Macroeconomic Sentiments and Job Search Behavior

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Abstract

Households' expectations about future economic conditions can play an important role in their job search behavior. Using survey data this paper finds that workers' expectations for the economy have significant impact on their search effort. Pessimistic workers who expect the future labor market to do worse, significantly increase their current search intensity, while optimistic workers report a decrease. The paper evaluates the effect of an expansionary corporate tax cut policy by introducing workers with heterogeneous beliefs to a stylized search model with endogenous search effort. The presence of heterogeneous beliefs dampens the effect of such a policy on the unemployment rate.

JEL codes: J22, E70

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Do households adjust their job search effort in anticipation of worsening labor market conditions? Recessions make job search significantly harder due to the scarcity of jobs, an increasing pool of job seekers and the increased risk of unemployment. If households foresee an economic downturn in the future, they may try to mitigate its effects by increasing their current job search effort (Hajdini et al., 2022; Pilossoph and Ryngaert, 2022). Indeed, household expectations have already been shown to matter for several fundamental economic decisions like consumption, savings and investment, (Kamdar, 2019; Roth and Wohlfart, 2019; Ryngaert, 2022; Binder and Brunet, 2022). In this paper I study whether (and how) expectations of future economic conditions affect the search effort of job seekers and apply these results to a general equilibrium model of the labor market to consider the implications for the effects of corporate tax cuts.

Using survey data from the United States and the Euro area, this paper provides evidence that individual expectations towards the aggregate economy, and specifically the labor market, play a significant role in influencing the job search behavior of households as well. Specifically, workers with pessimistic sentiments towards the future labor market increase their current job search intensity, while optimistic workers decrease their search intensity. Motivated by these findings, a stylized model of search and matching with endogenous search effort is introduced to evaluate the impact of an expansionary corporate tax cut policy in presence of heterogeneous beliefs. The model predicts that the presence of heterogeneous beliefs dampens the impact of such a policy on unemployment rate which declines less than it would in a model with unbiased expectations.

An individual's job search effort is a key determinant of labor market conditions: higher job search improves the efficiency and quality of matches, thus reducing unemployment (McCall, 1970; Pissarides, 1985; Mortensen and Pissarides, 1994; Burdett and Mortensen, 1998).[1] I use the Federal Reserve Bank of New York's Survey of Consumer Expectations (SCE) to estimate a reduced form relationship between the search intensity of workers and their expectations about the economy and document a negative relationship between the two. On average, employed workers decrease their weekly search hours by 1.25 (0.75) hours per week or about 34% (6%), in response to a 1 standard deviation (23 percentage points)

[1]Furthermore, search effort is costly and workers face a choice of optimal effort. This trade-off calls for a rational decision from the workers and it is reasonable to assume that the beliefs and perceptions are taken into consideration for their choice of optimal search effort. Impact of sentiments on individual search effort can thus be important for evaluating the effect of various policies on labor market outcomes.

increase in the 12-month ahead expected probability of higher unemployment.[2]

I exploit an exogenous variation in expectations, driven by the 2016 Presidential elections, to estimate the impact of macroeconomic expectations on search effort. States that voted for Republicans reported more optimistic expectations about the labor market relative to states that voted for the Democrats in the 2016 elections.[3] Given that the 2016 presidential election was not only one of the most polarising elections in terms of public opinion (Mian, Sufi and Khoshkhou, 2018) but also had a largely unanticipated outcome, I then argue that the election can serve as an exogenous shock to the sentiments of the two partisan groups. Using state level data from 2015 to 2017, a difference-in-difference framework is then used to show that following the 2016 Presidential election, more optimistic workers living in Republican states, searched for a job about 3.75 hours per week less than the more pessimistic workers living in Democrat states.

While the primary evidence is from the United States, this paper additionally presents some novel, supporting evidence from the Euro area. It uses the European Central Bank's Consumer Expectations Survey (2020-2022) to show similar patterns for the extensive margin of search. Job search as well as the probability of job search in the next 3 months is positively correlated with the 12-month ahead expected unemployment rate. On the other hand, job search is negatively correlated with the 12-month ahead expected economic growth in the country of residence. This implies that optimistic individuals decrease their current and expected search effort in the near future while pessimistic workers join the search effort when they expect the economy to do worse a year ahead. This suggests that an inter-temporal substitution between searching in the present and searching in the future is at play here. Search effort is costly and workers for whom the marginal cost of searching in the present outweighs the benefit from search, choose to defer the full intensity of their effort to the future. Expansionary expectations decrease the cost of searching in the future which then decreases the current search hours. Additionally, the results from both the United States and the Euro area establish that search effort is counter-cyclical: expecting recessionary outcomes increases current search effort. This paper further finds that household expectations reported in the survey are quite dispersed. Not only is the variance

[2] As Faberman et al. (2017) find, employed workers not only engage in on the job search, but they are also more efficient at it. However, the dynamics of the two groups can be very different from each other and hence I consider both these groups separately as well. As expected, unemployed workers exhibit higher search effort than their employed counterparts. They also respond less to changes in expectations.

[3] I find that the 12-month ahead expectations about higher unemployment rate for Republican states declined relative to the Democrat states right after the election.

for the reported expectations large, the evidence from the partisan groups also demonstrates that different groups can report very different sentiments about the economy. Literature has documented that workers' have biased (and heterogeneous) beliefs and they respond to labor market shocks in a way that is consistent with presence of information frictions (Spinnewijn, 2015; Conlon et al., 2018; Mueller, Spinnewijn and Topa, 2018; Jäger et al., 2022). In the empirical exercise, I find that while some individuals have expectations that predict expansionary outcomes for the economy, at the same time, some individuals expect recessionary outcomes. This translated into their search effort as well since the workers who are optimistic and expect expansionary outcomes tend to search less than pessimistic workers who expect recessionary outcomes.[4] This indicates the presence of heterogeneity in beliefs of workers about the economy.

These empirical findings then motivate the introduction of belief dependent search effort in a stylized model of a frictional labor market with endogenous search effort to study the impact of macroeconomic policies on aggregate outcomes like unemployment rate and vacancies. This is done by introducing heterogeneity in the workers' expectations towards labor market tightness. Specifically, there are two types of workers: *optimists* and *pessimists* who do not observe the true labor market tightness and their heterogeneity manifests in difference in their beliefs about it. Optimistic workers, overestimating the true conditions, decrease their search efforts more in response to an improvement in expectations about the labor market. Pessimistic workers, in contrast, underestimate the true conditions and do not decrease their search effort as much as the optimists. The model is first calibrated to match the empirical facts uncovered in the paper and then is used to analyze the effects of a corporate tax cut which mimics the Tax Cuts and Jobs Act, 2017. Quantitative results show that the presence of heterogeneous expectations dampen the effect of such a policy. The model predicts the unemployment rate to decline only by 0.70 percentage points over 4 quarters from the time of policy impact. In comparison, the unemployment rate declines by about 1.10 percentage points over the same time horizon in the model with homogeneous and unbiased expectations.

Related Literature This paper contributes to two strands of literature. The first contribution is to the literature that studies the impact of household expectations on their behavior. By doing so, the paper also contributes to the literature documenting whether survey based

[4] I define this following Kamdar (2019). Using the SCE data, the author suggests that the main driver of household beliefs is sentiment and households can range on a spectrum of being optimistic to being pessimistic.

expectations inform actual choices of the households in accordance with the predictions of a macroeconomic model. Several studies document the role of expectations in the labor market. Several papers document that worker beliefs are biased and they also affect worker decisions and outcomes such as outside options, job to job transitions, wages, offer arrival rates, uptake of unemployment benefits amongst others (Spinnewijn, 2015; Hendren, 2017; Mueller, Spinnewijn and Topa, 2018; Conlon et al., 2018; Potter, 2020; Jäger et al., 2022). My paper complements the literature by developing evidence that expectations also play an important role in determining the search effort of workers. In doing so, this paper is most closely related to Hajdini et al. (2022) and Ryngaert (2022), who study the effects of inflation expectations on job search behavior of households. I focus primarily on expectations towards the labor market and the economy in general. The aforementioned papers also contribute to a growing strand of literature that tries to understand the role of biased beliefs in labor market decisions. Heterogeneity in expectations and deviation from the standard assumptions is well documented (Coibion and Gorodnichenko, 2012, 2015; Bianchi, Ludvigson and Ma, 2022) and this paper complements these studies and extends the literature by documenting evidence about individual search behavior in presence of biased beliefs. Furthermore, I extend a standard search model by introducing biased beliefs about the labor market conditions.

Second, this paper contributes to the literature trying to understand the job search behavior of workers (Krueger and Mueller (2010); Faberman et al. (2017); Faberman and Kudlyak (2019); DellaVigna et al. (2022), among others). The dynamics of the extensive and intensive margin of search are important to fully understand the tightness of the labor market. Standard models of search and matching define labor market tightness as ratio of vacancies to unemployment. However, as highlighted by a number of recent empirical studies, most new hires originate from out of the labor force or from job-to-job flows rather than from unemployment. In that case, the standard measure of tightness might not be capturing the true tightness as the number of unemployed workers underestimates the total number of workers available to fill vacant jobs. As Abraham, Haltiwanger and Rendell (2020) find, a generalized measure of labor market tightness based on the ratio of vacancies to effective searchers exhibits substantially less volatility than the standard measure. The intensive margin of search is also an important factor required to understand the aggregate dynamics of the labor market tightness and this paper is related to the search and matching models that introduce endogenous search effort (Pissarides, 2000; Shimer, 2004; Christensen et al., 2005; Bagger et al., 2014; Eeckhout and Lindenlaub, 2019; Gertler, Huckfeldt and Trigari, 2020).

Moreover, a key variable in the labor market is the job finding rate which determines the transitional dynamics of the workers, can depend directly on the intensive margin of search. Indeed, as Mukoyama, Patterson and Şahin (2018) show, search effort dampens the labor market fluctuations and an increase in search effort dampened the rise in unemployment rate during the Great Recession.

The rest of the paper is organized as follows. Section 1 discusses the survey data from the United States and the Euro Area. Section 2 presents new empirical evidence about the effect of macroeconomic expectations on search behavior of workers. Section 3 introduces the theoretical framework and describes the model with endogenous search effort and places the empirical evidence in its context. It also introduces heterogeneity in worker expectations and information friction to the model and quantifies the impact of expectations on search effort. Section 4 concludes.

1 Survey Data on Household Expectations and Job Search

This section describes the survey data from the United States and the Euro area used in this paper to study the relationship between a worker's expectations towards the economy and their search behavior. This would require a measure of individual search effort directly observed in the data as well the corresponding expectations about aggregate economic outcomes. While the American Time Use Survey records time use of survey participants, it is only at an annual frequency. Furthermore, there is no direct way to elicit the respondents' expectations about aggregate economic outcomes. Both of these issues are taken care of by using the data from the Survey of Consumer Expectations (henceforth SCE), described in Section 1.1. For the Euro area, I rely on the European Central Bank's Consumer Expectations Survey, which provides supporting evidence since the survey only records the extensive margin of search. This data is described in Section 1.2.

1.1 Survey of Consumer Expectations: United States

The SCE is fielded by the Federal Reserve Bank of New York and is a monthly survey of an annually rotating panel of approximately 1300 household heads from across the US. The survey also has a Labor Market module which is administered every 4 months.[5] Thus, each household stays in the panel for 12 months during which they are administered a labor market

[5]For further discussion about the survey, refer to Armantier et al. (2017).

module 3 times. The core module of the survey, administered monthly, elicits household expectations on various aggregate and personal economic outcomes. Although there are several surveys that elicit household expectations on various macroeconomic outcomes, SCE is unique in also administering a detailed survey about labor market outcomes and perceptions. The labor market module asks a variety of questions on labor market outcomes of the respondents and includes the number of hours searched for a job in a week.

Appendix Table A1 lists some descriptive statistics for the SCE. The monthly module of the SCE runs from 2013:06 to 2020:02. As the sample period for the SCE is short, I compare it to the corresponding statistics in the Current Population Survey (CPS) as CPS not only has a long time-line, it is the main source of aggregate labor market statistics in the US. The sample period for this study is 2014:03 to 2020:03. The SCE data set consists of 11,537 unique individuals. Out of these individuals, about 7,094 (61%) have taken the labor market survey at least once. The sample is comparable to demographic characteristics of the CPS as seen in Table A1. About 74% of respondents were employed while about 4.8% were unemployed. The perceived probability of finding a job in the next three months was about 56% for the employed workers and about 49% for the unemployed. The average search hours reported was about 4 hours weekly for employed workers and about 12 hours weekly for unemployed workers. Furthermore, on an average, 20% of the respondents were optimistic about better access to credit in future, while 33% were pessimistic about the same. 43% of the respondents expected their personal finances to be better while 13% of the respondents expected it to be worse than their current status. Coming to labor market variables, only about 25% of those who take the labor market survey report their search hours. Conditional on searching, 83% of the respondents reported engaging in multiple activities to look for a job. The most popular methods were browsing and applying to job postings online. Overall, this sample is nationally representative.

Descriptive statistics for the optimistic and pessimistic workers are reported in the Appendix Table A2. The workers who report their expected probability of higher unemployment in the top 20 percentile are classified as optimistic. Analogously, the ones who report their expected probability of higher unemployment in the bottom 20 percentile are classified as pessimistic. A higher percent of workers who were high school pass out or less were more optimistic. Also, a higher percent of the unemployed workers were pessimistic, which is not surprising.

