Heterogeneous Expectation Uncertainty and News Shock*

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Abstract. In this paper, I document systematic differences in households' individual belief uncertainty regarding macroeconomic conditions and its relation to portfolio choices. I develop a heterogeneous agent New Keynesian model characterized by endogenous information acquisition and portfolio allocation. I demonstrate how the impact of an anticipated TFP shock is amplified through heterogeneous expectations. Quantitatively, the model aligns with observed household uncertainty and portfolio shares. Compared to a representative agent model, the impact of an anticipated TFP shock is amplified by nearly two times.

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JEL Classification. D82, E25, E32

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1 Introduction

Expectations play a crucial role in macroeconomics. Workhorse macro models typically assume that households have homogeneous expectations with no systematic differences across agents. However, recent empirical literature has documented substantial heterogeneity in household expectations, with forecast errors systematically related to household demographic characteristics such as income, education, and demographic factors. Given the importance of expectations in economic decision-making, it is essential to fully characterize how expectations differ across households and how heterogeneous expectations affect the real economy.

This paper makes two main contributions. Empirically, I provide new evidence on heterogeneous expectations across households. While the existing literature has documented systematic differences in household expectations across income groups. Specifically, wealthier households tend to have smaller forecast errors—I extend this analysis to the second moment. I show that wealthier households not only have more accurate expectations but also exhibit lower subjective uncertainty, as measured by the variance of their individual beliefs. This finding contradicts the common used assumption in the expectations literature that households share homogeneous ex-ante information structures, which implies that beliefs should differ only in their mean but have the same variance. Moreover, I demonstrate that household subjective uncertainty about macroeconomic variables significantly influences their portfolio allocation decisions. These results highlight the necessity of studying a model that incorporate asset market to study the effect of heterogeneous expectation.

Theoretically, I develop a heterogeneous agent New Keynesian model that incorporates endogenous information acquisition and portfolio allocation. In this model, households allocate their portfolios between government bonds and capital. Following the framework established by Kaplan et al. (2018), capital is modeled as a claim on the future profits of a representative firm, driven by future total factor productivity (TFP) shocks. Households can acquire information about these future TFP shocks at a monetary cost. I first illustrate the key mechanism using a simplified two-period model. Specifically, with costly information acquisition, wealthier households endogenously choose to obtain more precise information than the poorer households, resulting in heterogeneous portfolio allocations across income groups. When an anticipated TFP shock alters the capital price and redistributes wealth among households, endogenous information acquisition amplifies the impact of the shock on the real economy compared to a model with a homogeneous ex-ante information structure. I then extend the analysis to an infinite-horizon model. With calibrated parameters, the model successfully replicates observed patterns of subjective uncertainty and portfolio shares across income groups. Compared to a representative agent model with homogeneous information, the aggregate output response to a one-standard-deviation TFP shock is approximately 25 basis points larger.

I begin by presenting new empirical evidence on heterogeneous expectation uncertainty across income groups and its relationship to household portfolio choices. I use data from the Survey of Consumer Expectations (SCE), a widely utilized household survey that elicits expectations regarding macroeconomic variables. I focus specifically on households' forecasts of one-year-ahead inflation. A key advantage of the SCE is that it asks households to provide both point forecasts and their expected probabilities across potential outcome bins. Using both types of questions, I approximate each household's individual belief density and measure subjective uncertainty as the variance of this density. Intuitively, a more dispersed belief distribution reflects greater uncertainty about future inflation. I find that subjective uncertainty decreases sharply with household income: the subjective uncertainty of households in the highest income group is approximately 14% of that in the lowest income group. In other words, poorer households exhibit much more dispersed beliefs than wealthier households.

Another attractive feature of the SCE data is that it is complemented by a financial supplement sub-survey that provides detailed information about households' asset holdings. While it is intuitive that households' portfolio decisions are related to their subjective uncertainty regarding risky returns, the relationship between households' portfolio decisions and their subjective uncertainty regarding macroeconomic conditions remains largely unexplored. Given that households' expectations regarding macro conditions differ systematically across income groups, it is worthwhile to investigate the relationship between households' portfolios and their expectations regarding macro variables. Using data from the financial sub-survey, I examine the relationship between households' subjective uncertainty and their portfolio choices. I show that, after controlling for household income and other demographic characteristics, households' portfolio share of risky assets is significantly negatively related to their subjective uncertainty regarding macroeconomic conditions.

Motivated by these facts, I study a heterogeneous agent New Keynesian model with endogenous information acquisition. In the model, households differ in labor productivity and allocate wealth between government bonds and capital. The return on capital depends on the profits of the representative production firm, which in turn depends on future TFP. Households can acquire information regarding future TFP at a monetary cost, where higher expenditure corresponds to more precise signals. At the beginning of each period, households decide their expenditure on information and then observe a private signal regarding future TFP. After the private signal is realized, households make decisions on consumption and portfolio allocation.

Building on previous work that examines heterogeneous information acquisition across agents with different portfolios (Peress (2004)), I first show that in the model, wealthier households choose to pay more for information. On the one hand, wealthier households hold larger amounts of assets, so portfolio variance has a greater impact on their welfare. On the other hand, wealthier households have a lower marginal utility of consumption (shadow price of wealth), meaning that the monetary cost of acquiring additional information represents a smaller utility sacrifice for them. Through these two channels, additional information is relatively less costly for wealthier households, leading them to acquire more information.

With heterogeneous information acquisition, wealthier households face lower uncertainty and consequently hold a higher portfolio share in risky assets. I then demonstrate that this mechanism can amplify the impact of an anticipated TFP shock on the real economy.

Consider an anticipated positive TFP shock in the next period. Higher expected TFP increases the firm's expected profits, which are directly linked to risky asset returns, raising current capital demand and the capital price. The higher capital price has two effects. First, it directly stimulates investment since it becomes more profitable. Second, the higher capital price redistributes wealth toward households with larger capital holdings. With endogenous information acquisition, wealthier households simultaneously hold more capital and maintain a higher portfolio share in capital. The positive correlation between capital holdings and capital demand further amplifies aggregate capital demand. As a result, an anticipated TFP shock has a larger impact on the real economy compared to a model where households have homogeneous ex-ante information.

Quantitatively, using calibrated parameter values, the model successfully replicates the observed patterns of heterogeneous subjective uncertainty and portfolio shares across income groups. Compared to the representative agent New Keynesian (RANK) model with homogeneous ex-ante information, the impact of an anticipated TFP shock on real output is approximately 25 basis points larger in the heterogeneous information framework.

Related Literature. This paper contributes to two streams of literature. First, I closely follow the literature studying systematic differences in household expectations. Existing literature has documented that household expectations can systematically differ based on their personal experience (Malmendier and Nagel 2016,Pedemonte et al. 2025) and observed government actions (Binetti et al. 2024). Using survey data, Rozsypal and Schlafmann (2023) document that richer households have smaller forecast errors regarding personal income, and they study a model where households overestimate the persistence of personal income. Similarly, Huo et al. (2024) document that richer households have smaller forecast errors regarding future inflation, and they study a model with heterogeneous extent of bias across income groups.

The existing literature on heterogeneous expectations focuses on the first moment of expectations, typically the forecast error. In contrast, this paper first documents that the variance of households' individual beliefs decreases with household income, and I study a rational model featuring endogenous information acquisition rather than heterogeneity in behavioral biases.

Most related to my work, Mitman et al. (2025) document heterogeneous forecast errors regarding future employment rates across households. They highlight the importance of saving motives in information acquisition and its implications for fiscal policy in a Krusell-Smith model. This paper complements their work in two ways. First, I focus on households' subjective uncertainty and highlight the channel through portfolio allocation. Second, parallel to their work, I study a heterogeneous agent New Keynesian model and focus on news shocks, thereby complementing the literature by highlighting the implications of heterogeneous information for the real economy through asset markets.

