers and biweekly earners. Moreover, both specifications underpredict the gaps in means and standard deviations of hourly wages between the two frequencies. The just-identified version also calibrates relatively low levels of wage standard deviations, which it does not target. This is not surprising, since apart from an assumption about the log normal distribution, I do not impose further structure on the exogenous wage offers. In reality, there might be strategic responses from the firms side, such as offering lower wages for weekly paying positions to target liquid-constrained workers, which are not taken into account in my model.

Wage-Liquidity-Frequency Relation: Figure 4 illustrates the main economic mechanism that I propose in this paper. Specifically, it shows the reservation wages in equilibrium of the calibrated just-identified model[13]. The blue region is where the value of weekly paycheck is higher than that of biweekly, given the same liquidity and wage. The yellow region denotes the opposite: the workers prefer being paid biweekly more than weekly. The red curve is the reservation wage of an unemployed worker if she is offered a weekly-paying job, and the curve line is that for a biweekly-paying job. Both of these curves, which altogether represent the policy $w^*(a, s)$, move along the wage-liquidity plane.

Figure 4 is clearly compatible with my predictions from equilibrium analysis. At very low levels of assets, the need for liquidity outweighs the additional admin costs, and the workers value more frequent paychecks a lot. This behavior makes them willing to accept jobs at significantly lower wages as long as they pay weekly, as evident in the red curve lying below the green curve in the blue region. In fact, workers who are deeply in net liquid debts would only accept biweekly jobs if they are offered very high wages. Interestingly, this effect leads to the non-monotonic pattern of reservation wage for biweekly-paying jobs along liquid assets, as compared to that for weekly paychecks. Moreover, the gap in reservation wages at the same liquidity

[13] The respective figure for the over-identified model is available in the Appendix. The main results stay the same.

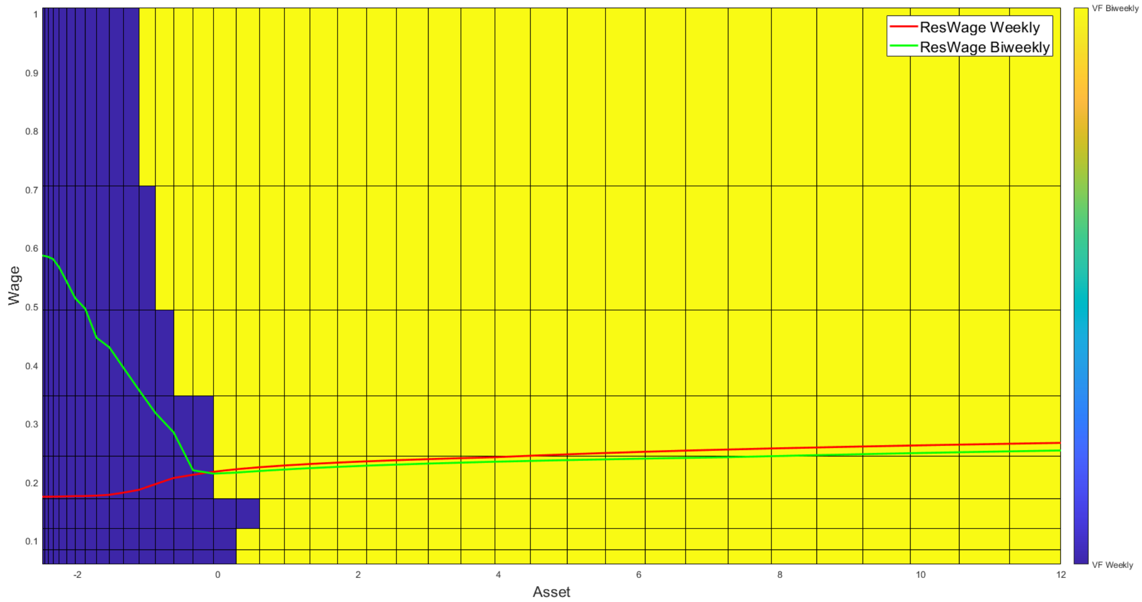

Figure 4: Reservation wages of just-identified calibrated model
The red (green) curve corresponds to weekly (biweekly) frequency. The blue (yellow) region is where the value of weekly paychecks are higher (lower) than that of biweekly ones, conditional on wages and liquid assets. Unit is \$10,000 (in 2015). Monthly wage is displayed here.

level between the two frequencies consistently narrows, clearly demonstrating that increasing costs make weekly paychecks relatively less attractive. Outside this region, liquidity constraints ameliorate and the workers prefer a biweekly frequency because it lowers the total admin costs and leaves them with more net earnings per month.