1.2 Consumer Expectations Survey: European Union

The Consumer Expectations Survey is an online panel survey of Euro area consumers which is carried out by the European Central Bank on a monthly basis with a quarterly supplement. The survey has a monthly core module which elicits point estimates for expectations about the consumers' expectations about the economy. The survey covers expectations regarding the labor market conditions, inflation, income, spending, housing market activity, borrowing and credit access conditions, and overall economic growth of the economy. The quarterly supplement records if the respondents are actively looking for a job along with their probabilities of looking/finding/losing a job in the next 3 months.

The sample period is from April 2020 to October 2022. The countries included are Belgium, Germany, Spain, France, Italy and the Netherlands. The sample size is roughly around 10,000 with 2000 from each country. Each respondent is expected to remain in the survey for 24 months.[6] 44% of the respondents are between the age of 35-50. 51% pf the sample is female. About 55% of the sample reported having an university diploma or equivalent professional degree. About 66% of the sample is employed while about 6.2% reported themselves to be unemployed.[7] About 18% of the total sample reported actively searching for a job. 14% of the employed and 69% of the unemployed workers reported looking for a job actively. About 33% expected their countries to grow in the next 12 months while about 40% expected the economy to actually shrink.

2 Empirical Evidence: Expectations and Job Search

This section establishes the empirical relationship between household expectations and their search behavior. Section 2.2 uses a reduced form framework to understand the relationship between expectations and job search. Section 2.2 discusses a difference-in-difference framework where I argue that the 2016 US Presidential elections can be an exogenous driver of variation in sentiments along partisan lines, to estimate the impact on search intensity.

[6] The survey targets used in the weight calibration model are age, gender and region, and are based on Eurostat's population statistics.

[7] The survey categorizes the respondents who consider themselves unemployed but are not actively searching for a job as unemployed, thus not necessarily matching the EU labor market statistics.

2.1 Reduced Form Framework

As a first step to examine how sentiments about the aggregate economy affect the search intensity of workers, the following relationship given by Equation 1 is estimated.

$$s_{it} = \alpha + \beta \mathbf{E}_{it}(\textit{State of Economy}_{t+12}) + \Gamma X_{it} + \rho_t + \theta_s + \epsilon_{it} \tag{1}$$

Here, i denotes an individual while t stands for time. s_{it} is the weekly search intensity reported by an individual i at time t, which is defined as the number of hours searched for a job in a week. X_{it} is a set of individual demographic controls.[8] ρ_t and θ_s are time and state fixed effects respectively. The coefficient of interest is β which captures the responsiveness of search intensity of workers to their expectations about the economy.

To capture the expectations about the state of the economy, multiple sentiment variables are used. Primarily, the analysis is done using three variables[9] which capture the expectation of the respondents towards aggregate economy along some relevant dimension. i) Expected probability of an increase in unemployment in the next 12 months, ii) Expected ease of credit access in the next 12 months and iii) Expected personal financial status in the next 12 months.[10] The expected probability of higher unemployment is the survey question that comes closest to measuring expected labor market tightness. The other two indicators reflect the general perception towards the economy.

As, Andre et al. (2019) find, expectations about macroeconomic variables are formed jointly and there is some evidence of co-movement of expectations. Similarly, Kamdar (2019) finds that macroeconomic expectations display co-movement and the main driver behind these expectations are sentiments. When households are optimistic, they expect typically expansionary outcomes (such as falling unemployment and improving business conditions) as well as improving personal financial conditions. Roth and Wohlfart (2019) find that a negative macroeconomic outlook has a negative effect on the financial prospects of households, and that a negative outlook increases the perceived chance of becoming personally unemployed. Thus, in absence of a direct question about the expected state of the economy in the survey, it seems reasonable to employ the expectations on inflation, ease of

[8] A standard set of demographic controls include age, age^2, household income, education, race, gender and marital status of the individual. Duration of search is also included as an additional control.

[9] The details of the survey questions are available in the Appendix section 1.3.

[10] Several other variables are also considered, such as the 12 month ahead expected stock prices, expected house prices, expected inflation rate, expected government debt and interest rate.

credit access and personal financial status. The primary result for the estimation in equation

Table 1: Sentiment towards the Economy and Job Search Hours

Search Hours/Week	(1)	(2)	(3)	(4)	(5)
$\mathbf{E}_{t+12}$(Probability of Higher Unemployment)	0.0212***				0.0132**
	(0.007)				(0.006)
$\mathbf{E}_{t+12}(\pi_{t+12})$		0.0695**			0.0511*
		(0.030)			(0.030)
$\mathbf{E}_{t+12}$(Credit Access): Harder			0.879***		0.842***
			(0.300)		(0.308)
$\mathbf{E}_{t+12}$(Credit Access): Easier			-0.724**		-0.744**
			(0.335)		(0.345)
$\mathbf{E}_{t+12}$(Personal Finances): Worse				1.379***	1.115**
				(0.469)	(0.479)
$\mathbf{E}_{t+12}$(Personal Finances): Better				0.886	0.227
				(0.604)	(0.315)
N	4473	4401	4478	4478	4396
R^2	0.307	0.310	0.309	0.329	0.346
Controls	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: This table presents estimates of how search intensity of workers is related to their expectations towards the economy. It is summarized by the coefficient β in equation 1. Columns (1)-(3) have a different sentiment indicator and Column (4) has all the sentiment variables together. Set of controls include economy wide unemployment rate and inflation rate; individual's employment status, age, age^2, household income, education, race, gender, and marital status for all columns. Fixed effects include time (monthly); and state fixed effects. The Sample period is from 2014:03 to 2020:03. Survey weights used. Clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

(1) is presented in Table 1. The key takeaway from these tables is that current search effort increases as households expect worse aggregate and personal economic outcomes in the future. The following paragraphs expands on each of the rows in Table 1.

12-month ahead expected probability of higher unemployment. The survey question for this variable is *"What do you think is the percent chance that 12 months from now*

the unemployment rate in the U.S. will be higher than it is now?". These results are summarized in Column (1) of Table 1. In Column (1), the results indicate a significant negative correlation between search effort and optimistic expectations about the economy. Workers who anticipate a higher probability of unemployment in the next 12 months devote more time to job searching than those who are more optimistic about the economy's future. For employed workers, a 1 standard deviation increase (23 pp) in their expected probability of higher unemployment is associated with a 1.3-hour per week increase in job search intensity, which represents a 34% increase from the average search time of 3.75 hours per week. Conversely, unemployed workers show a smaller increase in job search time of 0.72 hours per week in response to a 1 standard deviation improvement in economic expectations, which represents about 6% of their total search effort per week.[11] To provide context, a 10 pp increase in the perceived probability of higher unemployment, which is comparable to the drop in the actual job finding rate during recessions, leads to a 15% decline in search hours for employed workers and a 3% decline for unemployed workers. The standard deviation in expected probability of higher unemployment reported by households in the SCE is approximately 23 percentage points, so a 10 pp increase in this probability is not unusually large.[12]

12-month ahead expected ease of credit access. The survey question for this variable is *"And looking ahead, do you think that 12 months from now it will generally be harder or easier for people to obtain credit or loans (including credit and retail cards, auto loans, student loans, and mortgages) than it is these days?"*. These results are reported in Column (2) of Table 1. Expected ease of credit access in the economy is a categorical variable that takes values 1-3 corresponding to harder, about the same and easier access to loans respectively. The omitted category is those who expect the credit access to be the same as at the time of the survey. As we can see in Column (3) of Table 1, as optimism increases, search hours decreases. Employed workers who expect harder access to loans in future, thereby expecting worse economic conditions, search for jobs about 1 hour more per week than those who expect the economy to do better in terms of credit access (Table A3). Unemployed workers who are pessimistic search about 3.4 hours more per week than the optimistic workers (Table A4).

[11] This discrepancy may be because unemployed workers search for more hours on average and therefore cannot decrease their search hours as much as employed workers.

[12] In 2007, prior to the Great Recession, job finding probability, as calculated from CPS, was about 29% which then declined to about 17% in 2010. Similarly, it dropped from about 35% in 1999 to about 26% in 2002.

12-month ahead expected personal financial status. The survey question for this variable is *"And looking ahead, do you think you (and any family living with you) will be financially better or worse off 12 months from now than you are these days?"*. The results are reported in Column (3) of Table 1. Expected personal financial status is also a categorical variable that takes values 1-3 corresponding to worse, about the same and better personal financial status. It is thus, increasing in degree of optimism. Workers who are more optimistic about their personal finances in the future, search for lesser number of hours than those who are pessimistic about their finances. This result is consistent for both employed and unemployed individuals.

A caveat worth mentioning is that the expectations regarding ease of credit access and personal finances are also related to the income effect on labor supply.[13] If a worker expects easier access to loans in the future or better financial conditions, she expects an increase in her non-labor earnings. As a result she may expect to demand more leisure in future and therefore search less today for a job. To account for this, I estimate equation (1) including expected total earnings [14] in the next 4 months, in the set of controls. The results remain robust to inclusion of expected total earning.[15] The results in Table 1 are robust to further inclusion of current labor market tightness, suggesting that even when labor markets are tight or the economy is currently doing well, a pessimistic worker searches more than her optimistic counterpart. This indicates that expectations about the economy indeed matter for the current search behavior of workers as the model suggests.

The results in Table 1 suggest that an inter-temporal substitution takes place between searching in the current period and searching in future. This can arise from the fact that optimistic workers expect tighter markets in future, thereby increasing their surplus and decreasing their marginal cost of searching in the future. When a worker expects bad times ahead, she may also expect the matching efficiency or the vacancy posting to decline further in future and hence searches harder in the current period.

The other important takeaway is the heterogeneity in the beliefs of workers. This is specially

[13] An income effect on the labor supply increases demand for leisure if leisure is a normal good and not an inferior one. For all practical purposes, leisure is indeed a normal good and hence, an increase in non-labor income decreases labor supply and increases demand for leisure.

[14] I also consider expected labor earnings, and the results remain the same. However, there are fewer responses for expected labor earnings and hence I do not include this in my estimation.

[15] These results are conditional on searching which indicate that this is not a pure income effect. Furthermore, from a broader perspective, even if these expectations encompass the income effect, they remain relevant for the job search behavior of the workers.

evident in the beliefs about future credit access and personal finances. Agents expect future credit access to be easier or harder at the same point in time. Furthermore, as seen in Appendix Figure 5, the raw beliefs regarding increase in 12-month ahead expected unemployment rate are highly dispersed. This can have policy implications and I demonstrate the effects of a corporate income tax cut in Section 3.3. Finally, Tables A3 and Table A4 document the results for employed and unemployed workers respectively. Separate sub-samples of unemployed and, employed individuals who search for a job are considered because the behavior of the two groups can be different from each other.

Sentiments and Job Search in the Euro Area. I provide supporting evidence from the Euro Area using the ECB's Consumer Expectations Survey. The survey captures only the extensive margin of job search as it only records if the respondent is actively searching for a job or not. It also asks the respondents to report their probability of looking for a job in the next 3 months. In the core module, the survey elicits the expected 12-month ahead unemployment rate ($E_t(u_{t+12})$) as well as an estimate for the current unemployment rate ($E_t(u_t)$). As for the general economy, the survey reports subjective expectations about whether the economy will grow 12 months ahead and elicits point estimates for 12-month ahead expected economic growth in the country of residence of the respondent. I estimate the reduced form relationship in equation 2.

$$y_{it} = \alpha + \beta \mathbb{E}_t^i(X_{t+h}) + \Gamma_{it} + \delta_t + \epsilon_{it} \tag{2}$$

Where, $y_{it} = 1(Search_{it})$ which takes value 1 if actively looking for job. I also consider $y_{it} = P_{t+3}(search)$ which is the probability of looking for a job in 3 months. $\mathbb{E}_t^i(X_{t+h})$ are the expected macroeconomic outcomes. I mainly consider 3 outcomes which are: 12-month ahead expected unemployment rate, $\mathbf{E}_t^i U_{t+12}$, current unemployment rate as reported by the households $\mathbf{E}_t^i U_t$, and 12-month ahead expected economic growth rate. Γ_{it} is a set of controls which include employment status, country FE, age, gender, education, income, number of children, marital status and household size. The results are presented in Table 2.

The results are overall consistent with what I find in the SCE. Job search is positively correlated with the 12-month ahead expected unemployment rate (although the magnitude is small). Probability of looking for a job in the next 3 months is also positively correlated with the 12-month ahead expected unemployment rate.[16] The expectation of positive economic

[16]The results remain consistent when Logit or Probit specifications are used since $y_{it} = 1(Search_{it})$ is an

Table 2: Household Expectations and Search in the Euro Area

	(1) Actively Searching	(2) Probability(Search in 3-months)
$E_t^i(u_{t+12})$	0.0828***	0.108***
	(0.029)	(0.017)
N	31909	29121
R^2	0.186	0.174
$E_t^i(u_t)$	0.0733**	0.102***
	(0.031)	(0.018)
N	31909	29121
R^2	0.187	0.174
$E_t^i(\text{Growth})_{t+12}$ in %	-0.109***	-0.0932***
	(0.032)	(0.023)
N	31909	25838
R^2	0.188	0.179
Controls	Yes	Yes
Fixed Effects	Yes	Yes

Note: The dependent variable in Column (1) is a dummy variable which takes value one if the respondent is actively searching for a job. The dependent variable in Column (2) is Probability of searching for a job in the next three months. Demographic controls used are: age, income, education, gender, country, job status, household size, presence of partner and number of children. Clustered standard errors in parentheses, * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$). Survey weights used.

growth in the next 12 months is associated with a decline in job search as well as the probability of job search in the next 3 months.