Second, this paper also contributes to the growing literature on business cycles driven by anticipated "news shocks." Pioneered by Beaudry and Portier (2006), this literature has emphasized the effect of anticipated but unrealized shocks on the current economy. Several works have documented the sizable effects of anticipated news shocks on the current economy using news shocks estimated from aggregate data (Barsky and Sims 2011, Khan and Tsoukalas 2012, Görtz et al. 2022). These studies have documented that news regarding a positive future TFP shock can raise current consumption, output, and labor. Theoretically, to have consumption and output move in the same direction, Beaudry and Portier (2007) studied a multi-sector model and emphasized the role of investment. Using survey data, Miyamoto and Nguyen (2020) and Maćkowiak and Wiederholt (2025) documented that different assumptions about how agents form their expectations can largely affect the estimated impact of news shocks. The contribution of this paper is that I highlight the importance of heterogeneous information acquisition across agents. With heterogeneous acquisition, the impact of a news shock is amplified through heterogeneous portfolio choices.

In Section 2, I present new empirical findings based on the survey data. In Section 3, I illustrate the key mechanism using a two-period model, demonstrating how endogenous information acquisition amplifies the impact of an anticipated TFP shock. Section 4 introduces the infinite horizon model. Section 5 discusses the calibration and the simulated results of the real economy in response to the anticipated TFP shock. Finally, Section 6 summarizes the findings.

2 Evidence

In this section, I first present two new empirical facts that showing (1) across income groups, households' subjective uncertainty regarding the future inflation rate is decreasing with income groups; (2) within income groups, households holding of risky asset is negatively correlated with the subjective uncertainty regarding the future inflation rate.

2.1 Survey of Consumer Expectation

In this paper, I use data from the Survey of Consumer Expectations (SCE), a monthly survey with a rotating sample conducted by the New York Fed. Each month, approximately 1,300 households participate in the survey, and each household can remain in the sample for up to 12 months. The SCE provides household forecasts for a wide range of macroeconomic variables and includes detailed demographic information. The sample covers the period from June 2013 to February 2024. In appendix, I provides detailed information on the sample construction.

In addition to the monthly core survey, the SCE also includes a supplemental finance survey available from 2014 to 2019. The finance survey is conducted annually and provides detailed information about households' wealth decomposition and asset holdings. It is conducted alongside the core survey and uses the same sample, allowing me to match households' asset holdings with their expectations about future macroeconomic variables.

2.2 Subjective Uncertainty across Income Groups

In this paper, I focus on households' forecasts of the one-year-ahead inflation rate. A key feature of the SCE is that it not only asks households for point forecasts of future inflation but also requests that they assign probabilities to a series of possible outcome bins. The specific survey question for the point forecast is:

Over the next 12 months, I expect the rate of [inflation/deflation] to be __________ %.

Following this question, the question for the bin' probability is:

In your view, what would you say is the percent chance that, ***over the next 12 months...***

- the rate of inflation will be 12% or higher __________ percent chance
- ...
- the rate of deflation (the opposite of inflation) will be 12% or higher __________ percent chance

Together, these two questions allow me to approximate the distribution of households' beliefs. Note that a more dispersed belief distribution implies that a household is less confident about its point forecast—that is, it has greater subjective uncertainty. Therefore, I use the variance of the belief distribution as a measure of subjective uncertainty:

$$Uncer_{i,t} = \sum_j p_{i,j}(\bar{y}^j_{t+1})^2 - (F_{i,t}y_{t+1})^2,$$

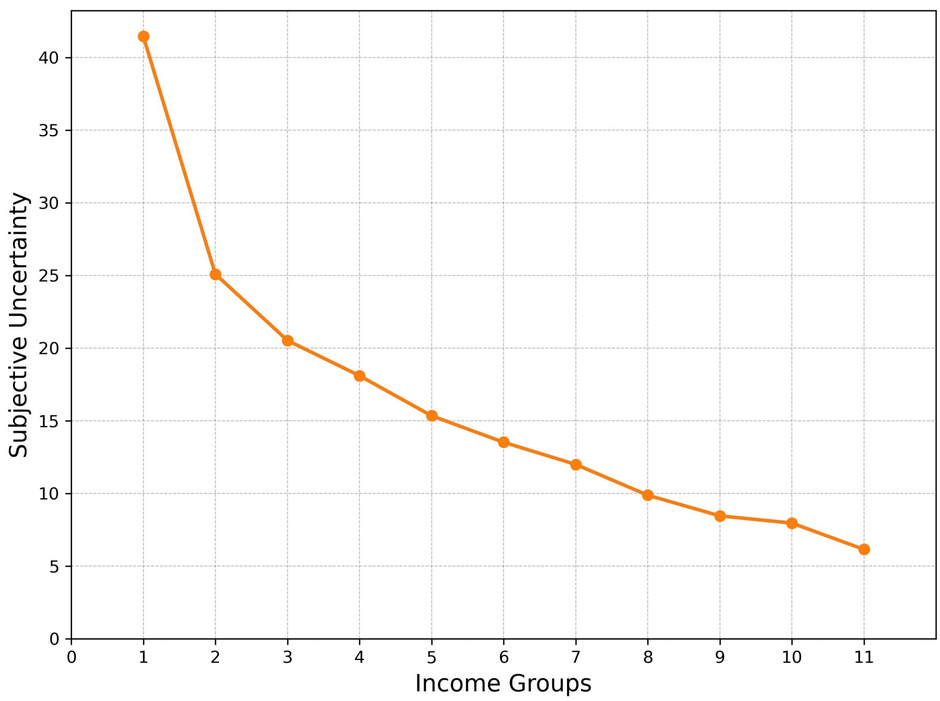


Figure 2.1. *Subjective uncertainty across income groups. Note: The figure plots subjective uncertainty regarding one-year-ahead inflation from the poorest group (Group 1) to the richest group (Group 11). The figure shows that households' subjective uncertainty decreases with income groups. Sample period is from 2013M6 to 2024M2.*

where $F_{i,t}y_{t+1}$ is the point forecast provided by household i for the one-year-ahead inflation rate. $p_{i,j}$ is the probability that household i assigns to outcome bin j. For the highest (lowest) bin, $\bar{y}^j_{t+1}$ represents the minimum (maximum) value of the bin, while for all other bins, $\bar{y}^j_{t+1}$ represents the midpoint of bin j.

Figure 2.1 plots households' subjective uncertainty across different income groups. The figure shows that subjective uncertainty declines as household income increases. Specifically, the subjective uncertainty of the richest group (group 11) is approximately 14% of that of the poorest group (group 1). In the appendix, I also report estimation results controlling for household age, education, and other demographic features. The findings remain robust: subjective uncertainty is significantly negatively related to income groups.

The decreasing subjective uncertainty implies that households' beliefs differ systematically not only in their mean, as documented in the literature, but also in their variance. Households in higher income groups tend to have more concentrated beliefs and face lower uncertainty.

Note that the observed decrease in subjective uncertainty contradicts the common assumption that households share a homogeneous ex-ante information structure. Such a structure implies that, although households' beliefs may differ in their mean due to realized noise, they share the same variance. To emphasize the importance of subjective uncertainty, the following subsection presents evidence showing that uncertainty is related to households' portfolio decisions.

2.3 Risky Asset Holding and Subjective Uncertainty

Households' portfolio shares are naturally related to their subjective uncertainty about risky returns, with higher uncertainty typically associated with a lower allocation to risky assets. However, it remains unclear whether portfolio decisions are also influenced by households' uncertainty about broader macroeconomic conditions. Given that objective uncertainty about future inflation systematically varies across income groups, it is important to examine whether households' portfolio choices are related to their subjective uncertainty regarding future macroeconomic variables.

To explore this, I use data from the SCE Finance Survey, which provides detailed information on households' asset composition. Specifically, I measure portfolio share as the ratio of stock and mutual fund holdings to total savings and investment accounts. To isolate the effect of subjective uncertainty (the second moment), it is necessary to control for households' expectations about future risky returns (the first moment). Although the SCE data does not directly report expected returns, it includes a question asking respondents whether they believe stock prices will increase over the next 12 months. I use this question as a proxy to control for households' expectations of future risky returns.