In equilibrium, since unemployed workers are offered the same distribution of job-bundles, the gap in hourly wage between weekly and biweekly earners that we empirically observe comes, through the lens of my model, from two sources. First, conditional on the same nominal, or before-admin-cost, wage, weekly earners always effectively receive 2ϕ less each month than biweekly earners due to the extra admin cost. However, this is a level-effect which only shifts the wage distribution but does not alter it. Second, and more interestingly, the wage discrepancy is also explained by the difference in reservation wage policies for the two frequencies, which in turn are functions of the stationary distribution of net liquid wealth of the job seekers. As we see in Figure 4, frequency serves as a compensating differential on the labor market for liquidity constrained workers, enticing them into weekly- yet lower-paying jobs. Because more weekly workers with little assets accept these low-wage jobs, this mechanism of selection further depresses their liquid wealth in equilibrium, leading to the gap in liquidity between pay frequencies in the data.

4.3 Counterfactuals

I now implement a couple of counterfactual policy exercises to further quantify the economic mechanism at hand and put it into perspective. The baseline model serving as the benchmark is the over-identified one. Since the key factor in my model is liquidity constraints, I focus my exercises on ameliorating these. First, I increase unemployment benefit amount by 20%, or $64 more per week, keeping other parameters them same. A more generous unemployment payment program provides unemployed workers with more liquidity, enabling them to borrow more and at the same time to wait for better offers. Now that the value of unemployment is higher, this effect also increases the reservation wage policy at every level of assets for both types of pay frequency, as illustrated in Figure 5.

The second column of Table 6 reports signed changes of some main moments of interest in equilibrium following an increase in unemployment benefits by 20%. Because

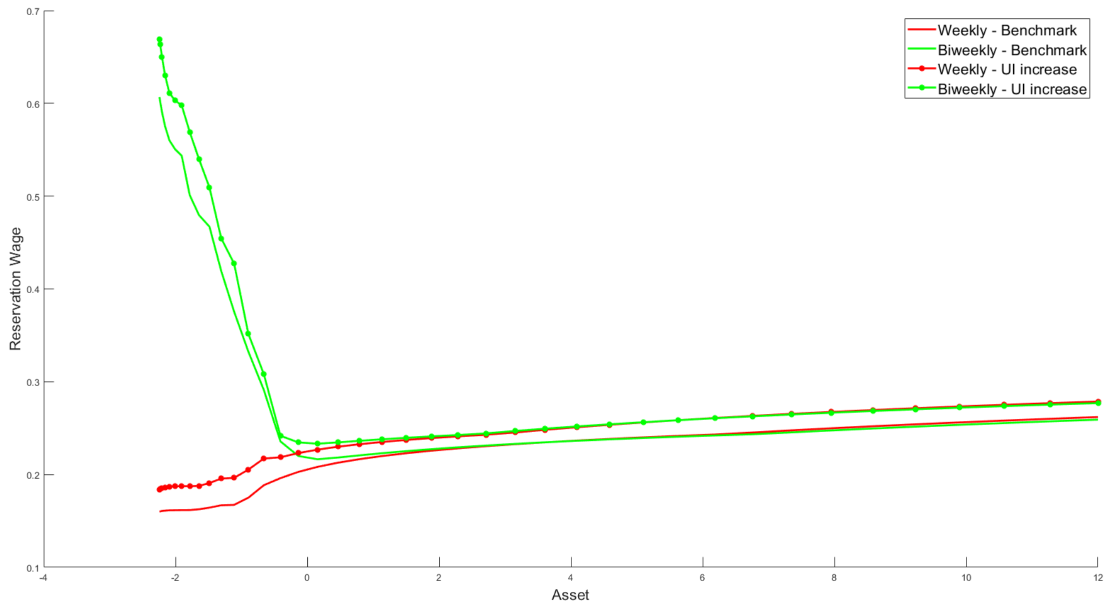

Figure 5: Reservation wages - Baseline vs. UI increase
The red (green) curve corresponds to weekly (biweekly) frequency. Plain lines are from benchmark model, lines with markers are from the counterfactual of 20% UI benefit increase.

of higher reservation wages, average hourly earnings now hike up for both weekly and biweekly earners by about \$2. Furthermore, workers significantly decrease their liquid holdings as both the average unemployed worker and the average weekly earner are now net borrower, while biweekly earners reduce their net liquidity by more than \$1,400 on average. The reasons are twofold: a more generous safety net substantially reduces the precautionary saving motive, while higher wages on average also imply more borrowings as the limits are anchored against earnings in my model.