In 2 Panel B, the coefficient is positive for $E_t(u_t)$, indicating that job search increases on an average when $E_t(u_t)$ increases. The coefficient is positive but insignificant for $E_t(u_{t+12}) - E_t(u_t)$, as reported in Appendix Table A9 and Table A10 (Column (4)). Taken together, we can interpret the result that when households expect the future labor market to worsen during an already worse labor market, they increase job search.

indicator variable.

Cyclicality of Search Effort. The main finding of the reduced form estimation is that job search increases when bad times are expected ahead. Now to argue that this suggests that the search intensity is counter-cyclical in nature, it needs to be established that households expect the 12-month ahead unemployment to increase when actual unemployment rate increases. This gives a sense of whether households anticipate a downturn in the future or expect expansionary outcomes in future. Now whether or not the search intensity is pro-cyclical (decreases in recessions) or counter-cyclical (increases in recessions), can be understood from the direction of co-movement between the 12-month ahead unemployment expectations ($\mathbb{E}^i[Prob(U_{t+12} - U_t > 0)]$) and the change in actual unemployment rate ($(U_t - U_{t-12})$). As reported in Appendix Table A6 that this correlation is > 0. This implies that when actual unemployment rate increases, expectations of 12-month ahead unemployment rate increases as well. As discussed earlier, search intensity is positively correlated with the expected 12-month ahead unemployment rate. Workers increase their search effort when they think they are (and expect in future to be) in a recession. This indicates that the intensive margin of search hours is counter-cyclical, complementing the findings in Mukoyama, Patterson and Şahin (2018) who find in their paper that individual search effort is counter-cyclical and my empirical exercise complements their result.[17]

2.2 A Difference-in-Difference Framework

The results from the reduced form estimation indicate that there could be biases in beliefs which lead individuals to have different sentiments towards the economy. An interesting exercise here would be to study the change in search behaviour of different demographic groups due to a variation in their sentiments in response to an exogenous event or shock. Expectations about the economy and choice of search hours maybe informed by local conditions or personal experiences that we do not observe. In that case, the impact on search hours that we observe from expectations about the economy may be biased. To address this issue, I exploit a novel difference-in-difference environment using an exogenous shock that shifts household expectations in a differential manner for two demographic groups. In this section I posit that the 2016 US Presidential elections led to an exogenous shift in expectations about the economy along partisan dimension.

[17] One could now further argue that the expectations reported by households are not in line with the data generation process. I estimate the following relationship for the sample period 2013:m6 to 2020:m3 (corresponding to the SCE sample period): $\mathbb{1}[U_{t+12} - U_t > 0] = \alpha + \psi(U_t - U_{t-12}) + \nu_t$. The coefficient ψ is positive and lines up with the of ϕ. This indicates that the expectations of households are in line with the data generation process. Further details of this exercise are in Appendix Section 1.1

2016 US Presidential Election and Household Expectations Presidential elections are known to cause partisan polarization of household expectations. In the political science literature, it has been established that individuals have a more positive assessment of current economic conditions when the party they support forms the government (Bartels, 2002; Gerber and Huber, 2009). Furthermore, the 2016 Presidential election caused an unprecedented increase in relative economic optimism for Republican voters as reported by Mian, Sufi and Khoshkhou (2018). The authors also find that the 2016 election was one of the most polarising US elections. Using the SCE Armantier et al. (2019) find that after the 2016 election, depending on partisan affiliation, political and economic outlook of the American electorate shifted. Republican voters became substantially more optimistic than their Democratic counterparts. Coibion, Gorodnichenko and Weber (2020) find that Americans hold fundamentally different conditional expectations about the economy over the next year depending on the Presidential winner. As these evidences suggest, and along with the fact that The 2016 election result was largely unanticipated; the 2016 Presidential election is a good candidate to generate exogenous variation in household sentiments along the party lines. I therefore exploit this exogenous shift in expectations caused by the tightly contested Presidential election in 2016 to estimate the impact on household expectations and subsequently on their search behavior.

The publicly available data from SCE does not include the county or party affiliation of the respondents, but does include the states the respondents reside in. I therefore use states of the respondents to classify them into Democrats or Republicans. To do this, I assign the respondents in states that the Democrats (Republicans) won by a significant majority as Democrats (Republicans). A significant majority is defined as a difference in vote share greater than 5%. States with less than 5% margin are defined as swing states and 13 such states are dropped from the sample for this analysis.[18]

The evidence of a shift in sentiments along partisan lines are presented in Figure 1a, which is in agreement with the findings by Armantier et al. (2019) at the county level.[19] Republican states were more pessimistic than Democratic states prior to the election and grew relatively

[18]The omitted states are Arizona, Colorado, Florida, Maine, Michigan, Minnesota, Nevada, New Hampshire, North Carolina, Ohio, Pennsylvania, Virginia and Wisconsin.

[19]The article and the county level trends can be found here. This study compares expectations between the two electoral groups for personal finances, chance of increase in stock prices and unemployment, government debt and taxes. They find evidences of partisan polarization in household expectations. However, both Mian, Sufi and Khoshkhou (2018), and Conlon et al. (2018) find that polarized economic expectations did not translate into polarized consumer spending.

much more optimistic immediately after the election. As seen in Figure 1a, prior to the 2016 elections, Democratic states were reporting a lower probability of a higher year-ahead unemployment rate than Republican states, but this pattern reversed immediately after the election. Right after the election in November 2016, the 12-month ahead expectation for

Figure 1: Time Trend for Republican and Democrat States

(a) Monthly Average $\mathbb{E}(P(\Delta \text{Unemp}_{t+12} > 0))$ (b) 4 Month Average of Weekly Search Hours

Note: This figure plots the time trend of the weighted average of the 12-month ahead expected probability of higher unemployment for Republican and Democrat states (defined as per the 2016 election) on the left panel. On the right panel, the figure plots the time trend of the weighted average of search hours for Republican and Democrat states (defined as per the 2016 election). The averages are weighted with state-level population as weights. Swing states with a victory margin of less than 5% have been dropped.

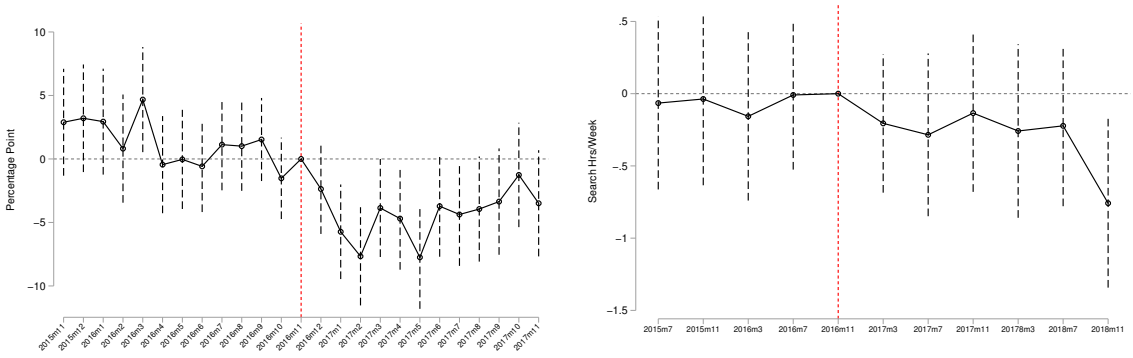
higher unemployment plummeted for Republicans while it increased for Democrats. This indicates an increased pessimism about the economy amongst Democrats while an increased optimism amongst the Republicans. In figure 1b, we can see that the average search hours, which had declined before the election for the Democrats sharply increased following the election while it declined for the Republicans.[20]

To further understand whether these differences in levels are significant, the outcome of an event study for the 12-month ahead expected probability of higher unemployment and search hours are reported in Figures 2a and 2b respectively. These figures plot the expectations regarding higher chance of unemployment and search hours of individuals in Republican states relative to those in Democratic states. To be more specific, these figures plot the coefficient β_k in Equation 3 and 95% confidence interval around them. Several individual

[20] Although it is true that Republican states can be systematically different from Democratic states, these differences are not enough to explain these trends since even after controlling for demographic differences I observe similar trends.

Figure 2: Event Study: Republicans Relative to Democrats

(a) Monthly Average $\mathbb{E}(P(\Delta\text{Unemp}_{t+12} > 0))$ (b) 4 Month Average of Weekly Search Hours



Note: The left panel plots the difference (and confidence interval) in 12-month ahead expected probability of higher unemployment between Republican and Democrat states pre and post 2016, after controlling for demographic differences. The right panel plots the same for search hours. Controls used are age, age^2, job status, household income, education, gender and race. Clustered standard errors, survey weights used. Swing states with a victory margin of less than 5% have been dropped.

characteristics such as age, age^2, job status, household income, education, gender, marital status and race are controlled for in this estimation.

$$y_{it} = \alpha + \sum_{k \neq 2016:11} \beta_k Party_i \times \mathbb{1}[t = k] + \mu \mathbb{X}_t + \epsilon_{it} \tag{3}$$

For the 12-month ahead expected probability of higher unemployment, the difference between the two electoral groups prior to the election is around zero. However, post election this difference becomes negative and significant, even after controlling for demographics. Specifically, Republicans post election have a lower $\mathbf{E}_{t+12}(\text{Prob}(\Delta \text{ Unemp} > 0))$, that is, they turn more optimistic relative to the Democrats. For search hours the trend is not as stark, but it appears that Republicans who were searching about the same or even somewhat more than Democrats, started searching lesser post election. Since Presidential elections have been known to polarize economic expectations, the shift in expectations post election is not surprising. The shift in search hours immediately after the elections is thus, likely to be coming from this exogenous shift in expectations about the economy.

Keeping these evidences in mind, I conduct a difference-in-difference style analysis, by dividing the sample into two groups: Republicans and Democrats and the time period into pre and post November 8, 2016 when the result for the Presidential election was announced.

Appendix Table A5 reports the summary statistics for the demographic groups in question. Most of the demographics are similar across both groups. The 12-month ahead expected probability of higher unemployment is on an average the same across Democrats and Republicans. For search hours, Democrats and Republicans seem to be putting in similar number of hours weekly. Formally, equation 4 is estimated

$$y_{it} = \alpha + \gamma Party_i \times Post_t + Party_i + Post_t + \Gamma X_{it} + \epsilon_{it} \tag{4}$$

where y_{it} is 12-month ahead expected probability of higher unemployment ($\mathbf{E}_{t+12}$(Prob(Δ Unemployment Rate > 0)) and weekly search hour respectively. $Post$ is the post election time dummy which takes value 1 if date of survey was on or after the 9^{th} of November, 2016. $Party$ is the party for which the state of the respondent's residence voted and it is either Republican or Democratic. As mentioned earlier, 13 swing states which had a margin of less than 5% of vote share are dropped in this analysis. The coefficient of interest here is γ. It captures the effect of being a Republican voter post the election in 2016. $Party$ and $Post$ capture all other events that were common to the electoral groups and the time period. X_{it} includes demographic controls such as age, age^2, job status, household income, education, gender, marital status and race. State specific unemployment rate is also included to control for differences in aggregate labor market conditions across the states. The results are reported in Table 3 and 4 respectively for the two dependent variables. Demographic controls are included in column (2) of Table 3 and 4, to purge away all other influences coming from demographic differences in the two groups. Table 3 reports that the sentiments of Republicans towards the economy improved post election. Republicans reported a decline of 5.5 pp in their 12-month ahead expected probability of higher unemployment as compared to the Democrats. This result is in line with findings from Coibion, Gorodnichenko and Weber (2020) who find that for the 2020 elections, households predict better economic condition if their preferred candidate wins but a dire one if the other candidate wins. According to the results in Table 3, Democrats grew immediately pessimistic about the economy in the coming year, even though as Blinder and Watson (2016) find, Presidents do not seem to have a strong effect on the economy, especially over short horizons. The main results are documented in Table 4 which corroborates the findings in section 2.2 since as we see in Table 3, Republicans turned optimistic post election about the economy while the Democrats grew pessimistic immediately after the election. Republicans searched, on an average about

Table 3: Difference-in-Differences: Expected Probability of Higher Unemployment

Dep Var: $\mathbf{E}_{t+12}$(Prob(Δ Unemp > 0))	(1)	(2)
Republican $\times$ Post Election	-5.552***	-5.498***
	(1.662)	(1.596)
Post Election	1.230	-1.108
	(1.382)	(1.791)
Republican	0.638	0.455
	(1.288)	(1.275)
Controls	No	Yes
Observations	15243	15135
R^2	0.008	0.045

Note: This table presents estimates of changes in Expected probability of higher unemployment for individuals in Republican states after the 2016 Presidential Elections. These estimates correspond to the coefficient γ from equation 4. Post Election period is from 2016:11 to 2017:11. Sample period is from 2015:11 to 2017:11. Set of controls include age, age^2, job status, household income, education, race, gender and marital status. Clustered standard errors in parentheses. Survey weights used. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

3.7 hours less than the Democrats after the election, as reported in Table 4, Column (2).[21] The set of demographic controls include age, age^2, household income, education, job status, occupation, race, gender and marital status. As the results indicate, although the coefficient decreases marginally upon controlling for observable characteristics of the households, there is still a significant decline in search hours for Republicans after the election. To control for differences in aggregate labor market conditions across the states, the local unemployment rate is also added to the controls. It is worthwhile to note that immediately after the election, the actual economy did not change instantaneously. Only the sentiments of the households changed in line with their political affiliation in response to this shock. Therefore, the response in search hours after the election is likely coming from this shift in sentiments. To summarize, by exploiting this novel exogenous variation in sentiments due to the 2016 Presidential election, I find that pessimistic sentiments towards the economy translate into higher search hours while optimistic sentiments about the economy translate into lower search hours.