Using these measures, I then investigate the relationship between households' subjective uncertainty and their portfolio shares:

$$Share_{i,t} = \alpha + \beta_0 Uncer_{i,t} + \boldsymbol{\beta X_{i,t}} + \eta_{i,t}, \tag{1}$$

where $Share_{i,t}$ denotes household i's portfolio share invested in risky assets, $Uncer_{i,t}$ represents the subjective uncertainty about future inflation, and $\mathbf{X}_{i,t}$ is a vector of control variables that includes household demographic characteristics as well as beliefs about the probability that stock prices will increase. Table 2.3 presents the estimation results.

Column (1) of Table 2.3 presents the results controlling only for the probability that stock prices will increase. The coefficient β is significantly negative, indicating that households' portfolio shares in risky assets decrease as their subjective uncertainty about future inflation rises. In column (2), I further control for additional household demographic characteristics. Column (3) reports the result controlling for year fixed effect. As shown in the table, the β coefficient remains significantly negative even after controlling for households' income and other demographics. This suggests that the observed negative relationship is not driven by differences in portfolio shares across

	Proportion of Risky Asset Holding		
	(1)	(2)	(3)
Subjective Uncertainty	-0.1377***	-0.0786**	-0.0780**
	(0.026)	(0.034)	(0.034)
Stock Increase Prob.	0.0766***	0.0387	0.0400
	(0.024)	(0.026)	(0.026)
Income Group		1.8670***	1.8363***
		(0.272)	(0.272)
Age		0.4616***	0.4594***
		(0.038)	(0.038)
Male		2.6626**	2.7002**
		(1.202)	(1.202)
Married		0.2572	0.3789
		(1.397)	(1.399)
Educ		4.5940***	4.6145***
		(0.953)	(0.953)
Constant	30.9480***	15.6396***	15.5675***
	(1.189)	(3.615)	(3.616)
Time FE	NO	NO	YES
Observations	4,312	3,788	3,788
R-squared	0.010	0.068	0.070

Note: This table shows the estimation results from Equation (1). The sample period is from 2014 to 2019. Standard errors are clustered at individual level.

income groups. In the appendix, I also report robustness checks using a broader definition of risky assets, which includes personal business holdings, the main conclusion remains unchanged.

2.4 Information across Income Groups

As discussed above, the observed differences in households' subjective uncertainty imply that their belief distributions vary not only in mean but also systematically in variance. Within a noisy information framework, this suggests that households differ not only in their ex-post realized signals but also in their ex-ante information structures. In this subsection, I demonstrate that higher-income households tend to acquire more information than lower-income households. In other words, households across different income groups exhibit heterogeneous ex-ante information structures.

To this end, I use data from the Michigan Survey of Consumers, a monthly survey conducted by the University of Michigan with approximately 1,000 households participating each month. The survey has been conducted since 1978, and I restrict the sample to the period from January 2010 to February 2024 to ensure comparability with

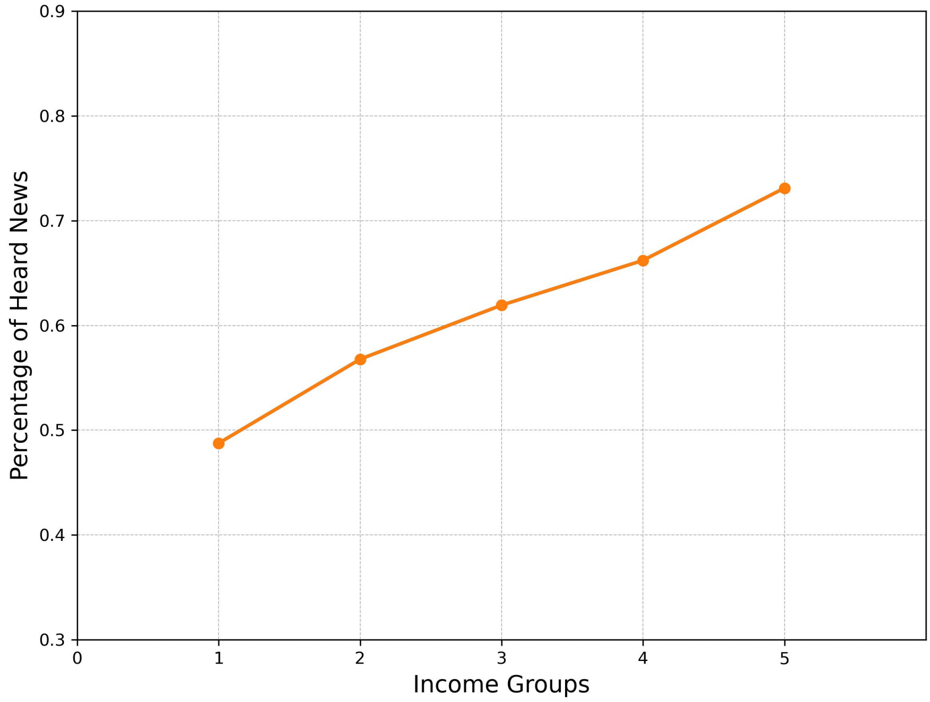


Figure 2.2. *Percentage of households who have heard news about macro conditions across income groups. Note: The figure plots the percentage of households that report having heard news about macro conditions in each income group. The figure shows that higher-income groups tend to have a larger share of households that have heard news about business conditions. The sample period is from 2010M1 to 2024M2.*

the SCE data.

The survey includes a question designed to capture households' exposure to macroeconomic information: *"During the last few months, have you heard of any favorable or unfavorable changes in business conditions?"* Respondents indicate whether they have heard any news about recent changes in the broader economic environment. For each income group, I calculate the proportion of households reporting that they have heard such news. This measure captures the heterogeneity in information exposure across the income distribution. Figure 2.2 presents these results.

The figure illustrates that the percentage of households that have heard news of macroeconomic conditions increases from the lowest income group (Group 1) to the highest income group (Group 5). This pattern suggests that, compared to lower-income households, those in higher income groups are more likely to access information. This directly contradicts the commonly used assumption that all households share the same ex-ante information structure. Specifically, the figure indicates that wealthier households have access to more information—corresponding to more precise signals—than the poorer households.

In summary, the evidence presented in this section contradicts the commonly held assumption that all households share the same ex-ante information structure. Households in higher income groups tend to have access to more information and exhibit more concentrated beliefs about macroeconomic conditions. Importantly, the empirical evidence also suggests that households' subjective uncertainty regarding macro variables is related to their portfolio choices. Motivated by these findings, in the next section, I study a model in which households can acquire information about future TFP at a monetary cost. Additionally, households need to make portfolio decisions regarding a risk-free bond and capital, the returns of which depend on the realized TFP shock.

3 Two-period Model

To illustrate the key mechanism, I first present a simple two-period model that allows to obtain analytical results. When households are allowed to acquire information, wealthier households tend to acquire information more actively and thus face lower uncertainty. Consequently, wealthier households hold a larger share of risky capital. When there's an anticipated TFP shock that increases the return on capital, the current price of capital rises, redistributing wealth toward wealthier households since they hold more capital. This redistribution further stimulates investment. Compared to a model with homogeneous ex-ante information, the future TFP shock has a stronger impact on the current economy.

3.1 Set up

The model has two periods, 0 and 1. And to obtain analytical results, I make a number of parametric assumptions, which will be relaxed in the infinite horizon model.