The second counterfactual exercise is to relax the borrowing limit, which I do by decrease the factor γ to -3 instead of -2.22 as in the baseline, i.e. workers can now borrow up to 3-month worth of their earnings. In relative terms, it is a 35% increase

Δ **Moments**	**UI $\uparrow$ 20%**	γ**=-3**
Δ Avg. net liquid wealth - Unemployed	-\$1,512	-\$984
Δ Avg. net liquid wealth - Weekly	-\$1,664	-\$983
Δ Avg. net liquid wealth - Biweekly	-\$1,418	-\$244
Δ Mean hourly wage - Weekly	\$1.72	\$0.13
Δ Mean hourly wage - Biweekly	\$2.42	\$0.79

\$ denotes 2015 US Dollars. Δ = Counterfactual − Baseline

Table 6: Changes in Moments - Two counterfactual exercises

in borrowing capacity. The third column of Table 6 reports outcomes of this exercise. Liquidity in equilibrium also decreases for all types of workers, but to a much lower extent than in the unemployment benefit exercise. Compared to the baseline, net liquid assets of unemployed workers drops the most in absolute terms, followed by a milder decrease in those of weekly and biweekly earners. Recall that borrowing limits depend on earnings, this pattern can be explained by relatively small changes in average wages of employed workers in this exercise. Expanding borrowing capacity for everyone is a 'rising tide lifts all boats' situation, as it does not make the value of unemployment relatively higher in comparison to the value of employment, thus little increase in reservation wages.

In summary, reducing liquidity constraints by increasing unemployment benefits has quantitatively larger effects on wages and liquidity in equilibrium than by allowing more borrowing against earnings. The latter exercise changes only the borrowing limits, while, on top of that, the former also changes the value of unemployment relative to that of employment.

5 Conclusion

In this paper I explore the empirical links 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 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 can then smooth their intra-month consumption better without having to borrow at an expensive rate. The more constrained workers are, the more they are willing to accept weekly-paying jobs even at lower wages. Frequency serves as a compensating differential in the equilibrium of the labor market. The key counter-balancing parameter is admin costs, which increase with paycheck frequency and discourage workers with adequate liquidity from accepting jobs that pay every week.

When calibrated to CEX data, my model is successful in capturing some key data moments, namely the average wages and liquidity among different types of workers as well as the fraction of weekly earners among the employed ones. The admin costs are pinned down to be around $20 per payroll, or 2.6% of median labor earnings every week, accounting for a significant part of the wage gap between weekly and biweekly earners. Policy exercises aiming at relaxing liquidity constraints suggest that a greater borrowing capacity does not have as large effects on wages and liquidity in equilibrium as increasing unemployment benefits.

In future work, the model can still be extended by incorporating labor-hiring firms and consider the ensuing equilibrium. The wage offer distributions, conditional on frequency, would then be the results of the decisions made by firms. Another player in the general equilibrium setting is a government who collects income taxes from workers to pay for unemployment benefits. A counterfactual exercise on increasing unemployment benefits, for example, can then capture both direct and indirect effects on wages and liquidity in equilibrium.