[21] Standard errors are clustered at the household level.

Table 4: Difference-in-Differences: Search hours

Dep Var: Search Hours	(1)	(2)
Republican × Post Election	-4.046**	-3.749**
	(1.909)	(1.752)
Post Election	2.428	1.892
	(1.609)	(2.139)
Republican	1.895	1.951**
	(1.188)	(0.958)
Demographic Controls	No	Yes
N	745	743
R^2	0.009	0.241

Note: This table presents estimates of changes in search hours for individuals in Republican states after the 2016 Presidential Elections. These estimates correspond to the coefficient γ from equation 4. Post Election period is from 2016:11 to 2017:11. Sample period is from 2015:11 to 2017:11. Set of controls include state unemployment rate, age, age^2, job status, household income, education, race, gender and marital status. Clustered standard errors in parentheses. Survey weights used. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Taking stock, the empirical findings in the previous section establish that worker beliefs significantly affect their search behavior. Furthermore, the findings imply that the workers are heterogeneous in their beliefs and that these beliefs are biased. Some workers expect expansionary outcomes for the economy while some expect the economy to worsen during the same time horizon, and adjust their search effort accordingly. It is therefore important to incorporate information friction in models of search and matching to capture the true search effort of workers and hence the impact on aggregate variables as well. These elements are introduced in a Diamond-Mortensen-Pissarides (DMP) model of job search in a frictional labor market with endogenous search effort. There has been an increase in models with worker heterogeneity in a standard DMP model with endogenous search effort in some cases (Pries, 2008; Bils, Chang and Kim, 2011; Stupnytska and Zaharieva, 2015). However, all of these studies introduce heterogeneity in worker productivity or match surplus, but not in beliefs. The model is then used to study the effects of an expansionary policy such as a corporate tax cut policy, on search effort and unemployment rate in presence of biased beliefs.

3 Search and Matching Model with Heterogeneous Beliefs

This section introduces heterogeneous beliefs in a Diamond-Mortensen-Pissarides model with endogenous search effort and job-to-job transitions. It describes the model in some detail and discusses the calibration strategy. The empirical findings of this paper are used to discipline the model and thereafter, the effects of an expansionary corporate tax-cut policy on labor market outcomes in presence of heterogeneous beliefs are presented.

3.1 The Economy

Consider an economy comprised of continuum of workers and firms, each of measure unity with discrete time t over an infinite horizon. Each period, all members of the household pool all wages and unemployment income and consume the same amount. Workers can be either employed or unemployed and they discount future at the rate $\beta \in (0,1)$. Productivity $z \sim \{z_g, z_b\}$ is match specific and can be either good or bad, with $z_g > z_b > 0$. A good match implies high productivity and a bad match implies low productivity. A match is good with probability λ and bad with probability $1-\lambda$.

Labor Market Job search is random. Firms post vacancies and workers are randomly matched with it via an aggregate matching function for them to be employed.

$$\mathcal{M} = m(s, \bar{s}, v)$$

Here $\bar{s_t}$ is the aggregate search effort and s is the total number of searchers. Thus, the total number of matches are governed by the matching function. Workers are indexed as i, j where i reflects the belief type which can take values {optimists (o), pessimists (p)}, while j reflects job status which can take values {unemployed (u), employed (e)}. Both the unemployed and employed workers search for a job. Searching is costly and the cost function is increasing and convex. The search cost is given by

$$c(s) = \phi s^{\omega}/\omega, \quad \omega > 1$$

The probability of finding a job for a worker is given by the function $f(s_{jit}, \bar{s}_t, \theta_t)$. The tightness is given by $\theta = \frac{v}{s}$, which is the vacancy (v_t) to total job searchers ratio. Separation risk is exogenous for all workers, given by probability $1-\sigma$.

An employed worker in a bad match keeps searching on the job. They only accept a good job and are indifferent between two bad jobs.[22] A worker in a good match does not search. Unemployed workers search and accept any match.

Let g_t be the number of good matches within a firm that are working during period t and b_t the number of bad matches. Then, the total number of unemployed workers is given by

$$u_t = 1 - g_t - b_t$$

The ratio of bad jobs to good jobs is held constant. The probability that a job is filled is given by

$$q_t = \frac{\mathcal{M}_t}{v_t}$$

However, not all matches lead to hires since workers in bad matches only accept good matches. Hence the probability q_t^g that a vacancy leads to a good quality match and q_t^b that lads to a bad quality hire.

$$\begin{aligned} q_t^g &= \lambda q_t \\ q_t^b &= (1-\lambda)(1 - \frac{\sigma s_{et} b_t}{\bar{s}_t})q_t \end{aligned} \tag{5}$$

Heterogeneity in Beliefs Now consider two types of workers in the economy: Pessimists and Optimists, denoted by $i = \{p, o\}$. Pessimistic workers have a mass of $p \in [0,1]$ while the optimistic workers have a mass of $1-p$. Thus, the total mass of workers remains 1. Optimistic workers expect expansionary outcomes for the economy while the pessimistic workers expect recessionary outcomes. This difference manifests in the belief that they form about the labor market tightness and their separation rate. The workers do not observe the true value of θ_t and their separation risk, σ . Rather, they only observe a signal $\tilde{\theta}_{it}$ about the actual labor market tightness. I assume that the signals for worker i take the following form

$$\tilde{\theta}_{it} = \theta_t \delta_i \tag{6}$$

where, θ_t is the actual labor market tightness. The worker does not know what δ_i is and only observes $\tilde{\theta_{it}}$. δ_i can take positive values and $\delta_i > 1$ implies that the worker observes the labor market to be tighter than the actual, while $\delta_i < 1$ implies that the worker observes a

[22] I assume the worker stays in the current bad match if they do not find a good match upon searching.

slacker labor market than the actual. δ_i thus indicates the position of the worker on sentiment spectrum, that is, the degree of optimism (or pessimism) towards the economy. I also assume that a worker does not change her beliefs over her lifetime.

It is important to note that the form of bias introduced here does not account for learning or updating of beliefs, unlike other forms of signals, where agents incorporate learning in their estimates, as in Conlon et al. (2018).[23] Though the signal in equation 6 does not consider prior beliefs of agents, it still captures their current perception or, an immediate albeit biased, update to the latest θ_t. The workers have no other differences in terms of productivity or bargaining power apart from this single difference in their beliefs about the state of the economy. Firms, on the other hand, have full information about the macroeconomic variables and can observe the true values. The firms are aware of existence of two belief types of workers. However, the firms do not have any other mechanism to reveal the belief type when a match occurs.

Worker's Problem Workers can either be employed or unemployed and their job status is indexed by $j = \{e, u\}$. The employed worker with belief type $i = \{o, p\}$, and job type $k = \{g, b\}$ has the value function W_i^k while the value of being unemployed is given by U_i. An employed worker earns a wage w_i^k while employed. A worker in a bad match keeps searching on the job. If another match is found and accepted, the worker goes to the new firm at the end of the period. Otherwise the worker remains with the firm for another period. An employed worker in a bad match earns wage w^b and keeps searching for a new job while in the current firm with search intensity s_{jit} if the match is not destroyed by the exogenous separation shock. Since search is costly, the worker pays the search cost $c(s_{jit})$. If the separation shock is realized (with probability $(1-\sigma)$), then the worker becomes unemployed in the next period and gets value $U_i(X_{t+1})$. With $(\sigma\lambda f(s_{jit}, \tilde{\theta_{it}}))$ she finds a good match while searching on the job and gets $W_i^g(X_{t+1})$ in the next period when she moves to the new job. With $(\sigma(1-\lambda f(s_{jit}, \tilde{\theta}_{it})))$ she finds a bad match while searching on the job and gets $W_i^b(X_{t+1})$ in the next period while staying with the current firm. Thus, the

[23]The signal following Conlon et al. (2018) would be of the form $\tilde{\theta}_{it} = \zeta\tilde{\theta}_{it-1} + (1-\zeta)\theta_t$, where ζ is the learning parameter. Here, I have zero weight on the prior and hence there is no learning. However, this simplistic signal manages to capture the essence of information frictions

[23]I assume that the worker remains with their current firm if they find a new bad match while searching on the job. further details can be found in Gertler, Huckfeldt and Trigari (2020).

value of being employed for a worker type i in a bad match is thus given by

$$W_{it}^{b} = \max_{s_{eit}} \Bigg\{ w_t^b - \sigma c(s_{jit}) + \beta \mathbf{E_t} \Big[\sigma(1 - \lambda f(s_{jit}, \tilde{\theta}_{it})) W_{it+1}^{b} + \sigma \lambda f(s_{jit}, \tilde{\theta}_{it}) W_{it+1}^{g} + (1 - \sigma) U_{it+1} \Big] \Bigg\} \tag{7}$$

The first order conditions for each type i for the employed workers in a bad match are now given by

$$c'(s_{jit}) = \beta \lambda \sigma f_1(s_{jit}, \tilde{\theta}_{it}) \mathbf{E_t} \left[W_{it+1}^{g} - W_{it+1}^{b} \right] \tag{8}$$

The optimal search effort that satisfies (8) equates the marginal cost of searching to the expected benefit from an additional unit of search.

An employed worker type i in a good match earns wage w^g and does not search for a new job. If the separation shock is realized (with probability $(1 - \sigma)$), then the worker becomes unemployed in the next period and gets value $U_i(X_{t+1})$. She continues to earn $W_i^g(X_{t+1})$ in the next period if the match is not destroyed. Thus, the value of being employed for a worker in a good match is thus given by

$$W_{it}^{g} = w_t^g + \beta \mathbf{E_t} \Big\{ \sigma(1 - \lambda f(s_{jit}, \tilde{\theta}_{it})) W_{it+1}^{g} + (1 - \sigma) U_{it+1} \Big\} \tag{9}$$

An unemployed worker with type i gets b from being unemployed in terms of unemployment benefit and searches for a job. She exerts optimum search effort that maximizes her value from search. Since job search is costly, she incurs a cost $c(s_{uit})$. In the next period, the unemployed worker can be matched with either a good match and become employed with the probability $\lambda f(s_{uit}, \theta_t)$ and get value W_{it+1}^{g} or with a bad match and become employed with the probability $(1 - \lambda) f(s_{uit}, \theta_t)$ and get value W_{it+1}^{b}. With remaining probability, she continues to be unemployed and gets value U_{it+1}.

$$U_{it} = \max_{s_{jit}} \Bigg\{ b - c(s_{jit}) + \beta \mathbf{E_t} \Big[f(s_{jit}, \tilde{\theta}_{it}) (\lambda W_{it+1}^{g} + (1 - \lambda) W_{it+1}^{b}) + (1 - f(s_{jit}, \tilde{\theta}_{it})) U_{it+1} \Big] \Bigg\} \tag{10}$$

The first order conditions for each type i for the unemployed workers are now given by

$$c'(s_{jit}) = \beta f_1(s_{jit}, \tilde{\theta}_{it}) \mathbf{E_t} \left[(\lambda W^g_{it+1} + (1-\lambda) W^b_{it+1}) - U_{it+1}) \right] \tag{11}$$

The optimal search effort that satisfies (11) equates the marginal cost of searching to the expected benefit from an additional unit of search.

Firm's Problem The value that the firm gets from a good match is given by J^g_t. A firm earns z_{gt} from the match while incurs the worker's wage as a cost in the current period. In the next period, the firm is separated from the worker with probability σ and gets value from the vacancy $V(X_{t+1})$. With remaining probability the worker continues to work at the firm and the firm gets the value $J(X_{t+1})$.

$$J^g_t = (z_{gt} - w_{gt})(1-\tau_t) + \beta \mathbf{E} \Big[\sigma J^g_{t+1} + (1-\sigma) V_{t+1} \Big] \tag{12}$$

where τ_t is the tax rate and follows an AR(1) process such that

$$log(\tau_t) = (1-\rho_\tau) log(\bar{\tau}) + \rho_\tau log(\tau_{t-1}) + \epsilon^\tau_t$$

where, $\epsilon^\tau_t \sim N(0, \sigma^2_\tau)$.

The value that the firm gets from a bad match is given by J^b_t. A firm earns $z_{bt} = \zeta z_{gt}$ from the match while incurs the worker's wage as a cost in the current period. In the next period, the firm is separated from the worker either if the match is destroyed endogenously or if the worker finds a good match and moves to a new job in which case the job remains vacant. With remaining probability the worker continues to work at the firm and the firm continues to get J^b_{t+1}.

$$J^b_t = (\zeta z_{gt} - w_{bt})(1-\tau_t) + \beta \mathbf{E} \Big[\sigma (1 - \lambda f(s_{jt}, \tilde{\theta}_{it})) J^b_{t+1} + (1-\sigma) V_{t+1} \Big] \tag{13}$$

Note that here $f(s_{jt}, \tilde{\theta}_{it})) = p f(s_{jpt}, \tilde{\theta}_{it}) + (1-p) f(s_{jot}, \tilde{\theta}_{it})$, which is a weighted average of the job finding rate of the pessimist and the optimist worker since the firm is not aware of the belief type it matches with directly.[24] Although the firms are aware of the existence of

[24]Here, because of the non-linear matching function, if the economy has half pessimistic workers and half optimistic workers who symmetrically evaluate the state of the labor market, we would still see some differences in the aggregate job finding rate. This is demonstrated in Appendix Section 3.2.

heterogeneous workers, they cannot differentiate between the belief type of worker upon matching and can not predict the type they will be matched with. Note that, even ex-post, the firms do not have a mechanism to identify the type of the worker they match with. Thus, firms have an expected value for the probability of separation over the two belief types. The value of a vacancy is the same for each job and since in the future the firm can be matched with either type of worker, we have the following value function,

$$V_t = -\kappa + \beta \mathbf{E}\Big\{ q^g(\bar{s}_t, \theta_t) J^g_{t+1} + q^b(\bar{s}_t, \theta_t) J^b_{t+1} + (1 - q(\bar{s}_t, \theta_t)) V_{t+1} \Big\} \tag{14}$$

Wage Setting I assume that there is a worker union which bargains with firms on behalf of all workers. The union is assumed to be aware of the expected surplus of the workers given by $\tilde{S}^k_{it}$ for each match quality $k = \{g, b\}$. I further assume that the firms also know the expected surplus of the workers. Firms and the union both know the true surplus of the firms. The expected surplus of the workers is given by:

$$\tilde{S}^k_t = p(W^k_{pt} - U_{pt}) + (1 - p)(W^k_{ot} - U_{ot}) \tag{15}$$

Wages are bargained for the good matches and the bad matches receive wage $w_b = \zeta w_g$, proportional to their productivity. Therefore, the bargaining rule yields,

$$(1 - \gamma)\tilde{S}^g(w, X_t) = \gamma[J^g(w) - V] \tag{16}$$

where γ is the worker's bargaining power. There are no re-negotiations here and wages are assumed to be flexible.