Households. There is a continuum households of measure one index by $i \in [0,1]$. Households have an Epstein-Zin preference over the consumption $\{c_{i,0}, c_{i,1}\}$ and labor supply l_0:

$$\log v_{i,t} = E_s \left[(1-\beta) \log c_{i,0} - \bar{\theta} \frac{l_0^{1+1/\theta}}{1+1/\theta} + \beta \log \left(E[(c_{1,0})^{1-\gamma}] \right)^{\frac{1}{1-\gamma}} \right], \tag{2}$$

with discount factor β, relative risk aversion γ, disutility of labor $\bar{\theta}$ and Frisch elasticity θ. The notation $E_s[\cdot]$ denotes the expectation taken before receiving new signals. To isolate the key mechanism, I assume that each household supplies the same amount of labor, l_0, in the first period, but with heterogeneous labor productivity. In period 1, production relies solely on capital, so there is no labor supply in period 1. Note that given the preference, households consume a fixed proportion of their total wealth in period 0. This structure serves two purposes: it isolates the portfolio allocation mechanism rather than the consumption-saving decision, as documented in Mitman et al. (2025), and it enables an analytical solution.

Households also need choose their portfolio holding between the nominal bond B

and capital k, subject to the resource constraint:

$$P_0 c_{i,0} + B_{i,0} + Q_0 k_{i,0} + H_{i,0} \leq \phi^i W_0 l_0 + (1+i_{-1})B_{i,-1} + [\tilde{\Pi}_0 + (1-\delta)Q_0]k_{i,-1}, \quad (3)$$

$$P_1 c_{i,1} \leq (1+i_0)B_{i,0} + \tilde{\Pi}_1 k_{i,0}, \quad (4)$$

where ϕ^i denotes the labor productivity of household i, with $\int_0^1 \phi^i \, di = 1$. $B_{i,-1}$ and $k_{i,-1}$ represent household i's initial endowments of the bond and capital, respectively. Household i's initial wealth is thus given by $a_{i,-1} \equiv (1+i_{-1})B_{i,-1} + \left[\tilde{\Pi}0 + (1-\delta)Q_0\right]ki, -1$. For simplicity, I assume all households have the same initial wealth, i.e., $a_{i,-1} = a_{-1}$, though they may hold different portfolio compositions. Each dollar of nominal bonds purchased in period 0 pays $(1+i_0)$ dollars in period 1. Following Auclert (2019), capital is modeled as a claim on the future profits of the representative firm. Each unit of capital, purchased at price Q_t, yields a dividend $\tilde{\Pi}$ in period 1. Capital depreciates at rate δ in period 0 and is fully depreciated after period 1. There is only one final consumption good, which is traded at price P_t at time t. W_0 denotes the nominal wage in period 0. Finally, H_i denotes household i's expenditure on information acquisition, which will be discussed in more detail later.

Supply Side. The nominal wage is assumed to be fully sticky:

$$W_0 = W_{-1}.$$

Households are assumed to be willing to supply any amount of labor demanded by the firm. In the quantitative model, I'll relax this assumption.

There is a representative firm that produces both the consumption and capital goods. In period 0, the firm hires l_0 units of labor and rents k_{-1} units of capital. It produces the final consumption good using a Cobb-Douglas production function with the TFP normalized to 1. The firm also uses the consumption good to produce capital goods, incurring an adjustment cost. To produce x_0 units of capital goods, the firm requires $\left(\frac{k_0}{k_{-1}}\right)^{\chi^x} x_0$ units of the consumption good, where χ^X is the parameter indexing the adjustment cost. The profit of the representative firm in period 0 is given by:

$$\tilde{\Pi}_0 k_{-1} = P_0 l_0^{1-\alpha} k_{-1}^{\alpha} - W_0 l_0 - P_0 (\frac{k_0}{k_{-1}})^{\chi^X} x_0 + Q_0 x_0. \quad (5)$$

In period 1, only capital is used for production. The TFP shock of period 1 is ϵ^z. The representative firm then earns:

$$\tilde{\Pi}_1 k_0 = P_1 \exp(\epsilon^z) k_0^{\alpha},$$

where the TFP shock ϵ^z follows:

$$\epsilon^z \sim N(0, \sigma_z^2). \tag{6}$$

Information Structure. At the beginning of period 0, households decide how much to spend on acquiring information. After choosing their information expenditure, household i observes a private signal s_i about the shock ϵ^z:

$$s_i = \epsilon^z + e_i,$$

where e_i is a noise term assumed to be normally distributed with zero mean and variance $\sigma_{i,e}^2$. The precision of the signal depends on the household's information expenditure. Specifically, the variance of the noise term is given by:

$$\sigma_{i,e}^2 = \frac{\bar{\sigma}^2}{1+n_i}, \tag{7}$$

where n_i measures the effort household i exerts in acquiring information. The parameter $\bar{\sigma}^2$ represents the maximum noise variance when the household exerts zero effort (i.e., when $n_i = 0$). Higher effort reduces the noise variance, thereby improving signal precision.

The cost of acquiring information is specified as:

$$h_i = (\theta^I n_i)^{\chi^I}, \tag{8}$$

where $\theta^I > 0$ and $\chi^I > 1$ are parameters that govern the cost of information acquisition.

Policy. The government sets monetary policy by committing to $P_1 = P_0 \exp(u\epsilon^z)$, so that the nominal bond is exposed to inflation risk. I assume that $u \in [0, 1)$ to ensure that the risk associated with the bond is lower than that of capital. Furthermore, the government sets the nominal interest rate on the nominal bond according to a Taylor rule:

$$(1+i_0) = (1+\bar{i})(\frac{P_0}{P_{-1}})^{\phi}\exp(\epsilon^m), \tag{9}$$

where the ϵ^m is the monetary shock.

Market Clearing. The model features four markets: the goods market, the capital rental market, the capital claims market, and the bond market. In equilibrium, all markets must clear.

Goods market clearing:

$$\int_0^1 c_{i,0}di + (\frac{k_0}{k_{-1}})^{\chi^X} x_0 = l_0^{1-\alpha}k_{-1}^{\alpha}; \quad \int_0^1 c_{i,1}di = \exp{(\epsilon^z)}k_0^{\alpha}. \tag{10}$$

Capital rental market clearing:

$$\int_0^1 k_{i,-1} di = k_{-1}; \quad \int_0^1 k_{i,0} di = k_0. \tag{11}$$

Capital claim market clearing:

$$(1-\delta) \int_0^1 k_{i,-1} di + x_0 = \int_0^1 k_{i,0} di. \tag{12}$$

Bonds market clearing:

$$\int_0^1 B_{i,0} di = 0. \tag{13}$$

Equilibrium. Given the state variables $\{W_{-1}, k_{-1}, i_{-1}, \{B_{i,-1}, k_{i,-1}\}, \epsilon^m\}$, and the stochastic process (6), an equilibrium is a set of polices and prices such that (i) each household choose $\{H_i, c_{i,0}, B_{i,0}, k_{i,0}, c_{i,1}\}$ to maximize (2) and subject to (3) - (4). (ii) wage is fully rigid. (iii) the representative firm chooses $\{l_0, x_0\}$ to maximize (5). (iv) the government sets $P_1 = P_0 \exp(u\epsilon^z)$ and sets the nominal interest rate follows (9), and (v) the goods, capital, bonds markets are clear.

3.2 Information Acquisition across Households

I first derive how households' information acquisition decisions relate to their labor productivity (ϕ^i). Note that households first decide on the optimal expenditure for acquiring information. And after they observe their private signals, households decide their portfolio allocation. Therefore, I begin by analyzing households' optimal portfolio choices, and then work backward to determine the optimal information acquisition.