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A Appendix

A.1 Graphics

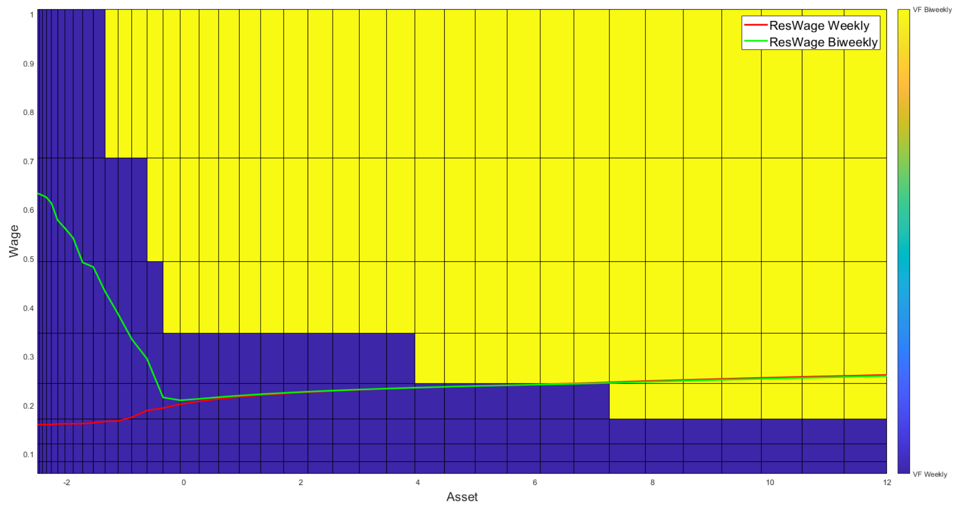

Figure 6: Reservation wages of over-identified calibrated model
The red (green) curve corresponds to weekly (biweekly) frequency. The blue (yellow) region is where the value of weekly paychecks are higher (lower) than that of biweekly ones, conditional on wages and liquid assets. Unit is $10,000 (in 2015). Monthly wage is displayed here.

A.2 Tables

	Mean difference	Standard error	t-test statistics	N
Liquid wealth	-7099.8***	1754.679	-4.05	2925
Liquid borrowing - All	-528.1*	204.9728	-2.58	2925
Liquid borrowing - Only borrowers	-299.8	491.6563	-0.61	1109

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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

	(1) Log wage	(2) Log wage	(3) Log wage	(4) Log wage
Age	0.0466***	0.0475***	0.0440***	0.0434***
	(0.00688)	(0.00688)	(0.00649)	(0.00650)
Age Squared	-0.0004***	-0.0004***	-0.0004***	-0.0004***
	(0.00008)	(0.00008)	(0.00007)	(0.00007)
Biweekly dummy	0.116***	0.118***	0.080***	0.078***
	(0.0209)	(0.0209)	(0.0205)	(0.0205)
Education dummy - Elementary	0.0275	0.0524	0.0484	0.0286
	(0.158)	(0.158)	(0.149)	(0.149)
Education dummy - Some high school	0.0751	0.0983	0.0885	0.0699
	(0.155)	(0.155)	(0.146)	(0.146)
Education dummy - High school grad	0.293	0.313*	0.255*	0.239*
	(0.152)	(0.152)	(0.144)	(0.144)
Education dummy - Some college	0.364*	0.386*	0.299**	0.279*
	(0.153)	(0.153)	(0.144)	(0.144)
Education dummy - Bachelor's degree	0.501**	0.523***	0.398***	0.380***
	(0.153)	(0.153)	(0.145)	(0.145)
Education dummy - Associate's degree	0.764***	0.784***	0.588***	0.571***
	(0.153)	(0.153)	(0.145)	(0.145)
Education dummy - Post grad degree	0.950***	0.970***	0.722***	0.707***
	(0.154)	(0.154)	(0.146)	(0.147)
Female dummy	-0.236***	-0.238***	-0.217***	-0.216***
	(0.0183)	(0.0183)	(0.0186)	(0.0186)
Constant	1.421***	1.325***	1.682***	1.762***
	(0.214)	(0.212)	(0.202)	(0.204)
Adjusted R^2	0.293	0.290	0.371	0.373
Year FE	Yes	No	No	Yes
Occupation FE	No	No	Yes	Yes

Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: OLS Regression of log hourly wage (2015 US $)

"No schooling or less than 1 year" is the omitted education category. Only those employed at their last interview and working more than 50 weeks past year. Sample size: 2925.

	(1) Current Liquidity	(2) Current Liquidity
Liquidity one year before	1.0010***	1.001***
	(0.0036)	(0.0036)
Biweekly dummy	1,020**	1,024**
	(343.314)	(343.425)
Wage	24.1435*	23.4021*
	(11.2265)	(11.3035)
Age		7.8404
		(13.805)
Constant	-842.61*	-1,171.355
	(355.99)	(679.56)
Adjusted R^2	0.9669	0.9668

Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9: OLS Regression of net liquid assets (2015 US $)
Age is included to capture life-cycle features. Only those employed at their last interview and working more than 50 weeks past year. Sample size: 2925.