Equilibrium In equilibrium, the free entry condition, $\tilde{V} = 0$, is imposed. An equilibrium is a solution for a set of functions $\{W^k_{it}, U^k_{it}, J^k_t\}$; the Nash wage w^k_t; the search intensities for the unemployed workers s_{uit}, for the employed workers s_{eit}; average vacancies, unemployment and employed workers in good and bad matches; and labor market tightness θ_t. Unemployment evolves according to

$$u_{t+1} = (1 - u_t)\sigma + u_t f(\bar{s}_t, \theta_t) \tag{17}$$

The solution is such that the first order conditions for the search intensities are satisfied; the wages satisfy the Nash bargaining condition.

3.2 Calibration

This section summarizes the calibration strategy. The parameter values are in Table 5. In the model, every period corresponds to a month.

Functional Form of the Matching Function. The matching function takes a generalised form, following Mukoyama, Patterson and Şahin (2018). Specifically,

$$m(s,\bar{s},v) = \chi\left(\alpha\bar{s}^{\psi} + (1-\alpha)\theta^{\psi}\right)^{\eta} s \tag{18}$$

The job finding probability is given by

$$f(s,\theta) = \chi\left(\alpha s^{\psi} + (1-\alpha)\theta^{\psi}\right)^{\eta}$$

Here, $\chi \geq 0$ and $\alpha \in [0,1]$. This is a departure from the standard assumption in Pissarides (2000), of the job finding probability being proportional to s, in a model with endogenous search intensity. Here, the choice of the parameter α and ψ are important for the direction of response of search intensity to the labor market tightness.[25] Since I find evidence that search is counter-cyclical, I consider the generalised form for quantitative analysis and the calibrations presented in Table 5 correspond to this matching function for counter-cyclical search effort. For this, we need $f_{s\theta} < 0$, which is achieved by $\psi > 1$. Furthermore, for the matching function to exhibit regular properties such as increasing in s, v and u; I assume that $\psi\eta < \dfrac{1}{(1-\alpha)}$. The two key parameters ψ and α are set to match the elasticity of search effort to labor market tightness following Mukoyama, Patterson and Şahin (2018) as $\psi = 1.33$ and $\alpha = 0.15$. The matching efficiency parameter χ is set to 0.49.

Productivity Process. The aggregate productivity process z_t is given by the AR(1) process

$$log(z_{t+1}) = \rho log(z_t) + \epsilon_{t+1} \tag{19}$$

Here $\epsilon \sim N(0,\sigma_{\epsilon}^2)$. Following Hagedorn and Manovskii (2008), I set the monthly auto-correlation of log of labor productivity to be $\rho = 0.0065$ and $\sigma_{\epsilon}^2 = 0.949$ and in steady state, $\bar{z} = 1$.

[25] As discussed in detail by Mukoyama, Patterson and Şahin (2018), this generalized matching function collapses to the standard Cobb-Douglas matching function with search effort ($m(s,\bar{s},v) = \chi\bar{s}^{\alpha}\theta^{(1-\alpha)})s$) as $\psi \to 0$. In that case, $f_{s\theta} > 0$, that is search effort is pro-cyclical.

Other Standard Parameters. The convexity of the search cost function is set to be $\omega = 2$ following Yashiv (2000). The worker's bargaining power is set as $\gamma = 0.5$ (Shimer, 2005) and the results are robust to a range of realistic bargaining power between 0.2 to 0.8. Following Shimer (2005), I set the discount rate $\beta = 0.988^{\frac{1}{3}}$. I follow Bawa and Vu (2020) for calibrating $\bar{\tau} = 0.36; \rho_t = 0.97; \sigma_\tau = 0.011$ to match US Tax Cuts and Jobs Act of 2017, which reduced the statutory corporate tax rate from 35% to 21%.

Internally Calibrated Parameters. Some parameters are jointly calibrated to match certain targets in the steady state. The cost of vacancy κ and the search cost parameter ϕ are targeted to match the U-E probability and E-E probability respectively. The separation rate σ is targeted to match the E-U probability. The ratio of bad jobs to good jobs is held constant and is calibrated following Gertler, Huckfeldt and Trigari (2020).[26]

To set the value of unemployment, I consider Shimer (2005) and set $b - \frac{\phi}{\omega} = 0.4$. The proportion of pessimists and optimists is constant and the proportion of pessimists is set as $p = 0.32$, as I find in the SCE data post 2016 election. I define Pessimists as those whose 12-month ahead expected chance of higher unemployment was greater than 75% in the data.

Information Parameters. To calibrate the information parameter δ_i, I use the ECB's Consumer Expectations Survey (CES). The SCE does not elicit a point estimate for current or expected future unemployment rate. However, in the CES, the respondents are asked to report their estimates of the current unemployment rate in their country of residence.[27] This information allows me to calculate the error term : $e_t^i = u_t - \mathbb{E}_t^i u_t$. In presence of full information, the errors should be zero, but as reported in the distribution in Appendix figure 6, it is clear that these estimates are biased in both positive as well as negative direction. I classify an individual i as "pessimist" for whom the current estimate of the unemployment rate is greater than the actual unemployment rate in their country $e_t^i < 0$ while an optimist is defined as an individual who estimates the current unemployment rate to be less than the actual unemployment rate, $e_t^i > 0$. I can then estimate the following regression for each survey respondent i, residing in country k at time period t with $e_t^i < 0$ and $e_t^i > 0$

[26]
$$\frac{\bar{b}}{\bar{n}} = \frac{(1-\lambda)(p^{EE} + p^{EU})}{p^{EE} + \lambda p^{EU}}$$
where p^{EE} and p^{EU} are probability of E-E transitions and E-U transitions respectively

[27]The two surveys are comparable, specially in terms of distribution of expectations and response of search behavior to their expectations as seen from Table 1 and Table 2.

respectively.

$$\mathbb{E}_t^i u_{kt} = \alpha + \varsigma u_{kt} + \nu_{it} \tag{20}$$

I then simulate the model to match the parameter ς for Pessimists and Optimists respectively from the empirical equation 35, the results for which are reported in Appendix Table A12. This is then used to calibrate the parameter values for δ_p and δ_o.

Table 5: Calibrated Parameter Values

Parameters	Description	Value	Source
β	Discount Rate	0.996	Shimer (2005)
ρ	Correlation of Labor Productivity	0.949	Hagedorn and Manovskii (2008)
σ_ϵ	Std Dev of Labor Productivity	0.0065	Hagedorn and Manovskii (2008)
ω	Convexity of Search Cost	2	Yashiv (2000)
χ	Efficiency of Matching Function	0.49	Mukoyama, Patterson and Şahin (2018)
α	Non standard $M(s,\theta)$ parameter	0.15	Mukoyama, Patterson and Şahin (2018)
ψ	Non standard $M(s,\theta)$ parameter	1.33	Mukoyama, Patterson and Şahin (2018)
γ	Worker's Bargaining Power	0.5	Shimer (2005)
ζ	Productivity parameter for bad job	0.8	Gertler, Huckfeldt and Trigari (2020)
	Internally Calibrated Parameters		
Parameters	**Description**	**Value**	**Target**
σ	Separation Rate	0.025	E-U probability (0.025)
λ	Probability of good match	0.27	Average wage-improv flow share Gertler, Huckfeldt and Trigari (2020)
κ	Cost of Vacancy	0.68	U-E Probability (0.42)
ϕ	Scale parameter of Search Cost	0.16	E-E Probability (0.025)
b	Value of Unemployment	0.42	UI Benefits (0.40) Shimer (2005)
p	Proportion of Pessimist workers	0.32	Matched SCE proportion of Pessimists
δ_p	Information Parameter For Pessimists	0.723	Targeted to match bias from the CES data
δ_o	Information Parameter For Optimists	1.324	Targeted to match bias from the CES data

3.3 A corporate income tax cut experiment

In this section I present the results of a policy experiment that I conduct to highlight the role of heterogeneous and biased beliefs. This exercise is motivated by the corporate income tax reduction following the US Tax Cuts and Jobs Act of 2017, which reduced the statutory corporate tax rate from 35% to 21%. A corporate income tax cut increases the surplus for

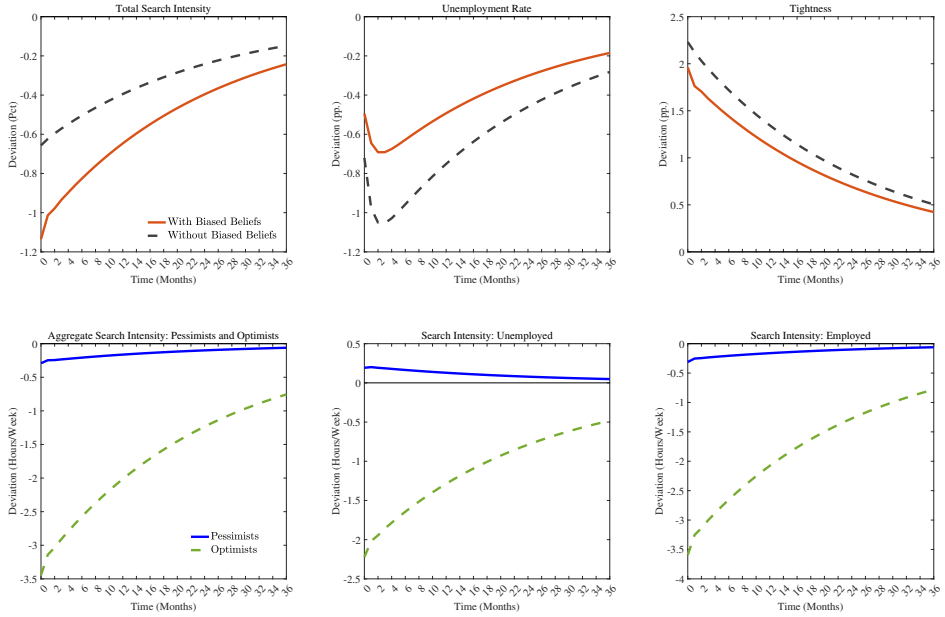
the firm and thus they post more vacancies. Unemployment decreases as there are more jobs available in the economy. Search intensity decreases as workers need to exert less effort in order to find jobs due to increased number of vacancies. However, in the heterogeneous agents model, optimists over estimate the tightness and further decrease their search effort while pessimists under-estimate the tightness and do not decrease as much. Therefore, total search effort and thus aggregate number of matches in such an economy will depend on the degree of bias as well as the distribution of the population as pessimists and optimists. If the economy is on an average optimist (pessimist), the total search effort declines (increases) and the number of matches fall (increase) as compared to the representative agent full information model.

Given that this is a large corporate tax cut, this should lead to a substantial impact on the labor market. As seen in Figure 3, the aggregate search intensity decreases in response to a tax cut shock in both the cases: with and without biased beliefs. However, the decline in search effort for the model with biased beliefs is almost twice as compared to the model without biased beliefs. This dampens the decline in unemployment rate substantially, leading to a difference of about 0.40 pp at 4-month horizon. In the quantitative exercise outlined here, total search effort declines as the fraction of pessimists has been calibrated to the SCE data and on an average the share of optimists is greater than the share of pessimists. Thus, unemployment rate does not decrease as much as in the representative agent framework. As Figure 3 plots, the majority of this muted decline in searchers is coming from the optimists who decrease their search effort more since they perceive the market to be tighter than it actually is.

On impact, the unemployment rate decreases by 0.5pp in presence of biased beliefs, while it decreases by 0.7pp in the standard model. However over the next quarter, unemployment rate only decreases by 0.6pp in presence of biased beliefs. In the standard model, unemployment rate decreases much more, by 1.10pp. In the model with biased beliefs, search effort decreases more due to anticipated good times. Optimists overestimate the tightness of the market and hence decline their search effort more than the actual tightness calls for. This exercise signifies the importance of biased beliefs in the standard models of search and matching. From a policy perspective,the effect of an expansionary policy like the tax cut, on unemployment rate is significantly muted in presence of biased beliefs.