Throughout the paper, I use lowercase letters to denote the real terms of nominal variables. After observing the private signal, the expected real return on capital is:

$$E_i[(1+r^k)] \equiv E_i[\frac{\tilde{\Pi}_1}{Q_0}\frac{P_0}{P_1}] = E_i[\frac{\tilde{\pi}_1}{q_0}]. \tag{14}$$

The real interest rate for the bond is:

$$E_i[(1+r^f)] \equiv E_i[(1+i_0)\frac{P_0}{P_1}] = E_i[(1+i_0)\exp(-u\epsilon^z)] = E_i[(1+\bar{i})(\frac{P_0}{P_{-1}})^{\phi}\exp(\epsilon^m - u\epsilon^z)]. \tag{15}$$

Define household i's total wealth and portfolio share:

$$a_{i,1} = k_{i,0}q_0 + b_{i,0},$$

$$\omega_i \equiv \frac{k_{i,0}q_0}{k_{i,0}q_0 + b_{i,0}}.$$

Optimal condition for the share ω_i is:

$$E_i[(c_{i,1})^{-\gamma}(r^k - r^f)] = 0. \tag{16}$$

Using a second-order Taylor approximation, the optimal portfolio share is given by:

$$\omega_i^* \approx \frac{1}{\gamma}\frac{E_i[\log(1+r^k)] - E_i[\log(1+r^f)] + [\frac{1}{2}(1-u)^2 - (1-\gamma)u(1-u)]\sigma_i^2}{(1-u)^2\sigma_i^2}, \tag{17}$$

where $\sigma_i^2 = \frac{\sigma_{i,e}^2\sigma_z^2}{\sigma_{i,e}^2+\sigma_z^2}$ is the variance of households' posterior belief regarding ϵ^z.

Given the optimal portfolio share, the marginal benefit for information expenditure is given by:

$$\frac{1-\gamma}{2}\frac{\partial}{\partial h_i}E_i[(1 - \frac{(1+u)(1-\omega_i^*)E_i[\log(1+r^f)]}{\omega_i^* E_i[\log(1+r^k)]})^2\sigma_i^2] - \beta^{-1}(a_{-1} - h_i + \phi^i W_0 E_i[l_0])^{-1}. \tag{18}$$

The following proposition characterizes the relationship between optimal information expenditure h_i and labor productivity ϕ^i.

Proposition 1. *When the risk aversion satisfies $\gamma > 1$, household i's optimal information expenditure h_i is increasing in labor productivity ϕ^i.*

All proofs are collected in the Appendix. Proposition 1 states that households with higher labor productivity acquire more information compared to households with lower productivity. Note that in Equation (18), the first term characterizes the benefit from information: when households are risk averse, more information helps lower portfolio risk, thereby raising utility. The second term captures the cost of information, as acquiring additional information requires sacrificing consumption goods.

Given households' preferences, Equation (17) shows that the optimal portfolio share ω_i^* does not depend on wealth. Therefore, for a given σ_i^2, all households choose the same optimal portfolio share. This implies that the first term in Equation (18) is independent of household labor productivity, while the second term decreases with households' initial wealth. Specifically, the second term decreases with household labor productivity because higher labor productivity corresponds to lower expected marginal utility of consumption. As a result, households with higher productivity find it relatively less costly to acquire information and therefore choose to acquire more.

3.3 Anticipated TFP Shock and Real Economy

In this section, I present results characterizing the effects of an anticipated TFP shock on the real economy. I demonstrate that when households endogenously acquire information, an anticipated TFP shock has a larger impact to the real economy compared to the scenario where households share homogeneous ex-ante information structures.

Note that in the model, the firm's investment decision helps align expectations across households. According to Equation (5), under optimal investment, the capital price satisfies:

$$q_0 = (\frac{k_0}{k_{-1}})^{\chi^X}. \tag{19}$$

In other words, the capital price q_0 directly reflects the capital stock. This mechanism helps overcome the problem of higher-order beliefs highlighted by Angeletos and Huo (2021) and Mitman et al. (2025), whereby households must form expectations about the average expectation of others.

Therefore, I start form the response of capital price q_0 to the anticipated TFP shock ϵ^z. Given the capital price and the nominal return on government bonds, the expected excess return on capital based on public information is $\log(\frac{k_0^{\alpha-1}}{q_0}) - \log(1+i_0)$. Together with the household's portfolio rule in Equation (17), the following proposition characterizes how the excess return on capital responds to the anticipated TFP shock:

Proposition 2. *The excess return of capital based on public information satisfies:*

$$\log(\frac{k_0^{\alpha-1}}{q_0}) - \log(1+i_0) = \gamma(1-u)^2\tau^{-1},$$

where

$$\tau = \int \frac{a_{i,1}}{\sigma_i^2 \int [1-\epsilon^z(1-u)/\sigma_{i,e}^2] a_{i',1} di'} di.$$

The response of capital to a news shock is:

$$\frac{d\log(\frac{k_0^{\alpha-1}}{q_0}) - \log(1+i_0)}{d\epsilon^z} = \gamma(1-u)^2\tau^{-1}\left[\int \frac{a_{i,1}/\int a_{i',1}di'}{d\epsilon^z}(1-\omega_i) + \frac{a_{i,1}(1-\omega_i)}{\int a_{i',1}di'}\int \frac{1-u}{\sigma_{i'}^2}di'di\right]. \tag{20}$$

Proposition 2 shows that the response of current capital investment and its price to a news shock depends on two factors: the covariance between household wealth and portfolio choices, and the precision of households' signals. When all households hold the same portfolio share (i.e., $\omega_i = 1$ for all i), a news shock does not affect the risk premium based on public information. However, when households have heterogeneous information and portfolios, the first term in Equation (20) captures a redistribution effect. If the news shock redistributes wealth toward wealthier households with larger portfolio shares in risky assets, the response to the anticipated shock is amplified.

The second term in Equation (20) captures the direct information effect. Intuitively, publicly observed variables (k_0, q_0) should also reflect information about the capital return in period 1. When households' signals become noisier (i.e., $\sigma_{s,i}^2$ increases), capital investment and prices in period 0 reveal less information about the shock in period 1, and the direct effect diminishes. In the limit where households have no information ($\sigma^2_{s,i} \to \infty$), the second term vanishes, and the shock affects the risk premium solely through the redistribution channel.

Given that the capital price satisfies Equation (19), household i's belief regarding the capital return is expressed as:

$$E_i[\log(1+r^k)] = E_i[\epsilon^z] + \chi^X k_{-1} - (1-\alpha+\chi^X)k_0.$$

The investment x_0 and the corresponding capital k_0 must satisfy Equation (**??**) for all households. Therefore, the response of investment to the anticipated TFP shock can be written as:

$$\frac{dk_0}{d\epsilon^z} = -\frac{k_0}{1-\alpha+\chi^X}\left[\frac{d\left(\log\left(\frac{k_0^{\alpha-1}}{q_0}\right) - \log(1+i_0)\right)}{d\epsilon^z} + \frac{\log(1+i_0)}{d\epsilon^z}\right].$$

On the consumption side, given households' preferences, household i's consumption is a proportion of total wealth:

$$c_{i,0} = (1-\beta)\left\{\phi^i w_0 l_0 + \frac{1+i_{-1}}{P_0}B_{i,-1} + [\tilde{\pi}_0 + (1-\delta)q_0]k_{i,-1} - h_i\right\} \equiv (1-\beta)a_{i,0}.$$

Along with the firm's labor choice condition, households' consumption response to the news shock is given by:

$$\frac{dc_{i,0}}{d\epsilon^z} = (1-\beta)\left\{\phi^i\frac{dy_0}{d\epsilon^z} - \frac{1+i_{-1}}{P_0}\frac{d\log P_0}{d\epsilon^z}B_{i,-1} + \left[\frac{d\tilde{\pi}_0}{d\epsilon^z} + (1-\delta)\frac{dq_0}{d\epsilon^z}\right]k_{i,-1}\right\},$$

where $y_0 = l_0^{1-\alpha}k_0^\alpha$ is the output in period 0. Equations (**??**) and (**??**) indicate that the news shock affects households' consumption through investment, directly impacting their portfolio income and indirectly affecting output and labor income.

Together with consumption and investment, the impact of the anticipated TFP shock on the real economy is summarized in Proposition (3).