In the bottom panel of Figure 3, I plot the impulse response of the search intensity of Optimists and Pessimists. As expected, I find that a corporate tax cut shock reduced the

Figure 3: Impulse Response Functions to 14pp Negative Tax Shock



Note: The solid Red lines are for the Heterogeneous Agent Model while the dashed black lines are for the Representative agents model without bias. The solid Blue lines are for the Pessimist agents in the Heterogeneous Agent Model while the dashed Green lines are for the Optimist agents in the Heterogeneous Agent Model. The model here has counter-cyclical search intensities with $\psi = 1.33, \alpha = 0.15$.

average search effort. This decline is much more for the optimists who over-estimate the impact of the tax shock on labor market tightness. The pessimists also decline their search effort, but by a lesser degree. On impact, optimists decline their search effort by 3.5 hours whereas the pessimists only decline it by less than 30 minutes. We also see that employed workers are more sensitive as compared to the unemployed workers. Pessimistic unemployed workers actually increase their job search effort. This exercise thus demonstrates that due to biased beliefs, policies can have heterogeneous effect on search effort and thus aggregate labor market. Information friction also dampens the overall impact of the tax cut. This suggests that it is important to take into account the biases in beliefs of workers in the labor market models.

4 Conclusion

Macroeconomic expectations play a central role in most macroeconomic frameworks. This is true for not only consumption and savings, but also for other economic decisions that the households make, like investment, labor supply, educational choices, unemployment benefit uptake and reservation wages; to name a few.[28] Given that the decision to search for a job is one of the most primary decisions that a worker takes, it is important to understand the factors affecting it. This paper documents the role of macroeconomic expectations in job search behavior of workers using both empirical and quantitative analysis.

Using survey data for the United States as well as the Euro Area, this paper finds that workers who expect expansionary outcomes for the economy tend to spend less time searching for a job than those pessimistic about the labor market and the economy in general. Placing this empirical finding in context of a DMP model with endogenous search efforts, this paper introduces biased beliefs. Using a corporate tax cut policy, I demonstrate that presence of biased beliefs dampen the impact of such an expansionary policy on unemployment rate, relative to the standard model.

Overall this paper highlights the importance of household expectations in labor market. Furthermore, it documents the lack of complete information on part of workers, thus highlighting the need for information frictions in models of labor market search. In terms of the empirical framework, the SCE also has a panel dimension to it, which could allow one to potentially study the role of learning in presence of the documented information frictions. Furthermore, it would be interesting to incorporate endogenous job separations in the model. The SCE elicits workers' expected probability of leaving and losing a job, which could provide interesting insights into the role of beliefs in leaving a job. At present, I leave these questions to future research on this project.

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A Empirical Appendix

1 Evidence from the Survey of Consumer Expectations

A.A1: Descriptive Statistics for Survey of Consumer Expectations

	SCE	CPS
Demographics		
Age (Years)	45.8	42.2
Female (%)	48.3	51.0
High school or less (%)	31.7	37.7
Some college (%)	18.8	19.2
Bachelor's Degree or more (%)	49.4	43.1
White (%)	80.7	77.2
Black (%)	11.6	13.2
Married (%)	65.5	56.7
Labor Market Outcomes		
Employed (%)	73.6	72.3
Unemployed (%)	4.8	3.6
Search Hours/ Week: Employed	3.9	
	(5.1)	
Search Hours/ Week : Unemployed	11.8	
	(9.7)	
Average household expectations		
Expected probability of Higher	0.37	
Unemployment in next 12 months	(0.23)	
Expected inflation (%)	5.8	
	(7.7)	
Expected Probability of Job Finding	0.56	
in the next 3 months: Employed	(0.32)	
Expected Probability of Job Finding	0.49	
in the next 3 months: Unemployed	(0.30)	
Number of Labor Market Survey respondents	7094	
Number of Total Respondents	11537	

Note: This table shows the descriptive statistics in the SCE and compares it to the CPS. Samples in both SCE and CPS are restricted to ages 20-65. Survey weights are taken into account while computing these statistics. Standard errors in parenthesis.

A.A2: Descriptive Statistics for Optimistic and Pessimistic Workers

	Optimistic Bottom 20% $\mathbb{E}(P(\Delta U_{t+12} > 0)$	**Pessimistic Top 20%** $\mathbb{E}(P(\Delta U_{t+12} > 0)$
Age (Years)	53.8	49.9
Female (%)	47.7	51.1
High school or less (%)	39.6	31.4
Some college (%)	19.4	19.8
Bachelor's Degree or more (%)	43.8	48.8
White (%)	80.5	79.5
Black (%)	12.0	11.8
Married (%)	66.8	62.7
Labor Market Outcomes		
Employed (%)	74.4	72.2
Unemployed (%)	2.8	6.3
Search Hours/ Week: Employed	4.2	4.5
Search Hours/ Week: Unemployed	13.0	10.16

Note: This table presents descriptive statistics for optimistic and pessimistic workers. I define define optimistic workers as those who report the expected probability of higher unemployment in the top 20 percentile. Pessimistic is defined as those in the bottom 20 percentile. Samples restricted to ages 20-65. Survey weights are taken into account while computing these statistics. Standard errors in parenthesis

A.A3: Macroeconomic Expectations and Job Search Hours: Employed Workers

Search Hours/Week	(1)	(2)	(3)	(4)
$\mathbf{E}_{t+12}$(Probability of Higher Unemployment)	0.0573***			0.0304***
	(0.006)			(0.006)
$\mathbf{E}_{t+12}$(Credit Access): Harder		0.692**		0.611**
		(0.281)		(0.282)
$\mathbf{E}_{t+12}$(Credit Access): Easier		-0.338		-0.267
		(0.176)		(0.177)
$\mathbf{E}_{t+12}$(Personal Finances): Worse			1.945***	0.713**
			(0.361)	(0.355)
$\mathbf{E}_{t+12}$(Personal Finances): Better			-0.254*	0.161
			(0.154)	(0.152)
N	3711	3714	3714	3711
R^2	0.139	0.139	0.138	0.137
Controls	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes

Note: This table presents estimates of how search intensity of *employed* workers is related to their expectations towards the economy. It is summarized by the coefficient β in equation 1, for the sub-sample of employed workers. Set of controls include economy wide unemployment rate and inflation rate; , age, age^2, household income, education, race, gender, marital status and current wage for all columns. Fixed effects include time (monthly); and state fixed effects. The Sample period is from 2014:03 to 2020:03. Survey weights used. Clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

A.A4: Macroeconomic Expectations and Job Search Hours: Unemployed Workers

Search Hours/Week	(1)	(2)	(3)	(4)
$\mathbf{E}_{t+12}$(Probability of Higher Unemployment)	0.0315*			0.0240
	(0.017)			(0.020)
$\mathbf{E}_{t+12}$(Credit Access): Harder		1.631*		0.242
		(0.910)		(1.061)
$\mathbf{E}_{t+12}$(Credit Access): Easier		-1.813**		-2.908**
		(0.859)		(1.191)
$\mathbf{E}_{t+12}$(Personal Finances): Worse			1.433	1.257
			(1.215)	(1.243)
$\mathbf{E}_{t+12}$(Personal Finances): Better			-0.641	-0.0684
			(1.034)	(1.031)
N	773	776	776	773
R^2	0.294	0.300	0.298	0.318
Controls	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes

Note: This table presents estimates of how search intensity of *unemployed* workers is related to their expectations towards the economy. It is summarized by the coefficient β in equation 1, for the sub sample of unemployed workers. Set of controls include economy wide unemployment rate and inflation rate; , age, age^2, household income, education, race, gender, marital status and unemployment duration for all columns. Fixed effects include time (monthly); and state fixed effects. The Sample period is from 2014:03 to 2020:03. Survey weights used. Clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

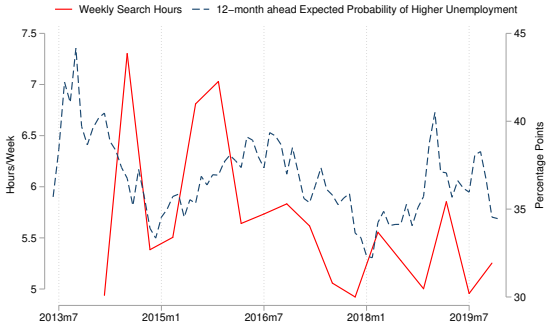
A.A5: Descriptive Statistics by Party: 2013:06 to 2019:12

	Democrat States	**Republican States**
Demographics		
Age (Years)	51.4	50.8
Female (%)	49.7	50.3
High school or less (%)	30.5	36.2
Some college (%)	19.4	19.2
Bachelor's Degree or more (%)	38.3	32.8
White (%)	79.6	83.8
Black (%)	7.6	11.8
Married (%)	64.8	62.4
Labor Market Outcomes		
Employed (%)	63.7	63.4
Unemployed (%)	5.6	4.5
Search Hours/ Week: Employed	3.7 (4.9)	3.8 (5.2)
Search Hours/ Week: Unemployed	10.2 (9.4)	12.3 (9.6)
Average household expectations		
$\mathbf{E}_{t+12}\{\text{Prob}(\Delta \text{ Unemp} > 0\}$	0.38 (0.22)	0.37 (0.23)
$\mathbf{E}_{t+3}\{\text{Prob(Job Finding)}\}$: Employed	0.53 (0.32)	0.55 (0.32)
$\mathbf{E}_{t+3}\{\text{Prob(Job Finding)}\}$: Unemployed	0.42 (0.30)	0.51 (0.30)
Number of Total Respondents	28,578	47,185

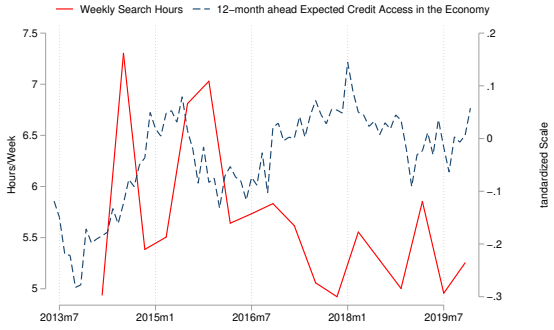
Note: This table presents descriptive statistics for respondents in states that voted for Democrats and Republicans in 2016 Presidential elections. Sample 2013:06 to 2020:03 Samples are restricted to individuals with ages 20-65, and those with responses to both search hours and expected probability of higher unemployment. Swing states are omitted. Survey weights are taken into account while computing these statistics. Standard errors in parenthesis.

A.4: Time Trend of Search Hours and Household Expectations

(a) Monthly Average $\mathbb{E}(P(\Delta \text{Unemp}_{t+12} > 0))$



(b) 12-month ahead Expected Credit Access



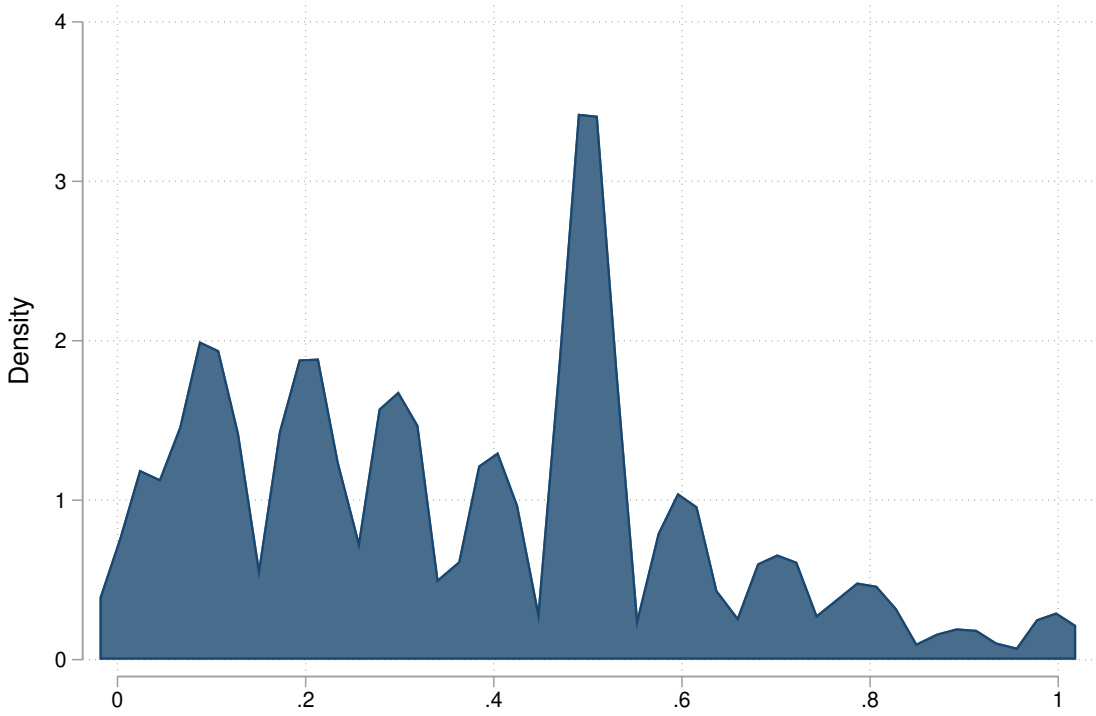
Note: This figure plots the time trend of the Average 12-month ahead expected probability of higher unemployment and Weekly Search Hours. The expected probability of higher unemployment is reported here in percentage points. The sample is restricted to respondents aged 20-65.

1.1 Cyclicality of Search Hours

The main takeaway from the empirical exercise is that search hours increase as individuals expect worsening of the economy. Now to argue that this suggests that the search intensity is counter-cyclical in nature, we need to establish that households expect 12-month ahead unemployment to increase when actual unemployment rate increases. This gives a sense of whether households anticipate a downturn in the future or expect expansionary outcomes in future. To be more precise, I estimate the relationship in equation 21. I have previously established that search intensity and $\mathbb{E}^i[Prob(U_{t+12} - U_t > 0)]$ are positively correlated. Now whether or not the search intensity is pro-cyclical (decreases in recessions) or counter-cyclical (increases in recessions), can be understood from the direction of co-movement between the 12-month ahead unemployment expectations and the change in actual unemployment rate. We find in Table A6 that $\phi > 0$. This implies that when actual unemployment rate increases, expected 12-month ahead unemployment rate also increases (search intensity increases since it is positively correlated). This in turn implies that individuals increase their search effort when they think they are in (and expect in future to be) a recession. This indicates that the intensive margin of search hours is also counter-cyclical, complementing the findings in Mukoyama, Patterson and Şahin (2018).