Proposition 3. *Allowing for heterogeneous information acquisition across households, and assuming household i's initial portfolio in period* -1 *is the same as in period* 0*, a positive TFP shock stimulates larger investment, output, and consumption compared to an economy where all households share the same ex-ante information structure.*

Intuitively, when there is a positive anticipated TFP shock ($\epsilon^z > 0$), it directly increases the expected return on capital, leading to a rise in capital demand today and an increase in capital prices. Consequently, wealth is redistributed to households that initially hold more capital. With endogenous information acquisition, households with higher productivity tend to simultaneously hold a larger portfolio share and more capital. In other words, in the presence of a positive anticipated TFP shock, wealth is redistributed to those households with greater capital demand, further increasing both capital demand and investment. In a model where households share the same ex-ante information structure, portfolio heterogeneity arises only from realized signal noise. As a result, households that initially hold more capital do not necessarily have higher capital demand, meaning that redistribution does not contribute to capital demand in this scenario. Therefore, compared to a model with a homogeneous ex-ante information structure, this model predicts a larger response to the anticipated TFP shock.

4 Quantitative Model

In the previous section, I used a two-period model to illustrate the key mechanism by which endogenous information acquisition amplifies the impact of an anticipated TFP shock to the real economy. In this section, I extend the model to an infinite-horizon setting and relax the assumptions regarding labor market structure and price determination that were present in the two-period framework. This model builds upon the framework developed by Kekre and Lenel (2022), with a key modification: households are allowed to acquire information about future TFP shocks at a monetary cost.

4.1 Households

Preference. The economy is assumed to have a continuum of households indexed by $i \in [0,1]$. There is only one type of consumption good, and households are assumed to have Epstein–Zin preferences:

$$v_{i,t} = \left\{ (1-\beta)[c_{i,t}\Phi(l_{i,t})]^{1-1/\psi} + \beta E[(v_{i,t+1})^{1-\gamma}]^{\frac{1-1/\psi}{1-\gamma}} \right\}^{\frac{1}{1-1/\psi}}, \tag{21}$$

where $\Phi(l_{i,t})$ is the disutility from labor:

$$\Phi(l_{i,t}) = \left[1 + (\frac{1}{\psi} - 1)\bar{\theta}\frac{(l_{i,t})^{1+1/\theta}}{1+1/\theta} \right]^{\frac{1/\psi}{1-1/\psi}}. \tag{22}$$

Each household is comprised of a measure one continuum of workers j, each supplying a different variety of labor. Households pay a Rotemberg (1982) wage adjustment cost for each variety j:

$$AC_t^W(j) = \frac{\chi^W}{2} W_t l_t \left(\frac{W_t(j)}{W_{t-1}(j)} - 1 \right)^2, \tag{23}$$

where χ^W captures the wage adjustment cost. Following Kekre and Lenel (2022), I assume that the adjustment cost is paid to the government and subsequently rebated back to households. Therefore, the adjustment cost affects the allocation only through the dynamics of wages. Given the wage for each labor variety, a household earns labor income $\phi^i \int_0^1 W_t(j) l_{i,t}(j) dj$, where ϕ^i is a household-specific labor productivity parameter satisfying $\int_0^1 \phi^i di = 1$.

As in the two-period model, households can save in two types of assets. The risk-free government bond B pays a nominal interest rate $(1 + i_t)$ in the next period. Households can also invest in capital k. The price of capital in period t is Q_t. Each unit of capital pays $\tilde{\Pi}_{t+1} + (1 - \delta) Q_{t+1}$ in the next period. The expected return on the capital is therefore $E_{i,t} \frac{\tilde{\Pi}_{t+1} + (1-\delta) Q_{t+1}}{Q_t}$. Household i's per period constraint is given by:

$$P_t c_t + Q_t k_{i,t} + B_{i,t} + H_{i,t} \leq \phi^i \int W_t(j) l_{i,t}(j) dj + (1 + i_{t-1}) B_{i,t-1} + [\tilde{\Pi}_t + (1 - \delta) Q_t] k_{i,t-1} + T_t.$$

Information Structure. The information structure for households is assumed to be the same as in the two-period model. In each period, households first decide on their expenditure for information acquisition. Each household then observes a private signal regarding the TFP shock:

$$s_{i,t} = \epsilon_t^z + e_{i,t}, \tag{24}$$

where ϵ_t^z represents the productivity shock and $e_{i,t}$ denotes the signal noise, which is normally distributed with a mean of zero. The relationship between the signal variance $\sigma_{i,e}^2$ and the expenditure on information is characterized by Equations (7) and (8).

4.2 Supply Side

For each type of labor j, a representative union chooses the wage $W_t(j)$ and the labor supply $l_t(j)$ to maximize the utilitarian welfare of its members, subject to the labor allocation:

$$l_t(j) = \int \phi^i l_i(j) di.$$

A representative labor packer purchases labor from each union and aggregates it using a CES technology:

$$l_t = \left[\int l_t(j)^{\frac{\epsilon - 1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon - 1}},$$

where ϵ represents the elasticity of substitution. The representative labor packer then sells the aggregated labor at the wage W_t and earns the following profit:

$$W_t l_t - \int l_t(j) W_t(j)\, dj.$$

A representative final goods producer purchases the aggregate labor and rents capital from households to produce consumption goods using a Cobb-Douglas production technology. As in the two-period model, the representative firm also uses the consumption goods to produce new capital goods with adjustment cost index by χ^X. The final goods producer then earns profit:

$$\tilde{\Pi}_t k_{t-1} = P_t (z_t l_t)^{1-\alpha} k_{t-1}^{\alpha} + Q_t x_t - W_t l_t - P_t (\frac{k_t}{k_{t-1}})^{\chi^X} x_t. \tag{25}$$

The aggregate productivity is assumed to follows a random walk:

$$log(z_t) = log(z_{t-1}) + \epsilon_{t-1}^z, \quad \text{with} \quad \epsilon_{t-1}^z \sim N(0, \sigma_z^2). \tag{26}$$

Therefore, the TFP shock ϵ_t^z directly affects the economy until period $t+1$.

4.3 Monetary and Fiscal Policy

The monetary policy implemented by the central bank is characterized by a Taylor rule:

$$1 + i_t = (1 + \bar{i})(\frac{P_t}{P_{t-1}})^{\phi^m} + m_t, \tag{27}$$

where m_t is the monetary shock follows an AR(1) process:

$$log(m_t) = \rho^m log(m_{t-1}) + \epsilon_t^m, \quad \text{with} \quad \epsilon_t^m \sim N(0, \sigma_m^2).$$

The government's fiscal policy consists of two components. First, I assume that the government subsidizes households' labor income at a constant rate of $\frac{\epsilon}{\epsilon-1}$ to eliminate the wage markup, allowing all types of labor to be treated as equivalent. Second, the government participates in the bond market, financed by a lump-sum tax. Each household pays a fixed share ν^i, which is proportional to their total wealth. The government is assumed to maintain a constant real value of bonds given by $b^g \equiv \frac{B_t^G}{P_t z_t}$.

The market clearing conditions and equilibrium definition of the infinite-horizon model is analogous to those in the two-period model. The detailed conditions and definitions are provided in the Appendix.

5 Model Solution and Calibration

Note that in the model, each household's total wealth and individual information expenditure affect their capital demand. Therefore, for each household i, we need to track the household's wealth and information expenditure. To keep the model com-

Table 5.1. *Heterogeneous subjective uncertainty and portfolio share across groups*

	Households Groups		
	Low Income	Medium Income	High Income
Household Income (thousands dollar)	33.76	84.20	212.60
Subjective Uncertainty	17.52	9.52	5.02
Portfolio Share (%)	26.31	30.68	40.71
Obs.	1520	2535	1603

Note: This table displays the average income, subjective uncertainty, and portfolio share for households in each group. The data is sourced from the SCE Finance Survey. The sample period is from 2014 to 2019.

putation tractable, I restrict household heterogeneity to three groups $i \in \{H, M, L\}$, representing high-income, medium-income, and low-income groups respectively. I denote the fraction of households in group i as λ^i with $\sum \lambda^i = 1$.