This exercise helps us elicit the cyclical property of search effort, when taken in conjunction

A.5: Distribution of Expected Probability of Increase in Unemployment Rate



Note: This figure plots the density function for the 12-month ahead Expected Probability of Increase in Unemployment Rate from the SCE sample in the United States.

with results from Table 1 which find that search effort is positively correlated with the $\mathbb{E}[Prob(U_{t+12} - U_t) > 0]$.

$$\mathbb{E}^i[Prob(U_{t+12} - U_t > 0)] = \alpha + \phi(U_t - U_{t-12}) + \mathbb{X}_t^i + \epsilon_t \quad (21)$$

$$\mathbb{E}^i[Prob(U_{t+12} - U_t > 0)] = \alpha + \phi U_t + \mathbb{X}_t^i + \epsilon_t \quad (22)$$

One could now further argue that the expectations reported by households are "incorrect". I estimate the following relationship for the sample period 2013:m6 to 2020:m3 (corresponding to the SCE sample period):

$$\mathbb{1}(U_{t+12} - U_t > 0) = \alpha + \psi(U_t - U_{t-12}) + \nu_t. \quad (23)$$

The coefficient $\psi = 0.374$ is positive and is comparable to ϕ. This indicates that the

A.A6: Relationship between Expected Unemployment and Actual Unemployment Rate

Dep Var: E[Prob($U_{t+12} - U_t$) > 0]	(1)	(2)	(3)	(4)
$(U_t - U_{t-12})$	0.455***	0.439***		
	(0.055)	(0.043)		
(U_t)			0.612***	0.613***
			(0.081)	(0.082)
N	127,511	125,786	127,511	125,786
R^2	0.005	0.027	0.004	0.021
Controls	No	Yes	No	Yes

Note: This table documents the results from the Equation 21. Set of controls include age, age^2, household income, education, race, gender, marital status and unemployment duration for all columns. The Sample period is from 2014:03 to 2020:03. Survey weights used. Clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

expectations of households are indeed in line with the data generation process. Thus, taking the results in Table A6 and A7 together, we can say that search effort is counter-cyclical for this sample.

A.A7: Relationship between Actual Increase in Unemployment and Past Actual Unemployment Rate

Dep Var	(1)	(2)
$\mathbb{1}[U_{t+12} - U_t > 0]$	2013:m6 to 2019:m12	1960:m1 to 2022:m9
$U_t - U_{t-12}$	0.374^{***}	0.038^{**}
	(0.194)	(0.013)
N	79	753
R^2	0.165	0.013

Note: This table documents the results from the Equation 23. Set of controls age, age^2, household income, education, race, gender, marital status and unemployment duration for all columns. The Sample period is from 2014:03 to 2020:03. Survey weights used. Clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

1.2 Sentiments towards the Economy and Perceived Probability of Job Finding

In this section, I present some additional evidence on the role of sentiments in guiding the labor market behavior of workers. In light of the evidences presented in the main text, it is only natural to test whether sentiments about the economy also influence other labor market outcomes. In particular, expectations about the economy are likely to influence one's perception about the probability of finding a job. It is plausible that an optimistic worker perceives her probability of job finding to be higher in future that a pessimistic worker. This hypothesis can be tested by using the SCE data and a variation of equation 1.

$$Y_{it} = \alpha + \beta_2 \mathbf{E}_i(\textit{State of Economy})_t + \Gamma X_{it} + \rho_t + \theta_s + \epsilon_{it} \tag{24}$$

Here, as before, i denotes an individual while t stands for time. Y_{it} is the perceived probability of job finding. X_{it} is a set of individual demographic controls. ρ_t and θ_s are time and state fixed effects respectively. I consider the employed and the unemployed separately. The results are presented in the Table A8 below.

Expecting the economy to do better in future is positively correlated with higher perceived probability of finding a job. Optimistic workers appear have higher perceived probability of job finding compared to the pessimistic workers. This result is consistent for both the employed and the unemployed workers. This result is in support of the findings discussed in the main text and highlights the role of sentiments in shaping worker beliefs about their own labor market outcomes.

A.A8: Impact of Sentiment towards the Economy on Perceived Probability of Job Finding

	(1)	(2)
Panel A. Sentiment Indicator: Exp(Prob(ΔUnemp) >0)		
	Employed	**Unemployed**
Expected Probability of	-0.373***	-0.203
Higher Unemployment	(0.015)	(0.412)
N	52938	2575
R^2	0.089	0.296
Expected Probability of higher unemployment is in percents		
Panel B. Sentiment Indicator: Expected Inflation		
Expected Inflation Rate	-1.164***	0.937*
	(0.039)	(0.55)
N	52795	2568
R^2	0.090	0.297
Expected inflation is in percents		
Panel C. Sentiment Indicator: Expected Ease of Credit Access		
Exp(Credit Access): Harder	-2.241***	-5.413***
	(0.751)	(1.856)
Exp(Credit Access): Easier	4.303***	1.902*
	(0.747)	(1.238)
N	52971	2579
R^2	0.093	0.304
Omitted category Exp(Credit Access):About the Same		
Panel D. Sentiment Indicator: Expected Personal Finance Status		
Exp(Personal Finances): Worse	-5.865***	-2.583**
	(1.100)	(1.251)
Exp(Personal Fiances): Better	7.607***	6.671***
	(0.657)	(1.928)
N	44597	1737
R^2	0.114	0.384
Omitted category Exp(Personal Finances):About the Same		
Controls	Yes	Yes
Fixed Effects	Yes	Yes

Note: This table presents estimates of how perceived job finding probability of workers is impacted by their expectations towards the economy. It is summarized by the coefficient β_2 in equation 24. Each panel has a different sentiment indicator. Actual rate of unemployment is included for all specifications.For the unemployed sample, Unemployment duration is included as a control. For Panel C and D, Expected earnings are also included. Set of demographic controls include age, age^2, household income, education, race, gender, marital status and expected earnings in 4 months. Fixed effects include time (monthly); and state fixed effects. The Sample period is from 2014:03 to 2018:03. Survey weights used. Clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

1.3 Survey Questionnaires

Survey of Consumer Expectations The survey questions about individual expectations from the SCE are listed in this section. Questions on demographic details in the survey are standard and not reported here.

- Monthly SCE Survey

    1. Expected probability of higher unemployment rate.
    Q4new. *"What do you think is the percent chance that 12 months from now the unemployment rate in the U.S. will be higher than it is now?"*

    2. Expected rate of inflation.
    Q8v2part2. *"What do you expect the rate of inflation (or deflation) to be over the next 12 months?"*

    3. Expected financial status. The survey asks the following question
    Q2. *"...looking ahead, do you think you (and any family living with you) will be financially better or worse off 12 months from now than you are these days"*.
    The respondents can respond on a scale of 1-5 (much worse off, somewhat worse off, about the same, somewhat better off, much better off)

    4. Expected credit constraint. The survey asks the following question to elicit expectations about future credit constraints.
    Q29 *"And looking ahead, do you think that 12 months from now it will generally be harder or easier for people to obtain credit or loans (including credit and retail cards, auto loans, student loans, and mortgages) than it is these days?"*
    The respondents can respond on a scale of 1-5 (much worse off, somewhat worse off, about the same, somewhat better off, much better off)

- SCE Labor Market Module (Every 4 month)

    1. Search Intensity.
    Q js9. *"number of hours you searched for a job in the last 7 days?"*

    2. Probability of job finding. The following question is asked separately to the employed and the unemployed individuals
    Q oo2u and oo2e. *"What do you think is the percent chance that within the coming four months, you will receive at least one job offer from another*

employer? Remember that a job offer is not necessarily a job you will accept"

Consumer Expectation Survey The survey questions about individual expectations from the the CES (Euro Area) are listed in this section. Questions on demographic details in the survey are standard and not reported here.

- CES monthly module

  1. Expectation for the economy next 12 months - qualitative
     C4010. *"During the next 12 months, I expect the economy of the country I currently live in to grow/shrink/neither grow nor shrink"*

  2. Expectation for the economy next 12 months - open-ended
     C4020. *"During the next 12 months, by how much do you think the economy will grow (shrink)? Please give your best guess of the expected change in percentage terms. You can provide a number up to one decimal place"*

  3. Current unemployment rate - open-ended.
     C4030. *"What do you think is the current unemployment rate in the country you currently live in?"*.

  4. Expectations about unemployment rate next 12 months - open-ended
     C4031. *"What do you think will be the unemployment rate 12 months from now in the country you currently live in?"*

- CES quarterly module

  1. Actively looking for job
     Q2253:. *"Are you currently actively looking for a job? Yes/No"*

  2. Probability of finding a job in 3 months.
     Q2302. *"Please think about the types of job that may be available to you. What do you think is the percent chance that, within the next 3 months, you will find a job that you will accept?"*

2 Evidence from the Consumer Expectations Survey: European Union

This section documents additional evidence from the Euro Area. The survey captures the extensive margin of job search as it only records if the respondent is actively searching for a

job or not. It however, also asks the respondents to report their probability of looking for a job in the next 3 months. In the core module, the survey elicits the expected 12-month ahead unemployment rate ($E_t(u_{t+12})$ as well as an estimate for the current unemployment rate ($E_t(u_t)$). I estimate the following equations:

$$y_{it} = \alpha + \beta \mathbb{E}^i_{t+12}(u_t) + \mathbf{X}_{it} + \delta_t + \epsilon_{it} \quad (25)$$

$$y_{it} = \alpha + \beta \mathbb{E}^i_{t}(u_t) + \mathbf{X}_{it} + \delta_t + \epsilon_{it} \quad (26)$$

$$y_{it} = \alpha + \beta \{\mathbb{E}^i_{t+12}(u_t) - \mathbb{E}^i_{t}(u_t)\} + \mathbf{X}_{it} + \delta_t + \epsilon_{it} \quad (27)$$

Where, $y_{it} = 1(Search_{it})$ which takes value 1 if actively looking for job. I also consider $y_{it} = P_{t+3}(search)$ which is the probability of looking for a job in 3 months. $\mathbf{X}_{it}$ is a set of controls which include employment status, country FE, age, gender, education, income, number of children, marital status and household size. The results are presented in Table A9 and A10. The results are overall consistent with what I find in the SCE. Job search is positively correlated with the 12-month ahead expected unemployment rate (although the magnitude is small). Probability of looking for a job in the next 3 months is also positively correlated with the 12-month ahead expected unemployment rate. The results remain consistent when I use logit or probit since $y_{it} = 1(Search_{it})$ is an indicator variable.

I also consider the general expectations towards economic growth. The question asked is "During the next 12 months, I expect the economy of the country I currently live in to grow/shrink". This is followed by an actual estimate: " during the next 12 months, by how much do you think the economy will grow (shrink)? Please give your best guess of the expected change in percentage terms". The results for this exercise are reported in Table A10. Here also, the takeaway is that expectation of economy growing in the next 12 months is associated with a decline in job search as well as the probability of job search in the next 3 months.

A.A9: Expected Unemployment Rate and Active Job Search

	(1) 1(Search)	(2) 1(Search)	(3) 1(Search)	(4) 1(Search)
$E_t^i(u_{t+12})$	0.0828***		0.108*	
	(0.029)		(0.063)	
$E_t^i(u_t)$		0.0733**	-0.0298	
		(0.031)	(0.067)	
$E_t^i(u_{t+12}) - E_t^i(u_t)$				0.0909
				(0.063)
N	31909	31909	31909	31909
R^2	0.187	0.187	0.187	0.187

Note: This table reports the results from equation 25 for $y_{it} = 1$ if actively looking for a job. Standard demographic controls used. Clustered standard errors in parentheses. Winsorized sample (5%). Survey weights used. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A.A10: Expected Unemployment Rate and Probability of Job Search in the next 3 months

	P_{t+3}(search)	P_{t+3}(search)	P_{t+3}(search)	P_{t+3}(search)
$E_t^i(u_{t+12})$	0.108***		0.110***	
	(0.017)		(0.036)	
$E_t^i(u_t)$		0.102***	-0.00213	
		(0.018)	(0.038)	
$E_t^i(u_{t+12}) - E_t^i(u_t)$				0.0828**
				(0.036)
N	29121	29121	29121	29121
R^2	0.174	0.174	0.174	0.171

Note: This table reports the results from equation 25 for y_{it} = probability of looking for a job in the next 3 months. Standard demographic controls used. Winsorized sample (5%). Clustered standard errors in parentheses. Survey weights used. * p<0.10, ** p<0.05, *** p<0.01

A.A11: Expected Growth Rate and Job Search

	(1) $\mathbb{I}$Search	(2) $\mathbb{I}$Search	(3) P_{t+3}(search)	(4) P_{t+3}(search)
E_t^i(Economy will Grow)$_{t+12}$	-0.0241***		-0.765**	
	(0.007)		(0.381)	
E_t^i(Growth)$_{t+12}$ in %		-0.109***		-0.0932***
		(0.032)		(0.023)
N	21765	31909	17611	25838
R^2	0.186	0.188	0.173	0.170
Controls	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes

Note: This table reports the results from equation 25 for $y_{it} = 1$ if actively looking for a job in Columns (1) and (2) and y_{it} = probability of looking for a job in the next 3 months in Columns (3) and (4). Standard demographic controls used.The omitted category is Expectation that the economy will shrink in the next 12 months. Winsorized sample (5%). Clustered standard errors in parentheses. Survey weights used. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3 Theoretical Appendix

3.1 Representative Agent Model

This section discusses a theoretical framework for the representative agent model with endogenous search effort and on the job search.

Setup. Consider an economy comprised of workers and firms with discrete time t over an infinite horizon. Workers can be either employed or unemployed and they discount future at the rate $\beta \in (0,1)$. Firms post vacancies and workers must be matched with it for them to be employed. Only the unemployed workers search for a job with individual search effort s_{it} for a worker i at time t. Searching is costly and the cost function is increasing and convex. It takes the form $c(s_{it}) = \phi s^{\omega}/\omega$, where $\omega > 1$. The probability of finding a job for an unemployed worker is given by the function $f(s_{it}, \bar{s_t}, \theta_t)$. $\theta_t = \frac{v_t}{u_t}$, which is the vacancy ($v_t$) to unemployment ($u_t$) ratio. An employed worker can be separated from his job with an exogenous probability given by σ. The probability of a firm finding a worker for its vacancy is given by $q(\bar{s_t}, \theta_t)$. At the aggregate level, total number of matches are governed by a matching function $\mathcal{M}(\bar{s}, \theta)$. A job-worker match produces z_t units of output each period which is stochastic. $X_t \equiv \{z_t, u_t\}$ is the state space.

Value Functions. First consider the workers' value functions. The value of being employed in a bad match is given by W^b while the value of being unemployed is given by U. An employed worker earns a wage w while employed. She can be separated from her job in the next period with probability σ, becomes unemployed and gets value $U(X_{t+1})$. With $(1-\sigma)$ she continues to remain employed and gets $W(X_{t+1})$ in the next period.

$$W_t^b = \max_{s_{et}} \Bigg\{ w_t^b - \sigma c(s_{et}) + \beta \mathbf{E_t} \Big[\sigma(1 - \lambda f(s_{et}, \theta_t)) W_{t+1}^b + \sigma \lambda f(s_{et}, \theta_{it}) W_{t+1}^g + (1-\sigma) U_{t+1} \Big] \Bigg\} \tag{28}$$

The first order conditions for each type i for the employed workers in a bad match are now given by

$$c'(s_{et}) = \beta \lambda \sigma f_1(s_{et}, \theta_t) \mathbf{E} \left[W_{t+1}^g - W_{t+1}^b \right] \tag{29}$$

An employed worker type in a good match earns wage w^g and does not search for a new job. If the separation shock is realized (with probability $(1-\sigma)$), then the worker becomes

unemployed in the next period and gets value U_{t+1}). She continues to earn W^g_{t+1}) in the next period if the match is not destroyed. Thus, the value of being employed for a worker in a good match is thus given by

$$W^g_t = w^g_t + \beta \mathbf{E_t}\Big\{\sigma(1-\lambda f(s_{et},\theta_t))W^g_{t+1} + (1-\sigma)U_{t+1}\Big\} \tag{30}$$

An unemployed worker gets b from being unemployed in terms of unemployment benefit and searches for a job. She exerts optimum search effort that maximizes her value from search. Since job search is costly, she incurs a cost $c(s_{ut})$. In the next period, the unemployed worker can be matched with either a good match and become employed with the probability $\lambda f(s_{ut},\theta_t)$ and get value W^g_{t+1} or with a bad match and become employed with the probability $(1-\lambda)f(s_{ut},\theta_t)$ and get value W^b_{t+1}. With remaining probability, she continues to be unemployed and gets value U_{t+1}.

$$\begin{aligned} U_t = \max_{s_{ut}} \Big\{ b - c(s_{ut}) + \beta \mathbf{E_t}\Big[& f(s_{ut},\theta_t)(\lambda W^g_{t+1} + (1-\lambda)W^b_{t+1}) \\ & + (1-f(s_t,\theta_t))U_{t+1}\Big]\Big\} \end{aligned} \tag{31}$$

The first order condition for the unemployed workers are now given by

$$c'(s_{ut}) = \beta f_1(s_{ut},\theta_t)\mathbf{E}\left[(\lambda W^g_{t+1} + (1-\lambda)W^b_{t+1}) - U_{t+1})\right] \tag{32}$$

The firm side remains the same, except there is no worker union. Wages are bargained for the good matches and the bad matches receive wage $w_b = \zeta w_g$, proportional to their productivity. The surplus of the workers in a job of type $k = \{g, b\}$ is given by:

$$S^k_t = W^k_t - U_t \tag{33}$$

Wages are bargained for the good matches and the bad matches receive wage $w_b = \zeta w_g$, proportional to their productivity. Therefore, the bargaining rule yields,

$$(1-\gamma)S^g(w, X_t) = \gamma[J^g(w) - V] \tag{34}$$

where γ is the worker's bargaining power. There are no re-negotiations here and wages are assumed to be flexible. In equilibrium value from vacancy is set to zero.

3.2 Calibration

In this subsection I report the results for the calibration strategy for the information parameter δ_i. I use the ECB's CES to calibrate this parameter. In the CES, the respondents are asked to report their estimates of the current unemployment rate in their country of residence. This information allows me to calculate the error term : $e_t^i = u_t - \mathbb{E}_t^i u_t$. Figure 6 reports that the error term is not zero for all individuals and there is both negative and positive bias. Using this, I classify an individual i as "pessimist" for whom the current estimate of the unemployment rate is greater than the actual unemployment rate in their country $e_t^i < 0$ while an optimist is defined as an individual who estimates the current unemployment rate to be less than the actual unemployment rate, $e_t^i > 0$. I can then estimate the following regression for each survey respondent i, residing in country k at time period t with $e_t^i < 0$ and $e_t^i > 0$ respectively. I then simulate the model to match the parameter ς_i for Pessimists and Optimists from the empirical equation 35, the results for which are reported in Appendix Table A12. This gives me the parameter values for δ_p and δ_o.

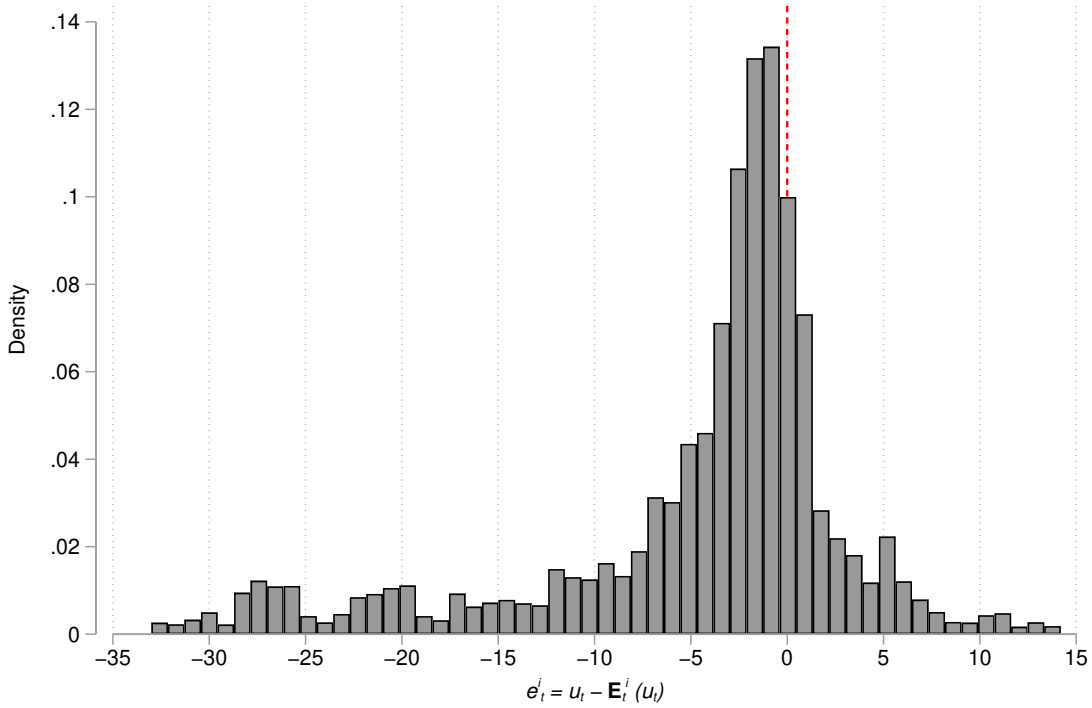
$$\mathbb{E}_t^i u_{kt} = \alpha + \varsigma u_{kt} + \nu_{it} \tag{35}$$

A.A12: Calibrating Information Parameter using ECB's CES

Dep Var: $\mathbb{E}_t^i U_t$	(1) Optimists ($e_t^i > 0$)	(2) Pessimists ($e_t^i < 0$)
U_t	0.692***	1.322***
	(0.009)	(0.016)
N	81,524	267,142
R^2	0.52	0.311

Note: This table reports the estimates of ς from equation 35. Clustered standard errors in parentheses. Survey weights used. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

A.6: Distribution of Unemployment rate Nowcast Errors



Note: This figure plots the density function for the nowcast error term defined as $e^i_t = u_t - \mathbb{E}^i_t u_t$. The sample has been winsorized at 5%. The sample comes from ECB's CES and the actual unemployment rates are from EuroStat.

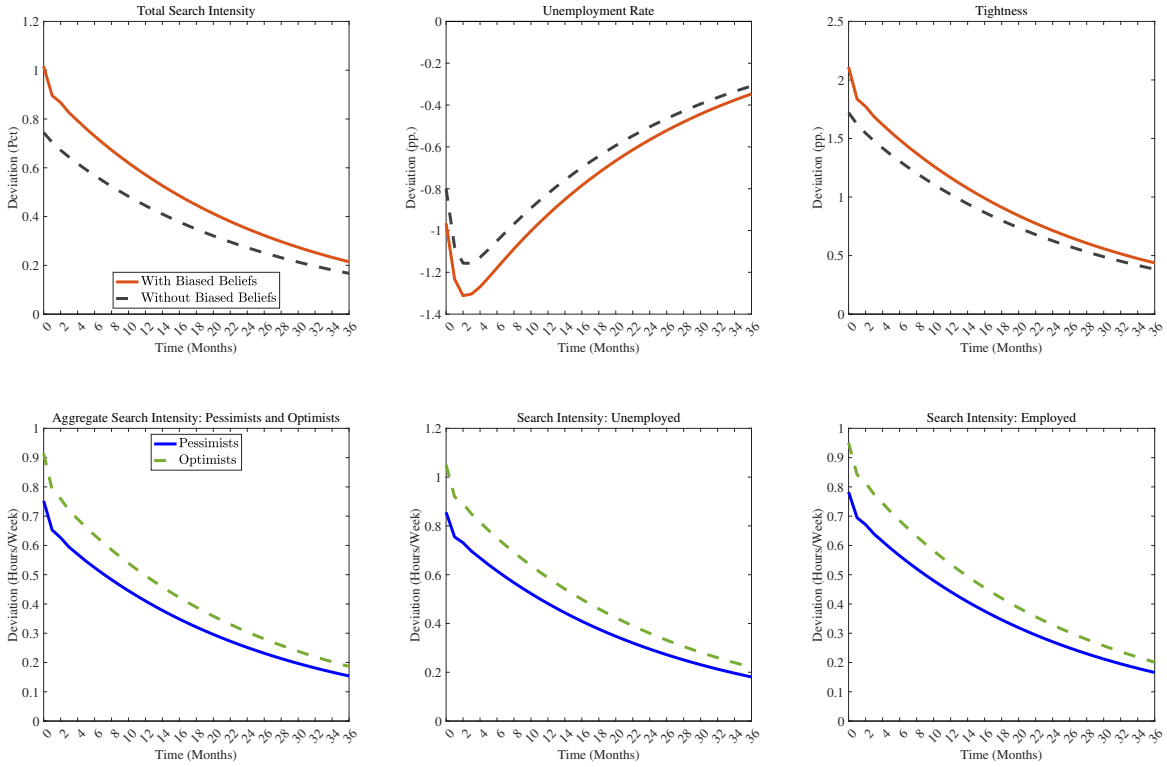
3.3 Corporate Income Tax Shock: Pro-Cyclical Search Effort

In this section I present some results for the case when search effort is pro-cyclical. Although the empirical evidence points towards search being counter cyclical in nature, some search and matching models still use pro-cyclical search effort as the standard case. Here, the pro-cyclical specification is derived from the generalised matching function when $\psi = 0$ (Cobb-Douglas case). Here I take $\alpha = 0.5$.

Figure 7 plots the impulse response of various labor market outcomes when search effort is pro-cyclical. Here, search effort increases in response to a corporate tax cut shock. This increase is slightly more for the optimists who over-estimate the impact of the tax shock on labor market tightness. The pessimists also increase their search effort, but by a lesser degree. Overall, the pro-cyclical model predicts slightly higher decline in unemployment rate as compared to the standard model without bias. Search intensity increases more as

optimists over-estimate the tightness and increase their search effort more than the standard model without bias would predict. Thus, overall the tightness is also higher in the model with biased beliefs.

A.7: Impulse Response Functions to 14pp Negative Tax Shock When $\psi = 0$



Note: The solid red lines in the top panel is for the model with biased beliefs. The dashed black lines in the top panel are for the model without biased beliefs. The solid blue lines in the bottom panel are for the Pessimists while the dashed green lines are for the Optimist agents. The model here has pro-cyclical search intensities with $\psi = 0$.