I first perform a stationary transformation by dividing all nominal variables by $P_t z_t$ and dividing all real variables except for labor by z_t. Note that although the TFP shock ϵ_t^z is not directly observed by households, it can affect household decisions in the current period through noisy signals. Therefore, I include the shock ϵ_t^z as a state variable. In the transformed economy, the aggregate state in period t is characterized by: transformed aggregate capital (k_t/z_t), transformed real wage (w_t/z_t), wealth shares of groups H and L (a_t^H, a_t^L), monetary policy (ϵ_t^m), and TFP shock (ϵ_t^z). I obtain a recursive representation of the stationary equilibrium, and the stochastic equilibrium is then computed using backward iteration.

Given the model timeline, households' problem is solved in two steps. First, at the beginning of each period, households observe the aggregate states expect for the TFP shock. Households first choose their optimal information expenditure to maximize the expected per period value:

$$\max_{h_{i,t}} E_i \left[v_{i,t} \right],$$

where $v_{i,t}$ is characterized in Equation (21). After households decide their information expenditure, they observe a private signal depending on the aggregate TFP shock and their information expenditure. Households then decide their consumption, ,portfolio and the labor unions decide labor supply. To eliminate the effect from asymmetric information as documented in Han (2024), I assume that the labor union shares the same information as households. Specifically, when the labor union maximizes the expected utility of member i, the union uses the same information as member i.

5.1 Calibration and Model Fit

The calibration aims to ensure that the model captures the observed patterns in households' subjective uncertainty and portfolio share. I also assume that one model period

Table 5.2. Externally set parameters

Parameter	Value	Moment	Note
ψ	IES	0.8	
θ	Frisch elasticity	1	Chetty et al. (2011)
α	Capital share	0.33	
ϵ	Elast. of subs. across workers	10	
ϕ	Taylor coeff.	1.5	Taylor (1993)
δ	Depreciation rate	2.50%	
χ^W	Rotemberg wage adj costs	170	Calvo stickiness 0.2
χ^X	Rotemberg wage adj costs	3.5	Kekre, R., & Lenel, M. (2022)
σ_m	Std. dev. MP shock	0.25%/4	
ρ^m	Persistence MP shock	0	
λ^H	Measure of H households	0.26	Measurement in SCE
λ^L	Measure of L households	0.28	Measurement in SCE
ϕ^H	Labor productivity H households	0.56	Labor income in SCE
ϕ^L	Labor productivity L households	0.08	Labor income in SCE
$\lambda^H \nu^H$	Share of tax from H households	0.54	Wealth in SCE
$\lambda^L \nu^L$	Share of tax from L households	0.06	Wealth in SCE

Note: This table shows parameters that are externally set. For most parameters, I use standard values to match aggregate moments documented in the literature. For the last six parameters, I set the values to be consistent with Table 5.1. The sample period is from 2014 to 2019.

corresponds to one quarter.

Externally Calibrated Parameters. First, a set of parameters is directly chosen to match the household shares and their incomes to be consistent with Table 5.1. These parameters include the proportions of high-income and low-income households (λ^H, λ^L), labor productivity for the high-income and low-income groups (ϕ^H, ϕ^L), and the implicit bond share held by households through the lump-sum tax (ν^H, ν^L).

On the supply side, I use standard parameter values for the capital share $\alpha = 0.33$, the intertemporal elasticity of substitution $\psi = 0.8$, and the depreciation rate $\delta = 2.5\%$. The elasticity of substitution across labor is set to $\epsilon = 10$, and the Rotemberg wage adjustment cost $\chi^W = 170$, which together are equivalent to wage changes every 4–5 quarters with Calvo wage stickiness, consistent with the evidence documented in previous studies.

Finally, for monetary policy, I use a standard Taylor rule coefficient $\phi^m = 1.5$ and set the standard deviation of the monetary shock to $\sigma_m = 0.06\%$, assuming zero persistence. Table 5.2 summarizes the externally calibrated parameters.

Calibrated Parameters. The remaining parameters are calibrated to match the corresponding macro moments and the subjective uncertainty of each income group.

To match the volatility of aggregate consumption and the investment, the standard deviation of the TFP is set to $\sigma_z = 0.22\%$ and the adjustment cost for capital is set to $\chi^X = 3.5$. To match the average return rate of the risk free asset, the discount factor is set to $\beta = 0.99$. And households risk aversion is set to $\gamma = 8.5$ to match the average

Table 5.3. *Calibrated parameters*

Parameter	Description	Value	Moment	Data	Model
β	Discount Factor	0.99	r^f	0.93%	0.98%
b^g	Real Value of Gov. bonds	0.64	$\sum b^i / \sum(b^i + qk^i)$	64.20%	63.52%
γ	Risk Aversion	8.5	$r^k - r^f$	6.30%	6.50%
σ_z	Std.dev. Prod shock	0.21%	Std.dev. $\ln c$	0.16%	0.18%
$\bar{\sigma}$	Upper bound of signal variance	0.004	$Uncer_L$	17.52	13.48
χ^I	Curvature cost of effort	2	$Uncer_M$	9.52	8.23
θ^I	Scale cost of effort	0.013	$Uncer_H$	5.02	4.67

Note: This table presents the calibrated parameter values and the moments most closely associated with each parameter. The sample period is from 2014 to 2019.

risk premium. The share of the government bonds holding is set to $b^g = 0.64$ to match the average share of bond holding across all households.

In the model, the households in the lowest income group have very limited expenditure on information, therefore, I set the upper bond of signal noisy $\bar{\sigma} = 0.004$ to match the subjective uncertainty of the households in the lowest income group. The scalar parameters of information expenditure χ^I and θ^I are hard to separately calibrate. Both of them have large effect on the subjective uncertainty of the households in the medium and high income groups. I set the cost function to be quadratic ($\chi^I = 2$) to match the difference in the subjective belief of the high income group and medium income group. And set $\theta^I = 0.013$ to match the subjective uncertainty of the medium income group.

Table 5.3 summarizes the values of the parameters and the moments most closely related to them. The model successfully replicates the observed pattern of subjective uncertainty across income groups, although it generally indicates lower uncertainty for all groups. In the data, there is significant heterogeneity within income groups, while the model fails to capture this heterogeneity, which lowers the overall uncertainty.

Portfolio Share on Risky Asset. Table 5.4 reports the portfolio shares of households in risky assets across different income groups, which are not directly targeted in the model. Overall, the model aligns well with empirical portfolio shares, successfully capturing the pattern that households in higher income groups hold larger shares of risky assets.

The table also presents results from a representative agent model with a homogeneous information structure. In the RANK model, I assume that households cannot acquire information; instead, each household observes a private signal with the same precision. I calibrate the signal precision to match the overall subjective uncertainty across all households. The results indicate that, given the Epstein-Zin preferences and homogeneous information structure, households choose nearly identical portfolios,

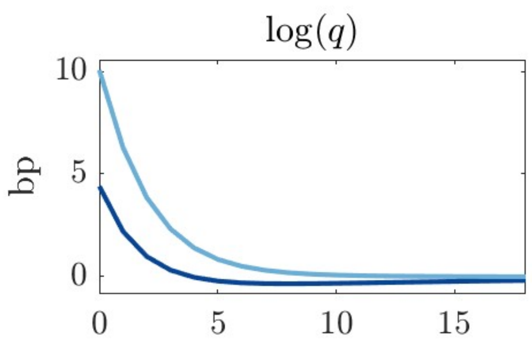
Table 5.4. *Untargeted moment: household's portfolio share*

Moment	Data	Model	RANK
$Share_L$	26.31%	30.40%	35.31%
$Share_M$	30.68%	35.61%	35.20%
$Share_H$	40.71%	39.70%	36.83%

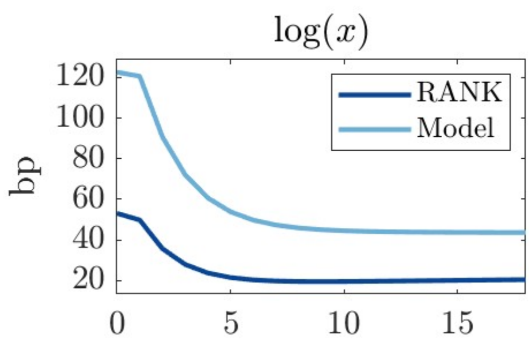
which aligns with the findings documented by Merton (1973).

5.2 Response to News Shock

In this section, I simulate the effects of a positive TFP shock on the real economy. I compare the results to those of a RANK model with a homogeneous ex-ante information structure. The endogenous information acquisition enlarges the effect of the shock on real output by 25 basis points.



(a) Capital price

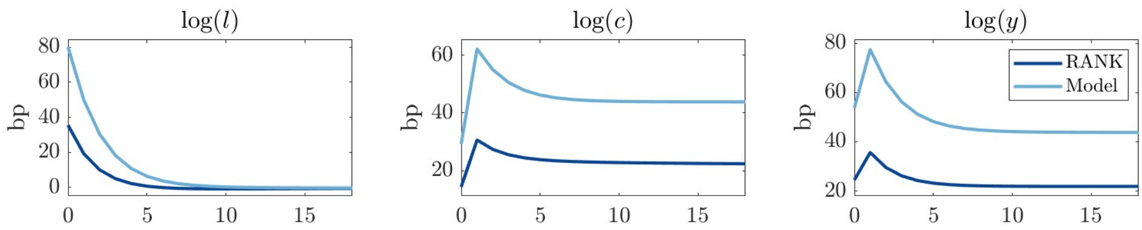


(b) Investment

Figure 5.1. *Impulse response of capital price and investment. Note: This figure plots the impulse responses of capital price and investment to a positive anticipated TFP shock of one standard deviation. The shock is anticipated at period 0 and is realized in period 1. The y axis denotes the basis points (0.01%).*

Figure 5.1 displays the impulse response of capital prices and investment. The shock occurs in period 1 and is anticipated in period 0. The left panel reports the effects on capital price. Consistent with Beaudry and Portier (2006), the positive news shock results in an increase in capital prices. Compared to the RANK model, the incorporation of endogenous information acquisition amplifies this impact by 6 basis points. As discussed in Section 3, heterogeneous information acquisition amplifies the demand for capital, leading to higher capital prices. The right panel presents the response of investment. In line with the changes in capital prices, the model predicts a larger increase in investment. In the long run, the rise in investment raises capital supply, the capital price declines and returns to it initial level. Furthermore, since the capital adjustment cost depends on the difference between capital levels at time t and $t-1$, the new shock would result in a permanent increase in investment.

Figure 5.2 reports the responses of labor, consumption, and output to the anticipated TFP shock. Note that, in contrast to a one-sector model where firms only have the incentive to hire more labor until the shock is realized, the model in this paper assumes that the representative firm produces capital using consumption goods. As a result, a higher capital price raises labor demand. Consistent with the changes in capital prices, the positive TFP shock increases labor demand, and the endogenous information acquisition amplifies this effect by almost two times. In the second and third panels, in line with the changes in investment, the shock permanently increases consumption and output. Quantitatively, the stimulation is of two times larger than it in a RANK model.



(a) Labor (b) Consumption (c) Output

Figure 5.2. *Impulse response of labor, consumption and output. Note: This figure plots the impulse responses of labor, consumption and output to a positive anticipated TFP shock of one standard deviation. The y axis denotes the basis points (0.01%)*

6 Conclusion

Recent literature has documented that households' expectations systematically differ in the first moments across income groups. In this paper, I demonstrate that the variance of households' individual beliefs regarding future inflation rates also systematically differs across income groups. Wealthier households have more concentrated beliefs compared to poorer households. Furthermore, I show that subjective uncertainty about inflation relates to households' portfolio decisions, with larger uncertainty corresponding to lower portfolio shares in risky assets.

I then study a heterogeneous agent New Keynesian model featuring information acquisition and portfolio allocation. Households are endowed with heterogeneous labor productivity and can acquire information regarding future TFP shocks at a monetary cost. I show that with endogenous information acquisition, households with higher labor productivity acquire more information and hold higher portfolio shares in risky assets. Moreover, endogenous information acquisition amplifies the impact of anticipated TFP shocks.

This work highlights the importance of beliefs regarding macroeconomic variables for households' portfolio decisions and suggests two avenues for future research. First, it would be worthwhile to study how different types of behavioral biases that have been documented using survey data about macroeconomic conditions affect the economy through asset markets. Second, the simulation results reported in this paper show that compared to a RANK model, the impact of an anticipated TFP shock is amplified when households endogenously acquire information. The existing literature that assumes all households have the same information structure may underestimate the impact of news shocks. Therefore, it is important to utilize forecast data and estimate the news shocks perceived by different households.

References

Angeletos, G.-M. and Z. Huo (2021). Myopia and anchoring. *American Economic Review 111*(4), 1166–1200.

Auclert, A. (2019). Monetary policy and the redistribution channel. *American Economic Review 109*(6), 2333–2367.

Barsky, R. B. and E. R. Sims (2011). News shocks and business cycles. *Journal of monetary Economics 58*(3), 273–289.

Beaudry, P. and F. Portier (2006). Stock prices, news, and economic fluctuations. *American economic review 96*(4), 1293–1307.

Beaudry, P. and F. Portier (2007). When can changes in expectations cause business cycle fluctuations in neo-classical settings? *Journal of Economic Theory 135*(1), 458–477.

Binetti, A., F. Nuzzi, and S. Stantcheva (2024). People's understanding of inflation. *Journal of Monetary Economics 148*, 103652.

Görtz, C., J. D. Tsoukalas, and F. Zanetti (2022). News shocks under financial frictions. *American Economic Journal: Macroeconomics 14*(4), 210–243.

Han, Z. (2024). Asymmetric information and misaligned inflation expectations. *Journal of Monetary Economics 143*, 103529.

Huo, Z., M. Pedroni, and G. Pei (2024). Bias and sensitivity under ambiguity. *American Economic Review 114*(12), 4091–4133.

Kaplan, G., B. Moll, and G. L. Violante (2018). Monetary policy according to hank. *American Economic Review 108*(3), 697–743.

Kekre, R. and M. Lenel (2022). Monetary policy, redistribution, and risk premia. *Econometrica 90*(5), 2249–2282.

Khan, H. and J. Tsoukalas (2012). The quantitative importance of news shocks in estimated dsge models. *Journal of Money, Credit and Banking 44*(8), 1535–1561.

Maćkowiak, B. and M. Wiederholt (2025). Rational inattention and the business cycle effects of productivity and news shocks. *American Economic Journal: Macroeconomics 17*(1), 274–309.

Malmendier, U. and S. Nagel (2016). Learning from inflation experiences. *The Quarterly Journal of Economics 131*(1), 53–87.

Merton, R. C. (1973). An intertemporal capital asset pricing model. *Econometrica: Journal of the Econometric Society*, 867–887.

Mitman, K., B. Tobias, K. Alexandre, and S. Kathrin (2025). Expectation and wealth heterogeneity in the macroeconomy. Technical report, working paper.

Miyamoto, W. and T. L. Nguyen (2020). The expectational effects of news in business cycles: Evidence from forecast data. *Journal of Monetary Economics 116*, 184–200.

Pedemonte, M., H. Toma, and E. Verdugo (2025). Aggregate implications of heterogeneous inflation expectations: The role of individual experience. *The Economic Journal*, ueaf115.

Peress, J. (2004). Wealth, information acquisition, and portfolio choice. *The Review of Financial Studies 17*(3), 879–914.

Rotemberg, J. J. (1982). Sticky prices in the united states. *Journal of political economy 90*(6), 1187–1211.

Rozsypal, F. and K. Schlafmann (2023). Overpersistence bias in individual income expectations and its aggregate implications. *American Economic Journal: Macroeconomics 15*(4), 331–371.